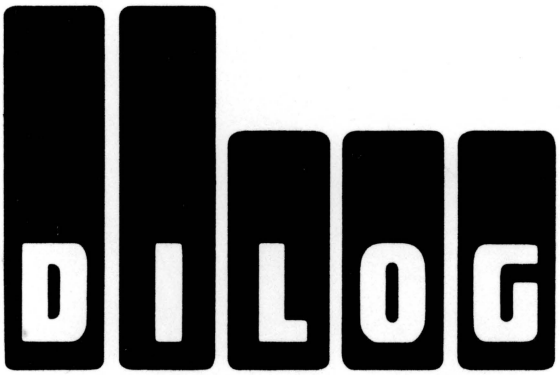
DISTRIBUTED LOGIC CORPORATION

MODEL DQ153

MAGNETIC TAPE COUPLER

INSTALLATION AND OPERATION MANUAL



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MODEL DQ153

MAGNETIC TAPE COUPLER

INSTALLATION AND OPERATION MANUAL

REVISION E

1 November 1989

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SECTION 1

DESCRIPTION

INTRODUCTION

This manual describes the installation and operation of Distributed Logic Corporation (DILOG) Model DQ153 Magnetic Tape Coupler. The coupler interfaces DEC* LSI-11 bus based (the Q bus) PDP-11/23, PDP-11/23 PLUS, PDP-11/73, and MicroVAX computer systems to Pertec Industry-Standard formatted 1/2" reel-to-reel magnetic tape drives. The complete coupler occupies one dual module in the computer backplane. The coupler is compatible with DEC MU class drivers for magnetic tape subsystems in RT-11, RSX-11M+, RSTS/E, MicroVMS, ULTRIX, UNIX, and MUMPS operating systems. The coupler supports both block and non-block mode memory transfers and is programmable by the host software driver to transfer from one to eight words per DMA request.

COUPLER CHARACTERISTICS

A magnetic tape subsystem consists of a coupler, a formatter and up to four tape drives. The function of the coupler is to buffer commands, status, and data between the host computer I/O bus and the formatter. The formatter, which is typically embedded in the drive, establishes the data format, controls tape motion, and performs some error checking. The overall tape control function is a combination of the coupler functions and the formatter functions.

Figure 1-1 is a simplified diagram of a magnetic tape subsystem.

A microprocessor is the sequence and timing center of the coupler. Control information is stored as firmware instructions in Programmable Read Only Memory (PROM) on the coupler board. One section of the PROM contains a diagnostic program that tests the functional operation of the coupler. This self test is performed automatically each time power is applied or whenever a specific diagnostic command is issued. A green diagnostic indicator (LED) on the board lights to indicate diagnostic or command activity, or flashes a 5-bit (MSB first) error code if self test fails. During self test, the LED will alternate ON and OFF every seven seconds. If self test fails, the coupler has an automatic feature that stops the computer from interacting with the tape formatter to prevent writing erroneous information into critical data base areas.

Q-BUS INTERFACE

Commands, data and status transfers between the coupler and the computer are executed via the parallel I/O bus (Q Bus) of the computer directly to memory, via the DMA facility of the Q bus. Coupler/Q-Bus interface signals are listed in Table 1-1.

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* DEC is a registered trademark of Digital Equipment Corporation.

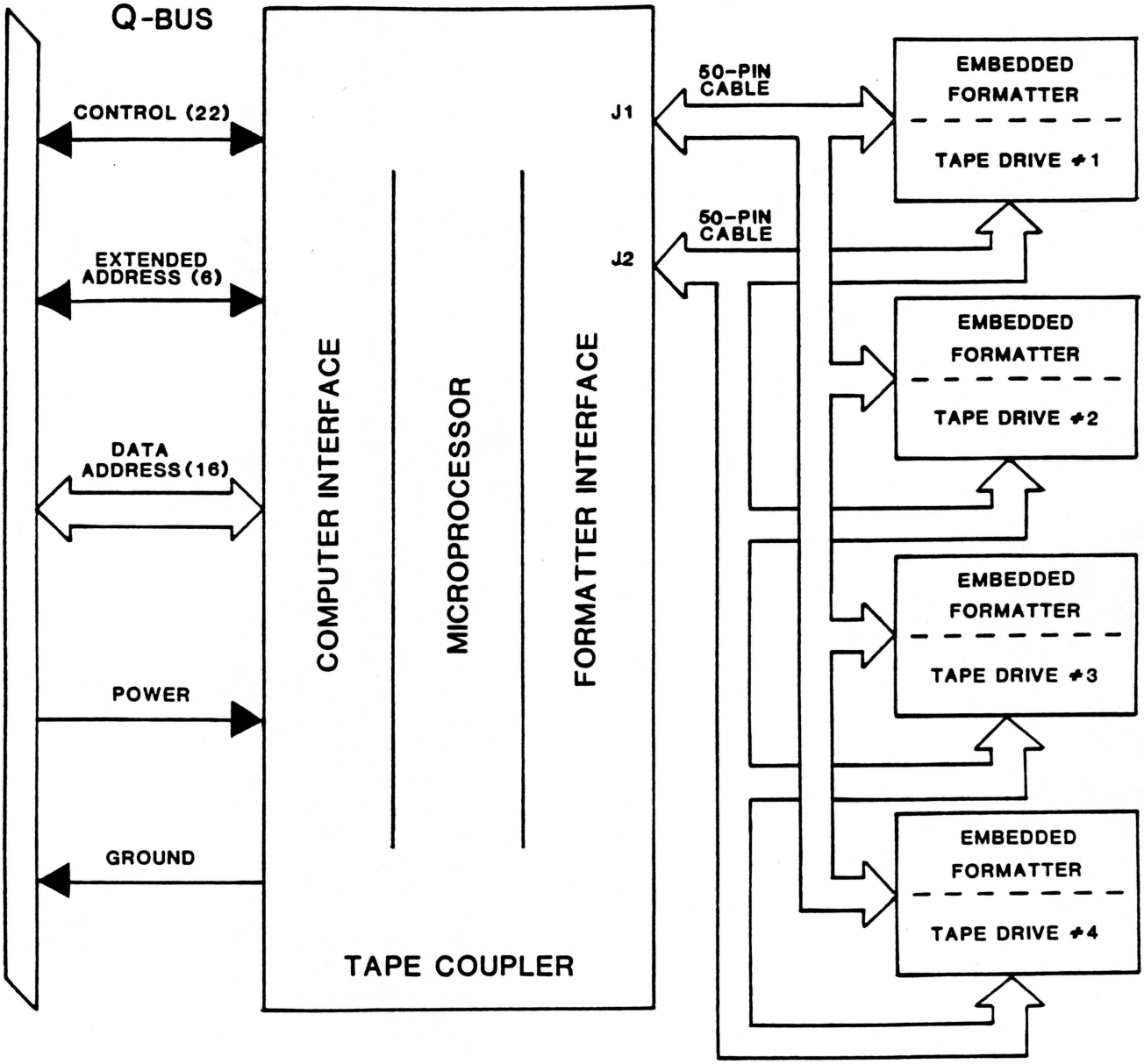

Figure 1-1. Tape System (Maximum Configuration)
Four Embedded Formatter Tape Drives

Table 1-1. Coupler/Q-Bus Interface Lines (Dual Module)

BUS PIN	MNEMONIC	INPUT/ OUTPUT	DESCRIPTION
AJ1, AM1, BJ1, BM1, BT1, BC2	GND	O	Signal Ground and DC return.
AN1	BDMR L	O	Direct Memory Access (DMA) request from controller; active low.
AP1	BHALT L	N/A	Stops program execution. Refresh and DMA is enabled. Console operation is enabled.
AR1	BREF L	N/A	Memory Refresh. Used for Block Mode DMA.
BA1	BDCOK H	I	DC power OK. All DC voltages are normal.
BB1	BPOK H	I	Primary power OK. When low activates power fail trap sequence.
BN1	BSACK L	O	Select Acknowledge. Interlocked with BDMGO indicating controller is bus master in a DMA sequence.
BR1	BEVNT L	N/A	External Event Interrupt Request.
BV1, AA2, BA2	+5	I	+5 volt system power.
AD2, BD2	+12	N/A	+12 volt system power.
AE2	BDOUT L	I/O	Data Out. Valid data from bus master is on the bus. Interlocked with BRPLY.
AF2	BRPLY L	I/O	Reply from slave to BDOUT or BDIN and during IAK.
AH2	BDIN L	I/O	Data Input. Input transfer to master (states master is ready for data). Interlocked with BRPLY.
AJ2	BSYNC L	I/O	Synchronize: becomes active when master places address on bus; stays active during transfer.
AK2	BWTBT L	I/O	Write Byte: indicates output sequence to follow (DATO or DATOB) or marks byte address time during a DATOB.
AL2, A1, AB1, BP1	BIRQ4-7 L	O	Interrupt Request 4-7.
AM2 AN2	BIAK1I L BIAK1O L	I O	Serial Interrupt Acknowledge Input and output lines routed from Q Bus, through devices, and back to processor to establish an interrupt priority chain.
AT2	BINIT L	I	Initialize. Clears devices on I/O bus.
AU2, AV2, BE2, BF2, BH2, BJ2, BK2, BL2, BM2, BN2, BP2, BR2, BS2, BT2, BU2, BV2	BDAL0 L through BDAL15 L	I/O	Data/address lines, 0-15
AR2 AS2	BDMG1I L BDMG1O L	I O	DMA Grant Input and Output. Serial DMA priority line from computer, through devices and back to computer.
AP2	BBS7 L	I/O	Bank 7 Select. Asserted by bus master when address in upper 4K bank is placed on the bus. Also asserted for Block Mode DMA.
AC1, AD1, BC1, BD1, BE1, BF1	BDAL16 L -BDAL21 L	O	Extended Address Bits 16-21

FORMATTER INTERFACE

The coupler interfaces with the formatted tape drives through two 50-pin flat cable connectors at the top of the coupler board. The maximum cable length between coupler and formatter is 20 feet. Coupler/formatter interface signals are listed in Tables 1-2 and 1-3. At the formatter end of the cable, the card edge connectors are AMP 88373-1 (or equivalent). The keying-pin adapter for these connectors is AMP 88113-1 (or equivalent). At the coupler end the connectors are 3M 3425-6050 (or equivalent).

Table 1-4 lists tape drive manufacturers and connector correlations.

COUPLER SPECIFICATIONS

DATA FORMAT

- Industry standard non-return-to-zero (NRZ), Phase Encoded (PE), or Group Coded Recording (GCR) recording.
- 9 tracks.
- Recording densities:

  800 characters per inch (NRZ)
  1600 characters per inch (PE)
  3200 characters per inch (PE)
  6250 characters per inch (GCR)

- Inter-record Gap (IRG) = 0.50 inch minimum (NRZI/PE) or 0.30 inch minimum (GCR).
- Byte order can be swapped on a per drive basis to permit reading and writing IBM Formatted tapes.

MEDIA CHARACTERISTICS

- Type - 1/2" wide mylar base, oxide coated, magnetic tape.
- Reel Size - 7", 8-1/2", or 10-1/2" diameter tape reels containing 600, 1200, and 2400 feet of tape, respectively.
- Data Capacity (megabytes)

  Assumes approximately 80% recording efficiency:

		800 CPI	1600 CPI	3200 CPI	6250 CPI
600 Ft.	=	5.75	11.5	23.0	
1200 Ft.	=	11.5	23.0	46.0	
2400 Ft.	=	22.0	44.0	88.0	172.0

- Data Transfer Rate (Characters/Second):

	800 CPI	1600 CPI	3200 CPI	6250 CPI
12.5 ips =	10,000	20,000	40,000	
25.0 ips =	20,000	40,000	80,000	
37.5 ips =	30,000	60,000	120,000	
45.0 ips =	36,000	72,000	144,000	280,000
75.0 ips =	60,000	120,000	240,000	470,000
125.0 ips =	100,000	200,000	400,000	780,000
200.0 ips =	160,000	320,000	640,000	1,250,000

NOTE

The DQ153 contains a 64 Kbyte cache buffer to efficiently couple the 1250 Kbyte tape transfer rate to the coupler I/O bus.

COMMAND QUEUE

- Can queue up to 16 commands for up to four drives. The 16 commands may be distributed among the drives in any order.

EMULATION

- MU driver emulation under RT-11, RSX-11M+, RSTS/E, MicroVMS, ULTRIX, UNIX, and MUMPS operating systems.

HARDWARE BOOTSTRAP

- Onboard bootstrap support for RP02, RL01/02, RM02, RM05, RM80, RK06/07, RX02, TS-11, TSV05, TM11, MU, and DU driver devices. Onboard jumpers allow selectable bootstrap addresses, in addition to enabling/disabling the bootstrap. When the bootstrap is disabled, the coupler will boot from the standard DEC module.

REGISTER ADDRESS

- IP Address range from 160000 to 177774
- Initialization and polling (IP) register 160404 (octal).
- Status/Address (SA) register 160406 (octal).

