

MODEL SQ706A  
DISK CONTROLLER  
(HOST ADAPTER)  
FOR  
SCSI INTERFACE  
INSTALLATION AND OPERATION MANUAL

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SECTION 1  
DESCRIPTION

This manual describes the installation and operation of Distributed Logic Corporation (DILOG) Model SQ706A Disk Controller. This controller is a host adapter which may communicate with either an embedded controller in the drive or a bridge controller, which is a controller that communicates with more than one drive. The controller is a dual-module board that interfaces up to seven SCSI disk drives with DEC\* LSI-11/23, -11/23 PLUS, 11/73, MICRO/PDP-11 and MicroVAX II computer systems. The controller is software compatible with DEC DU drivers (MSCP) in RT-11, RSX-11M+, RSTS/E, MicroVMS, ULTRIX, UNIX, and MUMPS.

The controller supports both block mode and non-block mode memory.

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

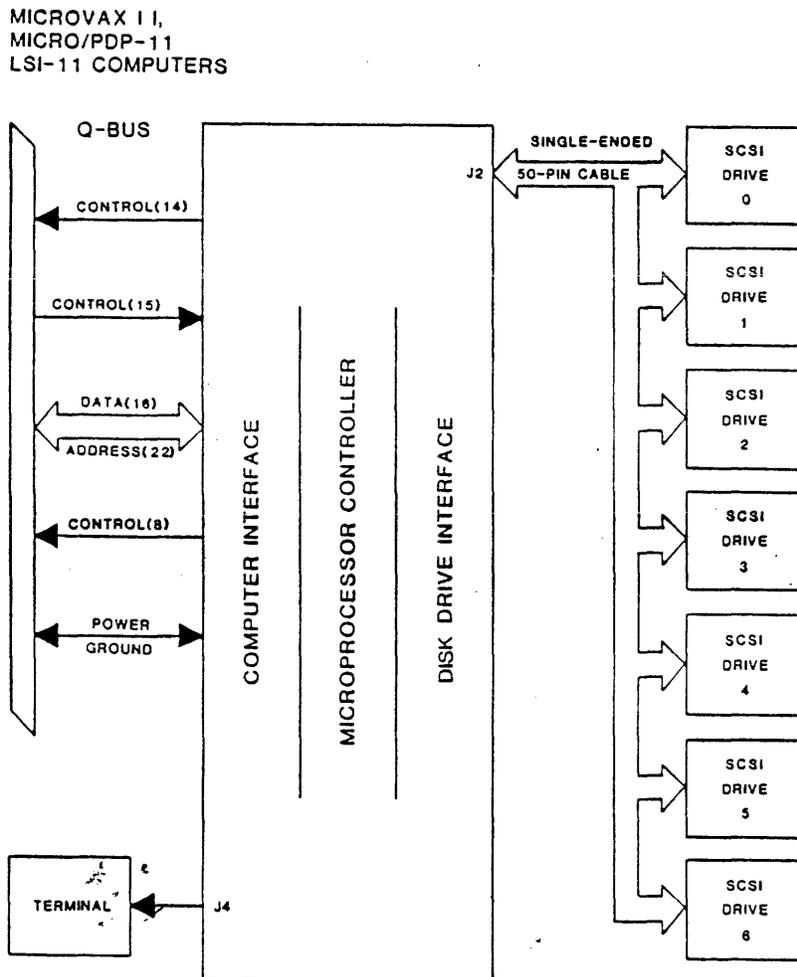


Figure 1-1. Disk System, Simplified

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

UNIVERSAL FORMATTING is a trademark of Distributed Logic Corporation.

## CHARACTERISTICS

Characteristics of the controller are as follows:

- o SUPPORTS 22-BIT ADDRESSING

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

- o SUPPORTS SCSI COMMON COMMAND SET FOR DISK DRIVES

The controller is compatible with SCSI Common Command Set for disk drives and connects up to seven SCSI units (either disks with embedded SCSI interface or SCSI controller/disk combinations). The following SCSI commands are, used by the host adapter:

FORMAT	REASSIGN BAD BLOCKS
INQUIRY	REQUEST SENSE
MODE SENSE	START/STOP
READ	TEST UNIT READY
READ CAPACITY	WRITE

- o SCSI PASS-THROUGH MODE

The controller has a special mode which permits passing SCSI commands directly from the host through the controller to the desired unit.

- o FULL SCSI IMPLEMENTATION

The controller offers a full SCSI implementation including disconnect/reconnect and synchronous data transfers.

- o ONBOARD FORMATTING

The onboard formatter uses either the system console or a DLV11-compatible connector to provide interactive terminal access. The formatter is menu driven and also provides controller and drive test options.

- o AUTOMATIC DIAGNOSTIC SELF TEST

The controller is supplied with an onboard automatic self-test diagnostic that is activated each time power is applied. These diagnostics are run repeatedly until the controller is brought online.

- o ONBOARD BOOTSTRAP PROM

The controller contains onboard bootstrap support for RP02, RL01/02, RM02, RM05, RM80, RK06/07, RX02, TS-11, RSV05, and DU driver devices. Onboard jumpers allow selectable bootstrap addresses, in addition to enabling/disabling the bootstrap.

o REASSIGNMENT OF BAD BLOCKS

The controller will handle media flaws by issuing a SCSI Reassign command.

o 16-ENTRY COMMAND QUEUE

The controller can queue up to 16 commands for up to seven units. Each unit has a command queue so that the 16 commands may be distributed among the drives in any fashion.

o SINGLE SCSI COMMAND

The configuration menu allows a single SCSI command to be manually entered and sent to the target.

o DISK DRIVES SUPPORTED

The controller is compatible with ANSI SCSI spec X3T9.2/85-52 Rev 4B for Direct Access devices. The coupler is compatible with disk drives from such manufacturers as:

CONTROL DATA	FUJITSU	HITACHI
IOMEGA	KODAK	MAXTOR
MICROPOLIS	MINISCRIBE	NORTHERN TELECOM
PRIAM	RODIME	SIEMENS
TOSHIBA		

For additional drive support, contact the factory.

Table 1-1 lists the Controller/Q-Bus Interface Signals, Table 1-2 lists the Controller/Drive Interface Signals, and Table 1-3 lists the 10-Pin Connector Signals to the terminal.

