

DISTRIBUTED LOGIC CORPORATION

MODEL DQ256

DISK CONTROLLER

INSTALLATION AND OPERATION MANUAL

Corporate Headquarters

1555 S. Sinclair Street
P.O. Box 6270
Anaheim, California 92816
Telephone: (714) 937-5700
Telex: 6836051

Eastern Regional Sales Office

64-A White Street
Red Bank, New Jersey 07701
Telephone: (201) 530-0044

European Sales and Service

England
Brackmills Business Park
Caswell Road
Brackmills, Northampton
NN4 OPW
Tel: 0604-767636

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11 December 1989



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SECTION 1

DESCRIPTION

This manual describes the installation and operation of Distributed Logic Corporation (DILOG) Model DQ256 Disk Controller. The controller interfaces up to four SMD/ESMD disk drives with DEC* MicroVAX II or any Micro PDP-11 or LSI-11 computer systems. Transfer rates of the system are up to 3.0 Mbytes per second (24 MHz).

The controller is software compatible with DU drivers (MSCP) in RT-11, RSX-11M+, RSTS/E, MicroVMS, ULTRIX, UNIX, and DMS operating systems. The controller supports both block mode and non-block mode memory and is programmable by the host software driver to transfer 8 or 16 words per DMA request.

Figure 1-1 is a simplified diagram of a disk system.

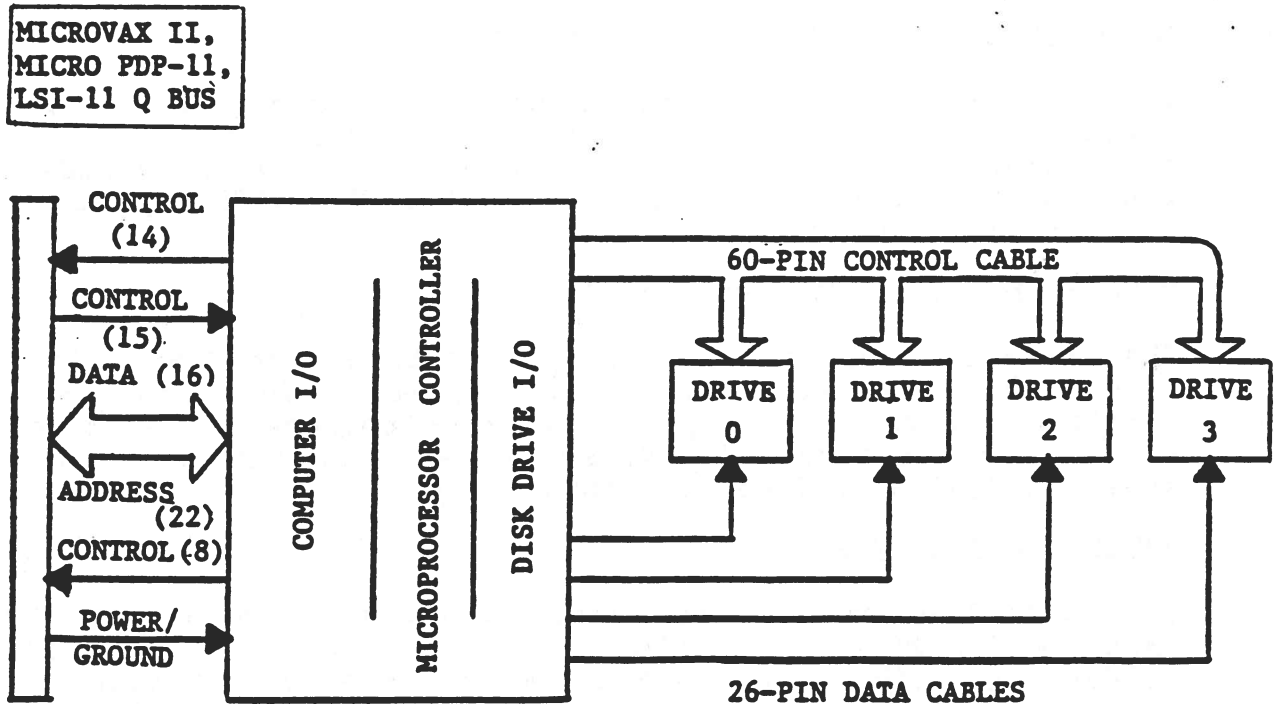


Figure 1-1. Disk System, Simplified Diagram

* DEC LSI-11, MICRO/PDP-11, MICRO/VAX 11, RT-11, RSX, RSTS/E, MICRO/VMS, and DU Driver, and MSCP are registered trademarks of Digital Equipment Corporation.

UNIVERSAL FORMATTING is a trademark of Distributed Logic Corporation.

CHARACTERISTICS

o ELEVATOR SEEK ORDERING ALGORITHM

The controller uses the elevator seek ordering algorithm to determine the execution order for commands stored in the command buffer. This feature reduces drive seek latencies.

o MAPPING MULTIPLE LOGICAL UNITS

The controller can map each physical drive attached to the controller into one or more logical units. This feature increases the usage of the formatted disk capacity by the operating system.

o DILOG'S UNIVERSAL FORMATTING

UNIVERSAL FORMATTING permits the attachment of drives that have the same or different characteristics, such as number of cylinders, heads, sectors, capacities, and transfer rates, without the need for drive configuration components on the controller. This feature removes all requirements for drive specific configuration components on the controller.

o SUPPORTS DRIVE TRANSFER RATES TO 3.0 MBYTES PER SECOND

The controller supports these drive transfer rates with a 1:1 sector interleave and a 32 Kbyte (64 sector) data buffer. The controller supports drives from the following manufacturers: CONTROL DATA CORP., CENTURY DATA, FUJITSU, HATACHI, NEC, PRIAM, and NORTHERN TELECOM.

o ONBOARD MULTIPLE PATTERN FORMATTING

The controller contains a multiple pattern formatter which allows a more effective detection of disk flaws. The formatter is accessible through the system console or optional Diagnostic Access Port. This feature eliminates the need for shipping format programs on user-specified distribution media.

o AUTOMATIC SELF TEST

The controller is supplied with an automatic self test function that is initiated each time power is applied. The controller performs additional tests each time it is brought online. A green card-edge LED is lit and remains lit after each successful completion. Should self test fail, the controller isolates the disk drive from the system and the LED is extinguished.

o HARDWARE BOOTSTRAP

The controller contains an onboard bootstrap support for RL01/02, RP02/03, RM02, RM05, RM80, RK06/07, RX02, TS11, TSV05, TM11, and MSCP devices. The controller contains switches for selecting bootstrap addresses, in addition to enabling/disabling this bootstrap feature. When the onboard bootstrap is disabled, the controller will boot from a standard DEC module.

o DILOG'S DYNAMIC TRANSFER SEGMENTATION

Three-dimensional RPS (Rotational Position Sensing)

Dilog's three-dimensional RPS (Rotational Position Sensing) determines the rotational position of each drive attached to the controller and initiates a transfer on the disk whose heads are positioned within or closest to the desired data transfer portion of the disk. The third dimension of RPS is achieved by looking down through the platters (heads) to see if the requested data is ready for transfer. This is implemented every time the controller is waiting for data to come under the initiated request. This feature reduces the rotational latency time associated with the total transfer time.

Data Transfer Fragmentation

Data transfer fragmentation allows the controller to start transferring any immediately accessible sector that is part of an active request to the host. The sectors that are part of the request are transferred to the host as they are encountered, rather than waiting for the first sector of the request to come under the read/write head. This feature reduces the rotational latency associated with the total transfer time.

Segmented Data Transfers Crossing Cylinder Boundaries

In transfers that cross cylinder boundaries, this feature will suspend the request after the last sector of a cylinder is read by the controller. At this time the controller will initiate another transfer on the same cylinder or start the drive seeking and initiate a transfer from another drive. When the second transfer is complete, the controller will proceed with the original request. This feature reduces the seek time associated with the total transfer time.

o MEDIA FLAW COMPENSATION

The following four functions are used to compensate for media defects:

FIRST - at format time one sector per track is reserved as a spare. The controller has the ability to reassign spare sectors for defective sectors.

SECOND - if an error is encountered after the drive is formatted, a sequence of read operations is performed with ECC disabled.

THIRD - if the error still exists, ECC is used to recover the data. The ECC polynomial used is 48 bits in length. Error log packets are generated by the controller every time an error recovery operation is performed.

FOURTH - After the drive is formatted, reassignment of defective sectors is accomplished through a dynamic block replacement scheme controlled by the host software.

o OPTIONS

Options for the controller are: disk drive I/O cables, maintenance manual, and factory integration of customer-supplied drives. Dual porting is also an option of the controller.

LSI-11 Q-BUS INTERFACE

Commands, data and status transfers between the controller and the computer are executed via the parallel I/O bus (Q bus) of the computer. Data transfers are direct to memory via the DMA facility of the Q bus; commands and status are under programmed I/O. Controller/Q-bus interface lines are listed in Table 1-1.

Table 1-1. Controller/Q-Bus Interface Lines

Bus Pin	Mnemonic	Controller Input/ Output	Description
AC2, AJ1, AM1, AT1, BJ1, BM1, BT1, BC2, CC2, CJ1, CM1, CT1, DC2, DJ1, DM1, DT1	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	Used for Block Mode DMA.
BA1	BDCOK H	I	DC power ok. All DC voltages are normal.
BB1	BPOK H	N/A	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	O	External Event Interrupt Request. Real Time Clock Control.
AA2, BA2, BV1, CA2, DA2	+ 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.
AA1, AB1, AL2, BP1	BIRQ4L,5,6,7	O	Interrupt Request.
AM2 AN2 CM2 CN2	BIAK1I L BIAK1O L BIAK2I L BIAK2O L	I O I O	Serial Interrupt Acknowledge input and output lines routed from Q-Bus, through devices, and back to processor to establish and interrupt priority chain.
AT2	BINIT L	I	Initialize. Clears devices on I/O bus.
AU2, AV2, BE2, BF2, BH2, BH2, BK2, BL2, BM2, BN2, BP2, BR2, BS2, BT2, BU2, BV2	BDAL0 L through BDAL15 L	I/O	Data/address lines, 0-15
AR2 AS2 CR2 CS2	BDMG1I L BDMG1O L BDMG2I L BDMG2O L	I O I I	DMA Grant Input and Output. Serial DMA priority line from computer, through devices and back to computer.
AP2	BBS7 L	I	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	BDAL 16 L BDAL 21 L	O	Extended Address Bits 16-21

DISK INTERFACE

The controller interfaces up to four disk drives through 60- and 26-pin cables. If two drives are used, the 60-pin control cable ("A" cable) is daisy chained to the drives. The 26-pin cables ("B" cables) are connected separately from the controller to each drive. The maximum length of the 60-pin cable is 100 feet. The maximum length of the 26-pin cable is 50 feet. Table 1-2 lists the 60-pin interface signals, and Table 1-3 lists the 26-pin interface signals.

