

MODEL DQ686
DISK CONTROLLER
INSTALLATION AND OPERATION MANUAL

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REVISION P

2 November 1989



DISTRIBUTED LOGIC CORPORATION
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SECTION 1
DESCRIPTION

This manual describes the installation and operation of Distributed Logic Corporation (DILOG) Model DQ686 Disk Controller. The controller interfaces up to four ESDI, 5-1/4-inch Winchester disk drives to DEC* MicroVAX II, or any MICRO/PDP-11 or LSI-11 computer systems. Transfer rates of the system are up to 20 MHz.

The controller is software compatible with DU drivers, MSCP, in MICRO/VMS, DSM, RT-11, RSTS/E, RSX-11, and ULTRIX operating systems. The controller supports both block mode and non-block mode memory and is programmable by the host software driver to transfer from 1 to 8 words per DMA request.

Figure 1-1 is a Simplified Diagram of a Disk System.

LSI-11, MICRO/PDP-11
MicroVAX II Computers

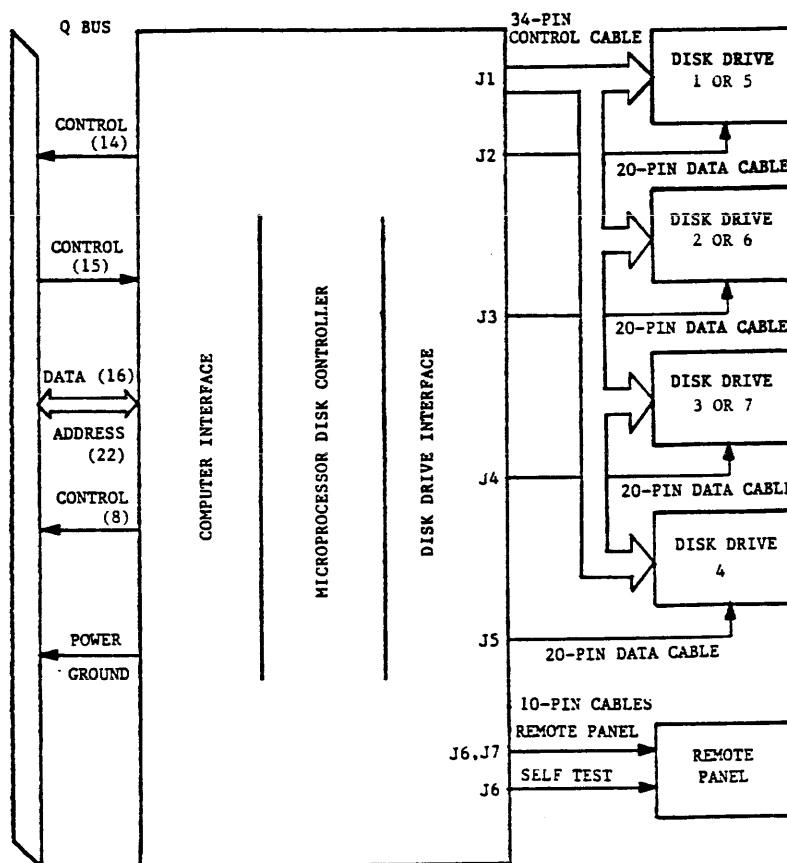


Figure 1-1. Disk System, Simplified

* DEC LSI-11, MICRO/PDP-11, MicroVAX II, RT-11, RSTS/E, MICRO/VMS, and DU Driver are registered trademarks of Digital Equipment Corp.

UNIVERSAL FORMATTING is a trademark of Distributed Logic Corp.

CHARACTERISTICS

Characteristics of the controller are as follows:

o DATA BUFFER

The controller contains a 28-sector FIFO data buffer to support a 1 to 1 sector interleave and reduce software-generated latencies between the Q bus and disk drive.

o COMMAND BUFFERING

The controller contains a command queue buffer capable of storing up to 16 commands. The buffer stores all commands received by the controller and queues the command, for proper order of execution on each drive.

o PARAMETER PASSING COMMANDS

With these ESDI commands, drive parameters are no longer stored in programmable components on the controller or recorded on the surface of the drive(s) attached to the controller. The drive(s) now communicates configuration information to the controller every time power is applied to the system.

o 22-BIT ADDRESSING

The controller supports 16-, 18-, and 22-bit Q-Bus addressing.

o INHIBIT DMA INCREMENT

The controller contains the ability to move blocks of data in or out of a specific memory of I/O address location. This function is software selectable for applications that require both incremental and non-incremental applications to run concurrently on the same controller.

o ONBOARD FORMATTING

The controller onboard formatter is accessible through the system processor to provide interactive terminal access to the controller. The formatter is menu driven and also provides controller and drive test options.

o MEDIA FLAW COMPENSATION

The following functions compensate for media defects:

FIRST, at format time one sector per track is reserved as an alternate, DILOG'S UNIVERSAL FORMATTING system has the ability to reassign reserved sectors for defective sectors. Also at format time the controller has the ability to read the manufacturer's defect map (if recorded per ESDI specification) and replace the sectors found bad by the drive manufacturer.

SECOND, if an error is encountered after the drive is formatted the controller will try to reread the sector with ECC disabled.

THIRD, if the error still exists, ECC is used to recover the data. This enhanced 32-bit ECC polynomial is capable of correcting one error per sector that is 11 bits or less in length. Error packets are generated by the controller every time an error recovery operation is performed.

FOURTH, if the error still exists, reassignment of defective sectors is accomplished through a dynamic replacement scheme controlled by the host software.

o HARDWARE BOOTSTRAP

The controller contains an onboard bootstrap support for RP02, RL01/02, RM03, RM05, RM80, RK06/07, RX02, TS11, TSV05, TM11 and DU driver devices. Onboard jumpers allow selectable bootstrap addresses, in addition to enabling/disabling the bootstrap. When the bootstrap is disabled, the controller will boot from the standard DEC module.

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 REMOTE PANEL INTERFACE

Two interface connectors are supplied for remote panels. The panels are user-supplied. Each panel contains four LEDs and four switches for drive selection and write protection. Error codes are also displayed on one of the remote panels.

o 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.

o DISK DRIVES SUPPORTED

The controller is compatible with disk drives from the following manufacturers. Contact the factory for additional drive support.

CONTROL DATA CORPORATION
FUJITSU
HITACHI
MAXTOR

MICROPOLIS
NEC
PRIAM
SIEMENS

o DISK INTERFACE

The controller interfaces up to four disk drives through 34- and 20-pin cables. If more than one drive is used, the 34-pin control cable is daisy-chained. The 20-pin cables are connected separately from the controller to each drive. Table 1-2 lists the 34-pin interface signals, and Table 1-3 lists the 20-pin interface signals.