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

BUS PIN	MNEMONIC	INPUT/ OUTPUT	DESCRIPTION
AJ1, AM1, BJ1, BM1, BT1, BC2	GND	O	Signal Ground and DC return.
AN1	BDMR L	O	Direct Memory Access (DMA) request from controller; active low.
AP1	BHALT L	N/A	Stops program execution. Refresh and DMA is enabled. Console operation is enabled.
AR1	BREF L	N/A	Memory Refresh. Used for Block Mode DMA.
BA1	BDCOK H	I	DC power OK. All DC voltages are normal.
BB1	BPOK H	I	Primary power OK. When low activates power fail trap sequence.
BN1	BSACK L	O	Select Acknowledge. Interlocked with BDMGO indicating controller is bus master in a DMA sequence.
BR1	BEVNT L	N/A	External Event Interrupt Request.
BV1, AA2, BA2	+ 5	I	+ 5 volt system power.
AD2, BD2	+ 12	N/A	+ 12 volt system power.
AE2	BDOUT L	I/O	Data Out. Valid data from bus master is on the bus. Interlocked with BRPLY.
AF2	BRPLY L	I/O	Reply from slave to BDOUT or BDIN and during IAK.
AH2	BDIN L	I/O	Data Input. Input transfer to master (states master is ready for data). Interlocked with BRPLY.
AJ2	BSYNC L	I/O	Synchronize: becomes active when master places address on bus; stays active during transfer.
AK2	BWTBT L	I/O	Write Byte: indicates output sequence to follow (DATO or DATOB) or marks byte address time during a DATOB.
AL2, A1, AB1, BP1	BIRQ4-7 L	O	Interrupt Request 4-7.
AM2 AN2	BIAK11 L BIAK10 L	I O	Serial Interrupt Acknowledge Input and output lines routed from Q Bus, through devices, and back to processor to establish an interrupt priority chain.
AT2	BINIT L	I	Initialize. Clears devices on I/O bus.
AU2, AV2, BE2, BF2, BH2, BJ2, BK2, BL2, BM2, BN2, BP2, BR2, BS2, BT2, BU2, BV2	BDAL0 L through BDAL15 L	I/O	Data/address lines, 0-15
AR2 AS2	BDMG11 L BDMG10 L	I O	DMA Grant Input and Output. Serial DMA priority line from computer, through devices and back to computer.
AP2	BBS7 L	I/O	Bank 7 Select. Asserted by bus master when address in upper 4K bank is placed on the bus. Also asserted for Block Mode DMA.
AC1, AD1, BC1, BD1, BE1, BF1	BDAL16 L BDAL21 L	O	Extended Address Bits 16-21

Table 1-2. Controller to Drive - J2

SIGNAL	PIN NUMBER	DESCRIPTION
D0 L	2	Data Bus 0 (LSB)
D1 L	4	Data Bus 1
D2 L	6	Data Bus 2
D3 L	8	Data Bus 3
D4 L	10	Data Bus 4
D5 L	12	Data Bus 5
D6 L	14	Data Bus 6
D7 L	16	Data Bus 7 (MSB)
DP L	18	Data Bus Parity
GROUND	20	-
GROUND	22	-
GROUND	24	-
PWR H	26	Power OK. Green LED on controller is on
GROUND	28	-
GROUND	30	-
ATN L	32	Attention
GROUND	34	-
BSY L	36	Busy - bus is being used
ACK L	38	Acknowledge for request data transfer handshake
RST L	40	Reset
MSG L	42	Message being transferred
SEL L	44	Select - selects drive or reselects controller
C/D	46	Control/Data - low indicates control; high indicates data
REQ L	48	Request - request for a request acknowledge data transfer handshake
I/O	50	Input/Output - indicates direction of data movement; low to controller; high to drive

All odd pins are ground.

Table 1-3. Controller to Terminal - J4

SIGNAL	DIR	PIN	DEFINITION
UARTCLK_L	0	1	(TTL) UART clock out. Normally inactive (0) output if not in TMODE. A positive transition shifts out LED display information on TXD* and shift in switch status on RXD*. Open if not used.
SGND	0	2	Signal Ground and logic Ground.
TXD*_L	0	3	(RS232) Transmit data in TMODE. Active (0) in Status MODE for ACTIVITY indication or front panel display shift data when DTR is inactive (0). Normally inactive (1).
DSR_H	I	4	(RS232) Data Set Ready if used in TMODE. Active (1) to indicate a switch has changed in Status MODE while DTR is inactive. Open if not used.
DTR_H	0	5	(RS232) Data Terminal Ready if used in TMODE. Active in Status MODE to load input shift register, inactive to shift data in on RXD* or to enable ACTIVITY LED.
NOT USED		6	Indexing Key - No Pin for RS232
TMODE*_L	I	7	(TTL) Terminal MODE when grounded. Enables terminal, diagnostic and formatter functions. Status/Activity MODE when open. Onboard 1K ohm or greater pullup.
RXD*_L	I	8	(RS232) Receive Data in TMODE. Active (0) in Status MODE for front panel input shift data when DTR is active. Normally inactive (1).
SGND	0	9	Signal Ground and logic Ground
+5V	0	10	+5 Volt with 1 Amp Fuse F1. Fused +5 Volt supply through JP4 2-3 jumper Jumper JP4 1-2 to supply +12 Volt for DLV11-KA RS232 to 20MA adapter.

## CONTROLLER SPECIFICATIONS\*

### MECHANICAL

The controller is completely contained on one dual height module 5.22 inches (13.2 cm) wide by 8.88 inches (22.56 cm) high and plugs into one dual slot in a Q-bus backplane.

BASE ADDRESS - Factory set at 160334

User selectable address range 160000 - 177774

IP	760334	760340	760344	760354
SA	760336	760342	760346	760356

Consult the factory for additional address requirements

INTERRUPT VECTOR ADDRESS - Host programmable 0-774

NUMBER OF DRIVES SUPPORTED - 8 units on 7 nodes

ADDRESS RANGE - Q-bus memory to 4 Mbytes

### DRIVE TRANSFER RATE

Up to 2.0 Mbytes per second Asynchronous.

Up to 3.0 Mbytes per second Synchronous.

PRIORITY LEVEL - Factory set at BR4, user selectable BR5, 6 and 7

### DISK DRIVE I/O

ANSI SCSI spec X3T9.2/85-52 Rev 4B Common Command Set for Direct Access devices.

### CONNECTOR

A 50-pin ribbon cable type mounted on outer edge of controller module. Mate is 3M 3452-5000 or equivalent.