**Table 1-2. Controller To Drive I/O Interface—
"A" Cable**

Signal Name	Pin Polarity (Active)		Source
	-	+	
DEVICE SELECT 0	23	53	Controller
DEVICE SELECT 1	24	54	Controller
DEVICE SELECT 2	26	56	Controller
DEVICE SELECT 3	27	57	Controller
SELECT ENABLE	22	52	Controller
SET CYLINDER TAG	1	31	Controller
SET HEAD TAG	2	32	Controller
CONTROL SELECT	3	33	Controller
BUS OUT 0	4	34	Controller
BUS OUT 1	5	35	Controller
BUS OUT 2	6	36	Controller
BUS OUT 3	7	37	Controller
BUS OUT 4	8	38	Controller
BUS OUT 5	9	39	Controller
BUS OUT 6	10	40	Controller
BUS OUT 7	11	41	Controller
BUS OUT 8	12	42	Controller
BUS OUT 9	13	43	Controller
BUS OUT 10	30	60	Controller
DEVICE ENABLE	14	44	Controller
INDEX	18	48	Drive
SECTOR MARK	25	55	Drive
FAULT	15	45	Drive
SEEK ERROR	16	46	Drive
ON CYLINDER	17	47	Drive
UNIT READY	19	49	Drive
WRITE PROTECTED	28	58	Drive
ADDRESS MARK	20	50	Drive
BUS-DUAL-PORT ONLY	21	51	Drive
SEQUENCE IN	29		Controller
HOLD	59		Controller

**Table 1-3. Controller To Drive I/O Interface—
"B" Cable**

Signal	Pin Polarity (Active)			Source
	-	+	Ground	
Ground			1	
Servo Clock	2	14		Drive
Ground			15	
Read Data	3	16		Drive
Ground			4	
Read Clock	5	17		Drive
Ground			18	
Write Clock	6	19		Controller
Ground			7	
Write Data	8	20		Controller
Ground			21	
Unit Selected	22	9		Drive
Seek End	10	23		Drive
Ground			11	
Reserved for Index	12	24		
Ground			25	
Reserved for Sector	13	26		

CONTROLLER SPECIFICATIONS *

MECHANICAL

The controller is completely contained on a quad-height module 26.4 cm (10.44 in.) wide by 22.8 cm (8.88 in.) deep and plugs into one standard Q-bus quad slot.

BASE ADDRESS - 8 choices, switch selectable

IP-772150	IP-760334	IP-760340
SA-772152	SA-760336	SA-760342
IP-760344	IP-760354	IP-760360
SA-760346	SA-760356	SA-760362
IP-760374	IP-760400	
SA-760376	SA-760402	

INTERRUPT VECTOR ADDRESS

Programmable by software, priority BR5 in etch; BR4, 6, and 7 by jumpers.

DMA BURST SIZE

Adaptive DMA 8 or 16 words

DISK TRANSFER RATES

Up to 3.0 Mbytes per second

DISK I/O

One 60-pin and four each 26-pin conductor flat ribbon cables

POWER

+5 volts at 2.8 amps

ENVIRONMENT

Operating temperature 50 degrees F. (10 degrees C.) to 104 degrees F. (40 degrees C.), Humidity 10-90% non-condensing

SHIPPING WEIGHT

5 pounds, including documentation and cables

MTTR

Less than 0.5 hours.

* SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

SECTION 2

INSTALLATION

The padded shipping carton contains the controller board and, if specified on the sales order, a 60-pin control cable to the drive, and four optional 26-pin data cables to the drives. Inspect the controller board and its components and the cables for damage.

NOTE

If damage to the board, components on the board, or cables is noted, do not install. Immediately inform the carrier and Dilog.

Figure 2-1 shows the locations of the switch and jumpers.

Table 2-1 describes the switch and jumper settings. Some jumper connections may be etched or cut on the board and are referred to in the table as installed or removed.

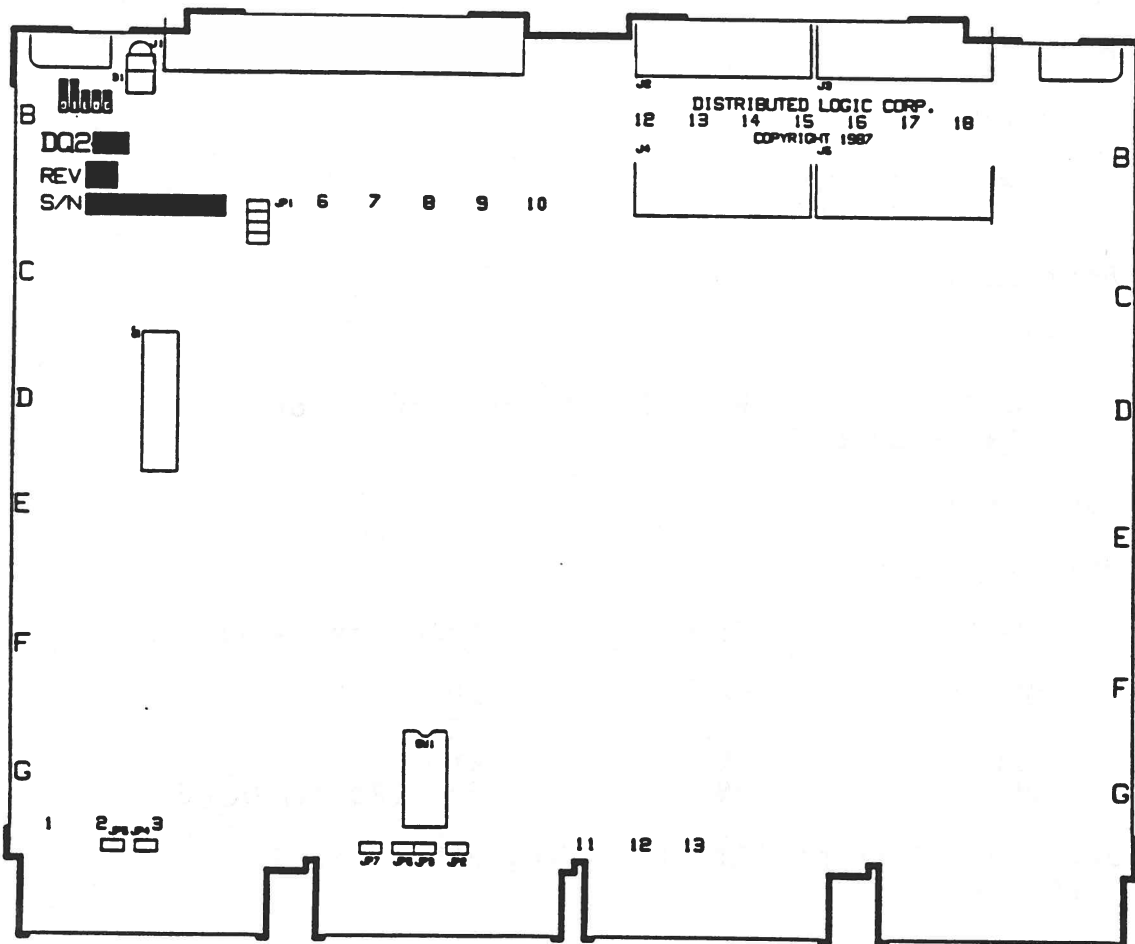


Figure 2-1. Controller Configuration

Table 2-1. Switches and Jumpers

Set and check the switches and jumpers before installing the controller in the backplane.

CAUTION

Ensure power is not applied to the CPU or drive when installing the controller board or cables.

Switch 1
Location 12F

Select Address

SW1-1	SW1-2	SW1-3	Address
OFF	OFF	OFF	= 772150
ON	OFF	OFF	= 760334
OFF	ON	OFF	= 760340
ON	ON	OFF	= 760344
OFF	OFF	ON	= 760354
ON	OFF	ON	= 760360
OFF	ON	ON	= 760374
ON	ON	ON	= 760400