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	Memory Refresh.
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	BIAK11 L BIAK10 L BIAK21 L BIAK20 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	BDMG11 L BDMG10 L BDMG21 L BDMG20 L	I O I O	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.
AC1, AD1, BC1, BD1, BE1, BF1	BDAL 16 L BDAL 21 L	O	Extended Address Bits 16-21

Table 1-2. Control Cable J1 - Controller to Drive

SIGNAL NAME	SIGNAL PIN	GROUND PIN	SOURCE
- Head Select 2 ³	2	1	Controller
- Head Select 2 ²	4	3	Controller
- Write Gate	6	5	Controller
- Configuration Status Data	8	7	Drive
- Transfer Acknowledge	10	9	Drive
- Attention	12	11	Drive
- Head Select 2 ⁰	14	13	Controller
- Sector	16	15	Drive
- Head Select 2 ¹	18	17	Controller
- Index	20	19	Drive
- Ready	22	21	Drive
- Transfer Request	24	23	Controller
- Drive Select 1	26	25	Controller
- Drive Select 2	28	27	Controller
- Drive Select 3	30	29	Controller
- Read Gate	32	31	Controller
- Command Data	34	33	Controller

Table 1-3. Data Cables J2, J3, J4, J5 - Controller to Drive

SIGNAL NAME	SIGNAL PIN	GROUND PIN	SOURCE
- Drive Selected	1		Drive
- Sector	2		NOT USED
- Command Complete	3		Drive
- Address Mark Enable	4		Controller
- Reserved	5	6	
± Write Clock	7/8		Controller
- Reserved	9		
± Read/Reference Clock	10/11	12	Drive
± NRZ Write Data	13/14	15/16	Controller
± DR Data	17/18	19	Drive
- Index	20		Drive

Figure 1-2 shows the interface for the customer-supplied remote panels. There are two panels; one connects from J6 and one from J7. The switches and LED connections depend on which drives are connected to J2, J3, J4 and J5. Error codes are displayed from J6 connectors. These codes are listed in Section 2.

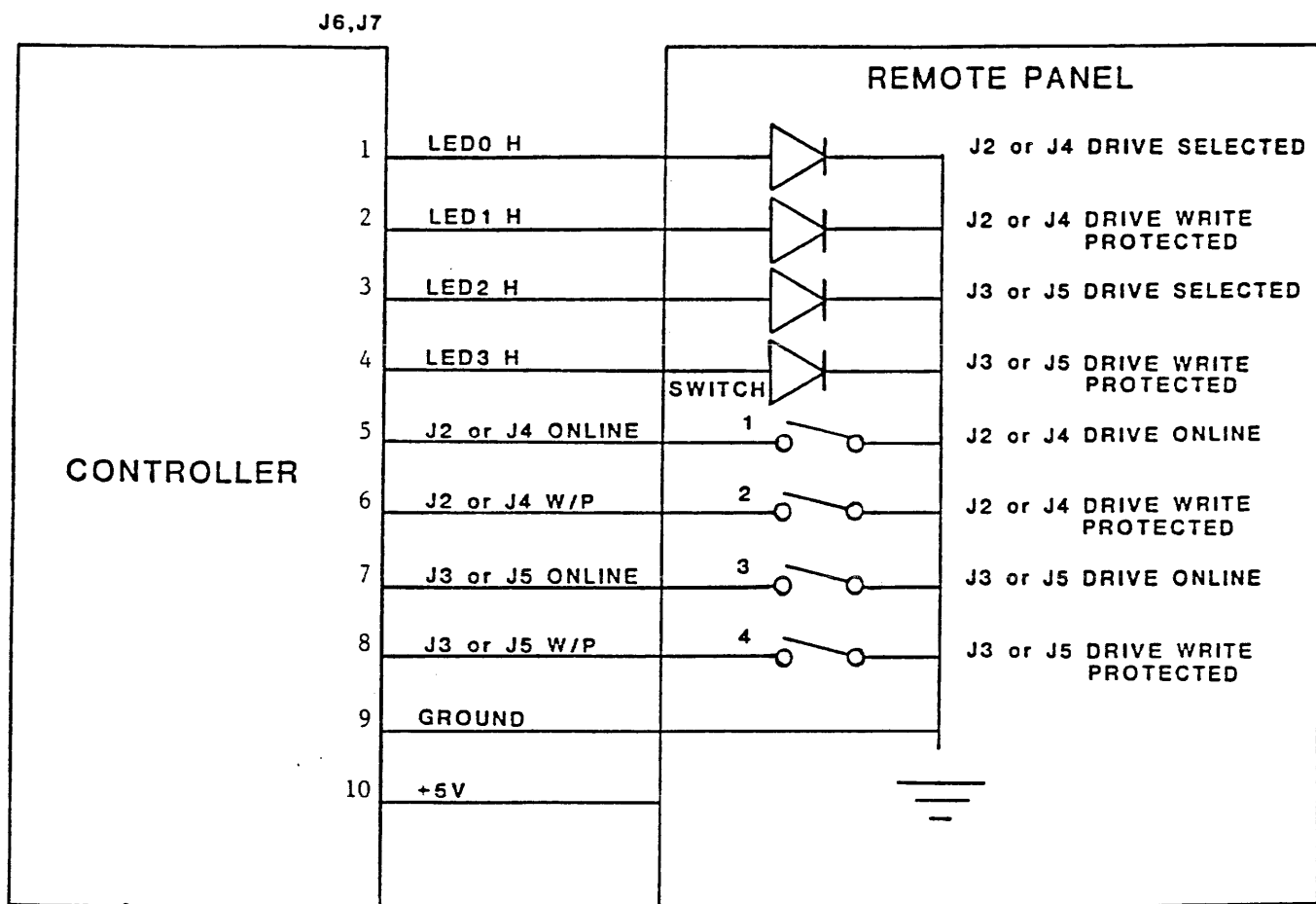


Figure 1-2. Remote Panel Interface

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-height slot.

BASE ADDRESSES

8 choices, switch selectable:

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

INTERRUPT VECTOR ADDRESS

Programmable by software.

PRIORITY LEVEL

BR5 in etch; BR4, BR6, and BR7 by jumpers.

DMA BURST SIZE

Preprogrammed for 8- and 16-word transfers.

DISK TRANSFER RATES

Up to 20 MHz per second.

DISK DRIVE I/O

One 34-pin flat ribbon cable and four 20-pin flat ribbon cables (one for each drive).

POWER

+5 volts at 2.5 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.

MTR

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 34-pin control cable to the drive(s) and 20-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.

Tables 2-1 and 2-2 describe 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.