POWER - +5 volts at 2.5 amps

### ENVIRONMENT

Operating temperature 50 deg. F to 104 deg. F, humidity 10% - 90% non-condensing

SHIPPING WEIGHT - 5 pounds, including documentation

\* 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 50-pin control and data cable to the first drive, optional data cables to other 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.

#### HARDWARE BOOTSTRAP JUMPERS

The enabling or disabling of the hardware bootstrap and the selection of the bootstrap address are coupler parameters that need to be configured before the coupler is installed in the computer backplane. The coupler contains a bootstrap PROM that can be enabled or disabled by jumper JP2. If enabled, the bootstrap address can be changed by jumper JP1.

#### NOTES

1. Installation in MicroVAX II systems requires disabling the bootstrap; remove JP2.
2. With JP2 removed, the JP1 jumper has no effect on coupler operation.
3. If jumper(s) are removed, it is recommended that they be rotated 90 degrees for storage to prevent loss, i.e., install with one jumper pin inserted over only one pin of the jumper location.

Figure 2-1 illustrates the location of the jumpers. Table 2-1 shows the jumper position possibilities. The controller is shipped with jumpers installed with the bootstrap PROM enabled and bootstrap address 175000 (octal) selected.

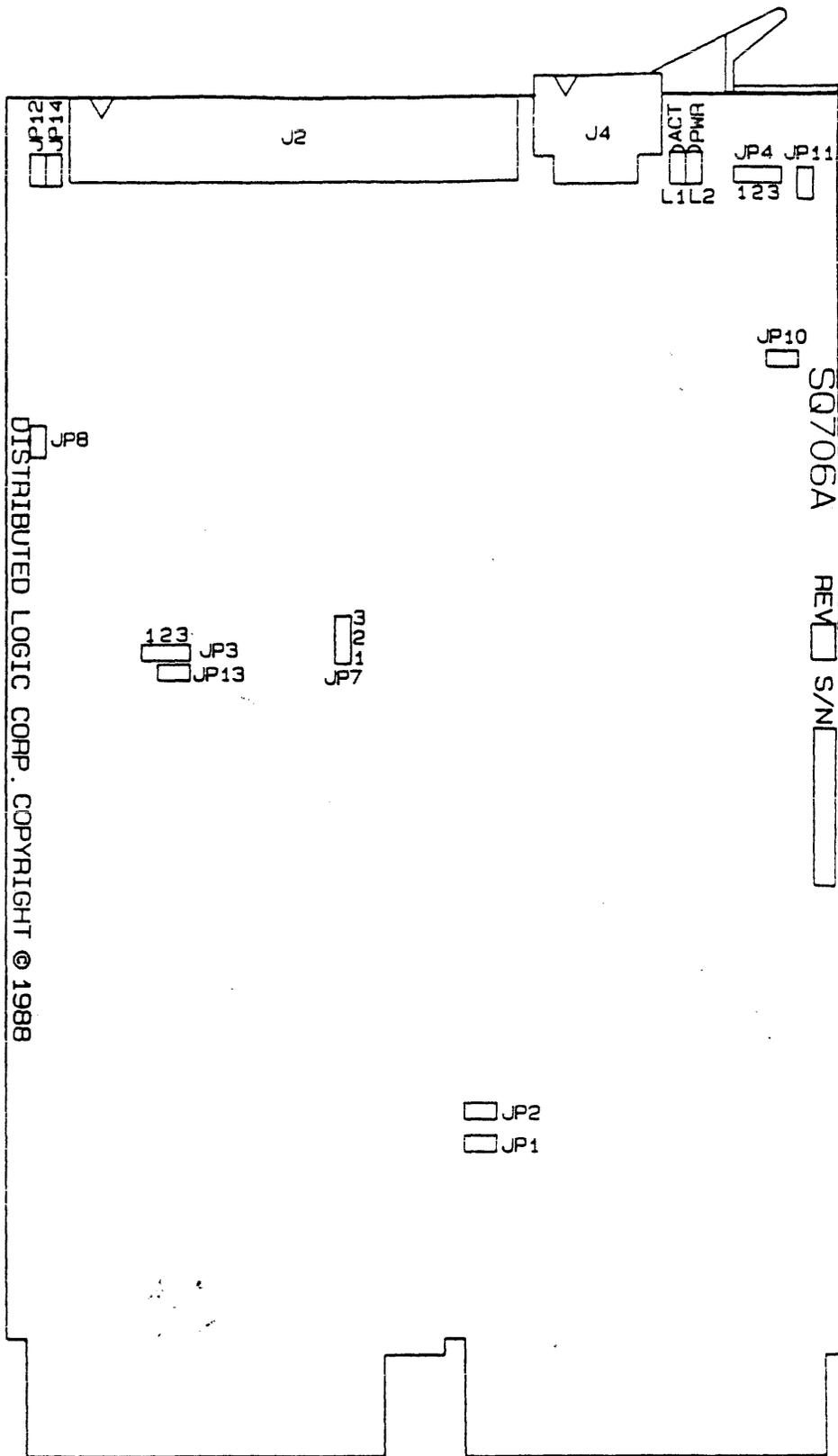


Figure 2-1. Controller Configuration

Table 2-1. Jumper Configuration

Jumper JP1

BOOT SELECT

Installed = Boot 775000  
Removed = Boot 773000\*

Jumper JP2

BOOT ENABLE

Installed = Enable Boot  
Removed = Disable Boot\*  
(must be removed for MicroVAX II systems)

Jumper JP3

FACTORY USE ONLY

Jumper JP4

Installed (etched) = +5V for J4 connector  
Removed (etch cut) = +12V for J4 connector

Jumper JP7

FACTORY USE ONLY

Jumper JP8, JP10

Installed = I/O Ground connected to Ground (Logic)

Jumper JP11, JP12

Installed = I/O Ground connected to Shielded Handle

Jumper JP13

FACTORY USE ONLY

Jumper JP14

Installed = I/O Ground connected to Cable Shield.  
(Pin 1 of SCSI Interface.)

\* When jumper plugs are not installed, they may be retained on the board by rotating the plug on one pin 90 degrees.

## CONTROLLER INSTALLATION

After the jumpers have been positioned install the controller as follows:

### CAUTION

ENSURE ALL POWER IS OFF BEFORE INSTALLING THE CONTROLLER OR CABLES.