Select Boot Address

SW1-4
OFF = 773000
ON = 775000

Select Boot Enable

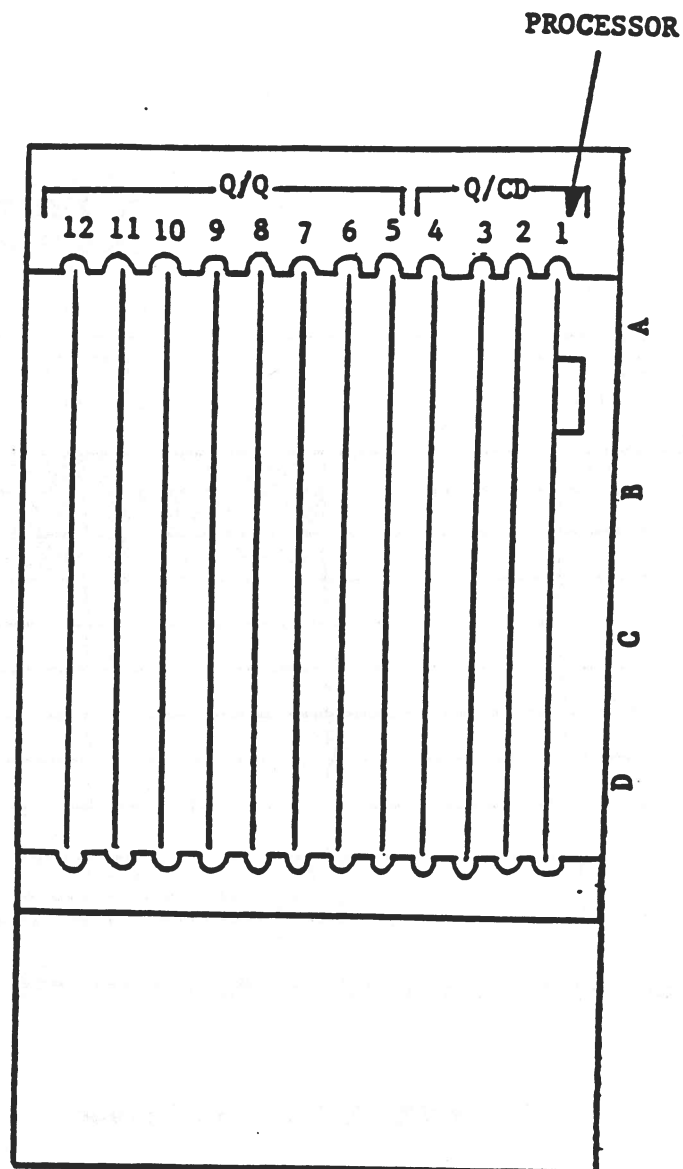
SW1-5
OFF = Disable Boot (MV II configuration)
ON = Enable Boot

SW1-6 - Not Used

Select Priority Level

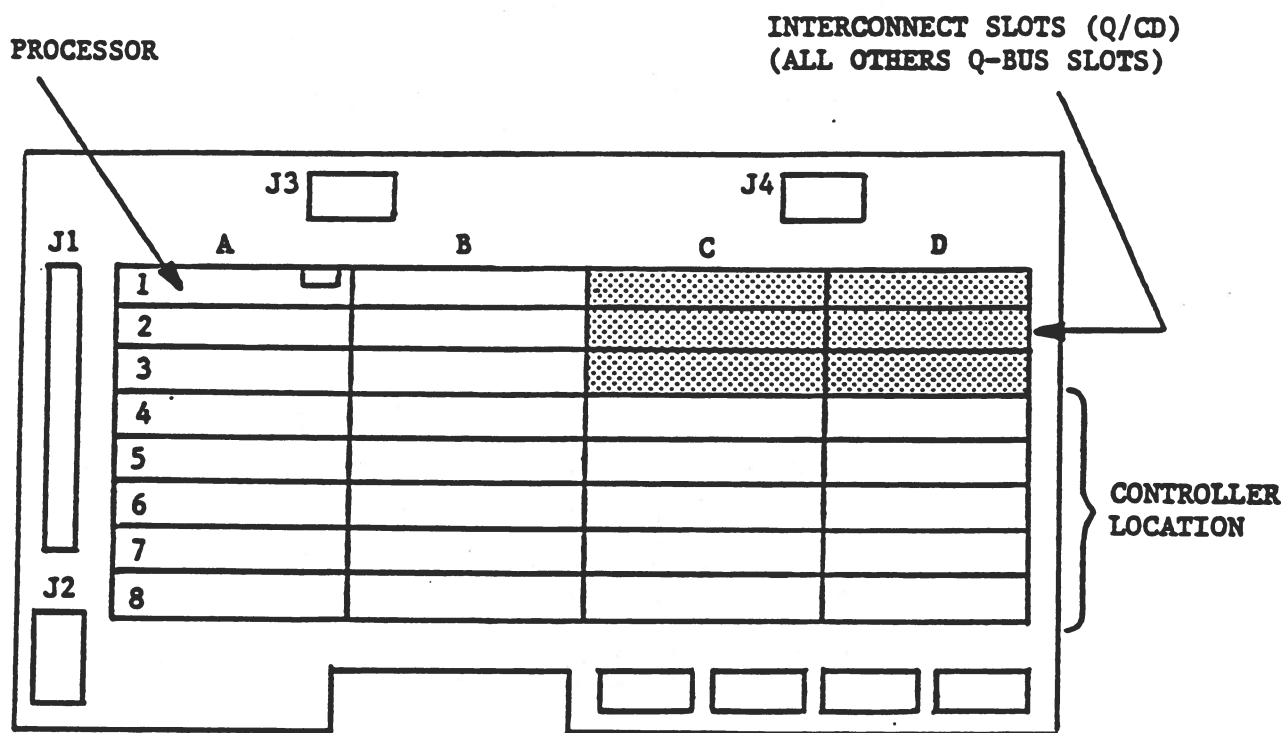
SW1-7	SW1-8	Priority Level
OFF	OFF	BR5
ON	OFF	BR6
OFF	ON	BR7
ON	ON	BR4 (Recommended)

Select Backplane Jumpers JP2, JP3, JP4, JP5, JP6, JP7
Location 2F, 9F



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

All jumpers must be installed unless the board is placed in a Q/CD backplane slot. See Figures 2-2 and 2-3. If placed in a Q/CD backplane slot, remove these six jumpers.

JP1 - Factory Use Only

J6 - Connector - Factory Use Only

INSTALLATION

After the jumpers have been positioned and the switches set, install the controller as follows:

CAUTION

Ensure all power is off before installing the controller or cables.

Damage to the backplane assembly will occur if the controller is plugged in backwards.

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

It is important that all option slots between the processor and the disk controller be filled to ensure that the daisy-chained interrupt (BIAK) and DMA (BDMG) signals be complete to the controller slots. If there must be empty slots between the controller and any option board, the following backplane jumpers must be installed.

FROM	TO	SIGNAL
CO x NS	CO x M2	BIAK1/LO
CO x S2	CO x R2	BDMG1/LO
^	^	

2. Install J1 and J2 into the connectors on the controller, and J3, J4, J5, if multiple drives are used. Ensure pin 1 on each cable is matched with the triangle on each connector as indicated on Figure 2-1.
3. Ensure the controller is oriented with the components facing row one, the processor, and gently press both handles until the module connectors are firmly seated in the backplane.

4. Connect J1 to the drive or drives if daisy-chained. Ensure the terminator is installed in the last drive. Connect the remaining cables to the appropriate drives.
5. Refer to the disk drive manual for operating instructions, and apply power to the drive(s) and the computer.
6. The system is ready to format the disks as described in Section 3.

DRIVE SWITCHES

The drive switches following are recommended for maximum capacity. Special requirements may require different switch settings.

For drives not listed in the following pages, Dialog uses 584 bytes/sector with a 21-byte preamble.

NOTE

Earlier DQ236 models (Revision D and earlier) require 590 bytes/sector with a 24-byte preamble.

Index and sector pulses are on the A cable.

CDC 9710

Display Drive Configuration

```
-----
Drive Name: 9710
Base DU Unit Number: 000
Number of Heads: 005
Number of Sectors Per Track: 034
Number of Cylinders: 00823
Number of Logical Units: 001

Logical Unit Size (Blocks): 00135465
Diagnostic Partition Size (Cylinders): 00001
```

DRIVE SWITCH SETTINGS

```
      (SECTOR)
      /      \

      1 2 3 4 5 6 7 8 9 10 11
on->| | |x| | | |x|x| | | |<-on
off->|x|x| |x|x|x| | |x|x|x |<-off
```

Display Drive Configuration

```

-----
Drive Name: 9715-515
Base DU Unit Number: 000
Number of Heads: 024
Number of Sectors Per Track: 051
Number of Cylinders: 00711
Number of Logical Units: 001

Logical Unit Size (Blocks): 00850800
Diagnostic Partition Size (Cylinders): 00001
  
```

DRIVE SWITCH SETTINGS
(SECTOR)

```

      0 1 2 3 4 5 6 7 8 9 10 11
on->| |x|x| | | | |x| | |<-on
off->|x| | |x|x|x|x|x| |x|x|x|<-off
  
```

Display Drive Configuration

```

-----
Drive Name: 9715-1030
Base DU Unit Number: 000
Number of Heads: 026
Number of Sectors Per Track: 070
Number of Cylinders: 00964
Number of Logical Units: 001

Logical Unit Size (Blocks): 01725828 (see note)
Diagnostic Partition Size (Cylinders): 00001
  
```

DRIVE SWITCH SETTINGS

```

              (SECTOR)
              /      \

      1 2 3 4 5 6          1 2 3 4 5 6
on->| |x| | | | |      |x|x| | | | |<-on
off->|x| |x|x|x|x|      | | |x|x|x|x|<-off
  
```

NOTE

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

```
Drive Name: 9720-368
Base DU Unit Number: 000
Number of Heads: 010
Number of Sectors Per Track: 051
Number of Cylinders: 01217
Number of Logical Units: 001
```

```
Logical Unit Size (Blocks): 00607500
Diagnostic Partition Size (Cylinders): 00001
```

DRIVE SWITCH SETTINGS

```

      1.6
      | N
      | 1 2 3 4 5 6
on-> | x | x | x | x | x |
off-> |   |   |   |   | x |
      | USEL | .8 |
      | WP

```

(SECTOR)

sw E875

1	2	3	4	5	6
	x	x			
x			x	x	x

sw F575

1	2	3	4	5	6
		x			
x	x		x	x	x

<-on
<-off

```

      sw A213
      1 2 3 4 5 6 7 8 9 10
on->| | | x x | | x x | | x | <-on
off->| x x | | | x | | | x x | | <-off

```

```
Logical Unit Size (Blocks): 00838350
Diagnostic Partition Size (Cylinders): 00001
```



Display Drive Configuration

 Drive Name: 9720-736
 Base DU Unit Number: 000
 Number of Heads: 015
 Number of Sectors Per Track: 051
 Number of Cylinders: 01635
 Number of Logical Units: 001

Logical Unit Size (Blocks): 01224750 (see note)
 Diagnostic Partition Size (Cylinders): 00001

DRIVE SWITCH SETTINGS

sw A213 (on I/O board)
 1 2 3 4 5 6 7 8 9 10
 on->| | |x|x| |x|x| | |x|<-on
 off->|x|x| | |x| | |x|x| |<-off