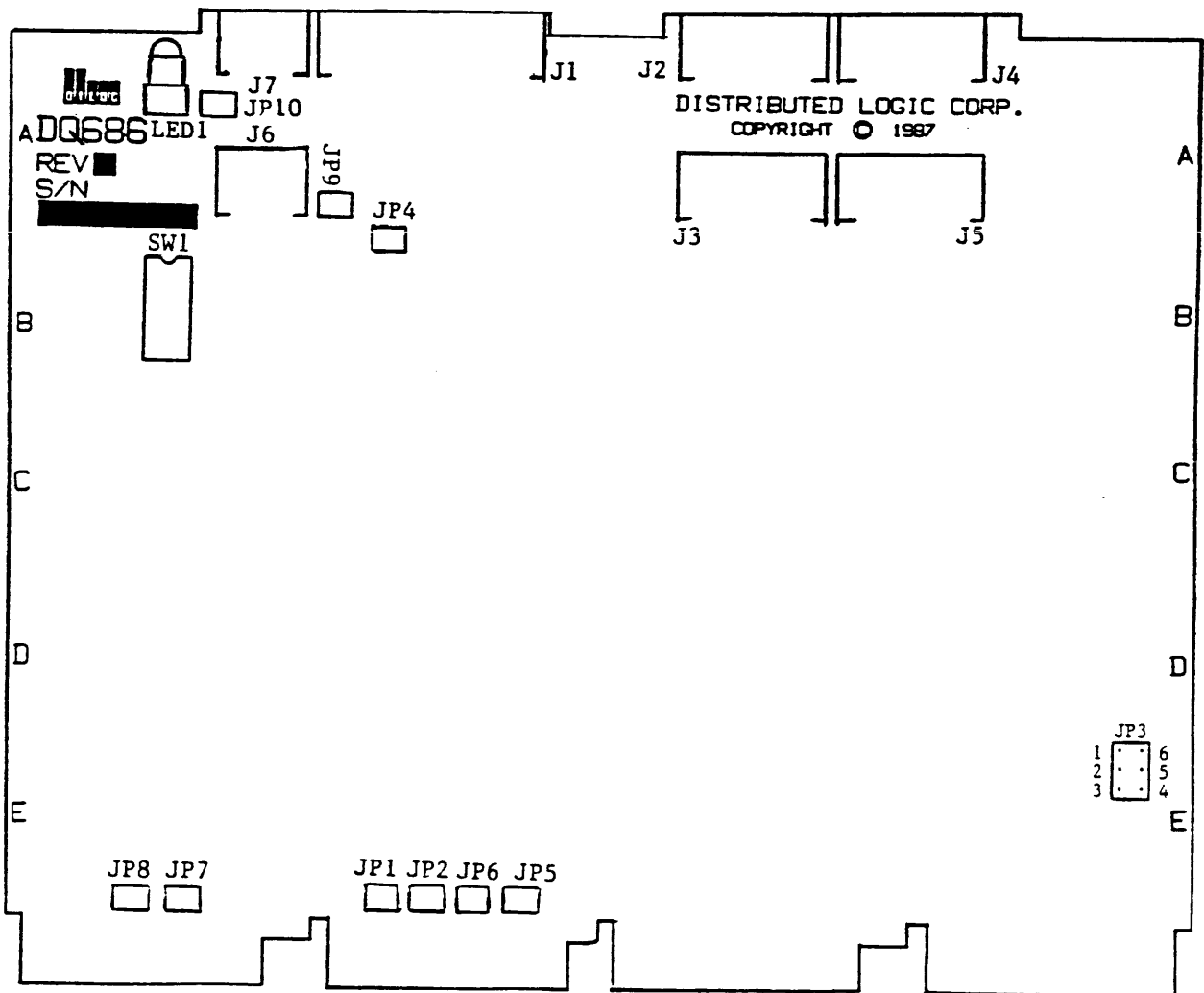


Figure 2-1. Controller Configuration

Table 2-1. Switch and Jumper Setting - LSI-11

Switch SW1

Slave Address Select (IP/SA Register)

SW1-1	SW1-2	SW1-3	ADDRESS SELECT
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

Switch SW1-4

SELECT BOOT ADDRESS

OFF = 773000
 ON = 775000

Switch SW1-5

BOOT ENABLE

ON = ENABLE LSI-11 BOOT
 OFF = DISABLE LSI-11 BOOT

Switch SW1-6

AUTOBOOT

ON = BOOTS DUO ON POWER UP/RESET
 OFF = AUTO BOOT DISABLED

Switch SW1-7

EXTENDED DWELL TIME

ON = Extends the dwell time between DMA bursts (12.8 usec)
 if pending interrupt requests.
 OFF = Normal dwell time between DMA bursts.

Switch SW1-8

Q-BUS PARITY ENABLE

ON = Checks and reports parity to host
 OFF = Parity disabled

Table 2-1. Switch and Jumper Setting - LSI-11 (Cont.)

Jumper JP3 - Priority Level

Pin Connections			
1 to 6	2 to 5	3 to 4	Priority Level
Installed (etch)	Installed (etch)	Installed	BR4 (Factory Set)
Installed (etch)	Installed (etch)	Removed	BR5
Installed (etch)	Removed (cut)	Installed	BR6
Removed (cut)	Removed (cut)	Installed	BR7

Jumper JP4 - Installed (Factory Etch)

When removed, indicates a future hardware revision.

Jumpers JP1, JP2, JP5, JP6, JP7, JP8 -

All jumpers are installed (etched) unless the board is placed in Q/CD backplane slots (refer to Figure 2-2). If placed in Q/CD backplane slots, remove these six jumpers (cut the etch).

Jumper JP9/JP10 - Removed (Factory Set)

These jumpers may be installed for +5V Remote Panel power.

Table 2-2. Switch and Jumper Setting - MicroVAX II

Switch SW1

Slave Address Select (IP/SA Register)

SW1-1	SW1-2	SW1-3	ADDRESS SELECT
OFF	OFF	OFF	= 20001469 (A)
ON	OFF	OFF	= 200000DD (B)
OFF	ON	OFF	= 200000E1 (C)
ON	ON	OFF	= 200000E5 (D)
OFF	OFF	ON	= 200000ED (E)
ON	OFF	ON	= 200000F1 (F)
OFF	ON	ON	= 200000FD (G)
ON	ON	ON	= 20000101 (H)

Switch SW1-4

SELECT TERMINAL

OFF = VT100
ON = GPX

Switch SW1-5

MUST BE OFF

Switch SW1-6

ONBOARD FORMATTER

ON = ENABLE B/8 DUA9
OFF = DISABLED B/8 DUA9

Jumper JP1 - Factory use only.

Jumper JP2 - Optional +5 volt power for remote panel

Jumper JP3 - Priority Level

Pin Connections

1 to 6	2 to 5	3 to 4	Priority Level
Installed (etch)	Installed (etch)	Installed	BR4 (Factory Set)
Installed (etch)	Installed (etch)	Removed	BR5
Installed (etch)	Removed (cut)	Installed	BR6
Removed (cut)	Removed (cut)	Installed	BR7

PRE-INSTALLATION CHECKS

Before the controller is installed, it may be necessary to check the operating system for device addresses. The drives are designated DUX except in VAX/VMS where they are designated DUAX. The "X" represents drive number and drives may be any number from 0 to 6. The numbering of drives is described in Section 3 under Main Menu, Select Drive.

NOTE

The ESDI drive numbering system is 1-7; the DEC numbering system is 0-6. Consult the drive manufacturer's documentation for selecting the ESDI configuration of the drive. The controller on-board formatting program lists both numbers; for example, "ESDI DRIVE 01 (DU00) SELECTED."

1. From the operating system, determine and select the address of the controller to be installed. Available addresses are listed in Table 2-1. Examples of controller names for the first controller for some operating systems are as follows:

OPERATING SYSTEM	CONTROLLER
RSTS/E	RU1
RSX-11M-PLUS	DUA
RT-11	Port0
VAX/VMS	DUA

2. Determine and select the drive name. The first drive may be DU0, except for VAX/VMS, which is DUA0. Set the switches and jumpers in the controller and drive for the selected addresses.
3. Remove power from the system and install the controller as described below.