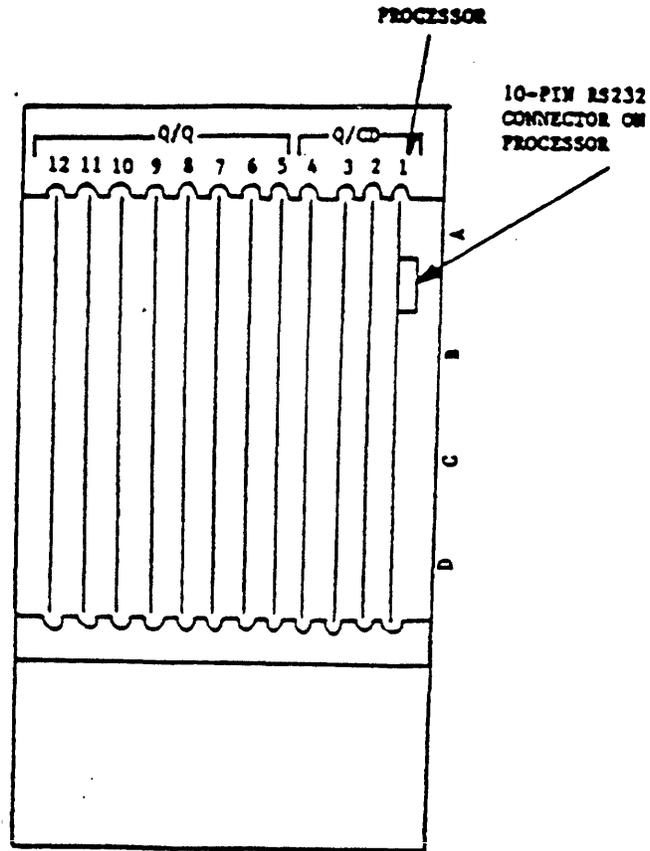
DAMAGE TO THE BACKPLANE ASSEMBLY WILL OCCUR IF THE CONTROLLER IS PLUGGED IN BACKWARDS.

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:

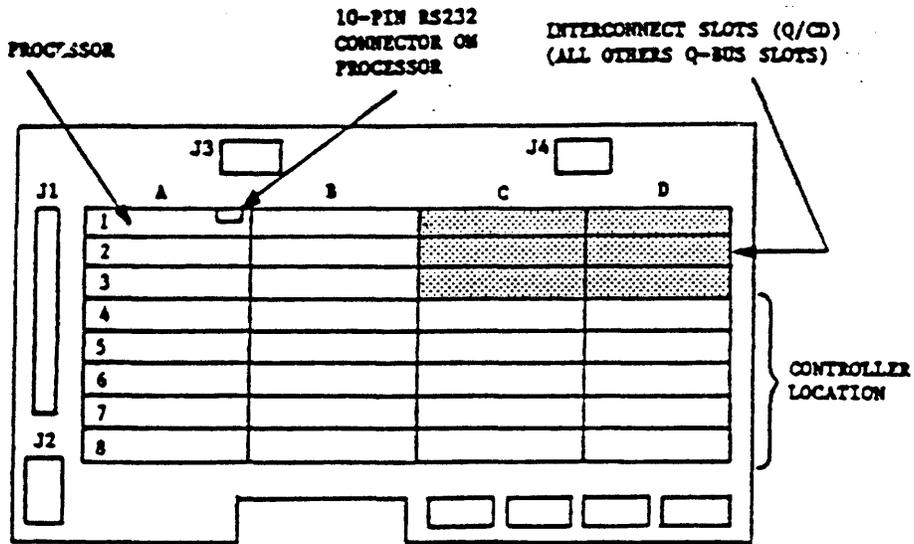
FROM	TO	SIGNAL
CO X NS	CO X M2	BIAK1/LO
CO X S2	CO X R2	BDMG1/LO

2. Perform this step if the serial port is to be connected. Connect the cable from J4 on the controller to the terminal. Refer to Table 1-3 for pinouts and descriptions.
3. Install one end of the cable into the J2 connector on the controller. ENSURE PIN 1 ON THE 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 sides until the module connectors are firmly seated in the backplane.
5. Connect the other end of the cable to the drive or drives if daisy-chained. Ensure the terminator is installed in the last drive.
6. Refer to the disk drive manual for operating instructions, and apply power to the drive(s) and the computer.



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

7. Power-up the system. Note that there are two green LEDs. The leftmost LED is the POWER LED; the rightmost LED is the ACTIVITY LED. If the Power LED lights, power to the SCSI bus terminators has been properly applied; if the Power LED does not light, the SCSI bus terminators have not received power. If this should happen, check the power supply on the system or the fuse on the controller. The user should note that the Power LED will turn ON if either a SCSI device with power applied is connected to the controller or power is applied to the controller. This is in accordance with the SCSI specification, which enables bus terminator power to be supplied by either the SCSI device or host adapter.
8. Upon a good power-up (i.e., the POWER LED lights), the ACTIVITY LED should turn on for 10 seconds and turn off for 10 seconds. Each 10-second transition of ON/OFF or OFF/ON of the ACTIVITY LED indicates a successful pass of the controller self tests. The controller will continue to perform its onboard self tests upon power-up until brought online by the system (i.e., the ACTIVITY LED will continue to flash on and off every 10 seconds). After it is brought online, the controller will turn on its ACTIVITY LED only during read and write activity between the controller and the SCSI device.
9. If an error is encountered at any point during the self tests, a 5-bit binary error code will be flashed on the ACTIVITY LED, signifying which error has occurred. (See ERROR CODES for details.) The most significant bit of the error code is flashed first. A long flash indicates a binary "1", while a short flash indicates a binary "0." This error code will continue to flash until the board is either powered down or reinitialized.
10. The system is now ready to operate. Format the disks as described in Section 3.

## SECTION 3

### OPERATION

This section covers the operation of the system, including establishing communication with the computer, the controller (host adapter), and the drives; bootstrapping for MSCP as well as other emulations; and formatting.

Diagnostics include ZRCFB3, ZRCDA1, and MicroVAX-II; MDM KDA50-Q. See Section 4 for details.

Error codes from the error logs and their formats are listed in Section 5.

### INITIATING COMMUNICATION

#### VIA CONTROLLER SERIAL PORT

In order to bring up communication via the serial port, a terminal must be connected to the 10-pin connector (J4) located on the controller board. Serial communications will then begin automatically upon power up of the controller or re-boot of the host system. Serial communications take place at a rate of 9600 baud; therefore, the terminal must be set to both transmit and receive at this rate. The serial communication protocol is 1 start bit, 1 stop bit, 8 data bits with no parity.