Series code 1 thru 3
 (SECTOR)

.8						/						\					
1 2 3 4 5 6						1 2 3 4 5 6						1 2 3 4 5 6					
off-> x						x x x x x						x x x x <-off					
on-> x x x x x						x						x x <-on					
USEL N																	
1.6																	

Series code 4 & above
 (SECTOR)

N																			
B /										\									
1 2 3 4 5 6 7 8 9 10										1 2 3 4 5 6 7 8 9 10									
on-> x x x x x x										x x x x x x x x									
off-> x x x x										x x									
USEL \																			
8 WP																			

JUMPERS

o	o	o	o	o
*		*		
o	o	o	o	o
G	R	D	S	S
T	U	U	W	W
/	N	B	P	P
S	T	D	1	

|=INSTALLED

*=FACTORY
 SET

NOTE

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

```
-----
Drive Name: 9720-750
Base DU Unit Number: 000
Number of Heads: 015
Number of Sectors Per Track: 070
Number of Cylinders: 01217
Number of Logical Units: 001
```

```
Logical Unit Size (Blocks): 01257525 (see note)
Diagnostic Partition Size (Cylinders): 00001
```

DRIVE SWITCH SETTINGS

						(SECTOR)											
						/ \											
.8																	
WP																	
1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
off->					x		x	x x x x x						x x x x x	<-off		
on->	x x x x x	x						x					x x			<-on	
USEL N																	
1.6																	

sw Axxx (on I/O board)										
1	2	3	4	5	6	7	8	9	10	
on->			x x	x x		x	<-on			
off->	x x		x		x x		<-off			

NOTE

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

 Drive Name: 9720-850
 Base DU Unit Number: 000
 Number of Heads: 015
 Number of Sectors Per Track: 070
 Number of Cylinders: 01381
 Number of Logical Units: 001

Logical Unit Size (Blocks): 01427265 (see note)
 Diagnostic Partition Size (Cylinders): 00001

DRIVE SWITCH SETTINGS

sw A213 (on I/O board)
 1 2 3 4 5 6 7 8 9 10
 on->| | |x|x| |x|x| | |x|<-on
 off->|x|x| | |x| | |x|x| |<-off

Series code 1 & 2
 (SECTOR)

						.8												
						WP												
						/												
						\												
1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6																
off-> x	x x x x x	x x x x <-off																
on-> x x x x x	x	x x <-on																
USEL N																		
1.6																		

Series code 3 & above
 (SECTOR)

										N										
										B /										
										\										
1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10																			
on-> x x x x x x x x	x x x x x x x x																			
off-> x x	x x																			
USEL \																				
8 WP																				

JUMPERS

o	o	o	o	o
#		#		
o	o	o	o	o
G	R	D	S	S
T	U	U	W	W
/	N	B	P	P
S	T	D	1	
=INSTALLED				

*=FACTORY
 SET

NOTE:

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

```

-----
Drive Name: 9720-1230
Base DU Unit Number: 000
Number of Heads: 015
Number of Sectors Per Track: 086
Number of Cylinders: 01635
Number of Logical Units: 001
  
```

```

Logical Unit Size (Blocks): 02082075 (see note)
Diagnostic Partition Size (Cylinders): 00001
  
```

DRIVE SWITCH SETTINGS

```

          sw A213 (on I/O board)
          1 2 3 4 5 6 7 8 9 10
on->| | |x|x| | |x| | |x|<-on
off->|x|x| | |x|x| |x|x| |<-off
  
```

(SECTOR)

```

          N
          B | /
          1 2 3 4 5 6 7 8 9 10
on->|x|x|x|x|x|x|x|x|x|
off->| | | | | | | | |x|
          | USEL | | \
          8      WP
  
```

```

          1 2 3 4 5 6 7 8 9 10 \
          |x|x| |x|x| |x|x|x|x|
          | | |x| | |x| | | | |
JUMPERS
o o o o o
* | * |
o o o o o

G R D S S
T U U W W
/ N B P P
S T   D 1
  
```

```

| = INSTALLED
* = FACTORY
  SET
  
```

NOTE:

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

```
-----
Drive Name: 9720-1350
Base DU Unit Number: 000
Number of Heads: 019
Number of Sectors Per Track: 086
Number of Cylinders: 01420
Number of Logical Units: 001
```

```
Logical Unit Size (Blocks): 02290070 (see note)
Diagnostic Partition Size (Cylinders): 00001
```

DRIVE SWITCH SETTINGS (SECTOR)

	swF556 /						\swF563						
	1	2	3	4	5	6		1	2	3	4	5	6
on->	x	x								x			<-on
off->			x	x	x	x		x	x	x	x	x	<-off

	sw C503 (on I/O board)									
	1	2	3	4	5	6	7	8	9	10
on->		x		x		x	x	x		x <-on
off->	x		x		x			x		<-off

NOTE:

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

```

-----
Drive Name:  M2322
Base DU Unit Number:  000
Number of Heads:  010
Number of Sectors Per Track:  035
Number of Cylinders:  00823
Number of Logical Units:  001

Logical Unit Size (Blocks):  00279140
Diagnostic Partition Size (Cylinders):  00001

```

DRIVE SWITCH SETTINGS (SECTOR):

		1	2	3	4	5	6	7
sw2	on	x	x	x			x	
	off				x	x	x	
sw3	on			x				
	off	x	x		x	x	x	x

FUJITSU M2333

Display Drive Configuration

```

-----
Drive Name:  M2333
Base DU Unit Number:  000
Number of Heads:  010
Number of Sectors Per Track:  069
Number of Cylinders:  00823
Number of Logical Units:  001

Logical Unit Size (Blocks):  00558280
Diagnostic Partition Size (Cylinders):  00001

```

DRIVE SWITCH SETTINGS (SECTOR):

		1	2	3	4	5	6	7
sw2	on	x	x	x		x		
	off				x	x	x	
sw3	on		x					
	off	x		x	x	x	x	x

Display Drive Configuration

```

-----
Drive Name:  M2344
Base DU Unit Number:  000
Number of Heads:  027
Number of Sectors Per Track:  069
Number of Cylinders:  00624
Number of Logical Units:  001

Logical Unit Size (Blocks):  01141992 (see note)
Diagnostic Partition Size (Cylinders):  00001

```

DRIVE SWITCH SETTINGS (SECTOR):

		1	2	3	4	5	6	7
sw3	on	x	x	x		x		
	off				x x	x	x	
sw4	on		x					
	off	x	x	x	x	x	x	

NOTE:

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

 Drive Name: M2351A
 Base DU Unit Number: 000
 Number of Heads: 020
 Number of Sectors Per Track: 048
 Number of Cylinders: 00842
 Number of Logical Units: 001

Logical Unit Size (Blocks): 00789600
 Diagnostic Partition Size (Cylinders): 00001

DRIVE JUMPER SETTINGS

(SECTOR)

LOC.	INSTALLED			
BC7	2-3	5-6	9-10	13-14
BD7	3-4	6-7	9-10	13-14
BE7	3-4	5-6	10-11	13-14
BF7	3-4	6-7	10-11	13-14

(INTERFACE)

LOC.	INSTALLED		
AE7	3-4	6-7	10-11

Display Drive Configuration

```

-----
Drive Name:  M2361A
Base DU Unit Number:  000
Number of Heads:  020
Number of Sectors Per Track:  069
Number of Cylinders:  00842
Number of Logical Units:  001

Logical Unit Size (Blocks):  01142400 (see note)
Diagnostic Partition Size (Cylinders):  00001

```

DRIVE JUMPER SETTINGS

(SECTOR)

	swB								swA							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
on->							x			x		x x x		<-on		
off->	x x x x x x	x							x	x x			x	<-off		

(INTERFACE)

LOC.

INSTALLED

AE7

3-4 6-7 10-11

NOTE

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

```
-----
Drive Name:  M2372
Base DU Unit Number:  000
Number of Heads:  027
Number of Sectors Per Track:  069
Number of Cylinders:  00745
Number of Logical Units:  001

Logical Unit Size (Blocks):  01364148 (see note)
Diagnostic Partition Size (Cylinders):  00001
```

DRIVE JUMPER SETTINGS

(SECTOR)

	sw3							sw4						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
on->	x	x	x			x			x					<-on
off->				x	x			x	x	x	x	x	x	<-off

NOTE:

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system you are using.

Display Drive Configuration

```

-----
Drive Name:  M2382
Base DU Unit Number:  000
Number of Heads:  027
Number of Sectors Per Track:  084
Number of Cylinders:  00745
Number of Logical Units:  001

Logical Unit Size (Blocks):  01665063 (see note)
Diagnostic Partition Size (Cylinders):  00001

```

DRIVE JUMPER SETTINGS

(SECTOR)

	sw3							sw4						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
on->	x	x	x			x			x					<-on
off->				x	x	x		x	x	x	x	x	x	<-off

NOTE:

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system you are using.