RECOMMENDED DRIVE SETUP

The switches and jumpers on the disk drive need not be set up to accommodate the controller. The controller interrogates the drive for the status and configuration and selects the optimum format. However, where there are choices for selecting drive options (for example, hard/soft sectoring), for the most efficient use of the system, DILOG recommends the following:

OPTION	RECOMMENDATION/REQUIREMENT
Hard/Soft Sector	Hard Sector - The controller can accept both, but hard sectoring is the most efficient use of drive capacity.
Motor Control Enable/Disable	Enabled - With motor control enabled, the controller can sequence the drive, requiring less power consumption.
Drive Cabling From J2, J3, J4 and J5	No recommendation - J2, J3, J4 and J5 cables may be connected to either drive. The remote panel connections depend on the J2, J3, J4 and J5 connections.
Step or Serial Mode	SERIAL MODE REQUIRED - Few drives offer a step mode option, but these must be set for serial mode. (With the step mode, the controller must know where the head is and where the next Seek must go. With the serial mode, a single command causes a Seek to a given track.)

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. Perform this step if the remote panel switch/indicators are to be connected. Connect the cables from J6 and J7 on the controller to the remote panels (not supplied by DILOG). Refer to Figure 1-2 for pinouts and descriptions.
3. Install J1 and J2 into the connectors on the controller and J3, J4 and J5, if four drives are used. Ensure pin 1 on each cable is matched with the triangle on each connector as indicated on Figure 2-1.
4. 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.
5. Connect J1 to the drive or drives if daisy-chained. Ensure the terminator is installed in the last drive. Connect the J2, J3, J4 and J5 cables to the appropriate drive as described in Section 3 under Drive Select.
6. Refer to the disk drive manual for operating instructions, and apply power to the drive(s) and the computer.

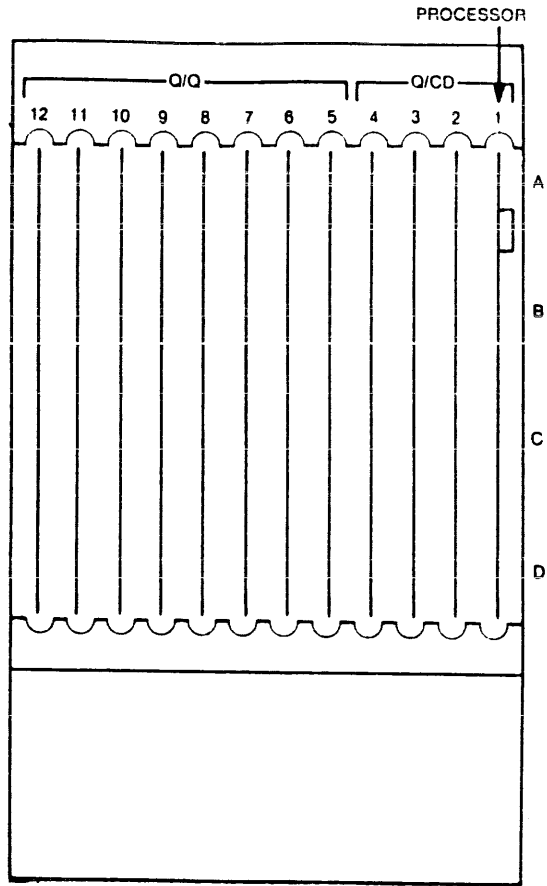


Figure 2-2. MicroVAX II Backplane (Typical)

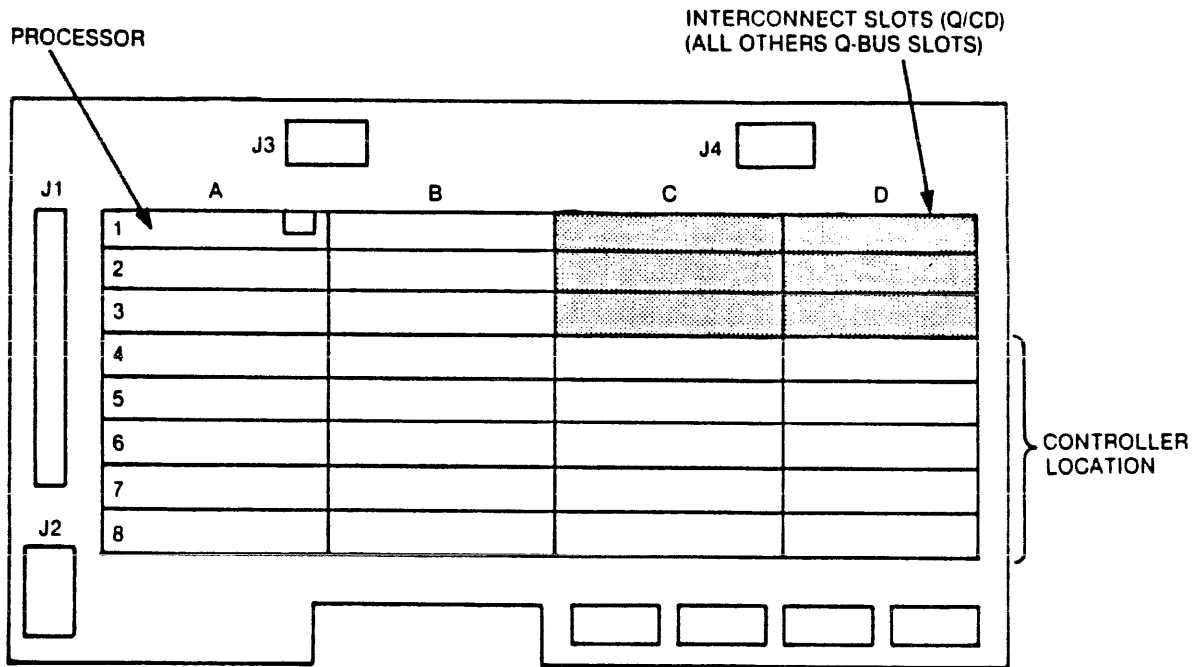


Figure 2-3. MicroVAX II H9278 Backplane

7. Power up the system. If the green LED lights, self test passed. If the green LED does not light, self test failed. If the remote panels (J6 and J7) are used, the remote panel LEDs will display the self test error code on J6 only. (See Table 2-3 for Self Test Error Code Definitions.) If the green LED does not light, perform the following steps:
 - A. Power down the system.
 - B. Remove all drive cables.
 - C. Power up the system.
 - D. If the green LED lights, the cabling was probably wrong. Install the cables into the proper connector.
8. The system is now ready to operate. Format the disks as described in Section 3.

Self test is entered upon initialization (Reset or Write IP Register). If self test fails, error code is displayed on the Remote Panel LEDs (J6 only) and self test LED is off. Upon self test failure, report status to DILOG Customer Service.