These are the (factory set) addresses of the coupler; recommended alternate addresses are software selectable and are as follows:

IP - 174500	160410	160414	160444	160450	160454
SA - 174502	160412	160416	160446	160452	160456

COMPUTER I/O INTERFACE

- Interrupt vector is set by the host software.
- Priority Level BR4 (levels BR5, BR6, and BR7 are software selectable).

- o DMA data transfers, block or non-block mode automatically selected: burst size and dwell time software selectable.
- o TMSCP type programming.
- o One std. DC bus load.

ADDRESSABLE MEMORY

- o 16, 18, and 22 bits (4.0 megabytes maximum)

COUPLER TO FORMATTER INTERFACE

- o The coupler is compatible with tape formatters manufactured by CDC, Cipher, Digi-Data, Kennedy, Pertec, S.E. Labs (EMI), IDT (Tandberg), Thorn Data, STC, Fujitsu, Megatape, and Telex.

PACKAGING

- o The coupler is completely contained on one dual module 5.22 inches (13.2 cm) by 8.88 inches (22.55 cm).

DOCUMENTATION

- o One Installation and Operation Manual supplied with each coupler.

POWER

- o +5 + 0.25 VDC at 2.5 amps, from computer backplane.

ENVIRONMENT

- o Operating temperature 50 deg. F (10 deg. C) to 104 deg. F (40 deg. C). Operating humidity 10% to 95% non-condensing.

NOTE

The quality of recording and reading information on magnetic tape is affected by temperature and humidity. The environment where the tape is used should be maintained within the following limits:

Ambient Temperature-	60 deg. F (15 deg. C) to 85 deg. F (32 deg. C).
Humidity-	20% to 80% non-condensing.

SHIPPING WEIGHT

- o Two pounds including documentation.

Table 1-2. Coupler Connector J1 to Formatter Interface Lines

J1 SIGNAL	J1 RETURN	MNEMONIC	DESCRIPTION
2	1	FFBY	Formatter Busy
4	3	CLWD	Last Word
6	5	CWD4	Write Data 4
8	7	CGO	Initiate Command
10	9	CWD0	Write Data 0
12	11	CWD1	Write Data 1
14	13	FDCK	Drive Check
16	15	CLOL	Load on Line
18	17	CREV	Reverse/Forward
20	19	CREW	Rewind
22	21	CWDP	Write Data Parity
24	23	CWD7	Write Data 7
26	25	CWD3	Write Data 3
28	27	CWD6	Write Data 6
30	29	CWD2	Write Data 2
32	31	CWD5	Write Data 5
34	33	CWRT	Write/Read
36	35	CRTH2 (FLGAP)	Density Select
38	37	CEDIT	Edit
40	39	CERASE	Erase
42	41	CWFM	Write File Mark
44	43	CRTH1	Gap Length
46	45	CTAD0	Transport Address 0
48	47	FRD2	Read Data 2
50	49	FRD3	Read Data 3

Note: () Parentheses are applicable to streaming and GCR drives.

The "C" prefix indicates signals to the tape drive;
The "F" prefix indicates signals from the tape drive.

Table 1-3. Coupler Connector J2 to Formatter Interface Lines

J2 SIGNAL	J2 RETURN	MNEMONIC	DESCRIPTION
1		FRDP	Read Data Parity
2		FRD0	Read Data 0
3		FRD1	Read Data 1
4		FLDP	Load Point
6	5	FRD4	Read Data 4
8	7	FRD7	Read Data 7
10	9	FRD6	Read Data 5
12	11	FHER	Hard Error
14	13	FFMK	File Mark
16	15	FCCG/ID	CCG/IDENT
18	17	CFEN	Formatter Enable
20	19	FRD5	Read Data 5
22	21	FEOT	End of Tape
24	23	COFL	Offline
26	25	FNRZ(FGCR)	NRZI (GCR) status
28	27	FRDY	Ready
30	29	FRWD	Rewinding
32	31	FFPT	File Protect
34	33	FRSTR	Read Strobe
36	35	FWSTR	Write Strobe
38	37	FDBY	Data Busy
40	39	(FHSPD)	High Speed Status
42	41	FCER	Corrected Error
44	43	FONL	Online
46	45	CTAD1	Transport Address 1
48	47	CFAD	Formatter Address
50	49	CDEN(FHISD)	Speed Select

Note: () Parentheses are applicable to streaming and GCR drives.

The "C" prefix indicates signals to the tape drive;
The "F" prefix indicates signals from the tape drive.

Table 1-4. Coupler to Formatter Connection Correlation

COUPLER CONNECTOR J1 TO:

MANUFACTURER	MODEL	CONNECTOR
CDC	Keystone 9218X	J4
CDC	Keystone 92185	J2
Cipher	F880	P1
	F100X, F900X (Adapter Required)	P4
Digi-Data	Formatted	JC
IDT	1012	J1
	1050	J124
Kennedy	6809 Streamer	J1
	Formatted	J5
Pertec	Formatted (Embedded)	P4
	External Formatter (Adapter Required)	P4

COUPLER CONNECTOR J2 TO:

MANUFACTURER	MODEL	CONNECTOR
CDC	Keystone 9218X	J5
CDC	Keystone 92185	J3
Cipher	F880	P2
	F100X, F900X (Adapter Required)	P5
Digi-Data	Formatted	JD
IDT	1012	J2
	1050	J125
Kennedy	6809 Streamer	J2
	Formatted	J1
Pertec	Formatted (Embedded)	P5
	External Formatter (Adapter Required)	P5

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SECTION 2

INSTALLATION

INSPECTION

The padded shipping carton that contains the coupler board also contains an Installation and Operation Manual and may contain cables (if this option is exercised) to the magnetic tape drive formatter. The coupler is completely contained on a dual-size printed circuit board. Inspect the coupler, its components, and the cables for damage.

CAUTION

IF DAMAGE TO THE BOARD, COMPONENTS ON THE BOARD, OR CABLES IS NOTED, DO NOT INSTALL. IMMEDIATELY INFORM THE CARRIER AND DILOG.

Installation instructions for the tape drive are contained in the tape drive manual. Before installing any components of the magnetic tape system subsystem, read Sections 1, 2, and 3 of this manual and the appropriate sections of the tape drive manual.

Figure 2-1 illustrates the locations of connectors, the LED, and jumpers on the coupler. Table 2-1 shows the jumper position possibilities.

HARDWARE BOOTSTRAP JUMPERS

The enabling or disabling of the hardware bootstrap and the selection of the bootstrap address are the only coupler parameters that need be configured before the coupler is installed in the computer backplane. The coupler contains a bootstrap jumper that can be enabled or disabled by jumper JP5. If enabled, the bootstrap address can be changed by jumper JP6.

NOTES

1. Installation in MicroVAX II systems requires disabling the bootstrap; remove JP5.

2. With JP5 removed, the JP6 jumper has no effect on coupler operation.

3. Unused jumpers should be placed on JS (Jumper Storage).

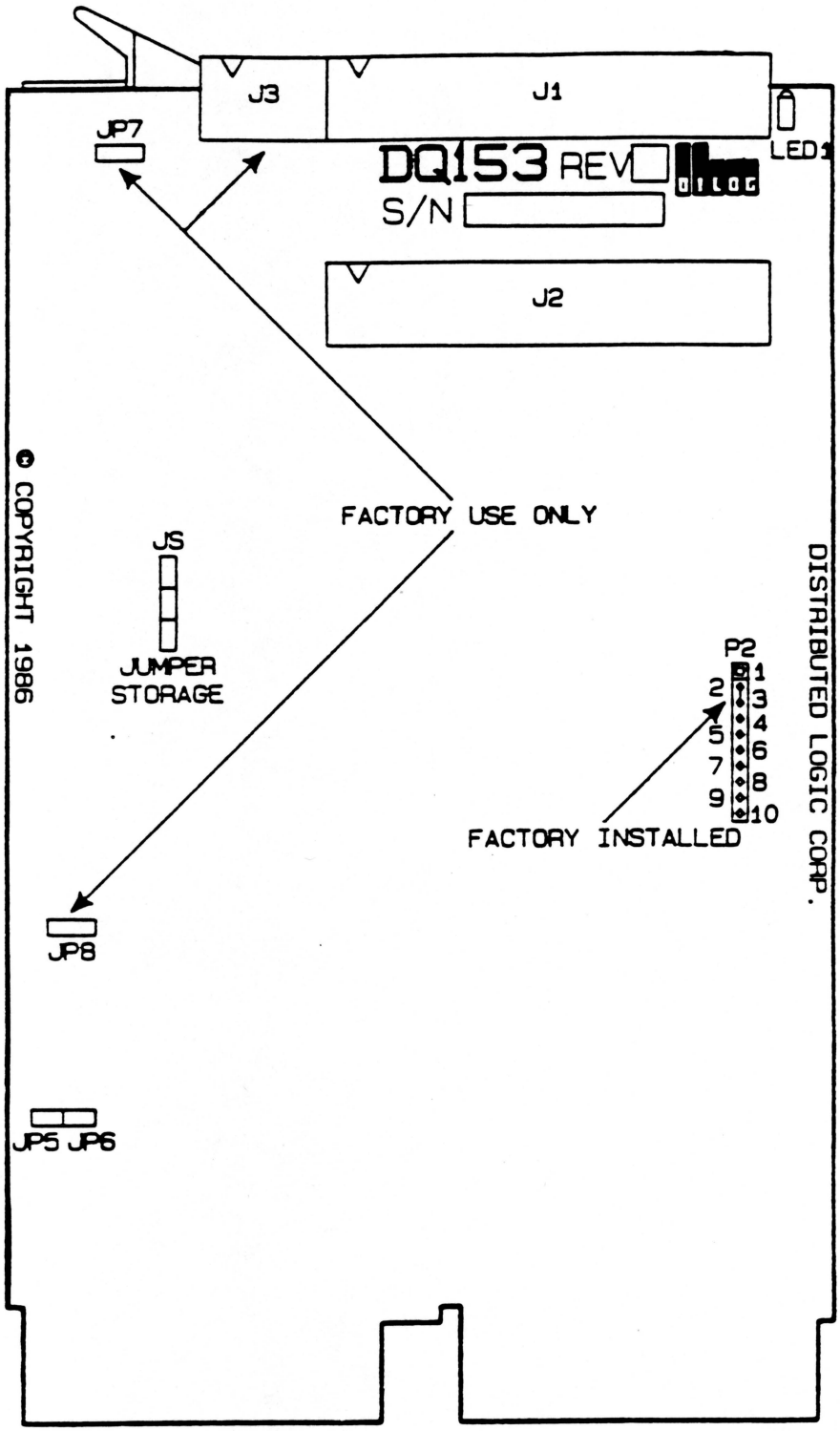
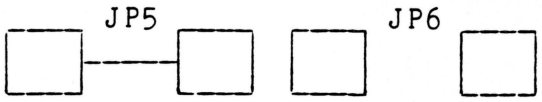
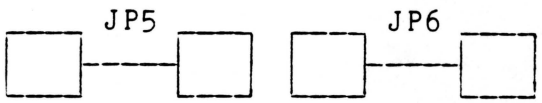
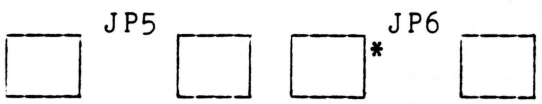


Figure 2-1. Coupler Configuration

Table 2-1. Bootstrap Select Jumpers

JUMPER CONFIGURATION	BOOTSTRAP
	Bootstrap Enabled Address 173000
	Bootstrap Enabled Address 175000
	Bootstrap Disabled: JP5 removed (Factory Select)
* Jumper can be in or out.	

PLUG P2

A factory configuration connector. Verify installation of jumper between P2-2 and P2-3.

INSTALLATION

After the bootstrap jumpers have been positioned, install the coupler as follows:

CAUTION

TURN POWER OFF ON THE COMPUTER BEFORE INSERTING OR REMOVING THE COUPLER MODULE.

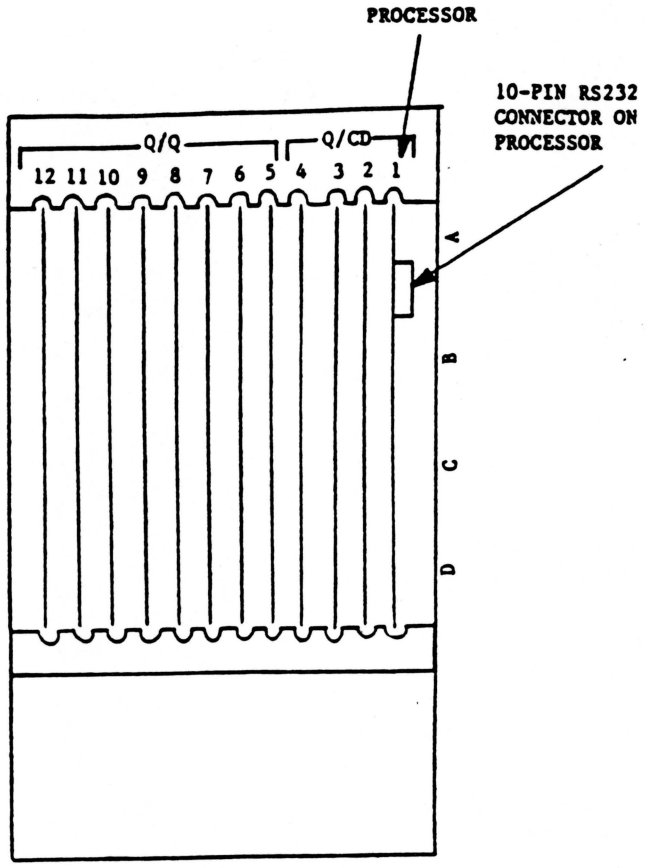
DAMAGE TO THE BACKPLANE ASSEMBLY MAY OCCUR IF THE COUPLER MODULE IS PLUGGED IN BACKWARDS.