Display Drive Configuration

```

-----
Drive Name:  DK815-10
Base DU Unit Number:  000
Number of Heads:  015
Number of Sectors Per Track:  070
Number of Cylinders:  01737
Number of Logical Units:  001

```

```

Logical Unit Size (Blocks):  01795725 (see note)
Diagnostic Partition Size (Cylinders):  00001

```

DRIVE SWITCH SETTINGS

			(SECTOR)		
			/		\
sw28			sw27		
1	x		1	x	
2	x		2	x	
3	x		3	x	
4	x		4		x
5		x	5	x	
6	x		6	x	
7	x		7		x
8		x	8	x	
o c			o c		
p l			p l		
e o			e o		
n s			n s		
e			e		
d			d		
sw41					
1	x		1	x	
2		x	2		x
3	x		3	x	
4	x		4	x	
5	x		5	x	
6	x		6	x	
7	x		7	x	
8	x		8	x	
o c			o c		
p l			p l		
e o			e o		
n s			n s		
e			e		
d			d		

NOTE:

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

 Drive Name: D2268
 Base DU Unit Number: 000
 Number of Heads: 010
 Number of Sectors Per Track: 070
 Number of Cylinders: 00823
 Number of Logical Units: 001

Logical Unit Size (Blocks): 00566490 (see note)
 Diagnostic Partition Size (Cylinders): 00001

sw2
 8 | x |
 7 | x |
 6 | x |
 5 | x |
 4 | x |
 3 | x |
 2 | x |
 1 | x |

o c
 p l
 e o
 n s
 e
 d

sw3
 8 | x |
 7 | x |
 6 | x |
 5 | x |
 4 | x |
 3 | x |
 2 | x |
 1 | x |

o c
 p l
 e o
 n s
 e
 d

(SECTOR)
 \ /

sw4
 10 | x |
 9 | x |
 8 | x |
 7 | x |
 6 | x |
 5 | x |
 4 | x |
 3 | x |
 2 | x |
 1 | x |

o c
 p l
 e o
 n s
 e
 d

Display Drive Configuration

```
-----
Drive Name:  D2362
Base DU Unit Number:  000
Number of Heads:  023
Number of Sectors Per Track:  070
Number of Cylinders:  00850
Number of Logical Units:  001
```

```
Logical Unit Size (Blocks):  01345776 (see note)
Diagnostic Partition Size (Cylinders):  00001
```

```

      sw2
8 | |x|
7 | |x|
6 | |x|
5 | |x|
4 | |x|
3 | |x|
2 | |x|
1 |x| |
```

```

o c
p l
e o
n s
e
d
```

```

      sw3
8 | |x|
7 | |x|
6 | |x|
5 | |x|
4 | |x|
3 | |x|
2 | |x|
1 |x| |
```

```

o c
p l
e o
n s
e
d
```

(SECTOR)

```

      sw4
10 |x| |
9 | |x|
8 | |x|
7 |x| |
6 | |x|
5 | |x|
4 | |x|
3 |x| |
2 |x| |
1 | |x|
```

```

o c
p l
e o
n s
e
d
```

NOTE:

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

TOSHIBA MK286FC

Display Drive Configuration

```

-----
Drive Name:  MK286FC
Base DU Unit Number:  000
Number of Heads:  011
Number of Sectors Per Track:  071
Number of Cylinders:  00823
Number of Logical Units:  001

Logical Unit Size (Blocks):  00632170
Diagnostic Partition Size (Cylinders):  00001
  
```

DRIVE SWITCH SETTINGS

option switch								sector switch												
	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8	9	10	
on	x	x	x			x			x		x	x	x	x	x	x				on
off				x	x	x	x			x	x			x						off

TOSHIBA MK288FC

Display Drive Configuration

```

-----
Drive Name:  MK288FC
Base DU Unit Number:  000
Number of Heads:  015
Number of Sectors Per Track:  071
Number of Cylinders:  00823
Number of Logical Units:  001

Logical Unit Size (Blocks):  00862050
Diagnostic Partition Size (Cylinders):  00001
  
```

DRIVE SWITCH SETTINGS

option switch								sector switch												
	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8	9	10	
on	x	x	x			x			x		x	x	x	x	x	x				on
off				x	x	x	x			x	x			x						off

SECTION 3

OPERATION -- BOOT, FORMAT, AND DIAGNOSTICS

The operation of the controller includes formatting the disk and running DEC diagnostics. Formatting is accomplished by prompting the operator for selecting inputs. The program is on components on the controller. Formatter error messages are also included in this section.

COMMUNICATION WITH CRT OR HARD COPY CONSOLE

If using the optional Dialog Format Paddle Card, the system console must be set up as follows:

- . 9600
- . 8 bit
- . no parity
- . 1 stop bit

If the system console is attached directly to the host, the setup is as follows:

- . 9600, 4800, 2400, 1200
- . 8 bit
- . no parity
- . 1 stop bit

DILOG LSI-11 BOOTSTRAP PROCEDURE

The controller not only supports standard DEC devices, but also allows the use of the onboard formatter. When DU is used, the standard DEC emulation is called. When FT is used, the onboard formatter is enabled for use through the system console.

The following assumes the system is in ODT mode. Note that the bootstrap can be used under processor Power Up Mode 2 conditions. Refer to the appropriate DEC manual for a discussion of the Power Up modes. Further note that the disk drive does not need to be READY to enter the bootstrap.

NOTE

The controller does not support boot on power up.

Reset the system by pressing RESET (Break) or enter the following (characters underlined are output by the system; characters not underlined are input by the operator):

- @ 773000G or 775000G
Depends on switch configuration set in Section 2.
- * Enter one of the following: DMO, DPO, DLO, DRO, MSO, MTO, DY0, DU, or FT <CR>.

Definitions are as follows:

DM = RK06/07 Disk
DP = RP02/03 Disk
DL = RL01/02 Disk
DR = RM02/03 Disk
MS = TS11 Tape
MT = Tape
MU = (TMSCP) Tape
DY = RX02 Floppy Disk
DU = DU emulation (see below)
FT = Enable onboard formatter through system console (see below)

Booting can be executed from logical units other than "0" shown above by entering the desired logical unit number, i.e., 1, 2, 3, ... or 7.

MICROVAX II COMMUNICATIONS PROCEDURE

A unique code is loaded into the SA register causing the controller to act as a UART. Proceed as follows:

1. On the MicroVAX II, perform INIT by depressing the RESTART switch.
2. Enter the code below. (Underlined values are outputs to the terminal.) The values of XXXXXXXX are hex values of the controller address of the SA register and are listed below:

>>>>D/P/L 20088004 80000001 <CR>

>>>>D/P/W 20001F40 20 <CR>

>>>>D/P/W XXXXXXXX 3FFF <CR>

>>>>S 200 <CR>

NOTE

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

L4 -/ The hex values of the addresses are as follows:

IP REGISTER OCTAL ADDRESS	SA REGISTER OCTAL ADDRESS	SA REGISTER HEX ADDRESS ENTERED
772150	772152	2000146A
✓ 760334	760336	200000DE
760340	760342	200000E2
760344	760346	200000E6
760354	760356	200000EE
760360	760362	200000F2
760374	760376	200000FE
760400	760402	20000102

An optional step may be used to examine the values entered. After the first three lines are entered and before S200 starts, examine by entering and checking for the following:

>>>E/P/W XXXXXXXX 800D

If 800D does not appear, there may be a problem in validating the memory maps. Contact the factory if this occurs.

After the bootstrap, the program is ready to format.

FORMATTING PROGRAM

After communication is established, the program is ready to format the disks.

The formatter's terminal I/O interface supports the following keys:

- DELeTe/Back Space: Delete the previous character input
- CTRL-U: Delete the entire input
- CTRL-C: Aborts the current process and returns to the menu
- CTRL-P: Prints out current cylinder address on the printer
- CTRL-S: (XOFF, Transmit Off); Stops the display on screen
- CTRL-Q: (XON, Transmit On); Continues display on screen after CTRL-S

Inputs and outputs to or from the program are in decimal with the exception of the following:

- IP/SA registers are displayed in octal.
- ECC error patterns are displayed in hexadecimal.
- Format data pattern is represented in hexadecimal.

The first display of the program will be:

```
-----  
DILOG On-Board Disk Formatter          IP/SA Address: 772150  
Model: DQ246/DQ256                     Version: A-A  
-----  
                        No Drive is Selected
```

Are you using a (P)rinter or (C)RT?

In the logo the IP/SA address depends on the switch settings described in Section 2. The address shown above is the IP register. Add 2 for the SA register (772152). The version is the hardware (first) and software (second) revision.

Enter P or C. If C is entered, rolling addresses will be displayed on the screen at format time. If P is entered, the address will not be printed unless an error is detected. To print a cylinder address at any time, press CTRL P. In the descriptions below, the logo is omitted but will be displayed on the screen, as shown above.

Main Menu

After the terminal type, C or P, has been selected, the logo will be displayed followed by the main menu:

No Drive is Selected

Main Formatter Menu

- 0 - Select SMD Drive 0
- 1 - Select SMD Drive 1
- 2 - Select SMD Drive 2
- 3 - Select SMD Drive 3
- 4 - Display Drive Configuration
- 5 - Rebuild Unit Control Block
- 6 - Modify Base DU Unit Number
- 7 - Format Drive
- 8 - Bad Block Scan

Enter a Selection:

If a drive has been selected previously, the display at the top will be similar to the following:

SMD Drive 000 Selected

A drive must be selected (0-3) before other items on the menu (4-6) can be entered. If a drive has been selected, the configuration of that drive may be displayed by entering 4. Item 6, Modify Base DU Unit Number, changes the previously assigned Base DU Number. Item 7, Format Drive, is used for partitioning discs on all four drives, identifying and replacing bad media areas, and reporting errors.

Items on the Main Menu are described below with the entry number in parentheses.

Select SMD Drive (0-3)

A maximum of four drives (0-3) may be selected. Each drive may be partitioned into a maximum of four logical units (0-3).

NOTE

The number of logical units is 4, but the designation of logical units in the format section is 0-3. When selecting, check the parameters in parentheses; for example, (2 ... 4) indicates number, (0-3) indicates designation.

If a drive is selected and has not been previously formatted, the program will prompt for the drive parameters, partitioning, and Base DU unit number. If the emulation cannot read the drive parameters from the Unit Control Block, the controller will disconnect from the host. If the formatter cannot read the drive parameters from the Unit Control Block, the program will invoke the query session. If the unit is selected and the parameters are displayed, the implication is the drive has a valid Unit Control Block. These terms are described below.

An example of a query session and responses follows:

SMD Drive 000 Selected

Drive Characteristics Query Session -
(CTRL-C ABORTS TO MAIN MENU)

Drive Name: XYZ

Number of Heads: 10

Number of Sectors Per Track: 32

Number of Cylinders: 800

Would you like to partition the drive (Y/N)?

Input ranges are as follows: Drive name, 14 alpha numeric characters; Heads, 1-127; Sectors, 2-127; Cylinders, 2-2047. The number of sectors per track is defined by the drive setup. If an incorrect value is entered, an error message will be displayed:

Input does not match number of sector pulses (064).