Table 2-3. Test in Error - Remote Panel

LED3 J3 Drive Write Protected	LED2 J3 Drive Selected	LED1 J2 Drive Write Protected	LED0 J2 Drive Selected	DESCRIPTION
0	0	0	1	Test Drive Status A Register
0	0	1	0	Test Drive Status B Register
0	0	1	1	Test Controller Status Register (Remote Write Protect)
0	1	0	0	Request QBIC Status Register and Test Status Bits
0	1	0	1	Test QBIC DMA LSB Byte Count Register
0	1	1	0	Test QBIC DMA MSB Byte Count Register
0	1	1	1	Test QBIC DMA MSB Byte Count Register
1	0	0	0	Clear QBIC DMA Byte Count Register
1	0	0	1	Test QBIC DMA Control Register (Enable Zero Fill)
1	0	1	0	Test Z80 Working RAM Address Test (only on power up)
1	0	1	1	Test Z80 Working RAM Pattern (5AH) (only on power up)
1	1	0	0	Test Z80 Working RAM Pattern (A5H) (only on power up)
1	1	0	1	Test Disk Data RAM Address/Pattern (only on power up) First 8K
1	1	1	0	Test Disk Data RAM Address/Pattern (only on power up) Second 8K
1	1	1	1	Zero Fill Data RAM and test for zeros (16K) (only on power up)

SECTION 3

OPERATION -- FORMAT, DIAGNOSTICS, AND ERROR LOGGING

The operation of the controller includes interrogating the drive, formatting the disk, running diagnostics, and checking the disk subsystem error log. Interrogating the ESDI drive is simply determining the drive parameters for formatting.

There are two methods for establishing communications with the formatting program:

- o DILOG LSI-11 Boot procedure
- o MicroVAX II Communications procedure

These methods are described below. Diagnostic procedures and error log messages are listed at the end of 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:

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

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

- o 9600, 4800, 2400, 1200
- o 8 bit
- o no parity
- o 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. Refer to Table 2-1 for LSI-11 switch settings.

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, MU, DY0, DU, or FT <CR>.

Definitions are as follows:

DM = RK06/07 Disk
DP = RP02/03 Disk
DL = RL01/02 Disk
DR = RM03/05/80
MS = TS11 Tape
MT = Tape
MU = (TMSCP) Tape
DY = RX02 Floppy Disk
DU = DU emulation (see below)
FT = Enable onboard formatter through system console

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

There are two methods to boot MicroVAX II. Refer to Table 2-2 for MicroVAX II switch settings. The first is as follows:

1. Press RESTART
2. Enter the following - >>> B/8 DUA9, where "A" is selected slave address.

With the second method, a unique code is loaded into the SA register causing the controller to act as a UART. Ensure the boot switch is disabled.

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.

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.

FORMATTING PROGRAM

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

NOTE

Inputs or outputs to or from the program may be in either decimal or Hexadecimal. In the upper right hand corner of the screen after the header, either "DECIMAL" or "HEX" will be shown. To change values, use the CONTROL and B keys. When these keys are pressed an audible alarm will sound, and outputs will toggle immediately. Exceptions are listed below:

The following outputs are fixed, and will not change:

- o SA/IP Registers - Always Octal
- o Firmware Version - Always Decimal
- o Date - Always Decimal
- o Drive Capacity and Transfer Rate - Always Decimal
- o Correction Pattern and Vector - Always Hexadecimal

The first display of the program will be:

```
-----  
DILOG On Board Disk Formatter      IP/SA Address = 772150  
Version: A-B-C      Model DQ686      Boot Address = 775000  
-----
```

NO DRIVE SELECTED

DECIMAL

ARE YOU USING A (P)RINTER OR (C)RT?

If a CRT is used, the program will display rolling cylinder addresses. If a printer is used, the addresses will not be printed unless an error is detected. If an address is needed when a printer is used, use the CONTROL and P keys and the address will be printed.

Each display on the screen will list the program name, the version, and the controller model, followed by either "NO DRIVE SELECTED" or "DRIVE 0 (or 1) SELECTED." The main formatter menu will appear next. The ESDI convention of numbering drives is 1-7; the DU driver convention is 0-6.

MAIN MENU

The logo is shown in the example, below, but is omitted in the subsequent examples.

The Main Formatter Menu is as follows:

```
-----  
DILOG On Board Disk Formatter      IP/SA Address = 772150  
Version: A-B-C      Model DQ686      Boot Address = 775000  
-----  
ESDI DRIVE 01 (DU00) SELECTED      DECIMAL
```

MAIN FORMATTER MENU

```
-----  
1 - SELECT DRIVE 01 OR 05          7 - SELECT DRIVE 03 OR 07  
2 - SELECT DRIVE 02 OR 06          8 - SELECT DRIVE 04  
3 - DISPLAY DRIVE CONFIGURATION  
4 - FORMAT DRIVE  
5 - READ DRIVE DATA  
6 - WRITE DATA TO DRIVE  
9 - MEMORY - DMA TEST  
E - PRINT ERROR LOG              R - REPLACE BAD BLOCKS  
T - READ/WRITE RANDOM SECTORS TEST  W - WR/RD/COMPARE DRIVE DATA
```

Enter a Selection:

The first letter (A) of the version number represents the hardware revision number, the second letter (B) represents the formatter version number, and the third letter (C) represents the DU emulation revision. The IP/SA and boot addresses are read from the switch settings. The address shown above is the IP register. Add 2 for the SA register (772152). Items 1, 2, 7, and 8, SELECT DRIVE, will be the number of the drive as wired on the drive; for example, if the second drive is selected (jumpered) as 6 on the drive, the display will be 06. A drive may be assigned the numbers 1 or 5 but not both; that is, if 1 is assigned, 5 may not be assigned. The same applies for 2 or 6 and 3 or 7. If the drives are assigned the same number or if the two least significant binary bits are the same, the program will prompt as follows:

```
ERROR - BOTH DRIVES HAVE THE SAME UNIT NUMBER  
RESET THE UNIT NUMBERS AND PRESS RETURN TO RESTART
```

or

```
ERROR - DRIVE UNIT NUMBERS MUST HAVE UNIQUE LEAST SIGNIFICANT  
BITS  
RESET THE UNIT NUMBER AND PRESS RETURN TO RESTART
```

DMA Memory Test

In the DILOG LSI-11 mode or the MicroVAX II mode, the system will only size, but will not test the memory. The onboard formatting program will size and test the memory. If a CRT is used, the size number in Kbytes will change continually until the total memory size is displayed. For the DILOG LSI-11 or MicroVAX II, the following message will appear:

CANNOT DO DMA TEST WHILE FORMATTING FROM HOST

Select Item 9 on the menu, and after the logo, a display similar to the following example will appear:

MEMORY SIZE (KBYTES) = 0512

```
*** *** *** C A U T I O N *** *** ***
      THIS TEST MODIFIES DEC MEMORY !!!
      IF THE HOST IS RUNNING AND YOU CONTINUE,
          YOU WILL CRASH THE OS!!!
*** *** *** **
```

```
      1 - Continue
<ANY OTHER KEY> - Abort, return to Main Menu
```

Enter a Selection: 1

CHECKING DMA - PLEASE WAIT

CHECKING DMA AT (KBYTES) = 0512

DMA IS OPERATIONAL OVER THE ENTIRE MEMORY RANGE

CHECKING NON-INC DMA AND BOOT ROM

Press RETURN to continue

NOTE

If a printer is used, the memory size will be displayed when the test is completed. The line "CHECKING DMA AT (KBYTES)" will be displayed only when a CRT is used.