1. Select the backplane location into which the coupler is to be inserted. There are several backplane assemblies available from DEC and other manufacturers. Figures 2-2 and 2-3 show typical backplane assemblies.

   All slots of the backplane of Q-bus based computers are not wired the same. With the introduction of the Micro/PDP-11 and the MicroVAX, the first three, and sometimes four (depending on the backplane), slots of the backplane make the C and D rows available for customer-defined signals or for the Private Memory Interconnect (PMI) bus in MicroVAX systems. These first few slots are termed Q/CD slots. In most older Q-bus based systems, the A/B and C/D slots were all wired the same so that two dual-height modules could be installed in a quad-height bus slot (these are called Q/Q backplanes). If the coupler is installed in one of the Q/CD slots, it must be installed in the A/B rows--no grant continuity card is required. If the coupler is installed in one of the Q/Q slots, it can be installed in either the A/B or C/D rows; however, the opposite rows must contain either another dual-height module or the appropriate DEC grant continuity module (M9047 for the MicroVAX; G7272 for the Micro PDP-11).

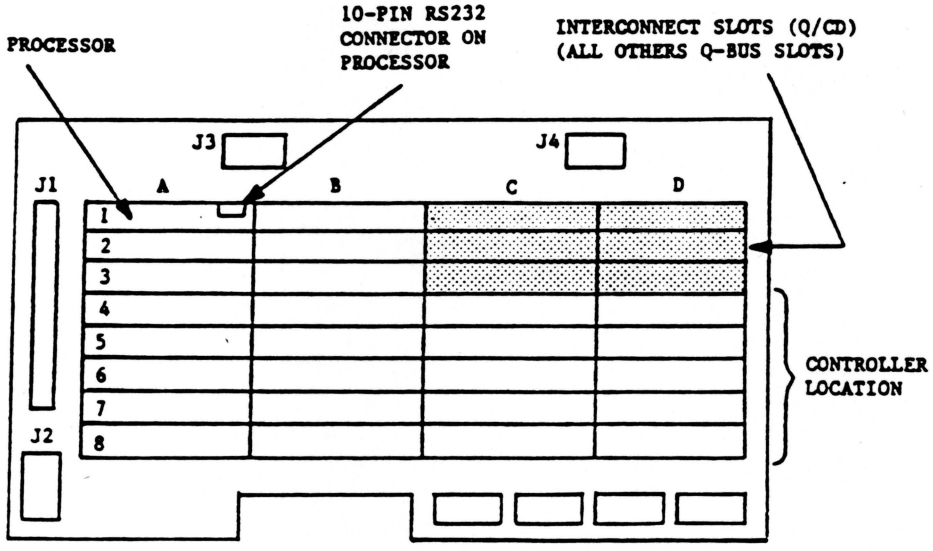
   NOTE

   The type of slot--Q/Q or Q/CD in the MicroPDP-11 or MicroVAX chassis--is identified by labels adjacent to the backplane slots in the chassis.



NOTE: Components on the board must be facing towards the Processor.

Figure 2-2. MicroVAX II Backplane (Typical)



NOTE: Components on the board must be facing towards the Processor.

Figure 2-3. MicroVAX II H9278 Backplane

2. Refer to the paragraph in this Section entitled, "Hardware Bootstrap Jumpers." Jumpers on the coupler enable or disable an onboard bootstrap jumper and also select one of two bootstrap addresses. The coupler is shipped with the bootstrap jumper disabled. Either leaving the jumper disabled or selecting an alternate address must be done before the coupler can be installed. For MicroVAX II systems, the bootstrap must be disabled.

3. Insert the coupler into the selected backplane position. Be sure the coupler is installed with the components facing row one, the processor.

   The coupler module is equipped with a handle on the side opposite the slot connectors. Gently position the module slot connectors into the backplane then press the handle until the module connectors are firmly seated into the backplane.

4. Feed the module connector end of the tape drive cable(s) into the coupler module connector(s). Install the cable connector(s) into the module connector(s). Verify that the connector(s) are firmly seated.

5. Connect the drive end of the I/O cables to the drive I/O connectors.

6. Refer to the magnetic tape manual for operating instructions and apply power to the drive and computer.

7. Observe that the green diagnostic LED on the coupler board is alternating ON and OFF about every seven seconds.

8. Refer to the paragraph in this Section entitled, "Configuring the Coupler." This paragraph describes how to modify factory-set parameters, such as coupler address, priority level, etc., if required by the system configuration.

9. The system is now ready to operate. Refer to Section 3 for operating instructions.

Except for enabling or disabling the coupler bootstrap jumper and selecting the bootstrap address (see preceding paragraph), all other user-selectable parameters which configure a magnetic tape subsystem to meet specific requirements are selected via a virtual terminal (the system console). This permits the user to modify parameters without removing the coupler board from the system. This "software configuration" technique eliminates all switches and most jumpers from the coupler board, which simplifies changing more frequently modified parameters.

Virtual terminal parameter selection is made possible by a non-volatile RAM (NOVRAM) contained on the coupler. The NOVRAM stores the coupler parameters and contains a configuration menu that is "brought up" (displayed) on the virtual terminal screen when requested by the user. The configuration menu comprises a "main" menu from which five selections may be made: two of the selections initiate diagnostic tests, two of the selections permit the user to either display or set coupler characteristics (parameters), and the last selection permits the user to set the configuration of the tape drives (units).

At the present time, 9 coupler/unit parameters may be modified by the user using the virtual terminal. All parameters are factory-set at delivery to values which, through experience, have been selected to meet the needs of the vast majority of users of magnetic tapes in their computer systems. When parameters need to be changed, typically only two or three of the 9 are involved:

A. IP/SA register address,
B. Interrupt priority.

The remaining parameters might need to be modified under special systems applications (real-time data acquisition), when a system is heavily loaded with I/O devices, or when newer tape drives with improved features become available.

The following paragraphs describe initiating communications via the virtual terminal, bootstrapping, and displaying/setting coupler parameters. A detailed description of the coupler parameters, i.e., the effect of the modification of parameters on tape subsystem operation, are contained at the end of this Section. This information is provided primarily for the use of maintenance personnel or for users that need to modify parameters to meet specific computer systems requirements.

Note that in the following discussions:

A. All addresses are in octal form unless otherwise indicated.

B. In the example user/terminal dialogue, characters underlined are output by the system; characters not underlined are input by the operator.

C. Throughout the following material, the words "coupler" and "controller" are used interchangeably and have the same meaning.

COUPLER BASE ADDRESS SELECTION CRITERIA

To operate properly in a DEC system, modules must be set to the correct base address and interrupt vector. Under the VMS operating system, the MSCP/TMSCP protocols select the interrupt vector via software: the base address, however, must be set by the user before any communication can be established with the coupler. This requires that the user have a good understanding of the rules for base and vector addressing conventions established by DEC for specifying devices in the floating address range. Only the base address for the first MSCP or TMSCP device is in the fixed address range; additional device addresses must be in the floating address range. Appendix A of this manual contains information about the rules for base address and vector addressing conventions.

The standard base address for the subsystem is 174500 (octal). This is the location of the Initialization and Polling (IP) register. The companion Status and Address (SA) register is at location 174502 (octal). As mentioned, interrupt vectors are software selectable. The standard interrupt vector for the first TMSCP device is 260 (octal). It is assumed that a DILOG coupler will be used in a system that already has one TMSCP device installed--typically the DEC "TK" type cartridge tape. Therefore, the coupler is delivered with the base address set to 160404 (octal) in the floating address range. Be aware that this address may have to be changed if:

A. There are additional TMSCP couplers installed in the system;

B. There is more that one MSCP (disk) controller installed in the system;

C. There are more than one or two communications controllers installed in the system.

To reemphasize, the base address of the DILOG coupler is dependent on the total system configuration. Therefore, it is advisable to use the "SYSGEN" utility under VMS to a) first determine existing system components and their addresses then b) assign an address, or addresses, to the DILOG device to be installed (see pages A-3 through A-10 of Appendix A).

NOTES

1. All TMSCP devices, i.e. TK50, TK70, TU80, TU81, TSV05, etc., (and tape emulators) have the same logical name in the SYSGEN device table, which is TU81, device name PT, rank #53, PU driver.

2. "CSR" and "IP" are used interchangeably as mnemonic designators of the base address register throughout DEC documentation. The base address register mnemonic relates to the class of software driver routine associated with the coupler/controller.

3. Throughout this document 16-bit octal address form is used even though most often the coupler will be installed in a 22-bit system, wherein the address entered to communicate with the coupler must be in 22-bit octal form, or 32-bit hex form when used with MicroVAX systems. This is because when setting up the base address via a terminal under the FT (format) program, the terminal display and values entered by the user MUST BE in 16-bit form.

4. When used with MicroVAX systems, if a TMSCP controller is already installed at the factory-selected base address, an alternate address must be selected.

   To select the alternate address via the console terminal: remove the installed controller with an address identical to the DILOG coupler, install the DILOG coupler and change the factory configured address to conform to the system configuration and address selection rules.

5. If there are two or more MSCP (disk) controllers installed in the MicroVAX, the address of the DILOG coupler must be changed from 160404 to 160444 (see example Table A-5, columns two and three, Appendix A). Further note that if additional communications controllers with higher rankings than the TMSCP device are installed, the DILOG coupler address must also be changed to 160444, and if a second MSCP controller is installed, the address may have to be changed to 160444. Again refer to Table A-5 in Appendix A. Alternate addresses are given in Tables 2-2 and 2-4 of this Section.

6. There is a difference between the terms "Default" and "Factory Set." The Default base address is that address specified by DEC for the first TMSCP device installed in the system; the Factory set base address is set by DILOG prior to delivery. Note if the user loses track of which base address has been selected, the DEC Default IP address 174500 can be loadedd into the NOVRAM by entering an "N" from the configuration menu. This will cause the following to be displayed:

   * * NOVRAM DEFAULT LOADED * *

INITIATING COMMUNICATIONS FOR LSI SYSTEMS VIA VIRTUAL TERMINAL

The system console is used as the terminal for serial communication. In order to initiate communication via the virtual terminal, the system console must first be placed in the ODT (Online Debugging Technique) mode.

If the bootstrap jumper on the coupler is enabled, a boot must be initiated by typing on the system console either 77775000G or 77773000G, depending on which boot address is selected on the coupler (see paragraph on hardware jumpers for details on boot address selection). The system console will respond with an "*" as a prompt. At this point, the user can respond to the prompt in two ways. The user can either type "MU," which will tell the coupler to attempt a boot from a bootable tape, or "FT," which will bring up the configuration menu.

NOTES

1. When making a selection, capital letters must be used.

2. All entries are in octal form.

For example, if the bootstrap is enabled and the boot address is 175000, proceed as follows (enter):

@ 77775000G
(If the bootstrap address is 173000, enter 77773000G.)

*

If the boot on the coupler is disabled, communications via the virtual terminal can be initiated by typing 77777 to the SA address (SA address = 160406) followed by a carriage return. The user must then type 2000G. The system console will respond with an "*" as a prompt. The user then has the option of typing either "MU" or "FT" (the same options as described above).

NOTE

This procedure will work regardless of whether the boot address of the coupler is enabled or disabled.

For example, if the IP address is 160404 (SA is 160406), proceed as follows:

@ 17160404/0 <CR>

@ 17160406/005600 77777 <CR>

@ 2000G

*

The coupler not only supports standard DEC devices during the bootstrap procedure, but also allows the use of the onboard configuration menu in NOVRAM. When "MU" is used, the standard DEC emulation is called. When "FT" is used, the onboard configuration menu is brought up for display and use via the system console. For example:

```
*   Enter one of the following: DMO, DPO, DRO, MSO, MTO, DYO,
    DU, MU, or FT <CR>
```

Definitions are as follows:

```
DM = RK06/07 Disk
DP = RP02/03 Disk
DL = RL01/02 Disk
DR = RM03/05/80 Disk
MS = TS11 Tape
MT = TM11 Tape
DY = RX02 Floppy Disk
DU = DU (Disk) Emulation
MU = MU (Tape) Emulation
FT =Enable onboard configuration menu through system
    console
```

INITIATING COMMUNICATIONS VIA VIRTUAL TERMINAL FOR MICROVAX SYSTEMS

In order to initiate communication via the virtual terminal, the system console is used for serial communications. Note that the bootstrap jumper must be disabled: JP5 removed.