## VIA VIRTUAL TERMINAL

### Procedure for Bringing Up the Virtual Terminal Via LSI-11 With Host Adapter Boot Enabled

In order to bring up communication via the virtual terminal, the system console is used as the terminal for serial communication. The system console must be placed in the ODT (Online Debugging Technique) mode. A boot must be initiated by typing on the system console either 77775000G or 77773000G, depending on which boot address is selected on the controller (see Section 2 on hardware jumpers for details on boot address). The system console will respond with an "\*" as a prompt. At this point, the user can type an "FT" which will bring up the Configuration Menu.

#### NOTE

In the following examples, all characters underlined are output by the system; characters not underlined are input by the user.

#### EXAMPLE:

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

@ 77775000G

\*

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

## Procedure for Bringing Up the Virtual Terminal Via LSI-11 With Host Adapter Boot Disabled

If the boot on the controller is disabled, communication via the virtual terminal can be brought up by typing 77777 (octal) to the SA address (SA default address = 160336) followed by a carriage return. The user must then type 2000G. The system console will respond with an "\*" as a prompt. The user should then type "FT" to bring up the Configuration Menu. In the following example underlined characters are output by the computer:

### NOTE

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

### EXAMPLE:

```
@ 160334/0 <CR>
@ 160336/005400 77777 <CR>
@ 2000G
```

Boot for the device as described below.

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

\* Enter one of the following: DMO, DPO, DLO, DRO, MSO, MTO, MUO, DY0, DU, or FT <CR>

### NOTE

When making a selection, capital letters must be used.

Definitions are as follows:

```
DM = RD06/07 Disk
DP = RP02/03 Disk
DL = RL01/02 Disk
DR = RM03/05/80 Disk
MS = TS11 Tape
MT = Tape
MU = (TMSCP) Tape
DY = RX02 Floppy Disk
DU = DU emulation
FT = Enable onboard Configuration Menu through system console
```

## Procedure to Bring Up the Virtual Terminal Via MICRO-VAX II

In order to bring up communication via the virtual terminal, the system console is used as the terminal for serial communication. Note that the bootstrap PROM must be disabled. (See Section 2 for jumper placement.)

Upon powering up the MicroVAX II, the user must set up the MicroVAX II I/O map via the system console, type 3FFF hex to the SA address (SA default address = 160336) and start executing code at location 200 hex. All this can be done by the user as shown below. After executing this procedure, the Configuration Menu comes upon the system console. Note that the bootstrap PROM must be disabled.

### EXAMPLE:

```
>>>D/P/L 20088004 80000001 <CR> <--Setup MicroVAX II I/O Map
>>>D/P/W 20001F40 20 <CR> <--Setup MicroVAX II I/O Map
>>>D/P/W xxxxxxxx 3FFF <CR> <--Deposit the 3FFF hex in SA ad-
    2000 000E                dress. The values of xxxxxxxx
                                are hex values of the control-
                                ler address of the SA register
                                and are listed in Table 3-1.
>>>S 200 <CR> <--Start executing code at 200
                                hex.
```

(At this point the Configuration Menu should appear.)

### NOTE

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

## CONFIGURATION MENU

Upon entering the controller's onboard Configuration Menu, the first prompt to appear is:

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

Type a "P" if a printer terminal is being used or a "C" if a CRT is attached, and a carriage return, then the Configuration Menu will appear as follows:

### CONFIGURATION MENU

- ```
-----  
1 - STANDARD DIAGNOSTICS  
2 - HOST Q-BUS MEMORY DMA TEST  
3 - DISPLAY CONTROLLER CHARACTERISTICS  
4 - SET CONTROLLER CHARACTERISTICS  
5 - SCSI DIRECT COMMAND  
6 - FORMAT SCSI DRIVE  
7 - SCSI UNIT MAPPING
```

ENTER A SELECTION:

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

### NOTE

A CTRL C (^C) entered during any of the selections will return to the Configuration Menu.

## STANDARD DIAGNOSTICS

Selection 1 of the Configuration Menu enables the controller to run its onboard diagnostics. Each time a diagnostic test is successfully passed, a "." will be printed onto the screen. It takes approximately 10 seconds for the controller to make one pass through all the diagnostic tests. The controller will continue to loop on the diagnostic tests until a CTRL C (^C) is typed on the terminal. (Notice that the controller does not respond immediately to the ^C when in the virtual terminal mode. It takes several seconds for the controller to respond, so please be patient.)

Upon recognizing the ^C, the controller will return to the Configuration Menu. If an error is encountered during the execution of a diagnostic test, an "E" will be printed onto the screen and the onboard LED will flash the appropriate error code. (See documentation on error code flashing for details.) The controller will conduct a loop on error process until either a ^C is detected or power on reset is conducted.

## HOST MEMORY DMA TEST

Selection 2 of the Configuration Menu enables the controller to conduct DMA transfers to and from the host system.

### CAUTION

THIS TEST WILL WRITE ALL OF HOST MEMORY -- THEREFORE, ANYTHING RESIDING IN HOST MEMORY AT THE TIME THIS TEST IS CONDUCTED WILL BE OVERWRITTEN!!

This test verifies that data written to and read from the host is valid to ensure that operations between the host and the controller are functioning properly. When using this selection, make sure the host system has finished initializing the mapping registers. Otherwise, the test will report memory size equal to zero.

### NOTE

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

Upon selecting the HOST MEMORY DMA TEST, the controller will go out and size the host memory. The controller will then begin a series of DMA tests to ensure host-controller DMA communications are functional. The following will be disabled upon a good pass of the DMA test.

(CTRL-C ABORTS BACK TO MAIN MENU)

```
SIZING HOST MEMORY...
MEMORY SIZE = XXXX HEX (IN KBYTES)
TESTING HOST DMA...
...TESTING DMA ON ODD, EVEN ADDRESSES W/EVEN BYTE COUNT
...TESTING READ REVERSE
...TESTING ONE WORD DMA
...TESTING ONE BYTE DMA (ALSO TESTS BYTE SWAP)
DMA IS OPERATIONAL OVER ENTIRE HOST MEMORY.
```

The test will continue to run until a CTRL-C is typed on the console. If the test ever detects an error, an error message will be displayed on the console. The following is a list of all possible errors.