***** UNIT SELECT ERROR: Drive Setup Conflict *****
** ** ** ** Press <CR> to continue ** ** ** **

The 064 indicates the number of sectors defined by the drive setup. Other inputs may vary within maximum ranges of the drive; for example, the user may require partitioning of 700 cylinders and 9 heads. If the inquiry to partition the drive is No, the drive will be partitioned as one logical unit. If Yes, the user may select from 2 to 4 logical units as shown in the following example:

Number of Logical Units (2 ... 4): 4

The next inquiry will be similar to the following:

Base DU Unit (0 ... 252): 250 (See Note)

The BASE DU Unit assigns a sequential DU number to each logical unit on the drive, such that the BASE DU UNIT is assigned to the first logical unit (Logical Unit 0). The range of the DU unit varies according to the previous response; for example, if 3 logical units had been selected, the range would be (0 ... 253), or 1 logical unit (0 ... 255). The logical unit corresponds to the DU unit. In the example above (4 logical units), the numbers would be as follows:

NOTE

This base unit number is for example only. In normal system configuration this will be a 0.

Logical Unit Number

DU Unit Number

0	250
1	251
2	252
3	253

The controller divides a drive into logical units and reports these units to the host as DU units. After the query session or if selected from the main menu, the drive configuration will be displayed.

Display Drive Configuration (4)

From the example above, the drive configuration will be displayed as follows:

SMD Drive 000 Selected (XYZ)

Display Drive Configuration _

Drive Number: XYZ
Base DU Unit: 250
Number of Heads: 010
Number of Sectors Per Track: 064
Number of Cylinders: 00800
Number of Logical Units: 004

Logical Unit Size (Blocks): 00234740
Diagnostic Partition Size (Cylinders): 000004

Modify Above Parameters (Y/N)? <N>

The logical unit and diagnostic partition sizes are the results of the input values above. The number of sectors per track is derived by taking the manufacturer's bytes per track and dividing by DILOG's bytes per sector--which have a value of 584 bytes/sector. Refer to Section 2 for drive switch settings. If heads, cylinders, or logical units are changed, the results will change. The sizes of logical units on the drive are equal and are determined by the drive size and number of logical units. Any cylinders remaining after the drive is partitioned will be added to the Diagnostic Partition (initially the Diagnostic Partition size is one cylinder). If modification is required, the program will prompt again for new inputs.

Rebuild Unit_Control_Block_(5)_

This portion of the program tests and rebuilds the Unit Control Block. The program formats the UCB, rewrites drive parameters, and reads back the drive parameters for verification; data from the host area in the drive is not changed during this operation. After 5 is selected from the main menu, the first display will be as follows:

Testing Unit Control Block ...

If the test is successful, the following will appear:

Successful; UCB is OK.

If the test fails, a display similar to the following will appear:

Failed; UCB is corrupted.

```
***** UCB READ ERROR: Non-correctable Data Field Error *****
** ** ** ** ** Press <CR> to continue ** ** ** ** **
```

The above error message indicates the reason for the failure. Furthermore, the error type corresponds to the error generated by reading the last UCB copy.

NOTE

Errors are listed below after the Format section.

The next display is:

```
*** ** CAUTION *** **
If you continue, Unit Control Block on
the selected drive will be overwritten.
*** ** *** ** *** **
```

Would you like to continue (Y/N)? <N>

If the response is No, the program will exit to the main menu. If the response is Yes, the program displays the current drive parameters and permits the user to modify the parameters, followed by:

Recovering Drive Parameters ... Rebuild Operation

If the rebuild is successful, the following will appear:

Rebuild operation completed.

If rebuild failed, a display similar to the following will appear:

Rebuild operation failed.

```
***** UCB READ: Non-correctable Data Error *****
** ** ** ** ** Press <CR> to continue ** ** ** **
```

NOTE

The Unit Control Block must be rebuilt with the same drive parameters with which it has been formatted previously (Item 7 from the Main Menu, Format Drive, is described below).

Modify Base DU Unit Number (6)

If Item 6 is selected, the DU unit numbers may be changed starting with the first or base unit number. For the above example, the following would be displayed:

Base DU Unit (0 ... 252): <250>

To change the unit number, enter the new number; for example, 200, and the following will appear:

Base DU Unit (0 ... 252): <250> 200
Current Base DU Unit Updated.

Updating Unit Control Block

** ** * Press <CR> to continue ** ** *

If the operation is successful, the Unit Control Block will be updated with the new Base DU number. If the operation fails, an error message similar to the one below will appear. This operation does not affect the data on the host area.

***** UCB READ ERROR: Invalid Drive Characteristics *****
** ** * ** * Press <CR> to continue ** ** * ** *

Format Drive (7)

After selection and configuration of drives, the drives are ready for formatting. The program divides, or partitions, the disks into areas for different uses. Figure 3-1 shows two examples of partitioning. Drive parameters are recorded in the Unit Control Block. The host area is for user data, the Replacement and Cache Table (RCT) is used for listing bad-media replacement. There is also a replacement sector at the end of each track. Each drive has an area for diagnostics for use by the host.

When 7 is entered from the Main Menu, the following will appear:

SMD Drive 000 Selected

Format Menu

- 1 - Format Entire Drive
- 2 - Format Logical Unit
- 3 - Format Diagnostic Partition
- 0 - Exit Menu

Enter Selection: <000>

An entire drive, a logical unit, or the diagnostic partition may be formatted. Formatting one logical unit or the diagnostic partition does not affect the data on the other logical units.

If 1 or 2 is selected, the following will appear:

```
***   ***   ***  CAUTION  ***   ***   ***  
      If you continue, ALL DATA will  
      be lost on the selected unit!!  
***   ***   ***  ***   ***   ***   ***   ***
```

Would you like to continue (Y/N)? <N>

If yes is selected, the following appears:

SMD Drive 000 Selected

Format_SMD_Drive_000_
(CTRL-C ABORTS TO FORMAT MENU)

Data Pattern (0...FF): <00>

The data pattern is a combination of 1's and 0's written to and read from the drive. To check all bits, the most efficient patterns, in hex, are AA and 55.

If 1 is selected, the entire drive will be formatted as illustrated in Figure 3-1. In the example below, the disk is partitioned into four logical units. The cylinder address and the bad-block scan will roll on the screen as each cylinder is addressed. The program writes headers, initializes the RCT to a no-defect state, scans and reports bad blocks, and lists the blocks available to the user. The cylinder addresses shown below are for the last cylinder in each logical unit. The diagnostic partition which is formatted last is generally one or two cylinders.

Formatting DU250 (Logical Unit 000):
Writing headers at cylinder 00145
Initializing RCT to no defect state
Bad-block scan at cylinder: 00145
Number of available blocks: 00031682

Formatting DU251 (Logical Unit 001):
Writing headers at cylinder 00292
Initializing RCT to no defect state
Bad-block scan at cylinder: 00292
Number of available blocks: 00031682

Formatting DU252 (Logical Unit 002):
Writing headers at cylinder 00439
Initializing RCT to no defect state
Bad-block scan at cylinder: 00439
Number of available blocks: 00031682

Formatting DU253 (Logical Unit 003):
Writing headers at cylinder 00586
Initializing RCT to no defect state
Bad-block scan at cylinder: 00586
Number of available blocks: 00031682

Formatting Diagnostic Partition
Writing headers at cylinder 00588
Diagnostic Partition Size (cylinders): 00001
Format operation has completed

** ** * Press <CR> to continue ** ** *

If a 2 is selected, the same prompts will appear as when an entire drive is formatted, except after Data Pattern, the following will appear:

Logical Unit Number (0...003): <000>

The selected logical unit will then be formatted:

Formatting DU000 (Logical Unit 000)
Writing headers at cylinder 00145
Initializing RCT to no defect state
Bad-block scan at cylinder 00145
Number of available blocks: 00031682
Format operation has completed

** ** * Press <CR> to continue ** ** *

If 3 is selected from the menu, the display will resemble the following:

Formatting Diagnostic Partition
Writing headers at cylinder 00588
Diagnostic partition size (cylinders): 00001
Format operation has completed

** ** * Press <CR> to continue ** ** *

If an error occurs, the bad-block display will resemble the following:

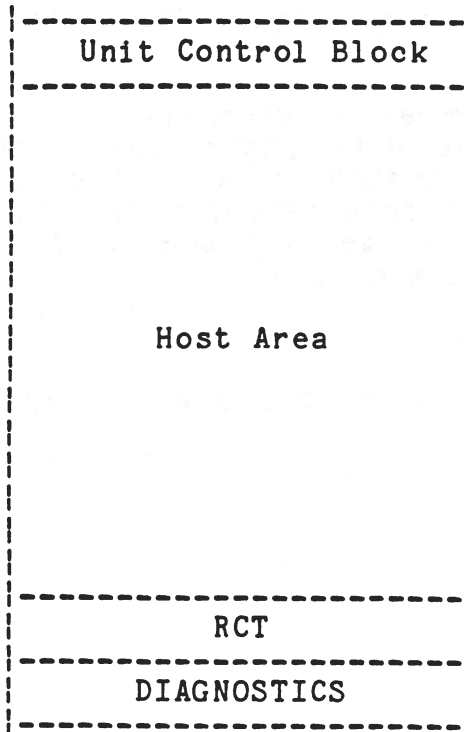
BAD-BLOCK found at LBN 00025050 (CYL:00632, HEAD:000, SECT:000)
Error Type: Correctable Data Field Error
(PATTERN: 01FA02, VECTOR: 00061, LENGTH: 10 bits)
Replacing LBN 00025050 with RBN 00000349 (Non-Primary)

In the example above, the error type is the ECC correction pattern. The vector is the number of bytes from the beginning of the sector in error and the length is the error burst in bits. Other errors are listed below.

An LBN (logical block number) is the position in the DU unit which is used by the host. The RBN (replacement block number) is also used by the host but is placed at the end of a track on the disk. If the replacement sector is not on the same track where the error occurred, the sector is considered as a non-primary replacement sector, and if at the end of a track where the error occurred, it is primary.