Upon powering up the MicroVAX II, the user must first set up the MicroVAX II I/O mapping register via the system console; type 3FFF hex to the SA register address (SA Factory Set address = 20000106 hex) and start executing code at location 200 hex as shown in Table 2-2. After executing the illustrated procedure, the configuration menu is displayed on the system console. Factory Set and alternate SA address possibilities are given in Table 2-2 in both octal and hex form.

Table 2-2. Procedure to Initialize Virtual Terminal Communications for MicroVAX II

>>>D/P/L 20088004 80000001 <CR>	<---- Setup MicroVAX II I/O map (hex notation).
>>>D/P/W 20001F40 20 <CR>	<---- Setup MicroVAX II I/O map (hex notation).
>>>D/P/W xxxxxxxx 3FFF <CR>	<---- Deposit 3FFF hex in SA address. The values of xxxxxxxx are hex values of the coupler address and are listed below.
>>>S 200 <CR>	<---- Start executing code at location 200 hex.

At this point the configuration menu should be displayed.

NOTE

When a GPX (Graphics Work Station) is used enter >>>S 218 <CR> instead of 200.

The octal and hex values of the recommended addresses are as follows:

IP REGISTER OCTAL ADDRESS	SA REGISTER OCTAL ADDRESS	IP REGISTER HEX ADDRESS ENTERED	SA REGISTER HEX ADDRESS ENTERED
174500	174502	20001940	20001942
*160404	160406	20000104	20000106
160410	160412	20000108	2000010A
160414	160416	2000010C	2000010E
160444	160446	20000124	20000126
160450	160452	20000128	2000012A
160454	160456	2000012C	2000012E

* Factory Set Address

CONFIGURATION MENU

The logo and configuration menu is shown in the first two examples that follow, but is omitted in the subsequent examples.

Upon entering the coupler's onboard configuration menu, the following will be displayed:

```
------------------------------------------------------------------------
   DILOG On Board Configuration Menu          IP/SA Address = 160404
   Version: XX   Model: DQ153
------------------------------------------------------------------------

     CONFIGURATION MENU
     ------------------
     1 - STANDARD DIAGNOSTICS
     2 - HOST Q-BUS MEMORY - DMA TEST
     3 - DISPLAY CHARACTERISTICS
     4 - SET CONTROLLER CHARACTERISTICS
     5 - SET UNIT CHARACTERISTICS

     ENTER A SELECTION:
```

Any of the five selections may be entered at the prompt by simply typing the number that corresponds to the desired selection, followed by a carriage return.

STANDARD DIAGNOSTICS

The first selection, enables the coupler to run its onboard diagnostics. Each time a diagnostic test is successfully passed, a "." will be printed on the screen. It takes approximately seven seconds for the coupler to make one pass through all the diagnostic tests. The coupler will continue to loop on the diagnostic tests until a CTRL C (^C) is typed on the terminal. (Notice that the coupler does not respond immediately to the ^C when in the virtual terminal mode. It takes several seconds for the coupler to respond, so please be patient.)

Upon recognizing the ^C, the coupler will return to the configuration menu. If an error is encountered during the execution of a diagnostic test, an "E" will be printed on the screen and the onboard LED will flash the appropriate error code (see documentation on error code flashing for details, Table 3-1). The coupler will conduct a loop on error process until either a ^C is detected or a power on reset is conducted.

The second selection, enables the coupler to conduct DMA transfers to and from the host system.

CAUTION

THIS TEST WILL WRITE ALL OF HOST MEMORY--THEREFORE, ANYTHING RESIDING IN HOST MEMORY WHILE THIS TEST IS BEING CONDUCTED WILL BE OVERWRITTEN!!

This test verifies that data written to and read from the host is valid to ensure that operations between the host and the coupler are functioning properly.

NOTE

This test will not be executed if operating in virtual terminal mode.

For example:

```
-------------------------------------------------------------------
 DILOG ON BOARD CONFIGURATION MENU          IP/SA ADDRESS = 160404
 VERSION: XX   MODEL: DQ153
-------------------------------------------------------------------

  CONFIGURATION MENU
  ------------------
  1 -STANDARD DIAGNOSTICS
  2 -HOST QBUS MEMORY - DMA TEST
  3 -DISPLAY CHARACTERISTICS
  4 -SET CONTROLLER CHARACTERISTICS
  5 -SET UNIT CHARACTERISTICS

  ENTER A SELECTION: 2
  (CTRL-C aborts back to menu)

  Sizing host memory....
  MEMORY SIZE = 0200 HEX (in Kbytes)
  Testing Host DMA....
  ...Testing DMA on odd, even addresses and byte count
  ...Testing write reverse
  E
```

The third, fourth and fifth selections enable the user to configure the coupler and tape drives. For details, see the "Display Controller/Unit Characteristics" and "Set Coupler/Unit Characteristics" paragraphs of this Section.

DISPLAY CONTROLLER/UNIT CHARACTERISTICS

The following are two examples of the third selection from the Configuration Menu:

NOTE

Throughout the following material, the IP/SA Address (in octal) in the "FT" (format) mode will be displayed in 16-bit form as shown in the following examples, i.e., 160404 rather than 760404 (18-bit form) or 17760404 (22-bit form). Sixteen bits is the maximum word length of a NOVRAM location. When changing the IP/SA address via the console monitor in the "FT" mode, the operator must enter the new address in 16-bit form.

```
DISPLAY CONFIGURATION
---------------------
IP/SA ADDRESS (IN OCTAL):                    [160404]
BASE LOGICAL UNIT OFFSET:                    [00]
INTERRUPT PRIORITY:                          [04]
DWELL TIME (1,2,4,8 USEC):                   [01]
BURST SIZE (IN WORDS):                       [08]
```

DISPLAY UNIT CHARACTERISTICS

```
                          LOGICAL UNIT 00        LOGICAL UNIT 01
TAPE DRIVE:                  [Cached]            [Not Configured]
BYTE SWAP (IBM format):     [Disabled]
800 BPI density:        [Not Supported] *
1600 BPI density:     [PERTEC CMD = 1C] *
6250 BPI density:     [PERTEC CMD = 1E] *


                          LOGICAL UNIT 02        LOGICAL UNIT 03
TAPE DRIVE:              [Not Configured]        [Not Configured]
BYTE SWAP (IBM format):
800 BPI density:
1600 BPI density:
6250 BPI density:
```

DISPLAY UNIT CHARACTERISTICS

	LOGICAL UNIT 00	LOGICAL UNIT 01
TAPE DRIVE:	[Cached]	[Cached]
BYTE SWAP (IBM format):	[Disabled]	[Disabled]
800 BPI density:	[Not Supported]*	[Not Supported]*
1600 BPI density:	[PERTEC CMD = 1C]*	[PERTEC CMD = 1C]*
6250 BPI density:	[PERTEC CMD = 1E]*	[PERTEC CMD = 1E]*

	LOGICAL UNIT 02	LOGICAL UNIT 03
TAPE DRIVE:	[Non-Cached]	[Non-Cached]
BYTE SWAP (IBM format):	[Disabled]	[Disabled]
800 BPI density:	[RTH2=0,RTH1=1,DEN=0]**	[RTH2=0,RTH1=1,DEN=0]**
1600 BPI density:	[RTH2=0,RTH1=0,DEN=1]**	[RTH2=0,RTH1=0,DEN=1]**
6250 BPI density:	[RTH2=0,RTH1=1,DEN=1]**	[RTH2=0,RTH1=1,DEN=1]**

* Illustrates one of the three ways Density can be configured at the coupler (see "Remote Selection of Tape Drive Density"). Enter carriage return <CR> to select "Not Supported".

** Illustrates one of the three ways Density can be configured and the only way speed can be configured at the coupler (see "Remote Selection of Tape Drive Density").

NOTE

Remote speed selection via the DEN line does not work with many of the older model tape drives. In these drives, the DEN signal line is still used to select between high or low density. With the introduction of the F880, and newer model tape drives, the tape drive manufacturers changed the signal characteristics of this line to permit remote selection of speed. It is important to examine the connector tables in the tape drive manual to determine how the manufacturer of your particular tape drive defines the function of the DEN line. IF IN DOUBT, SELECT SPEED LOCALLY AT THE TAPE DRIVE.

SET COUPLER/UNIT CHARACTERISTICS

Selection 4 and 5 of the Configuration Menu allows the user to set the coupler and unit characteristics (i.e. set up the NOVRAM).

In order to set the coupler/unit characteristics, the user is prompted for all information. First, the user is prompted for the IP/SA Address. The "IP/SA Address (in octal)" followed by a prompt (:) and the current setting in brackets is displayed.

The user now has the option of changing the current IP/SA address by typing a new address at the prompt, followed by a carriage return. If the user does not wish to change the address, typing a carriage return will leave the address unchanged. In either case, the user will next be prompted for the Base Logical Unit Offset.

The user will again have the option to either change or not change the value displayed. As each carriage return is typed, the user is prompted for a "change or not change" decision on each characteristic until all information on the coupler characteristics has been prompted for. The coupler will then prompt the user as to whether or not the new configuration is to be saved in the coupler NOVRAM. If the user chooses not to save the new configuration (N), the coupler will simply display a message saying that the new configuration was not saved. Typing a carriage return <CR> at this time will display the configuration menu again. If the user chooses to save the new configuration (Y), the coupler will respond with the following message:

```
NEW CONFIGURATION SAVED IN NOVRAM...
REBOOT SYSTEM TO CONFIGURE COUPLER HARDWARE!
```

The host system needs to be rebooted only if the IP/SA address was changed; if the IP/SA address was not changed, typing a carriage return will return the terminal display to the Configuration Menu.

During the prompting for the coupler characteristics, the coupler will respond with an "Invalid Setting" message if the user response is considered invalid.

Table 2-3 lists valid setting ranges for each of the coupler configuration characteristics. Following the table are examples of setting coupler and unit characteristics.

Table 2-3. Coupler Characteristics Valid Optional Values

CHARACTERISTIC	FACTORY SET	RANGE
IP/SA Address:	160404 octal	160404,160410,160414 160444,160450,160454 174500 octal values
Base Logic Unit Offset:	00 decimal	00-99 decimal
Interrupt Priority:	04 decimal	04,05 decimal
Dwell Time (1,2,4,8 usec):	01 decimal	1,2,4,8 decimal
Burst Size (in words):	08 decimal	2-16 decimal

Remote Density (See Note under DISPLAY UNIT CHARACTERISTICS)

The controller has the ability to select drive densities, and (depending upon your tape drive) in one case speed, remotely. This is done via the monitor NOVRAM. The monitor allows the user to specify the densities for each of the four drives. Density select is accomplished in one of three ways. The user can select one of the pre-configured drives, which are displayed, or select the "OTHER" option which provides two ways to enter the densities manually. The following is a list of drives supported and pre-configured:

DRIVE TYPE	800	1600	DEFAULT 3200/6250
Pertec FS2000	x	x	6250
Cipher M990		x	6250
Cipher M89X		x	3200 *
Cipher F880		x	3200 *
STC 2920 Series		x	6250
Kennedy 9400	x	x	6250
Kennedy 9600 Series	x	x	6250
Kennedy 9610/60 Series	x	x	6250
Hewlett-Packard 8878A		x	6250
CDC Keystone		x	6250
Fujitsu 244x Series		x	6250

* Since DEC Operating Systems don't recognize 3200 BPI and there are drives that have 3200 BPI and not 6250 BPI; these drives will select 3200 BPI when the Host selects 6250 BPI. This allows these drives to be remote density selected.

Selecting "0" after "Type of Drive," requires density and speed selection be done manually at the drive. Refer to the NOTE under "DISPLAY UNIT CHARACTERISTICS," depending upon your tape drive, it may not be possible to select speed remotely via the DEN line. Read your tape drive manual!

SAVE/NOT SAVE CONTROLLER CHARACTERISTICS

When item 4 of the Configuration Menu is selected, the new configuration can be optionally saved or not saved.

Characteristics Saved

```
SET CONTROLLER CONFIGURATION
----------------------------
[ ] = current configuration,  <CR> = defaults to current setting

IP/SA ADDRESS (in octal):                              [160404]
BASE LOGICAL UNIT OFFSET:                              [00]
INTERRUPT PRIORITY:                                    [04]
DWELL TIME (1,2,4,8 usec):                             [01]
BURST SIZE (in words):                                 [08]

     SAVE NEW CONFIGURATION  (Y/N)  ?  Y

     NEW CONFIGURATION SAVED IN NOVRAM...
REBOOT SYSTEM TO CONFIGURE CONTROLLER HARDWARE!

     ** ** ** PRESS <CR> TO CONTINUE ** ** **
```

Characteristics Not Saved

```
SET CONTROLLER CONFIGURATION
----------------------------
[ ] = current configuration,  <CR> = defaults to current setting

IP/SA ADDRESS (in octal):                              [160404]
BASE LOGICAL UNIT OFFSET:                              [00]
INTERRUPT PRIORITY:                                    [04]
DWELL TIME (1,2,4,8 usec):                             [01]
BURST SIZE (in words):                                 [08]

     SAVE NEW CONFIGURATION  (Y/N)  ?  N

     NEW CONFIGURATION NOT SAVED

     ** ** ** PRESS <CR> TO CONTINUE ** ** **
```

SET UNIT CHARACTERISTICS

Selection 5 of the Configuration Menu allows the user to set the unit characteristics.