If there is a failure, the program will give one of two reasons and display the address where DMA failed:

DMA TEST FAILED DUE TO DATA MISCOMPARE AT DEC ADDRESS = XXXXXX

DMA TEST FAILED DUE TO NONEXISTENT MEMORY AT DEC ADDRESS = XXXXXX

Select Drive

Before Items 3 through 6 are selected, a drive must be selected by selecting Items 1, 2, 7 or 8. If drive 1 is selected, the Main Menu will appear with a message similar to the following example:

```
ESDI DRIVE 01 (DU00) SELECTED                                DECIMAL
```

If a drive is selected, but the drive is not powered up, the message will be similar to the following:

```
1 - SELECT DRIVE NULL
```

When the drive is selected and powered up, the message will be:

```
1 - SELECT DRIVE 01
```

After a drive is selected, it must spin up. If the drive does not spin up within the program time-out period (approximately 45 seconds), the program will display the following error message:

```
DRIVE SETUP ERROR
```

```
Press RETURN to continue
```

When the Main Menu reappears, the message will again be:

```
NO DRIVE SELECTED                                DECIMAL
```

NOTE

Selecting a drive will clear the formatter's internal error log (see the "R" menu entry).

Display Drive Configuration

Item 3 in the Main Menu will present the drive configuration. An example follows:

```

          ESDI DRIVE 01 (DU00) SELECTED                                DECIMAL

DISPLAY DRIVE CONFIGURATION
-----
DRIVE IS HARD SECTORED                                MOTOR CONTROL = ON
DATA TRANSFER RATE (MHZ) = 5                               VENDOR ID = 15
NUMBER OF CYLINDERS = 0922                                MODEL NO. = 08
NUMBER OF HEADS = 0009
NUMBER OF USER SECTORS/TRACK
  (NOT INCLUDING ONE SPARE) = 0017                        INTERLEAVE = 01
USER DRIVE CAPACITY (MBYTES) = 071.8                      USER RECORDS = 00141066
  
```

Press RETURN to continue

NOTE

Data Transfer Rate and Drive Capacity will always be in decimal. Vendor Identification and Model Numbers will always be in hex.

The interleave factor may be specified or changed in the Format Section, Item 4, from the Main Menu.

The Vendor Identification Numbers are listed in Table 3-1. The Vendor Model Number may be obtained from the vendor's documentation.

Table 3-1. Vendor Identification Number

Vendor Identification Code	Company Name	Vendor Identification Code	Company Name
00	Vendor Not Identified	10	PRIAM
01	CONTROL DATA/MPI	11	SIEMENS COMMUNICATIONS
02	CYBERNEX-AST	12	TOSHIBA
03	ELECTRONIC PROCESSORS	13	IBM
04	FUJITSU	14	MINISCRIBE
05	HITACHI	15	HEWLETT PACKARD
06	INFORMATION STORAGE	16	RICOH
07	LASERDRIVE	17	MICROSCIENCE
08	MAXTOR	18	VERBATIM
09	MICROPOLIS	19	not assigned
0A	mitsubishi electric	1A	not assigned
0B	NEC	1B	not assigned
0C	NEWBURY DATA RECORDING	1C	not assigned
0D	NISSEI SANGYO	1D	not assigned
0E	OPTIMEM	1E	not assigned
0F	PERTEC PERIPHERALS	1F	not assigned

Format Drive

To format the drive, enter Item 4 from the Main Menu, and the following will appear:

ESDI DRIVE 01 (DU00) SELECTED

DECIMAL

Format Selected Drive

*** ** CAUTION *** **
IF YOU CONTINUE, ALL DATA WILL BE LOST
ON THE SELECTED DRIVE!!!
*** ** ** ** **

1 - Continue with format
<ANY OTHER KEY> - Abort format return to Main Menu

Enter a selection:

The default for the interleave prompt is 01. Interleaving is a technique of assigning successive addresses to sectors which are physically separated on the disk, in order to reduce access time. A 3 to 1 interleave requires three rotations of the disk to transfer one track. The range for interleaving is from 1 to 7; that is, 1 to 1 through 7 to 1. DILOG recommends a 1 to 1 interleave as the most efficient. Any response other than 2 through 7 will result in the interleave factor being set to 01, the default value. When the disk is formatted for the first time, the program in Item 3 will indicate that the interleave factor is UNKNOWN.

CAUTION

WHEN AN INTERLEAVE NUMBER IS CHANGED, THE ENTIRE DISK MUST BE FORMATTED WITHOUT ABORT (CTRL-A) OR THE DISK MAY BECOME FORMATTED WITH TWO DIFFERENT INTERLEAVES.

When the prompt CORRECT (Y/N)? appears, any response other than Y will force the prompt to repeat.

The program writes and reads two different data patterns to and from the drive. This technique precludes any possibility that a previously formatted drive will read erroneous data. If the controller is unable to read a sector, the next sector in the track is used.

To ensure the disk can be formatted, the program writes to and reads from cylinder 0, head 0, sector 0. If the disk cannot be formatted after two tries, the program will display the following message:

FORMAT ABORTED - UNABLE TO WRITE HEADERS

Pressing both the CONTROL and A keys will cause the program to stop the current step of the test and proceed to the next step. Pressing both the CONTROL and C keys will cause the program to proceed to the Main Menu.

If formatting continues, the program will write and read data and initialize the Replacement And Caching Table (RCT), but will do no re-vectoring. The addresses change as each cylinder is read from or written to.

If formatting is successful, a display similar to the following will appear:

ESDI DRIVE 01 (DU00) SELECTED DECIMAL

Format Selected Drive

(CTRL-A ABORTS TO NEXT STEP, CTRL-C ABORTS TO MAIN MENU)

INTERLACE FACTOR [1]? 1 INTERLEAVE = 01 CORRECT (Y/N)? Y

WRITING HEADERS
CYLINDER ADDRESS XXXX

WRITING HEADERS
CYLINDER ADDRESS XXXX

WRITING DATA
CYLINDER ADDRESS XXXX

INITIALIZING RCT TO NO DEFECT STATE

WRITING DATA
CYLINDER ADDRESS XXXX

READING DATA
CYLINDER ADDRESS XXXX

Press RETURN to continue

The first WRITING HEADERS is to the host area. The second is to the RCT. The WRITING ZERO DATA is to the RCT. The last two entries, WRITING DATA and READING DATA, are to the host area.