Figure 3-1 is a simplified description of the partitioning of two drives as one logical unit and three logical units.

Drive Partitioned
As 1 Logical Unit



Drive Partitioned
As 3 Logical Units

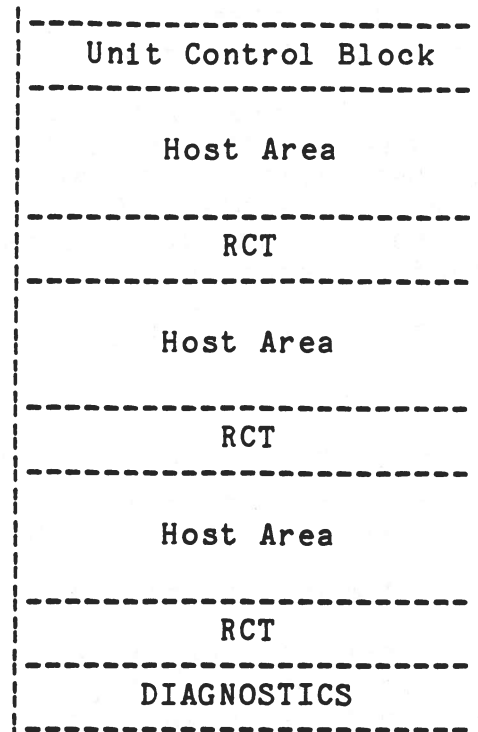


Figure 3-1. Drive Partitioning

Bad-Block Scan (8)

After the drives have been formatted, this option can be used to run patterns across the selected unit in order to locate and replace bad blocks. This can be achieved by means of read scan, write/read user-defined patterns, or write/read DILOG's default patterns. The entire drive or a logical unit may be scanned. The menu is as follows:

SMD Drive 001 Selected (XYZ)

Bad-Block Scan Menu

- ```

1 - Scan Entire Drive
2 - Scan a Logical Unit
0 - Exit Menu

```

Enter a Selection: <001> 1

Once the operator has selected the unit and the area which is to be scanned, the controller will prompt for the number of patterns. If the response to the above question is zero (0), the controller will read over the selected area without writing data patterns; any bad blocks found will then be replaced. Note that when a bad block is replaced, the data on the bad block will be lost.

If the operator responds with a nine (9), the controller will write eight data patterns across the selected area. Each write is followed by a read in order to detect bad media which will then be replaced. Patterns selected are as follows: 0000, 5555, AAAA, 8B8B, 3333, 3091, B6D9, 2D2D.

If the operator responds with a number between one (1) and eight (8), the controller will prompt for the data pattern(s). After the data pattern(s) have been selected, the controller will then write the "n" patterns (where "n" is the number of data patterns selected by the operator) across the selected area, each write will then be followed by a read in order to detect and replace bad media.

The following lists the data patterns:

SMD Drive 001 Selected (XYZ)

Scan SMD Drive 001 (XYZ)

-----  
(CTRL-C ABORTS TO FORMAT MENU)

Number of patterns (0..9): <009> 8

Data Pattern 1 (0...FFFF): <0000>

Data Pattern 2 (0...FFFF): <5555>

Data Pattern 3 (0...FFFF): <AAAA>

Data Pattern 4 (0...FFFF): <8B8B>

Data Pattern 5 (0...FFFF): <3333>

Data Pattern 6 (0...FFFF): <3091>

Data Pattern 7 (0...FFFF): <B6D9>

Data Pattern 8 (0...FFFF): <2D2D>

\*\*\*    \*\*\*    \*\*\*    CAUTION    \*\*\*    \*\*\*    \*\*\*  
If you continue, ALL DATA will  
be lost on the selected unit!!!  
\*\*\*    \*\*\*    \*\*\*    \*\*\*    \*\*\*    \*\*\*    \*\*\*

Would you like to continue (Y/N)? <N> No

## Errors

Error types and error contexts are listed below. The context describes what function was being performed when the error occurred. Error types may have more than one cause. Three stand-alone errors are listed separately.

| <u>Error Type</u>                 | <u>Description</u>                                                                                           |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------|
| Unit Not Selected                 | Drive is not selected--possible bad connection or drive not powered up.                                      |
| Multiple Unit Selected            | More than one drive has the same SMD unit number--check drive setup.                                         |
| Drive Not Ready                   | Drive did not spin up--perhaps drive power problem.                                                          |
| Seek Operation Failed             | Drive was not able to complete the seek, or the seek was to a non-existent cylinder--check drive parameters. |
| Drive Fault                       | Drive fault condition--consult drive manual.                                                                 |
| Sector Not Found                  | Unable to locate a sector or header miscompare--probably bad media in header.                                |
| RCT Access Failed                 | RCT partition corrupted.                                                                                     |
| Unable to Read Replacement Sector | During read scan, sector was previously replaced but replacement sector is bad.                              |
| Correctable Data Field Error      | Bad media in data field; error is corrected using ECC.                                                       |
| Non-correctable Data Field Error  | Bad media in data field; length of error is too large to be corrected.                                       |
| Sector Overrun                    | Drive not formatted properly--check drive setup.                                                             |
| No Data Synch Field               | Data Synch Field changed due to bad media.                                                                   |
| Unit Write Protected              | The drive is hardware write protected.                                                                       |
| No Sector/Index Pulse             | Sector or Index pulse not received--check drive manual.                                                      |

|                                   |                                                                                                                                                                                                                                                           |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unable to Write Headers           | During formatting, headers could not be written--check drive manual.                                                                                                                                                                                      |
| DDC Time-out                      | Integrated circuit in controller timed out--reselect drive from main menu.                                                                                                                                                                                |
| Drive Setup Conflicts             | During query session, program detects drive parameters which conflict with drive setup.                                                                                                                                                                   |
| Invalid Drive Characteristics     | Drive characteristics read from the drive are invalid. Could be number of sectors not set up properly, unit control block is corrupted (use 5 from the Main Menu to rebuild Unit Control Block), or drive has not been formatted via Universal Formatter. |
| Abort upon operator request       | Operator pressed CNTRL-C keys to abort operation.                                                                                                                                                                                                         |
| Unexpected Late-interlock (F)     | Fatal error--contact DILOG Customer Service.                                                                                                                                                                                                              |
| FIFO Data Lost (F)                | Fatal error--contact DILOG Customer Service.                                                                                                                                                                                                              |
| Fatal DDC Error (F)               | Fatal error--contact DILOG Customer Service                                                                                                                                                                                                               |
| Software Detected Fatal Error (F) | Fatal error--contact DILOG Customer Service.                                                                                                                                                                                                              |

| <u>Error Context</u> | <u>Description</u>                                                                                               |
|----------------------|------------------------------------------------------------------------------------------------------------------|
| UNIT SELECT          | Error occurred during unit select.                                                                               |
| UCB READ             | Error occurred when reading drive parameters from Unit Control Block; unable to read any of the multiple copies. |
| UCB WRITE            | Error occurred when writing drive parameters to Unit Control Block; unable to write any of multiple copies.      |
| UCB FORMAT           | Error occurred during formatting the Unit Control Block; unable to format any of multiple copies.                |

|            |                                                                                                             |
|------------|-------------------------------------------------------------------------------------------------------------|
| RCT READ   | Error occurred during reading an RCT block. Unable to read any of multiple copies.                          |
| RCT WRITE  | Error occurred during writing to RCT block. Unable to write any of multiple copies.                         |
| RCT FORMAT | Error occurred during formatting of RCT partition. Unable to format any of multiple copies.                 |
| READ       | Error occurred during reading data from the host area.                                                      |
| WRITE      | Error occurred during writing data to the host area.                                                        |
| FORMAT     | Error occurred during formatting to the host area.                                                          |
| REPLACE    | Error occurred during bad block replacement. Unable to replace bad LBN with RBN as described by type error. |

#### Stand-Alone Errors

#### Description

|                    |                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------|
| INPUT OUT OF RANGE | Input is not within the expected range.                                                              |
| INPUT IS REQUIRED  | No default for prompt.                                                                               |
| RCT IS FULL        | The Replacement Caching Table (RCT) on the selected drive is full. The drive should be re-formatted. |

## DIAGNOSTICS

Two DEC RC25 diagnostics may be used to test the controller. They are ZRCFB3, Front End Test, and ZRCDA1, Disc Exerciser. MicroVAX II, MKDA50-Q, diagnostics may also be used.

### SETUP AND SELF TEST

Install the controller as described in Section 2. Apply power to the system, and verify that the green LED lights. Install the XXDP+ diagnostic floppy in the floppy drive and boot the system. When the boot switch on the system is toggled, the LED will go out, but will light again when the controller is brought online by the diagnostic.

When booting is completed, the XXDP+ sign-on will appear:

```
XXDP-SM SMALL MONITOR VERSION 2
BOOT FROM DY0
28KW MEMORY
UNIBUS SYSTEM
```

```
RESTART ADDR: 152010
THIS IS XXDP-SM TYPE "H" OR "H/L" FOR HELP
```

(NOTE: 28KW = 28 Kilowords)

### FRONT END TEST ZRCFB3

The controller will only support tests 1-8 which must be selected by the user. These tests will bring the controller through initialization several times and do extensive checks on the DMA capability. Once the prompt "." has appeared, type the following command line to start ZRCFB3 diagnostic:

```
.R ZRCFB3
```

The system will echo the filename to let the user know that the file is being loaded.

```
.R ZRCFB3
ZRCFB3.BIN
```

When the diagnostic has been loaded, the diagnostic startup message will appear on the user's console.

```
DRSSM-F0
CZRCF-A-0
RC25 FRONT END/HOST DIAGNOSTIC
UNIT IS AZTEC RC25 PLATTER
RSTRT ADR 145676
```

```
DR>
```

The diagnostic can be started by typing the following command line:

```
DR>START/TEST:1-8<CR>
```

The above command line instructs the diagnostic supervisor to start the test but initiate only tests 1 through 8. The supervisor will then prompt the user for hardware or software changes.

CHANGE HW (L) ?

The diagnostic must be informed of the hardware parameters of the system under test. Enter the following information.