The following examples illustrate the different ways to set the logical unit characteristics:

```
SET UNIT CONFIGURATION
----------------------
BASE LOGICAL UNIT OFFSET = 00
CONFIGURE WHICH LOGICAL UNIT [00,01,02,03]  0

                  CONFIGURING LOGICAL UNIT 00
[ ] = current configuration,  <CR> = defaults to current setting

REMOVE CONFIGURATION     (Y/N) ?  N *
IS TAPE DRIVE CACHED:    [Cached]     (Y/N) ?
BYTE SWAP (IBM format):  [Disabled]   (E/D) ?

 0)  Remote Density Select Disabled
 1)  Pertec FS2000
 2)  Cipher M990
 3)  Cipher M89X
 4)  Cipher F880
 5)  STC 2920 Series
 6)  Kennedy 9400
 7)  Kennedy 9600 Series
 8)  Kennedy 9610/60 Series
 9)  Hewlett-Packard 88780A
10)  CDC Keystone
11)  Fujitsu 244x Series
12)  Other

          TYPE OF DRIVE?  11

     SAVE NEW CONFIGURATION  (Y/N)  ?  Y

     NEW CONFIGURATION SAVED IN NOVRAM...
REBOOT SYSTEM TO CONFIGURE CONTROLLER HARDWARE!

     ** ** ** PRESS <CR> TO CONTINUE ** ** **
```

* NOTE: If unit was <u>not</u> previously configured, this statement <u>will</u> <u>not</u> appear in the Menu.

```
SET UNIT CONFIGURATION
----------------------
BASE LOGICAL UNIT OFFSET = 00
CONFIGURE WHICH LOGICAL UNIT [00,01,02,03]  3

                    CONFIGURING LOGICAL UNIT 03
[ ] = current configuration,  <CR> = defaults to current setting

IS TAPE DRIVE CACHED:     [Non-Cached]      (Y/N) ?
BYTE SWAP (IBM format):    [Disabled]    (E/D) ?

 0)  Remote Density Select Disabled
 1)  Pertec FS2000
 2)  Cipher M990
 3)  Cipher M89X
 4)  Cipher F880
 5)  STC 2920 Series
 6)  Kennedy 9400
 7)  Kennedy 9600 Series
 8)  Kennedy 9610/60 Series
 9)  Hewlett-Packard 88780A
10)  CDC Keystone
11)  Fujitsu 244x Series
12)  Other

          TYPE OF DRIVE?  12

DENSITY SELECT VIA PERTEC COMMAND (Y/N)  ? N *

800 BPI density:
                RTH2= 0
                RTH1= 1
                DEN=  0
1600 BPI density:
                RTH2= 0
                RTH1= 0
                DEN=  1
6250 BPI density:
                RTH2= 0
                RTH1= 1
                DEN=  1

     SAVE NEW CONFIGURATION  (Y/N)  ?  Y

     NEW CONFIGURATION SAVED IN NOVRAM...
REBOOT SYSTEM TO CONFIGURE CONTROLLER HARDWARE!
```

* NOTE: If pre-configured drive type not selected, one of two additional ways to select Density and the only way to select speed at the coupler. Remember from preceding statements, i.e., NOTE under DISPLAY UNIT CHARACTERISTICS, for many older tape drives the DEN line may not be used to select speed. Read your tape drive manual!

```
SET UNIT CONFIGURATION
----------------------
BASE LOGICAL UNIT OFFSET = 00
CONFIGURE WHICH LOGICAL UNIT [00,01,02,03]  1

                  CONFIGURING LOGICAL UNIT 01
[ ] = current configuration,  <CR> = defaults to current setting

IS TAPE DRIVE CACHED:    [Non-Cached]     (Y/N) ?
BYTE SWAP (IBM format):   [Disabled]   (E/D) ?

 0)  Remote Density Select Disabled
 1)  Pertec FS2000
 2)  Cipher M990
 3)  Cipher M89X
 4)  Cipher F880
 5)  STC 2920 Series
 6)  Kennedy 9400
 7)  Kennedy 9600 Series
 8)  Kennedy 9610/60 Series
 9)  Hewlett-Packard 88780A
10)  CDC Keystone
11)  Fujitsu 244x Series
12)  Other

          TYPE OF DRIVE?  12 *

DENSITY SELECT VIA PERTEC COMMAND (Y/N)  ? Y
800 BPI density:
          PERTEC CMD (ED,ER,WF,RE,WR) = <CR>
1600 BPI density:
          PERTEC CMD (ED,ER,WF,RE,WR) = 1C
6250 BPI density:
          PERTEC CMD (ED,ER,WF,RE,WR) = 1E

     SAVE NEW CONFIGURATION  (Y/N)  ?  Y

     NEW CONFIGURATION SAVED IN NOVRAM...
REBOOT SYSTEM TO CONFIGURE CONTROLLER HARDWARE!
```

* NOTE: If pre-configured drive type not selected, one of two additional ways to select Density at the coupler.

The following illustrates how to remove saved configurations:

```
SET UNIT CONFIGURATION
----------------------
BASE LOGICAL UNIT OFFSET = 00
CONFIGURE WHICH LOGICAL UNIT [00,01,02,03]  3

                    CONFIGURING LOGICAL UNIT 03
[ ] = current configuration,  <CR> = defaults to current setting

REMOVE CONFIGURATION     (Y/N) ?  Y
```

Repeat the above on all logical units that need to be removed, substituting the "configured" logical unit number to be removed for "3" in the example.

HOW TO FIND CURRENT IP ADDRESS

In case the user ever changes the coupler address (IP address) and forgets what value it was set to, the following steps should be taken:

For LSI-11 System

1) Enable the boot address on the coupler and make sure that no other controller is using the same boot address (see details on hardware jumpers). IMPORTANT: Make sure the system is powered down before removing the coupler and changing jumpers!

2) Reinstall the coupler and power up the system. Conduct a boot by typing on the system console either 77775000G or 77773000G, depending on what boot address the user has enabled.

3) Wait for the "*" prompt.

4) Halt the host system processor and look at address location 0. Location 0 should contain the IP address.

For MicroVAX System

1) Conduct a power-on reset to the coupler (i.e., power down then power back up the host system).

2) Check all possible IP addresses that can be selected on the coupler via the system console (refer to hex address possibilities in Table 2-4).

   How to examine addresses on MicroVAX II:

   >>>E/P/W xxxxxxxx <CR> <---- Allows user to examine location xxxxxxxx, a coupler SA hex address from Table 2-4.

3) Once the user finds an address suspected to be the coupler address, a 0 should be deposited in the corresponding IP address. If the coupler responds with a 5600 hex in the SA address, the correct coupler address has been found.

   How to deposit a 0 on MicroVAX II:

   >>>D/P/W xxxxxxxx 0 <CR> <---- Allows user to deposit a 0 at location xxxxxxxx, an IP hex address from Table 2-4.

4) If the coupler address does not respond with 5600 hex, go back to step 2 of this procedure.

Table 2-4. IP and SA Octal and Hex Address Correlation

IP REGISTER OCTAL ADDRESS	SA REGISTER OCTAL ADDRESS	IP REGISTER HEX ADDRESS	SA REGISTER HEX ADDRESS
174500	174502	20001940	20001942
160404*	160406	20000104	20000106
160410	160412	20000108	2000010A
160414	160416	2000010C	2000010E
160444	160446	20000124	20000126
160450	160452	20000128	2000012A
160454	160456	2000012C	2000012E

* Factory-Set address when controller is delivered. If an existing TMSCP Controller is installed, it is assumed to be installed at address 174500.

NOTE

Alternate address for TMSCP devices. If there are two or more MSCP disk controllers installed in the MVAX, the address for MUB0 must be 160444. If there is only one MSCP controller installed the address for MUB0 is 160404. See Note 5, page 2-9.

For addresses other than the above (address range 160000-177774) perform the following to calculate hex addresses for MicroVAX computers:

A. Convert the 13 least significant bits of the address in octal to hexadecimal.

B. Add 20000000.

For example, if the octal address is 177774, the hex value is obtained as follows:

A. 177774 octal with 13 LS bits = 17774, converted to hex = 1FFC.

B. 1FFC + 200000000 = 20001FFC.

DESCRIPTION OF USER-SELECTABLE COUPLER PARAMETERS

The coupler contains a NOVRAM (non volatile RAM) and one set of jumpers that permit a user to configure a magnetic tape subsystem to meet specific requirements. That configuration parameter which is seldom changed--the bootstrap enable/disable and bootstrap address--can be modified by jumpers; more frequently modified parameters can be modified by changing the contents of locations in the NOVRAM. These parameters can be modified without removing the coupler from the system by means of a "software configuration procedure." This procedure is described in preceding paragraphs.

The following paragraphs present a briefdescription of the purpose of each parameter. A preceding paragraph of this section, CONFIGURING THE COUPLER, describes how to configure the coupler via a virtual terminal.

The coupler is shipped with all configuration parameters set to a "Factory Set" state, which is that configuration most commonly required for an MU device in a Q-bus based system. Those parameters that can be modified and their default settings are as follows:

A. Bootstrap jumper address select/enable or disable: Bootstrap disabled (jumper selectable).

		FACTORYSET VALUE
B.	IP/SA Address:	[160404 octal]
C.	Base Logical Unit Offset:	[00 decimal]
D.	Interrupt Priority:	[04 decimal]
E.	Dwell Time:	[01 decimal]
F.	Burst Size (in words):	[08 decimal]
G.	Configure which Logical Unit [00,01,02,03]: 0	
H.	Remove Configuration: (Y/N) ?	
I.	Is Tape Drive Cached: [Cached] (Y/N) ?	
J.	Byte Swap (IBM format): [Disabled] (E/D) ?	
K.	Density Select:	

COUPLER ADDRESS SELECT

If the system already has one MU compatible tape subsystem installed, the base address register setting of the coupler may have to be changed. When delivered, the Factory Set addresses stored in NOVRAM are:

IP = 160404
SA = 160406

These addresses are recognized by the driver software as the base logical unit (LU). Note that when the IP address is selected, the SA address is automatically selected Modulus 2 above the IP address. Suggested optional base register addresses are given in Table 2-4.

BASE LOGICAL UNIT OFFSET

Up to four physical tape drives can be connected to the coupler, typically identified as drives 0, 1, 2, and 3. MSCP and TMSCP drivers permit a large number of devices, termed "units," to be controlled. The Base Logical Unit Offset characteristic establishes the logical address of the first drive (physical drive 0) of up to four drives connected to the coupler. Additional drives connected to the coupler are automatically assigned the next highest logical unit number by the coupler. The base logical unit range is from 00 to 99 decimal. Thus, for the default setting of 00 the correlation between base units and physical drives would be as follows:

LOGICAL UNIT	PHYSICAL DRIVE
00	0
01	1
02	2
03	3

If the Base Logical Unit Offset value were set to 20, the correlation between base units and physical drives would be as follows:

LOGICAL UNIT	PHYSICAL DRIVE
20	0
21	1
22	2
23	3

INTERRUPT PRIORITY LEVEL

The interrupt priority level is set to BR4 (Factory Set) when the coupler is shipped. The priority level is software selectable to BR4, or BR5.

Even though BR4 is the lowest priority level, the priority level should not need to be changed. The 64K byte buffer on the coupler should prevent "data late" errors.

BLOCK MODE DMA BURST SIZE AND DWELL TIME

If block mode DMA is automatically selected, the number of words transferred in each block (burst size) and the dwell time between bursts is software selectable. The factory setting for burst size is eight (8) words; the factory dwell time setting between block mode transfers is 1 microsecond.

Block mode burst sizes are typically four, six, or eight words. The maximum burst size allowed is 16 words by DEC's definition. On older Q-bus based systems with block mode memory capability, the burst size may have to be set to two or four words maximum.

Dwell time is a feature of the DILOG coupler which permits devices at lower priority levels, either logically or physically, on the Q-bus to gain access to the processor. With the extensive buffering on the coupler a large amount of data could be stored in the coupler's FIFO buffer ready for transfer to memory. Therefore, as soon as one "burst" of data had been accepted by the memory, the coupler would be ready to request control of the bus almost immediately. If a device, either interrupt driven or DMA, on the same, or lower, priority level was requesting bus control, the coupler could block the processor DMA grant or interrupt acknowledge lines to this device effectively "locking" this device off the bus. Therefore, the coupler contains an adjustable timer which establishes a "dwell" time after a burst transfer and before a subsequent bus request from the coupler to preclude this "lock-out" condition. This dwell time feature can be adjusted for maximum system efficiency. One microsecond is usually adequate to permit all devices to gain access to the processor; four microseconds would be a very long dwell time. Note that the dwell time is adjustable between zero, which would be acceptable if the MU device were the only device at level BR4 and the coupler physically farthest removed from the processor in the backplane, and 8 microseconds.