#### > NON-EXISTENT MEMORY ERROR

This error indicates that the controller attempted to read or write a nonaccessible memory location. When receiving this error, the following message is displayed.

```
DMA FAILED DUE TO NON-EXISTENT MEMORY
...AT HOST ADDRESS BLOCK LOCATION XXXX HEX
```

The "xxxx" message above represents the address at which the test failed. Note that if a memory size of 0 HEX is calculated at the beginning of the test, the host memory is not accessible to the controller. This may be due to the host I/O memory being mapped incorrectly. Check the host system memory to make sure that I/O memory is available to the controller.

> DATA MISCOMPARE ERROR

This error indicates that the controller detected a data miscompare error (i.e. the data written and read did not compare). When receiving this error, the following message is displayed.

```
DMA FAILED DUE TO DATA MIS-COMPARE
...AT HOST ADDRESS BLOCK LOCATION XXXX HEX
DATA RECEIVED = XX HEX DATA EXPECTED = XX HEX
```

> Q-BUS PARITY ERROR

This error indicates that the controller detected a Q-bus parity error while performing a DMA transfer. When receiving this error, the following message is displayed.

```
DMA failed due to a QBUS Parity Error
...AT HOST ADDRESS BLOCK LOCATION XXXX HEX
```

> DMAC PARITY ERROR

This error indicates that the controller detected an internal parity error when reading the controller buffer RAM. When receiving this error, the following message is displayed.

```
DMA FAILED DUE TO A DMAC PARITY ERROR
```

Upon receiving an error, the test will also print an "E" on the console and flash an error code on the activity LED. The test will then attempt to restart the test. On occasion, the test will be unable to restart or be aborted via a CTRL-C; therefore a power on reset must be performed in order to reset the controller.

# DISPLAY CONTROLLER CHARACTERISTICS

Selection 3 of the Configuration Menu allows the user to display on the terminal the current controller characteristics as determined by what is currently set in the controller's NOVRAM. Selection 3 displays the following:

```
DISPLAY CONTROLLER CHARACTERISTICS
-----
IP/SA ADDRESS (IN OCTAL):           [XXXXXX]
DWELL COUNT (COUNT * 800 NSEC = DWELL TIME): [XXX]
BURST SIZE (# OF WORDS):           [XXX]
INTERRUPT PRIORITY:                [XX]

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

As seen above, the IP/SA address, the dwell time and burst size for DMAs, and the controller's interrupt priority to the host are displayed. The X's in the table above represent the current value of each controller characteristic. The address is given in octal value and all the other values are decimal. After displaying the controller characteristics, a carriage return, <CR>, will display the Configuration Menu again.

Below is a list of the default values of the controller configuration characteristics:

```
                                     DEFAULT VALUE
                                     -----
IP/SA ADDRESS (IN OCTAL):           [160334]
DWELL COUNT (COUNT * 800 NSEC = DWELL TIME): [02]
BURST SIZE (# OF WORDS):           [08]
INTERRUPT PRIORITY:                [04]
```

## SET CONTROLLER CHARACTERISTICS

Selection 4 of the Configuration Menu allows the user to set the controller characteristics (i.e., set up the NOVRAM). Selection 4 displays the following:

### SET CONTROLLER CHARACTERISTICS

-----  
[ ] = CURRENT CONFIGURATION, <CR> = DEFAULTS TO CURRENT SETTING

|                                |          |                 |
|--------------------------------|----------|-----------------|
| IP/SA ADDRESS:                 | [XXXXXX] | {USER RESPONSE} |
| DWELL COUNT:                   | [XXX],   | {USER RESPONSE} |
| (COUNT *800 NSEC = DWELL TIME) |          |                 |
| BURST SIZE (# OF WORDS):       | [XXX]    | {USER RESPONSE} |
| INTERRUPT PRIORITY:            | [XX]     | {USER RESPONSE} |

SAVE NEW CONFIGURATION (Y/N)?

In order to set the controller characteristics, the user is prompted for all the information. The user is first prompted for the IP/SA address. The current setting is displayed along with the "IP/SA Address" message. A prompt then appears and waits for user response. The user response in the above table is indicated by the message "{user response}." The user now has the option of changing the current IP/SA address. He can do this simply by typing a new address (in octal) at the prompt followed by a carriage return. If the user does not wish to change the address, he need simply type a carriage return and the address will remain unchanged. In either case, the user will then be prompted for the dwell time. He will again have the same option as before; he can either change the value or leave it at its current setting. He will then be prompted for the next piece of information, and this process will continue until all the information on the controller characteristics has been prompted for. The controller will then prompt the user as to whether or not the new configuration is to be saved in the controller's NOVRAM. If the user chooses not to save the new configuration, the controller will simply display a message saying that the new configuration was not saved. A <CR> at this time will simply take the user back to the Configuration Menu. If the user chooses to save the new configuration, the controller will respond with the following:

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

The host system only needs to be rebooted if the IP/SA address was changed; otherwise, the user need only type a <CR> to go back to the Configuration Menu.

During the prompting of the controller characteristics, the controller will respond with an "Invalid Response" message if the user response is considered invalid. The controller expects all user responses to be in decimal except for the IP/SA address which it expects to see in octal (for appropriate octal IP/SA addresses see the options listed below).