CHANGE HW (L) ? Y<CR>

Enter the number of controllers that are being tested.

# UNITS (D) ? 1<CR>

The diagnostic will then prompt the user to enter the following information for the number of units that have been selected. The following is an example:

```
UNIT 0
IP ADDRESS (O) 172150 ? <CR>
VECTOR (O) 154 ? <CR>
BR LEVEL (O) 5 ? <CR>
PLATTER ADDRESS[ES] (D) ? 0<CR>
```

The platter address is the unit number of the disc drive under test. Since the controller does not support the tests which require a disc, this question is not appropriate but must be answered to start the diagnostic. Once the hardware questions are answered, the supervisor will prompt for software changes.

CHANGE SW (L) ?

The software question can be answered NO because the controller does not support the tests which require a disc drive.

CHANGE SW (L) ? N<CR>

The diagnostic will print each test as it runs and will inform the user of any errors that occur.

```
TESTING UNIT #: 0 IP_REGISTER:172150 PLATTER #: 0

TEST 1 REGISTER EXISTENCE TEST
TEST 2 STEP 1 READ/WRITE POWERUP DIAGNOSTICS
TEST 3 DIAGNOSTIC WRAP TEST
TEST 4 VECTOR AND BR LEVEL TEST
TEST 5 STEP 1-3 READ/WRITE DIAGNOSTIC
TEST 6 PURGE POLL TEST
TEST 7 SMALL RING TEST
TEST 8 LARGE RING TEST
```

When the diagnostic has completed all the tests, the end of pass message will be printed and the diagnostic will be restarted.

```
DZRCF EOP 1
 0 TOTAL ERRORS
```

DR>EXIT<CR>

### DISC EXERCISER, ZRCDA1

The controller is also compatible with the multi-drive exerciser, ZRCDA1. This diagnostic will bring the controller online and issue random record numbers to the selected unit(s). This diagnostic also supports multiple controllers as well as multiple units on a single controller.

Once the XXDP prompt "." is displayed, run ZRCDA1 by typing the following command line:

.R ZRCDA1<CR>

The system will echo the filename to inform the user that the program is being loaded:

```
.R ZRCDA1
ZRCDA1.BIN
```

Once the diagnostic is loaded, the diagnostics startup message will be displayed on the user's console:

```
DRSSM-FO
CZRCD-A-0
RC25 DISC EXERCISER
UNIT IS SINGLE RC25 PLATTER
RSTRT ADR 145676
```

DR>

Patch as follows:

|         | ADDRESS | IS    | SHOULD BE |
|---------|---------|-------|-----------|
| PATCH 1 | 26070   | 16237 | 12737     |
|         | 26072   | 50    | 143326    |
| PATCH 2 | 30644   | 1003  | 1367      |
| PATCH 3 | 30704   | 1003  | 1367      |
| PATCH 4 | 37522   | 1416  | 240       |

Start the test after the diagnostic supervisor prompt "DR>" appears.

DR>START<CR>

The supervisor will then prompt the user to change hardware or software default parameters:

CHANGE HW (L) ?

The diagnostic must be informed of the hardware parameters of the system under test. Enter the following command line to change hardware parameters:

CHANGE HW (L) ? Y<CR>

Enter the number of controllers or drives that are currently being tested:

# UNITS (D) ? 1<CR>

If 2 is entered the next prompt will appear twice so that the second controller or second drive may be selected.

The diagnostic will prompt the user to enter the following information for the number of units that have been selected:

UNIT 0  
IP ADDRESS (O) 172150 ? <CR>  
VECTOR (O) 154 ? <CR>  
BR LEVEL (D) 5 ? <CR>  
PLATTER ADDRESS (UNIT PLUG) (D) 0 ? <CR>  
ALLOW WRITES TO CUSTOMER DATA AREA ON THIS PLATTER (L) ? Y<CR>  
\*\* WARNING - CUSTOMER DATA AREA MAY BE OVERWRITTEN! ...  
CONFIRM (L) ? Y<CR>

The platter address is the unit number of the disc drive under test. The customer data area is the host data area of the disc drive and is used to test the controller. Backup any data in the host partition, if necessary, before continuing with the diagnostic.

After the hardware questions are answered, the supervisor will prompt the user for any software changes:

CHANGE SW (L) ?

The user can take the default software values because all SMD drives are larger than an RC25. If the tests are being run on a contracted unit, some of the software values may have to be changed to prevent errors from occurring.

If the selected unit is fully formatted, use the default values by typing NO to the software query:

CHANGE SW (L) ? N<CR>

To change the software default values, answer YES to the software query:

CHANGE SW (L) ? Y<CR>

The user will then be prompted by the supervisor to input the following information:

ERROR LIMIT (0 FOR NO LIMIT) (D) 32 ? <CR>

Enter the error limit that must be reached before a unit is deselected by the diagnostic. The default value of 32 is used.

TRANSFER LIMIT IN MEGABYTES (0 FOR NO LIMIT) (D) 2 ? <CR>

Enter the number of bytes to be transferred between the controller and the diagnostic. Effectively, this selects the time required to reach an END OF PASS.

SUPPRESS PRINTING ERROR LOG MESSAGES (L) Y ? <CR>

The default value should be used unless multiple errors occur and more information is required to resolve the problem.

RUN DM EXERCISER INSTEAD OF MULTI-DRIVE SUBTEST (L) N ? <CR>

The default must always be taken because the controller does not support Diagnostic Mode (DM) of operation.

RANDOM SEEK MODE (L) Y ? <CR>

The best possible test is to seek randomly across the entire disc surface. Therefore, the default value should be used.

STARTING TRACK (D) 0 ? <CR>

The starting track number is to be entered. (Because the controller does not emulate the RC25, the questions regarding starting and ending track numbers do not apply. If the unit under test is fully formatted and is more than 40 megabytes, the diagnostic will not overflow the cylinder address.)

ENDING TRACK (D) 1641 ? <CR>

Enter the ending track number. If the unit is larger than an RC25 unit (40 megabytes), the default can be used.

READ-COMPARES PERFORMED AT THE CONTROLLER (L) Y ? <CR>

The default value is used to require the controller to compare the data read with host memory.

THE REMAINING QUESTIONS APPLY ONLY TO UNPROTECTED PLATTERS.

The user can use the default values for the remaining questions.

WRITE ONLY (L) N ? <CR>

The disc drive under test is never a write only disc; therefore, always take the default.

WRITE-COMPARES PERFORMED AT THE CONTROLLER (L) Y ? <CR>

The controller will perform write checks if the default is taken.

CHECK ALL WRITES AT HOST BY READING (L) N ? <CR>

The diagnostic will NOT issue read commands to check the data just written if the default is taken. Otherwise, the diagnostic software will perform the write check function.

USER DEFINED DATA PATTERN (L) N ? <CR>

The data pattern used in the diagnostic is worst case. To ensure prompt testing, always use the default value.

SELECT PREDEFINED DATA PATTERN (0 FOR SEQUENTIAL SELECTION)  
(D) 0 ? <CR>

Always use the default value.

The test will begin after the hardware and software questions are answered.

INIT SUBTEST START

ABOUT TO VERIFY VECTOR 154(0) FOR DEVICE 172150(0) ...COMPLETED

The diagnostic will run until the transfer limit is reached. After the limit has been reached, the diagnostic will print status information about the unit under test and display the END OF PASS message:

CZRCD EOP 1  
0 TOTAL ERRS

## MICROVAX II. MDM KDA50-Q

The controller is compatible with the MicroVAX II diagnostics as described below. Parts of the functional test, the exerciser, and the utility test are listed as either PASS or FAIL. Where FAIL is indicated, the error advisory is described.

### FUNCTIONAL TEST

#### Test 1 - PASS - Controller Wrap Mode Test

This test tests the ability of the controller to read in the SA register contents from the host and then turn around and write the same value back to the host.

#### Test 2 - FAIL - Controller Interrupt Test

This test tests the controller's ability to interrupt at the correct IPL and vector. It also verifies that the controller can be successfully initialized by the host.

The error advisory for this test failure was, "The controller interrupted above BR level 4," which is true since the controller's BR level is jumper selectable and was set to 5. The test will pass if the jumper is set to BR4 on the controller.

#### Test 3 - FAIL - Controller RAM Test

This test writes data patterns to the controller RAM and then reads the data patterns back to the host where they are verified.

The error advisory for this test failure was, "The controller SA register contains error code: 100016 <octal>." The controller does not allow direct access to its Data Buffer RAM.

#### Test 4 - PASS - Function Test (Verify Mode)

This test enables the controller and disk drives. An MSCP read and access command are issued to test the read and positioner circuitry of the drives.

#### Test 5 - PASS - Functional Test (Service Mode)

This test operates the same as Test 4 except in Service Mode.

### EXERCISER

#### Test 1 - PASS - Exerciser (Verify Mode)

This test performs random MSCP read and access operations on all of the drives selected for test. Data integrity is verified. The exerciser will run for 3 minutes.

#### Test 2 - PASS - Exerciser (Service Mode)

This test operates the same as Test 1 except in Service Mode.

## UTILITY

### Test 1 - PASS - MSCP Exerciser

This test is run the same as Test 2 of the Exerciser Section if run in the Read-Only Mode.

This test (when run in the Read/Write Mode) will perform random MSCP read, access, write, and erase commands. Error log and attention messages are enabled during this test. The exerciser will run for 3 minutes.

### Test 2 - FAIL - DUP Functional Test

This test loads a DUP program into the controller for improved fault isolation of controller and disk drives.

The error advisory for this test failure was, "The controller SA register contains error code: 100016 <octal>." The controller does not allow direct access to its Data Buffer RAM nor is it architecturally designed to run "downloaded" programs.

### Test 3 - FAIL - DUP RA Series Disk Formatter

This test loads a DUP program into the controller for disk formatting.

The error advisory for this test failure was, "The controller SA register contains error code: 100016 <octal>." The controller does not allow direct access to its Data Buffer RAM nor is it architecturally designed to run "downloaded" programs.



1  
2  
3



4  
5  
6