REMOTE SELECTION OF TAPE DRIVE DENSITY (800, 1600, 6250)

Typically, depending upon the tape drive, density selection is done by a switch or switches at the tape drive. The DENSITY SELECT switch(s) usually overrides any remote selection. Refer to the tape drive manual for details. Density selection, both manual and remote, is usually done only at BOT for write-type operations and is then stored in the drive until changed. For read operations, density is automatically selected at BOT by testing the "ID burst." In any case, remote density selection can be done ONLY if the tape drive is in the REMOTE DENSITY select mode. Selecting "0" after "Type of Drive?" prompt requires density selection be done manually at the drive.

The controller has the ability to select drive densities remotely. This is done via the monitor NOVRAM. The monitor allows the user to specify the densities for each of the four drives. Density select is accomplished in one of two ways. The user can select one of the preconfigured drives, which are displayed, or select the "OTHER" option which allows the densities to be entered manually. The following is a list of preconfigured drives supported:

DRIVE TYPE	800	1600	DEFAULT 3200/6250
Pertec FS2000	x	x	6250
Cipher M990		x	6250
Cipher M89X		x	3200 *
Cipher F880		x	3200 *
STC 2920 Series		x	6250
Kennedy 9400	x	x	6250
Kennedy 9600 Series	x	x	6250
Kennedy 9610/60 Series	x	x	6250
Hewlett-Packard 8878A		x	6250
CDC Keystone		x	6250
Fujitsu 244x Series		x	6250

* Since DEC Operating Systems don't recognize 3200 BPI and there are drives that have 3200 BPI and not 6250 BPI; these drives will select 3200 BPI when the Host selects 6250 BPI. This allows these drives to be remote density selected.

There are two ways to select density and (depending upon the tape drive) one way to select speed when the OTHER (12) option is selected either of the two ways is selected depending upon the "Y" or "N" response to the "DENSITY SELECT VIA PERTEC COMMAND (Y/N/)?" prompt in the "SET UNIT CONFIGURATION" menu.

Please refer to the two examples given in the preceding SET UNIT CONFIGURATION paragraph wherein 12 is entered after the TYPE OF DRIVE? prompt.

When N is entered in response to the DENSITY SELECT VIA PERTEC COMMAND (Y/N) ? the interface lines RTH2, RTH1, and DEN are used to select densities and speed from the coupler. This is the only case where speed can be selected from the coupler. RTH2 and RTH1 select density and DEN selects speed (high or low). Note that the signal states on these lines may vary depending upon the tape drive being configured; the appropriate tape drive manual must always be referred to. The examples given in this manual are with reference to the PERTEC FS2000 FORMATTED TAPE DRIVE INSTALLATION AND OPERATION manual No. 114067. The following table correlates the binary responses (1 or 0) to the 800, 1600, OR 6250 DENSITY prompts:

RTH1 AND RTH2 DENSITY SELECTION

RTH1	RTH2	DENSITY
0	0	3200 cpi (DDPE)
0	1	1600 cpi (PE)
1	0	800 cpi (NRZI)
1	1	6250 cpi (GCR)

For speed selection binary 1 or 0 entries after the DEN prompt select either high (typically 100 ips) or low (typically 50 ips) operation. Entering "1" selects high speed operation; entering "0" selects low speed operation, depending upon your tape drive model. See NOTE under "DISPLAY UNIT CHARACTERISTICS."

If "Y" is entered in response to the DENSITY SELECT VIA PERTEC COMMAND (Y/N) ? prompt, then the command lines are used to enter density settings to the tape drive from the coupler. In this mode speed cannot be selected from the coupler. After each density selection possibility, a PERTEC CMD (ED, ER, WF, RE, WR) = prompt will be displayed. The response to the prompt must be in hexadecimal form and refers to the command abbreviations in the parenthesis. The following table correlates the abbreviations with the commands and the binary position to form the hexadecimal number. Again, the command invoked based upon the bit configuration on the command lines may differ from tape drive to tape drive; the appropriate tape drive manual must be referred to.

Abbreviation/Command--most to least significant digit

ED--EDit ER--ERase WF--Write File mark RE--REverse WR--WRite

The equivalent command order, most to least significant digit, for the Pertec FS2000 tape drive is as follows:

IREVerse IWRite IWrite File Mark IEDIT IERASE

If one were to configure the Pertec densities using the OTHER prompt, the following hex values would be entered after the appropriate prompts:

```
 800 BPI DENSITY:   [PERTEC CMD = 0B]
1600 BPI DENSITY:   [PERTEC CMD = 1C]
6250 BPI DENSITY:   [PERTEC CMD = 03]
```

This would result in the following bit configuration in the NOVRAM and the corresponding bit configuration on the Pertec command lines:

	DILOG LINES (NOVRAM)						PERTEC LINES					
BPI	ED	ER	WF	RE	WR	HEX	IREV	IWRT	IWFM	IEDIT	IERASE	HEX
800	0	1	0	1	1	0B	1	1	0	0	1	19
1600	1	1	1	0	0	1C	0	0	1	1	1	07
6250	0	0	0	1	1	03	1	1	0	0	0	18

NOTE

When reading the appropriate tape drive manual command table, look at the bit logic of the read command. If all bits are high (H), then table is in "low true" form and hex digits entered after density prompt(s) must be entered in high true logic form: conversely, if table bits are all low (L) for this command then logic sense is high true and prompt entries must be entered in low true form. In the above example, the table is in low true form and prompt entries are in high true form.

BYTE SWAP

This option can be selected on a per drive basis. It gives the user the ability to read and write tapes in an IBM format.

STREAMING DRIVE LONG GAP SELECTION AND SPEED SELECTION

Gap length and speed selection (except in one case) is done at the tape drive (when these options are implemented). Refer to the tape drive manual for details.

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SECTION 3

OPERATION

INTRODUCTION

Prior to operating the system, the tape drive manual sections describing the controls and indicators on the tape drive and procedures for mounting and removing tape reels should be read. To prevent loss of data or damage to the magnetic tape, the following precautions should be observed:

a. Always handle a tape reel by the hub hole. Squeezing the reel flanges can cause damage to the tape edges when winding or unwinding tape.

b. Never touch the portion of tape between the BOT and EOT markers. Oils from fingers attract dust and dirt. Do not allow the end of the tape to drag on the floor.

c. Never use a contaminated reel of tape. This spreads dirt to clean tape reels and can affect tape drive operation.

d. Always store tape reels inside their containers. Keep empty containers closed so dust and dirt cannot get inside.

e. Inspect tapes, reels, and containers for dust and dirt. Replace take-up reels that are old or damaged.

f. Do not smoke near the tape drive or tape storage area. Tobacco smoke and ash are especially damaging to tape.

g. Do not place the tape drive near a line printer or other device that produces paper dust.

h. Clean the tape path frequently.

Note that tape drives permit offline or online operation. The offline mode is controlled by switches on the tape drive. The online mode is controlled by programmed commands from the computer via the coupler and formatter. When system operation is desired, be sure the tape drive ONLINE indicator is lit.

TAPE FORMAT

For detailed information on tape format characteristics see formatter and tape drive manuals.

BOOTING FROM MAGNETIC TAPES

Place the tape transport "ONLINE" and position the tape at "Beginning of Tape."

If the computer is equipped with a hardware bootstrap, or the bootstrap PROM on the coupler is enabled, simply type "MUO" <CR> (RETURN key).

DIAGNOSTICS

Online and offline diagnostics and switch settings for the tape drive are described in the tape drive manual. The board-edge, green diagnostic LED is used either to indicate command activity or to flash an error code.

During command processing, the LED will be ON while a command is active and OFF when a command is complete.

The error codes conform to MSCP defined codes (see Table 3-1). If an error occurs, the SA register will provide the error indication. The SA register will be loaded with a modified MSCP error definition (Bit 15 = error = 1, step 1-4 = 0 and error code), and the LED will flash the error code.

During self-test diagnostics, the LED will be ON for about seven seconds, then OFF for about seven seconds during each pass of the diagnostics.

If an error occurs during STANDARD diagnostics, an error code will be flashed on the ACTIVITY LED. A "long" flash represents a "1" and a "short" flash represents a "0". The flashes are decoded with the first flash representing the most significant bit and the last flash representing the least significant bit. The code can be identified by the following error code table:

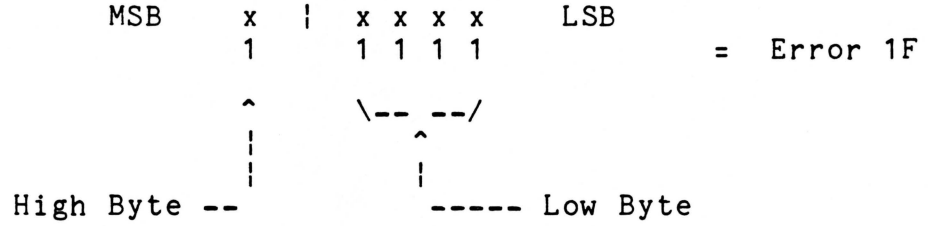

Table 3-1. Standard Diagnostic Error Codes

HEX	OCT	DEC	DESCRIPTION
01	001	01	QBUS Command Packet Read Error
02	002	02	QBUS Command Packet Write Error
03	003	03	Buffer RAM Parity Error
04	004	04	Buffer RAM Data Error
05	005	05	EEPROM Checksum Error
06	006	06	QBUS Command/Response Ring Read Error
07	007	07	QBUS Command/Response Ring Write Error
08	010	08	QBUS Interrupt Error
09	011	09	RESERVED
0A	012	10	RESERVED
0B	013	11	QBUS DMA Error
0C	014	12	CPU Failure
0D	015	13	Watchdog Timer Error
0E	016	14	RESERVED
0F	017	15	Interrupt Write Error
10	020	16	MAINTENANCE READ/WRITE Invalid Region Identifier (MSCP)
11	021	17	MAINTENANCE WRITE Load to Non-Loadable Controller (MSCP)
12	022	18	Static RAM Error (Non-parity)
13	023	19	INIT Sequence Error (MSCP Initialization)
14	024	20	RESERVED

Table 3-1. Standard Diagnostic Error Codes (Cont.)

HEX	OCT	DEC	DESCRIPTION
15	025	21	INIT Diagnostic Error (MSCP Initialization)
16	026	22	EEPROM Checksum Error
17	027	23	Pertec Byte Counter Error
18	030	24	DMA Controller Error
19	031	25	QBIC Error
1A	032	26	QBUS DMA Error
1B	033	27	QBUS Power Failure
1C	034	28	Non-existent Memory Error During Host/ Controller DMA
1D	035	29	Parity Error During Host/Controller DMA
1E	036	30	QBIC Data Compare Error During Host/ Controller DMA
1F	037	31	; port B or C Parity Error

OPERATING SYSTEM SOFTWARE DIAGNOSTICS

Most DEC operating system software packages include some form of concurrent DMA I/O exerciser tests. In some cases these tests can be run while online--as long as the peripherals to be tested are either not in use or. like disks, can have a reserved area assigned.

These exercisers are typically called MDM (MicroVAX Diagnostic Magnetic Tape), IOX (Input/Output Exerciser), or MTEXER (Magnetic Tape Exerciser).

The best way to run these exerciser tests is to activate testing on more than one DMA device simultaneously (such as disk and magnetic tape). In this way concurrent DMA operations are also tested.

The operating system exerciser programs that can be run with the coupler are as follows:

A. MicroVAX: MDM

B. RSX11M/M+: IOX

C. RSTS: MTEXER

Typically, these are the only programs that need be run after installation to verify proper subsystem operation.

FUNCTION AND DATA RELIABILITY DIAGNOSTICS

This class of diagnostics should be run when a subsystem failure is suspected. The diagnostics are run under an appropriate diagnostic operating system, such as XXDP+ for PDP-11 type systems.

PDP-11 DIAGNOSTICS

The tests that can be run under XXDP+ for Q-bus based PDP-11 systems are as follows:

A. ZTU1A0 - TU81 Data Reliability tests 1 through 6: all tests should run error free.

NOTE:

ZTU1A0, Test 2 will not run properly if less than a 1200 foot reel of tape is used during testing.

MICROVAX MDM DIAGNOSTICS

Run the MDM Diagnostic in Non-Menu mode and run the following test sections:

Service Functional	- 1 through 8, and 10
Service Exerciser	- 1 and 2
Verify Exerciser	- 1
Utility	- 1 through 4

MICROVAX MDM DIAGNOSTIC ERROR NOTES

Running the MDM utility will sometimes display Error Code Number 21500, Long Gap Encountered. This occurs when an error is found on tape.