If the remote panel is used and the WRITE PROTECT switch is ON, the following will appear:

*** DRIVE IS WRITE PROTECTED ***

Read Drive Data

When the disk is formatted, the program will return to the Main Menu. Item 5 from the Main Menu is a further test for reading data. The following is an example:

```
          ESDI DRIVE 01 (DU00) SELECTED                                DECIMAL

Read Drive Data
-----
(CTRL-L TO LOOP ON TEST, CTRL-R TO ENABLE RETRIES)
(CTRL-C ABORTS TO MAIN MENU)

READING DATA ** LOOP **
CYLINDER ADDRESS   XXXX

NUMBER OF PASSES   = 0001

NUMBER OF PASSES   = 0002

NUMBER OF PASSES   = 0003

NUMBER OF PASSES   = 0004

Press RETURN to continue
```

The Loop On Test feature is used for scanning for long periods to detect media flaws which are not on the manufacturer's defect list (NOM - Not On Map). The scan may be performed overnight or during weekends. All errors will be posted in the error log in the order in which they occurred. The sequence for using this procedure is as follows:

1. Format the drive (4)
2. Replace Manufacturer's Defect List (R and D)
3. Read Drive Data (5)
4. Replace from Error Log (R and L)
5. Change Pattern - Write Data to Drive (6) ****OPTIONAL****
6. Read Drive Data (5)
7. Replace from Error Log (R and L)
[Repeat Replace and Read until the media is error free.]
8. CTRL-L to Loop On Test
9. CTRL-C to discontinue test

DIALOG recommends items 1 through 7 be performed for all new drives.

If a printer is used, the cylinder address is given when the CONTROL and P keys are pressed.

Data errors will display the cylinder, head, sector, logical block address (LBA), type of error, and whether the error is correctable or uncorrectable. If the error is correctable, the pattern and the vector will be displayed. The following are examples of each:

```
CYL=0014 HEAD=0000 SECT=0013 LBA=000005545 READ DATA ERROR (UNCORRECTABLE)
CYL=0028 HEAD=0002 SECT=0007 LBA=000011091 READ DATA ERROR (CORRECTABLE)
                                CORR PAT=01FA02 (10 BITS CORR) CORR VEC=0061
```

Write Data to Drive

Item 6 from the Main Menu is a further test which writes zeroes to the disk. The following is an example:

ESDI DRIVE 01 (DU00) SELECTED DECIMAL

Write Data to Drive

```
*** ** CAUTION *** **
IF YOU CONTINUE, ALL DATA WILL BE LOST
      ON THE SELECTED DRIVE!!!
*** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
```

```
      1          - Continue with format
<ANY OTHER KEY> - Abort format return to Main Menu
```

Write Data to Drive

(CTRL-C ABORTS TO MAIN MENU)

ENTER 16-BIT HEX DATA PATTERN [0000]:

CYLINDER ADDRESS XXXX

Press RETURN to continue

If the remote panel is used and the WRITE PROTECT switch is ON, the following will appear:

```
*** DRIVE IS WRITE PROTECTED ***
```

Print Error Log

When E is selected from the Main Menu, the error log lists the errors from the last read operation. The error log may contain up to 150 entries, and after 150 entries, the log accepts no more. The following is an example of an error log:

Print Error Log

(USE CTRL-S/CTRL-Q TO START/STOP LISTING)

```
CYL=0014 HEAD=0000 SECT=0013 LBA=00005545  READ DATA ERROR (UNCORRECTABLE)
CYL=0028 HEAD=0002 SECT=0007 LBA=00011091  READ DATA ERROR (CORRECTABLE)
```

NUMBER OF ERRORS = 0002

Replace Bad Blocks

Ensure a drive is selected, then enter Item R, Replace Bad Blocks, from the Main Menu. The following Replace Bad Blocks menu will appear:

ESDI DRIVE 01 (DU00) SELECTED DECIMAL

Replace Bad Blocks

D - LOAD MANUFACTURER'S DEFECT LIST INTO ERROR LOG AND REPLACE
L - REPLACE ALL ENTRIES IN ERROR LOG
M - MANUALLY REVECTOR BAD BLOCKS
S - SUMMARIZE PRESENT RCT STATE
Q - RETURN TO MAIN MENU

Enter a selection:

Load Manufacturer's Defect List (Subset of Replace Bad Blocks)

If D, is selected from the replace menu, the following will appear:

ESDI DRIVE 01 (DU00) SELECTED DECIMAL

Replace Bad Blocks

*** ** C A U T I O N ** **
REVECTOR MANUF. DEFECT LIST ENTRIES.
*** ** ** ** **

1 - Continue
<ANY OTHER KEY> - Abort, return to main menu

Enter a selection:

If the response is 1, the following will appear:

ESDI DRIVE 01 (DU00) SELECTED DECIMAL

Replace Bad Blocks

REPLACE ALL DEFECTS (Y/N) ?

When Y is the response, the drive defect list is loaded into the error log and replacement is completed automatically.

If the response is N, the following will appear:

LOADING DRIVE DEFECT LIST FOR HEAD 00

CYL = 1186 BFI = 00005212
CYL = 0521 BFI = 00004599
CYL = 0052 BFI = 00020248

HEAD 00 DEFECT LIST CONTAINS 03 ERRORS AND WAS CREATED ON 03-05-86.

CYL=1186 HEAD=0000 SECTOR=0004 LBN=00483484 DRIVE DEFECT LIST ENTRY
CYL=0521 HEAD=0000 SECTOR=0021 LBN=00212181 DRIVE DEFECT LIST ENTRY
CYL=0052 HEAD=0000 SECTOR=0034 LBN=00020842 DRIVE DEFECT LIST ENTRY

NUMBER OF ERRORS = 03

REPLACE (Q TO QUIT) (Y/N/Q)?

Note that the defect list is in descending order.

The program takes the defect list from the drive and lists the cylinder and the Bytes From Index (BFI).

The ESDI specification lists four data field lengths: 256, 512, 1024, and 2048. DILOG supports 256 and 512.

If the response is Y to "REPLACE (Q TO QUIT)", the following will appear:

REPLACING LBN 00483484 WITH RBN 00014225
REPLACING LBN 00021061 WITH RBN 00006244

Press RETURN to continue

The program then repeats the above for each head.

If defect is in a spare sector, the program marks the spare unusable (MARKING UNUSABLE).

Replace Entries in Error Log (Subset of Replace Bad Blocks)

If L, is entered from the replace menu, the following will appear:

```
          ESDI DRIVE 01 (DU00) SELECTED                      DECIMAL
Replace Bad Blocks
-----
*** ** C A U T I O N ** **
      REPLACE ALL ENTRIES IN ERROR LOG.
*** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
          1          - Continue
<ANY OTHER KEY> - Abort, return to main menu

Enter a selection:
```

If 1 is selected and there are no errors in the error log, the following will appear:

```
          ESDI DRIVE 01 (DU00) SELECTED                      DECIMAL
Replace Bad Blocks
-----
Press RETURN to continue
```

Manually Revector Bad Blocks (Subset Replace Bad Blocks)

If M, is selected from the Replace Bad Blocks menu, a second menu is displayed for which the values must be entered for each defect. The program prompts to replace and does the replacement. The following are examples:

```
          ESDI DRIVE 01 (DU00) SELECTED                      DECIMAL
Replace Bad Blocks
-----
*** ** C A U T I O N ** **
      MANUALLY REVECTOR BAD BLOCKS.
*** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
          1          - Continue
<ANY OTHER KEY> - Abort, return to main menu

Enter a selection:
```

When 1 is the response the following secondary menu appears:

Replace Bad Blocks

SELECT ONE OF THE FOLLOWING INPUT FORMATS:

B - CYLINDER, HEAD, BYTES FROM INDEX
S = CYLINDER, HEAD, SECTOR
L - LOGICAL BLOCK NUMBER
Q - QUIT

Enter a selection:

(ENTER Q IN RESPONSE TO ANY PROMPT TO EXIT)

B - (Subset of M, Manually Revector Bad Blocks)

If B is entered, a display similar to the following will appear:

CYL=1186 HEAD=0000 BFI=5212 CORRECT (Y/N) ?