APPENDIX A
FLOATING DEVICE ADDRESS CONVENTIONS AND MICROVMS SYSGEN

Floating Device Address Conventions

On UNIBUS and Q-Bus systems a band of addresses from 17760010 to 17763776 in the top 4K words of memory is assigned as floating address space. Note that throughout this discussion, the top address bits (177) are understood and not given and all digits are assumed in octal form unless otherwise indicated.

Devices that can be assigned floating device addresses are listed in Table A-1. This table lists the devices in rank, or priority sequence, from highest to lowest. Devices of the same type are given addresses higher than DUV11s and lower than RLV11s. The column size (decimal) shows how many words of address space are needed for each device. The column modulus is the modulus used for starting addresses. For example, devices with an octal modulus of 10 must start at an address that is a multiple of 10. This same rule is used to select a "gap" address after a device or for a nonexistent device.

Table A-1. Floating Device Address Assignments

Rank	Device	Size (Decimal)	Modulus (Octal)
1	DJ11	4	10
2	DH11	8	20
3	DQ11	4	10
4	DU11, DUV11	4	10
5	DUP11	4	10
6	LK11A	4	10
7	DMC11/DMR11	4	10 (DMC before DMR)
8	DZ11/DZV11, DZS11, DZ32	4	10 (DZ11 before DZ32)
9	KMC11	4	10
10	LPP11	4	10
11	VMV21	4	10
12	VMV31	8	20
13	DWR70	4	10
14	RL11, RLV11	4	10*
15	LPA11-K	8	20*
16	KW11-C	4	10
17	Reserved	4	10
18	RX11/RX211, RXV11/RXV21		10 (RX11 before RX211)
19	DR11-W	4	10
20	DR11-B	4	10**
21	DMP11	4	10
22	DPV11	4	10
23	ISB11	4	10
24	DMV11	8	20
25	DEUNA	4	10*
26	UDA50	2	4*
27	DMF32	16	40
28	KMS11	6	20
29	VS100	8	20
30	Reserved	2	4
31	KMV11	8	20
32	DHV11	8	20

NOTES

1. DZ11-E and DZ11-F are treated as two DZ11s.
2. * = First device of this type has a fixed address. Any extra devices have a floating address.
3. ** = First two devices of this type have a fixed address. Any extra devices have a floating address.

Rules for Addressing Devices

There are six basic rules for addressing devices that must be followed during the ranking and selection process.

These rules are as follows:

Rule 1

Devices with fixed CSR and vector addresses must be attached according to device table listings.

This means the installer must set the address of the controller exactly as the device list priority dictates.

Rule 2

Devices with a floating CSR address must be attached in the order in which they are listed in the device ranking table.

The installer must set each controller with a floating CSR address according to the priority ranking of the device list. This rule has nothing to do with the physical order of the controllers when installed into the UNIBUS.

Rules 3 and 4 are actually continuations of this rule.

Rule 3

An 8-byte "gap" (octal 10) must be reserved between each different type of device attached in the floating CSR address space.

Once a device is attached, a "gap" must be left between it and the next device type. Devices of the same type must be addressed in order with no "gap."

Rule 4

An 8-byte "gap" (octal 10) must be reserved in the floating CSR address space for each device type that has no controller installed in the UNIBUS configuration.

When no device is attached (installed), an address "gap" must be assigned.

Rule 5

An extra 8-byte "gap" must be reserved between the KW11-C and the RX11 in the floating CSR address space.

A "gap" is reserved on the priority list and must be honored.

Rule 6

All floating vector addresses must be contiguous, beginning with address 300 octal. This rule is self-explanatory.

Floating Vector Address Conventions

Addresses between 300 (octal) and 776 (octal) are designated as the floating vector space. These addreses are assigned in sequence as listed in Table A-2.

Each device needs two 16-bit locations for each vector. For example, a device with one receive and one transmit vector needs four words of vector space.

The vector assignment rules are as follows:

1. Each device occupies vector address space equal to "size" words. For example, the DLV11-J occupies 16 words of vector space. If its vector was 300 (octal), the next available vector would be at 340 (octal).

2. There are no gaps, except those needed to align an octal modulus.

Table A-2. Floating Vector Address Assignments

Rank	Device	Size (Decimal)	Modulus (Octal)
1	DC11	4	10
1	TU58	4	10
2	KL11	4	10
2	DL11-A	4	10
2	DL11-B	4	10
2	DLV11-J	16	10
2	DLV11, DLV11-F	4	10
3	DP11	4	10
4	DM11-A	4	10
5	DN11	2	4
6	DM11-BB/BA	2	4
7	DH11 modem control	2	4
8	DR11-A, DRV11-B	4	10
9	DR11-C, DRV11	4	10
10	PA611 (reader + punch)	8	10
11	LPD11	4	10
12	DI07	4	10
13	DX11	4	10
14	DL11-C to DLV11-F	4	10
15	DJ11	4	10
16	DH11	4	10
17	VT40	8	10
17	VSV11	8	10
18	LPS11	12	10
19	DQ11	4	10
20	KW11-W, KWV11	4	10
21	DU11, DUV11	4	10
22	DUP11	4	10
23	DV11 + modem control	6	10
24	LK11-A	4	10
25	DWUN	4	10
26	DMC11/DMR11	4	10 (DMC before DMR)
27	DZ11/DZS11/ DZV11, DZ32	4	10 (DZ11 before DZ32)
28	KMC11	4	10
29	LPP11	4	10
30	VMV21	4	10
31	VMV31	4	10
32	VTV01	4	10
33	DWR70	4	10
34	RL11/RLV11	2	4*
35	TS11, TU80	2	4*
36	LPA11-K	4	10
37	IP11/IP300	2	4*
38	KW11-C	4	10
39	RX11/RX211, RXV11/RXV21	2	4* (RX11 before RX211)
40	DR11-W	2	4
41	DR11-B	2	4*
42	DMP11	4	10
43	DPV11	4	10
44	ML11	2	4 (MASSBUS device)
45	ISB11	4	10
46	DMV11	4	10
47	DUENA	2	4*
48	UDA50	2	4*
49	DMF32	16	4
50	KMS11	6	10
51	PCL11-B	4	10
52	VS100	2	4
53	Reserved	2	4
54	KMV11	4	10
55	Reserved	4	10
56	IEX	4	10
57	DHV11	4	10

NOTES

1. A KL11 or DL11 used as the console, has a fixed vector.
2. * = First device of this type has a fixed vector. Any extra devices have a floating vector.
3. ML11 is a MASSBUS device which can connect to UNIBUS via a bus adapter.

SYSTEM GENERATION (SYSGEN)

To operate properly in a Q-bus based system, devices must be set to the correct CSR address and interrupt vector. System initialization code performs a hardware configuration check each time the system is bootstrapped. The initialization code expects all devices within the system to be addressed according to the priority CSR and interrupt vector ranking discussed in previous paragraphs. The initialization code determines the existence of devices by attempting to force an interrupt from each addressed, and supported, device. There are several devices with fixed addresses and interrupt vectors. These devices must simply be set to the addresses and vectors prescribed for the device. Other devices have floating addresses and vectors. Although these devices also have suggested addresses and vectors, their addresses and vectors can be modified depending upon other devices in the system. It is the assignment of devices in this floating address area that will be discussed.

In older operating systems for Q-bus based systems, such as RSTS and RSX11M, device tables for the various device drivers usually contain only those devices that have fixed device addresses and interrupt vectors. The user must "manually" compute and enter into the system device addresses and vectors before the SYSTEM GENERATION (SYSGEN) process begins. For these operating systems, the user should first make a list of the devices in the system; next, assign device addresses and interrupt vectors for those devices in the floating address and vector area of memory following the rules and priority rankings given in Tables A-1 and A-2; last, enter the device addresses and vectors into the system according to the procedures outlined in the appropriate Operating System documentation.

Be aware that if new devices are added to the system, some device addresses and vectors may have to be reassigned. Also, even though the priority ranking rules are the same for all DEC PDP and VAX systems, the Operating System documentation should always be consulted because the devices supported may vary, particularly in older versions of the operating systems. Table A-3 shows the devices supported by most Q-bus based, PDP systems. Note that a DHV11 emulator is the lowest priority device. Thus, device address and vector calculations for the emulator are fairly simple; just select an address and vector well above the next specified in the Installation Section of this manual, enter them into the system, and perform SYSGEN.

Table A-3. PDP-11 Floating Address Priority Ranking

Rank	Device	Rank	Device	Rank	Device	Rank	Device
1	DJ11		DZS11	17	Reserved	25	DEUNA
2	DH11		DZ32 (2)	18	RX11 (3)	26	UDA50
3	DQ11	9	KMC11		RX211 (4)	27	DMF32
4	DU11	10	LPD11		RXV11	28	KMS11
	DUV11	11	VMV21		RXV21	29	VS100
5	DUP11	12	VMV31	19	DR11-W (5)	30	Reserved
6	LK11A	13	DWR70	20	DR11-B	31	KMV11
7	DMC11	14	RL11 (3)	21	DMP11	32	DHV11
	DMR11 (1)		RLV11 (3)	22	DPV11	33	
8	DZ11	15	LPA11-K (3)	23	ISB11	34	
	DZV11	16	KW11-CK	24	DMV11	35	

NOTES

(1) DMC before DMR
(2) DZ11 before DZ32
(3) First device of this type has a fixed address. Any extra devices have a floating address.
(4) First two devices of this type have a fixed address. Any extra devices have a floating address.
(5) DZ11-E and DZ11-F are treated as two DZ11's.

When DEC introduced the VAX systems and the attendant VMS operating system, in conjunction with the new architecture, many new features were included in the operating system to simplify operation. Several of these features affect the manner in which device addresses and vectors are assigned to the device driver tables during the SYSGEN procedure. It is those features that affect adding the DILOG device to a MicroVMS-based system that will be discussed in the following paragraphs.

SYSGEN Utility Commands

SYSGEN is a system management tool that performs system generation. Details of its use can be found in Chapter 18 of the *System Generation Utility Reference Manual* of VAX/VMS documentation. Additional information is contained in the *VAX/VMS System Management and Operations Guide.* Two commands under SYSGEN are of specific use when adding a DILOG device in the floating address area. These commands are Autoconfigure and Configure.

The VAX/VMS command prompt that invokes SYSGEN is as follows:

```
$ RUN SYS$SYSTEM:SYSGEN
```

The system responds with the following prompt:

SYSGEN>

SYSGEN can be terminated by typing either EXIT or CTRL/Z.

Access to many of the commands under SYSGEN that are of concern to the user within the context of this discussion require the CMKRNL privilege.

Autoconfigure is a command under SYSGEN that is run when the system is bootstrapped. This command finds and identifies input/output (I/O) devices in the I/O page of system memory and automatically connects the devices physically attached to the system and loads their drivers. Autoconfigure requires that specific device types be installed at specific address boundaries so that it can identify the devices that it finds. Autoconfigure checks each valid CSR address in the floating CSR address space for the presence of a device. Autoconfigure expects any devices installed in that space to be in the order specified in the SYSGEN Device Table (Table A-4). Also, the utility expects an eight-byte block to be reserved for each device that is not installed in the system. Each empty block tells Autoconfigure to look for the next valid address for the next device on the list.

When a device is detected, a block of addresses is reserved for the device according to the number of registers employed by the device. Autoconfigure then looks at the next CSR of that device type. If there is a device there, it is assumed to be of the same type as the one before it, and a block is reserved for that device. If there is no response at the next address, that space is reserved to indicate that there are no more devices of that type. The command then checks the CSR address (at the proper boundary) for the next device in the table.

The following is a list of the devices that might be installed in a MicroVAX system:

DZQ/V11
DPV11
DMV11
2nd MSCP
2nd TK50
DHV11

Table A-4. SYSGEN Device Table

DEVICE	NAME	VECT/RANK	VECTOR #		CSR/RANK	REGISTER #		DRIVER	SUPPORT
CR	CR11	230			777160			CRDRIVER	YES
DM	RK611	210			777440			DMDRIVER	YES
LP	LP11	200			777514			LPDRIVER	YES
—	—	170			764004			—	—
—	—	174			764014			—	—
—	—	270			764024			—	—
—	—	274			764034			—	—
DL[1]	RL11	160			774400			DLDRIVER	YES
MS[2]	TS11	224			772520			TSDRIVER	YES
DY[1]	RX211	264			777170			DYDRIVER	YES
DQ	RB730	250			775606			DQDRIVER	YES
PU[1]	UDA50	154			772150			PUDRIVER	YES
PT[1]	TU81	260			774500			PUDRIVER	YES
XE[1]	DEUNA	120			774510			XEDRIVER	YES
XQ	QNA	120			774400			XQDRIVER	YES
OM	DC11	RNK #1	2	10	774000			OMDRIVER	NO
—	—	—	2	10	774010			—	—
—	—	—	2	10	774020			—	—
—	—	—	2	10	774030			—	—
—	—	—	—	—	—			—	—

Table A-4. SYSGEN Device Table (Continued)

DEVICE	NAME	VECT/RANK	VECTOR #		CSR/RANK	REGISTER #		DRIVER	SUPPORT
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	MAXIMUM OF			—	—
—	—	—	—		32 UNITS			—	—
DD	TU58	RNK #1	2	10	776500			DDDRIVER	YES
—	—	—	2	10	776510			—	—
—	—	—	2	10	776520			—	—
—	—	—	2	10	776530			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	MAXIMUM OF			—	—
—	—	—	—	—	16 UNITS			—	—
YM	DM11B	RNK #4	1	4	770500			YMDRIVER	NO
—	—	—	1	4	770510			—	—
—	—	—	1	4	770520			—	—
—	—	—	1	4	770530			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	MAXIMUM OF			—	—
—	—	—	—	—	16 UNITS			—	—
OB	DN11	RNK #5	1	4	775200			OBDRIVER	NO
—	—	—	1	4	775210			—	—
—	—	—	1	4	775220			—	—
—	—	—	1	4	775230			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	MAXIMUM OF			—	—
—	—	—	—	—	16 UNITS			—	—
OA	DR11C	RNK #9	2	10	767600			OADRIVER	NO
—	—	—	2	10	767570			—	—
—	—	—	2	10	767520			—	—
—	—	—	2	10	767550			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	MAXIMUM OF			—	—
—	—	—	—	—	16 UNITS			—	—
PR	PR611	RNK #10	1	4	772600			PRDRIVER	NO
—	—	—	1	4	772604			—	—
—	—	—	1	4	772610			—	—
—	—	—	1	4	772614			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	MAXIMUM OF			—	—
—	—	—	—	—	8 UNITS			—	—
PP	PP611	RNK #10	1	4	772700			PPDRIVER	NO
—	—	—	1	4	772704			—	—
—	—	—	1	4	772710			—	—
—	—	—	1	4	772714			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	MAXIMUM OF			—	—
—	—	—	—	—	8 UNITS			—	—
OC	DT11	RNK #12	2	10	777420			OCDRIVER	NO
—	—	—	2	10	777422			—	—
—	—	—	2	10	777424			—	—
—	—	—	2	10	777426			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—

Table A-4. SYSGEN Device Table (Continued)

DEVICE	NAME	VECT/RANK	VECTOR #		CSR/RANK	REGISTER #		DRIVER	SUPPORT
—	—	—	—	—	MAXIMUM OF			—	—
—	—	—	—	—	8 UNITS			—	—
OD	DX11	RNK #1	2	10	776200			ODDRIVER	NO
—	—	—	2	10	776240			—	—
YL	DL11C	RNK #14	2	10	775610			YLDRIVER	NO
—	—	—	2	10	775620			—	—
—	—	—	2	10	775630			—	—
—	—	—	2	10	775640			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	—			—	—
—	—	—	—	—	MAXIMUM OF			—	—
—	—	—	—	—	31 UNITS			—	—
YJ	DJ11	RNK #15	2	10	RNK #1	4	10	YJDRIVER	NO
YH	DH11	RNK #16	2	10	RNK #2	8	20	YHDRIVER	NO
OE	GT40	RNK #17	4	20	777200			OEDRIVER	NO
—	—	—	4	20	772010			—	—
LS	LPS11	RNK #18	6	40	770400			LSDRIVER	NO
OR	DQ11	RNK #19	2	10	RNK #3	4	10	ORDRIVER	NO
OF	KW11W	RNK #20	2	10	772400			OFDRIVER	NO
XU	DU11	RNK #21	2	10	RNK #4	4	10	XUDRIVER	NO
XW	DUP11	RNK #22	2	10	RNK #5	4	10	XWDRIVER	NO
XV	DV11	RNK #23	3	20	775000			XVDRIVER	NO
—	—	—	3	20	775040			—	—
—	—	—	3	20	775100			—	—
—	—	—	3	20	775140			—	—
OG	LK11	RNK #24	2	10	RNK #6	4	10	OGDRIVER	NO
XM	DMC11	RNK #26	2	10	RNK #7	4	10	XMDRIVER	YES
TT	DZ11	RNK #27	2	10	RNK #8	4	10	DZDRIVER	YES
XK	KMC11	RNK #28	2	10	RNK #9	4	10	XKDRIVER	NO
OH	LPP11	RNK #29	2	10	RNK #10	4	10	OHDRIVER	NO
OI	VMV21	RNK #30	2	10	RNK #11	4	10	OIDRIVER	NO
OJ	VMV31	RNK #31	2	10	RNK #12	8	20	OJDRIVER	NO
OK	DWR70	RNK #33	2	10	RNK #13	4	10	OKDRIVER	NO
DL[1]	RL11	RNK #34	1	4	RNK #14	4	10	DLDRIVER	YES
MS[2]	TS11	RNK #35	1	4	772524			TSDRIVER	YES
—	—	—	1	4	772530			—	—
—	—	—	1	4	772534			—	—
LA[3]	LPA11	RNK #36	2	10	770460			LADRIVER	YES
—	—	—	2	10	RNK #15	8	20	—	—
OL	KW11C	RNK #38	2	10	RNK #16	4	10	OLDRIVER	NO
RSV	RSV	RNK #38	1	4	RNK #17	4	10	RSVDRIVER	NO
DY[1]	RX211	RNK #39	1	4	RNK #18	4	10	DYDRIVER	YES
XA	DR11W	RNK #40	1	4	RNK #19	4	10	XADRIVER	YES
XB[2]	DR11B	124			772410			XBDRIVER	NO
—	—	RNK #41	1	4	772430			—	—
—	—	—	1	4	RNK #20	4	10	—	—
XD	DMP11	RNK #42	2	10	RNK #21	4	10	XDDRIVER	YES
ON	DPV11	RNK #43	2	10	RNK #22	4	10	ONDRIVER	NO
IS	ISB11	RNK #45	2	10	RNK #23	4	10	ISDRIVER	NO
XD	DMV11	RNK #46	2	10	RNK #24	8	20	XDDRIVER	NO
XE[1]	DEUNA	RNK #47	1	4	RNK #25	4	10	XEDRIVER	NO

Table A-4. SYSGEN Device Table (Continued)

DEVICE	NAME	VECT/RANK	VECTOR #		CSR/RANK	REGISTER #		DRIVER	SUPPORT
PU[1]	UDA50	RNK #48	1	4	RNK #26	2	4	PUDRIVER	YES
TX	DMF32	RNK #49	8	40	RNK #27	16	40	YCDRIVER	YES
XG	—	RNK #49	—	—	RNK #27	—	—	XGDRIVER	YES
LC	—	RNK #49	—	—	RNK #27	—	—	LCDRIVER	YES
XI	—	RNK #49	—	—	RNK #27	—	—	XIDRIVER	NO
XS	KMS11	RNK #50	3	20	RNK #28	8	20	XSDRIVER	NO
XP	PCL11	RNK #51	2	10	764200			XPDRIVER	NO
—	—	—	2	10	764240			—	—
—	—	—	2	10	764300			—	—
—	—	—	2	10	764340			—	—
VB	VS100	RNK #52	1	4	RNK #29	8	20	VBDRIVER	NO
PT[1]	TU81	RNK #53	1	4	RNK #30	2	4	PUDRIVER	YES
OQ	KMV11	RNK #54	2	10	RNK #31	8	20	OQDRIVER	NO
UK	KCT32	RNK #55	2	10	764400			UKDRIVER	NO
—	—	—	2	10	764440			—	—
—	—	—	2	10	764500			—	—
—	—	—	2	10	764540			—	—
IX	IEQ11	RNK #56	2	10	764100			IXDRIVER	NO
TX	DHV11	RNK #57	2	10	RNK #32	8	20	YFDRIVER	YES
TX	DMZ32	RNK #58	6	20	RNK #33	16	40	YCDRIVER	YES
XG	CPI32	RNK #59	6	20	RNK #34	16	40	XGDRIVER	YES
DT	TC11	214			777340			DTDRIVER	NO
VC	VCO1B	060			777200			VCDRIVER	YES

NOTES:

1. The first device of this type has a fixed VECTOR and CSR address. Any extra devices will have floating VECTOR and CSR addresses.
2. The first device of this type has a fixed VECTOR address. Any extra devices will have floating VECTOR addresses.
3. The first device of this type has a fixed CSR address. Any extra devices will have floating CSR addresses.

The *MicroVAX II Technical Manual* and the *MicroVAX II Maintenance Manual* give configuration worksheets and examples of selecting CSR addresses and interrupt vectors. Table A-5 illustrates the selection of common devices that might be configured within a system and gives examples of CSR address selection.

Table A-6 gives two examples of interrupt vector selection for devices potentially configured within a system. Note that the DLVJ1 requires an increment of 40 between it and the next device. All other devices follow the rules given in Table A-2.

In summary, when preparing to install the DILOG controller in a VMS-based Q22 system, the following procedure is recommended:

A. Invoke the SYSGEN utility after the MicroVMS command prompt by typing:

MCR SYSGEN <return>

The utility will respond with the prompt:

SYSGEN>

B. Invoke the SYSGEN command SHOW/CONFIGURATION. This will generate a listing of all devices installed in the system, their CSRs and vector addresses. After the SYSGEN command prompt type:

SHOW/CONFIGURATION <return>

Table A-5. Floating CSR Address Selection

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

*Device may be installed or not.

Go DOWN through the columns in the table to find the column that matches your configuration.

Any device added to or removed from the list will not affect the addresses of devices above it.

The following two examples demonstrate use of the table:

Example 1

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

Example 2

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

Table A-6. Examples of Interrupt Vector Selection

EXAMPLE 1		EXAMPLE 2	
DLVJ1	300	DZQ11	300
DZV11	340	2nd MSCP	310
DZV11	350	DHV11	320
2nd MSCP	360		
DHV11	370		

The following is a one-device sample of the listing that would result from this command:

System CSR and Vectors on 28-JAN-1987 13:30:19.83

Name: PUA Units:1 Nexus:0 CSR:772150 Vector1:154 Vector2:000 SYSGEN

Note that the name is the logical name assigned to the device by the operating system. Make a list of the devices in floating address space and their CSR and interrupt vector addresses that are intended for installation with the DILOG controller.

C. Execute the CONFIGURE command under the SYSGEN utility. This command responds with the CSR and vector addresses for the devices in the system compatible with Autoconfigure. It saves the user the trouble of having to calculate the addresses. However, it must be provided with the names of the devices in, or to be installed in, the system. To execute this command, after the SYSGEN prompt appears type:

CONFIGURE <return>

The response will be the prompt:

DEVICE>

At this time it is necessary to enter the appropriate abbreviations for the devices in the system. Table A-7 lists the entries to be used. Always type the entry for one device in the system, then press the

Table A-7. Entries for Use with the SYSGEN Utility

DEVICE	ENTRY MADE AT THE DEVICE PROMPT	DEVICE	ENTRY MADE AT THE DEVICE PROMPT
DPV11	DPV11	DMV11-N	DMV11
DRV11-J	DR11W	DEQNA	QNA
LPV11	LP11	DHV11	DHV11
DLVJ1	DJ11	TQK50	TU81
DZQ11	DZ11	RQDXn	UDA
DZV11	DZ11	TSV05	TS11
DMV11-M	DMV11	KDA50	UDA

RETURN key. The DEVICE> prompt will then reappear permitting additional entries. After all devices have been entered, hold down the CTRL key and press the Z key. This exits the DEVICE prompt and displays the appropriate CSR addresses and vectors, the name the operating system has assigned to the device, and the operating system support status (yes if it is supported, no if not supported).

NOTE

If more than one of a particular device is present in the system, a comma followed by the number of like devices present should follow the device abbreviation (i.e., DHV11,2 indicates the presence of two DHV11 modules).

Table A-8 illustrates a sample output using the CONFIGURE command.

D. After the addresses have been selected for the DILOG controller to be installed, the CSR and vector addresses can be set on the controller board and the board installed. At this time it is a good practice to re-run the SHOW/CONFIGURATION command to be sure the MicroVMS detected the DILOG DHV11 emulations installed.

E. This should conclude the installation procedure under SYSGEN. To exit the SYSGEN utility, type the following after the SYSGEN prompt:

EXIT <return>

Table A-8. Sample Output Using CONFIGURE Command Under SYSGEN Utility

```
$ MCR SYSGEN
SYSGEN> CONFIGURE
DEVICE>DHV11, 2
DEVICE>DMV11
DEVICE>QNA
DEVICE>UDA, 2
DEVICE>TU81
DEVICE>Exit
Device: UDA      Name: PUA      CSR: 772150    Vector: 154    Support: yes
Device: TU81     Name: PTA      CSR: 774500    Vector: 260    Support: yes
Device: QNA      Name: XQA      CSR: 774440    Vector: 120    Support: yes
Device: DMV11    Name: XDA      CSR: 760320*   Vector: 300*   Support: yes
Device: UDA      Name: PUB      CSR: 760354*   Vector: 310*   Support: yes
Device: DHV11    Name: TXA      CSR: 760500*   Vector: 320*   Support: yes
Device: DHV11    Name: TXB      CSR: 760520*   Vector: 330*   Support: yes
```

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