The CORRECT prompts and the replacement results are described below.

S - (Subset of M, Manually Revector Bad Blocks)

If S is selected, a display similar to the following will appear:

CYL=1186 HEAD=0000 SECT=0004 CORRECT (Y/N) ?

The prompts and replacement results are described below.

L - (Subset of M, Manually Revector Bad Blocks)

If L is selected, the program will prompt for decimal or hexadecimal entries, depending on the current base (toggled by CONTROL B). If decimal, the display will be similar to the following:

ENTER 4 MOST SIGNIFICANT DIGITS OF 8 DIGIT
DECIMAL LBN VALUE - 0012

ENTER 4 LEAST SIGNIFICANT DIGITS OF 8 DIGIT
DECIMAL LBN VALUE - 3456

LBN=00123456 CORRECT (Y/N) ?

If hexadecimal, the display will be similar to the following:

ENTER 2 MOST SIGNIFICANT DIGITS OF 6 DIGIT HEX
LBN VALUE - AB

ENTER 4 LEAST SIGNIFICANT DIGITS OF 6 DIGIT HEX
LBN VALUE - CDEF

LBN=ABCDEF CORRECT (Y/N)?

If response is Y, a display similar to the following will appear:

REPLACING LBN=ABCDEF WITH RBN=XXXXXX

Any other combination of responses will present the Replace Bad Blocks Menu: B, S, L, Q.

Q - (Subset of M, Manually Revector Bad Blocks)

If Q is selected, the program will display the previous menu.

Summarize Present RCT State (Subset of Replace Bad Blocks)

If S, is selected from the replace menu, the program will list the RBN (Replacement Block Number) for the LBN (Logical Block Number) being replaced. The program will also specify if the RBN is at the end of the track on which the LBN resides (primary) or on another track on which the LBN being replaced does not reside (non-primary). The program will also specify unusable RBNs. The summary will list total spares, unused spares, primary and non-primary allocated spares, and unusable spares. The following is an example:

```
ESDI DRIVE 02 (DU01) SELECTED                                DECIMAL

Replace Bad Blocks
-----
RBN 00000200 IS ALLOCATED (PRIMARY)      FOR LBN 00006811
RBN 00000251 IS ALLOCATED (NON-PRIMARY)  FOR LBN 00008541
RBN 00000263 IS UNUSABLE
RBN 00000344 IS ALLOCATED (PRIMARY)      FOR LBN 00011725

TOTAL SPARES                = 00014568
UNUSED SPARES                = 00014564
ALLOCATED (PRIMARY) SPARES  = 00000002
ALLOCATED (NON-PRIMARY) SPARES = 00000001
UNUSABLE SPARES             = 00000001

Press RETURN to Continue
```

Read/Write Random Sectors Test

When T is entered from the Main Menu, the program either reads or writes, reads, and compares data randomly over the user portion of the drive (Host area). The pattern written corresponds to cylinder, head, and sector. The default value of NUMBER OF PASSES is infinite unless the CONTROL A or CONTROL C keys are pressed, in which case the program will return to the Main Menu. When T is entered, the following will appear:

```
Read/Write Random Sectors Test
-----
(R)EAD TEST OR (W)WRITE/READ TEST [R]?
NUMBER OF PASSES [INFINITE]?
```

R - If the response is R (or any key other than W), the following will appear:

```
Read/Write Random Sectors Test
-----
(CTRL-C ABORTS TO MAIN MENU)

CYLINDER ADDRESS XXXX
```

The XXXX above represents the random cylinder address displayed.

If an error occurs, the program will display the error and continue with the test. The error display will be similar to the following:

```
CYL=0014 HEAD=0000 SECT=0013 LBA=00005545
                                READ DATA ERROR (UNCORRECTABLE)
```

W - If W, write, is selected, the following will appear:

```
Read/Write Random Sectors Test
-----
(R)EAD TEST OR (W)RITE TEST [R] W

*** *** ***  C A U T I O N  *** *** ***
IF YOU CONTINUE, ALL DATA WILL BE LOST
ON THE SELECTED DRIVE!!!!
*** *** *** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
```

```
1 - continue
<ANY OTHER KEY> - abort, return to Main Menu
```

Enter a selection:

The cylinder address will be displayed as in the read test, and if an error appears, it will be displayed as in the read test.

Write, Read, and Compare Drive Data

When W is entered from the Main Menu, the program checks the complete data path between the controller and the drive by writing and reading to and from the disk and comparing data. This option also ensures revectoring was successful. An example of the first prompt is as follows:

ESDI DRIVE 01 (DU00) SELECTED DECIMAL

Write, Read, and Compare Drive Data

*** ** CAUTION *** **
IF YOU CONTINUE, ALL DATA WILL BE LOST
ON THE SELECTED DRIVE!!!
*** ** ** ** **

1 - Continue
<ANY OTHER KEY> - Abort, Return to Main Menu

Enter a selection:

The program will list the current cylinder (if a CRT is used) until a compare error occurs. An example is as follows:

ESDI DRIVE 01 (DU00) SELECTED DECIMAL

Write, Read, and Compare Drive Data

(CTRL-A ABORTS TO NEXT STEP, CTRL-C ABORTS TO MAIN MENU)

WRITING DATA
CYLINDER ADDRESS: XXXX

CYL=0082 HEAD=0011 SECTOR=0001 LBA=00033424
WRITE, READ, COMPARE TEST ERROR

If the remote panel is used and the WRITE PROTECT switch is ON, the following will appear:

*** DRIVE IS WRITE PROTECTED ***

DIAGNOSTICS

Two DEC RC25 diagnostics may be used to test the controller. They are ZRCFB3, Front End Test, and ZRCDA1, Disk Exerciser.

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 disk drive under test. Since the controller does not support the tests which require a disk, 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 disk 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>

Disk 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-F0  
CZRCD-A-0  
RC25 DISK 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 disk drive under test. The customer data area is the host data area of the disk 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 the 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 (O 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 disk 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 disk drive under test is never a write only disk; 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.

ERROR LOGGING

Error messages for the disk subsystem are as follows:

ERROR MESSAGE NUMBER	DESCRIPTION
0	Undefined error
1	Invalid Command
2	Command Aborted
3	Unit Offline
4	Unit Available
5	Media Format Error
6	Write Protected
7	Compare Error
8	Data Error
9	Host Buffer Access Error
10	Controller Error
11	Drive Error
12	Invalid CPU Type
13	Controller/drive contains unreasonable error rate
14	Cylinder 0 cannot be formatted
15	RCT area cannot be formatted
16	Drive not formatted
17	Controller interrupt but no transition indication
18	Command ring transition interrupt
19	Controller not online
20	Command Ring Error
21	Controller initialization failed
22	Controller interrupt never received