Below are lists of valid options for each of the controller configuration characteristics.

|                                 |                                                        |
|---------------------------------|--------------------------------------------------------|
| IP/SA ADDRESS (IN OCTAL):       | [160000 - 177774]                                      |
| SUGGESTED ADDRESSES:            | [172150,160334,160340,160344,<br>160354,160360,160374] |
| DWELL COUNT:                    | [1-63]                                                 |
| (COUNT * 800 NSEC = DWELL TIME) |                                                        |
| BURST SIZE:                     | [2-16]                                                 |
| INTERRUPT PRIORITY:             | [4-7]                                                  |

### How To Find Current Address

In case the user ever changes the controller slave address (IP/SA address) and forgets what value he set it to, the following steps should be taken:

#### FOR LSI-11 SYSTEM:

1. Enable the boot address on the controller and make sure no other controller is using the same boot address (see details on hardware jumpers).

#### CAUTION

MAKE SURE BOARD IS POWERED DOWN BEFORE  
CHANGING JUMPERS!

2. Power up the board, and get into ODT mode. Conduct a boot by typing on the system console either 77775000G or 77773000G, depending on what boot address the user has enabled. (See section on INITIATING COMMUNICATION for details on boot procedure.)
3. Wait for the "\*" prompt.
4. Halt the host system processor and look at address location 0. Location zero should contain the IP/SA address.

How to examine address 0 using ODT:

o 0/ (allows the user to examine location 0)

FOR MICRO-VAX II SYSTEM:

1. Conduct a power on reset on the board (i.e., power down the board and power it back up).
2. Check all the possible SA addresses that can be selected on the controller via the system console. (See Table 3-1 for listing of suggested IP and SA addresses, refer to hex address only.)

How to examine addresses on MicroVAX II:

>>>E/P/W xxxxxxxx <CR> <---- Allows user to examine location xxxxxxxx, a hex address from Table 3-1.

If required to check the range 160000Q-17774Q, a suggested method is to start examining at location 160000Q as shown above (corresponding hex address for MicroVAX II is 20000000 calculated as shown below Table 3-1. After examining the first address, the user can continue checking subsequent addresses by simply typing the following:

>>> E <CR> <---- allows the user to examine subsequent hex addresses.

3. Once the user finds the address he suspects is the controller slave address, he should deposit a 0 in the corresponding IP address. If the controller responds with a 0B00H in the SA address, then the correct slave address has been found. Deposit a 0 in the IP address as shown below:

How to deposit a 0 on MicroVAX II:

>>>D/P/W xxxxxxxx 0 <CR> <---- Allows user to deposit a 0 at location xxxxxxxx, a hex address from Table 3-1.

4. If the slave address does not respond with 0B00H, then go back to step 2 of this procedure.

Table 3-1. IP and SA Hex Addresses \*

| IP REGISTER<br>OCTAL ADDRESS | SA REGISTER<br>OCTAL ADDRESS | SA REGISTER<br>HEX ADDRESS<br>FOR MICROVAX II | IP REGISTER<br>HEX ADDRESS<br>FOR MICROVAX II |
|------------------------------|------------------------------|-----------------------------------------------|-----------------------------------------------|
| 172150                       | 172152                       | 2000146A                                      | 20001468                                      |
| 160334                       | 160336                       | 200000DE                                      | 200000DC                                      |
| 160340                       | 160342                       | 200000E2                                      | 200000E0                                      |
| 160344                       | 160346                       | 200000E6                                      | 200000E4                                      |
| 160354                       | 160356                       | 200000EE                                      | 200000EC                                      |
| 160360                       | 160362                       | 200000F2                                      | 200000F0                                      |
| 160374                       | 160376                       | 200000FE                                      | 200000FC                                      |

\* Suggested Addresses only; to be entered in place of xxxxxxxx for MicroVAX II.

For addresses other than the above (address range 160000Q-17774Q) perform the following to calculate hex address for MicroVAX II:

- A. Convert the 13 least significant bits of the address in octal to hexadecimal.
- B. Add 200000000.

For example, if the octal address is 17774Q, the hex value is obtained as follows:

- A. 17774 octal with 13 LS bits = 17774, converted to hex = 1FFC.
- B. 1FFC + 200000000 = 20001FFC.

## SCSI DIRECT COMMAND

Selection 5 of the Configuration Menu allows the user to input and execute SCSI commands. At this point, all user responses must be input in hex. All of the controller's responses will be displayed in hex.

Upon entering the SCSI DIRECT COMMAND mode the user is prompted for the SCSI device node number, logical unit number, and number of bytes in the command descriptor block (CDB). The user is then asked to input the SCSI command descriptor block (CDB) one byte at a time. The user is prompted as follows:

```
ENTER # OF COMMAND BYTES:                {USER RESPONSE}
ENTER SCSI COMMAND DESCRIPTOR BLOCK (CDB):
[E.G., FOR A FORMAT COMMAND, LUN = 00]

    BYTE #0 = 04
    BYTE #1 = 00
    BYTE #2 = 00
    BYTE #3 = 00
    BYTE #4 = 00
    BYTE #5 = 00
```

DATA TRANSFERS LIMITED TO 1 SECTOR [512 BYTES]

```
ENTER COMMAND BYTE #0 = {USER RESPONSE}
ENTER COMMAND BYTE #1 = {USER RESPONSE}
ENTER COMMAND BYTE #2 = {USER RESPONSE}
ENTER COMMAND BYTE #3 = {USER RESPONSE}
ENTER COMMAND BYTE #4 = {USER RESPONSE}
ENTER COMMAND BYTE #5 = {USER RESPONSE}
```

·  
·  
·

In order to input the command descriptor block, the user need simply type, in hex, each command byte when prompted for. An example of a FORMAT command is given as part of the prompt message to demonstrate how the user is to enter the command properly. The prompting of the command bytes will continue until the specified number of command bytes have been received. Note that all user responses above are indicated by "{user response}." If the user ever inputs an invalid response, the controller will respond with an "\*\*\* Invalid Setting" message. The user will then again be prompted for the appropriate information. Also, the user must note that all data transfer commands are limited to 512 bytes. An attempt to transfer more than 512 bytes of data will result in an error during the execution of the command.

Upon receiving the command descriptor block, the controller will display the command bytes entered. The user is then prompted as to whether or not the command bytes displayed are correct. If the command bytes are correct, the user need simply type "Y" for yes and the controller will continue on with its next prompt. If the command bytes are incorrect, the user must then type an "N" for no. At this point the controller will respond with a second prompt asking if the user wishes to go back to the Configuration Menu. If the user responds with a "Y" for yes, the controller will take him back to the Configuration Menu, otherwise an "N" for no will take the user back to reenter a SCSI command descriptor block (CDB).

Once the user has input a command correctly, the controller will prompt him as to whether or not he wishes to send data out during the execution of the command. The user need only send data out if the current command to be executed sends data to the target; otherwise, the user should respond to the prompt with an "N" for no. If data does need to be sent out to the SCSI device, the user should type a "Y" for yes, at which point the controller will prompt him for the number of data bytes to be entered. The user will then be asked to input the data bytes one byte at a time.

#### NOTE

The maximum number of data bytes that can be entered is 512 bytes.

ENTER # OF DATA BYTES: {USER RESPONSE}

DATA BYTE #0000 = {USER RESPONSE}  
DATA BYTE #0001 = {USER RESPONSE}  
DATA BYTE #0002 = {USER RESPONSE}  
DATA BYTE #0003 = {USER RESPONSE}  
DATA BYTE #0004 = {USER RESPONSE}  
DATA BYTE #0005 = {USER RESPONSE}  
DATA BYTE #0006 = {USER RESPONSE}  
DATA BYTE #0007 = {USER RESPONSE}  
DATA BYTE #0008 = {USER RESPONSE}  
DATA BYTE #0009 = {USER RESPONSE}  
DATA BYTE #000A = {USER RESPONSE}

.  
.  
.

In order to input the data bytes, the user need simply type, in hex, each data byte when prompted for. The prompting of the data bytes will continue until the specified number of data bytes have been received. Once all of the data has been input, the controller will display the data bytes. It will then prompt the user as to whether or not the data displayed is correct. If the data is correct, the user need simply type a "Y" for yes and the controller will continue on to the next prompt. If the data is incorrect, the user must type an "N" for no, at which point the controller will prompt the user to see if he wishes to go back to the Configuration Menu. If the user types a "Y" for yes, the controller will go back to the Configuration Menu. If the user types an "N" for no, then the controller will prompt the user for new data.

Upon inputting correct data or specifying that no data need be sent out, the user will be prompted as to whether or not the command entered is to be executed. The user is prompted as follows:

CAUTION

COMMANDS WILL BE EXECUTED AS ENTERED. CURRENT  
DATA ON THE DRIVE MAY BE OVERWRITTEN.

EXECUTE COMMAND (Y/N)?

The caution indicates that the SCSI device will receive the command as entered by the user; therefore, the user should ensure that the command is correct before executing. Also, in case the user issues a write command, he should be aware that any data on the SCSI device at the location of the write command will be overwritten. If the user chooses not to execute the SCSI command, he should type an "N" at which point the controller will take him back to the Configuration Menu. If the user chooses to execute the command, he need simply type a "Y." At this point the controller will display the following message:

EXECUTING SCSI COMMAND ...

Upon completion of the command a number of different messages may appear. The different messages and their meanings are as defined below:

> SCSI COMMAND COMPLETED WITH NO ERRORS

This message indicates that the command was successful and no errors occurred during its execution. If this message is displayed after executing a read command, the controller will automatically display the read data from the SCSI device.

> CHECK CONDITION ON SCSI COMMAND

This message indicates that a check condition occurred during the execution of the command. The controller will automatically request sense data from the SCSI device and display the sense data following this message.

> SCSI BUS PARITY ERROR

This message indicates that a SCSI bus parity error was detected during the execution of the command and subsequent retries of the command also produced parity errors.

> SCSI BUS PARITY ERROR  
RETRY WAS SUCCESSFUL

This message indicates that a SCSI bus parity error was detected during the execution of the command, but during a subsequent retry the command executed with no errors.

> QBUS PARITY ERROR

This message indicates that a QBUS parity error occurred during an access of QBUS memory.

> CONTROLLER PARITY ERROR DURING ACCESS OF DRAM

This message indicates that a controller parity error occurred during an access of the controller's Dynamic RAM.

> SCSI BUS RESET OCCURRED DURING COMMAND EXECUTION

This message indicates that a SCSI bus reset occurred during the execution of the command; therefore, the command was not completed.

> SCSI DEVICE NOT RESPONDING

This message indicates that the SCSI device is not responding to the command issued.

> TRANSFER TRUNCATED TO SINGLE SECTOR {512 BYTES}

This message indicates that a multi-sector data transfer command was attempted. The command was therefore truncated to a single sector command. If this message is displayed after a read command, only a single sector of data will be displayed.

> COMMAND TIMEOUT

This message indicates the requested command took over an hour without any activity on the SCSI bus.

Upon the completion of the command, the controller will prompt the user with the following:

ISSUE ANOTHER SCSI COMMAND (Y/N)?

At this point the user can either issue another SCSI command simply by typing a "Y" for yes, or he can go back to the Configuration Menu by typing an "N" for no.

## FORMAT SCSI DRIVE

Selection 6 of the Configuration Menu allows the user to format a SCSI drive. Upon entering FORMAT SCSI DRIVE mode, the user is prompted for all the SCSI drive information needed in order to format the drive. The prompting is as follows:

FORMAT SCSI DRIVE

-----  
NODE # OF DRIVE TO FORMAT (0-7): {USER RESPONSE}

LOGICAL UNIT NUMBER (LUN) OF DRIVE TO FORMAT (0-3): {USER RESPONSE}

DRIVE FORMAT INTERLEAVE (0-7): {USER RESPONSE}

FORMAT USING PRIMARY DEFECT LIST ONLY (Y/N)?

The user is first prompted for the SCSI node of the drive to be formatted (node selection varies between 0 and 7). The user need simply respond by typing a value between 0 and 7 followed by a <CR>. (Note that all user responses above are indicated by "{user response}".)

The user is next prompted for the Logical Unit Number (LUN) of the drive to be formatted (LUN selection ranges from 0 through 3). The user need simply respond by typing a value between 0 and 3 followed by a <CR>.

The user is next prompted for the drive format interleave. 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 on the host adapter is from 0 to 7, where an interleave of 0 allows the SCSI drive to set its own default interleave and 1 through 7 allows a 1 to 1 through 7 to 1 interleave, respectively. To set the interleave, the user need simply type a value between 0 and 7 followed by a <CR>.

The user is prompted if only the primary defect list will be used as the flaw map when formatting. Responding with a "Y" (Yes) will return the disk to the condition as originally shipped. No flaws found and reassigned since the original defect list will be added. Responding with an "N" (No) will include flaws found and reassigned in the growth list. Depending on the response, one of the following messages will be displayed:

PRIMARY DEFECT LIST HAS BEEN SELECTED

OR

PRIMARY AND GROWTH DEFECT LISTS HAVE BEEN SELECTED

After inputting all the requested information, the controller will respond with the following message:

CAUTION

ALL DATA WILL BE LOST TO THE SELECTED DRIVE.

CONTINUE WITH FORMAT (Y/N)?

The caution serves to warn the user that the data on the drive will be lost once the format command has taken place. Therefore, if the user does not wish to destroy the data on the disk, he can simply reply with an "N" at the prompt followed by a <CR> and the controller will take him back to the Configuration Menu. If the user wishes to continue with the format, he then need simply type a "Y" at the prompt followed by a <CR>.

Once the formatting has begun, the controller will print the following message:

FORMATTING SELECTED DRIVE ...

This message will remain until the drive has completed the format command.

At this point, if the SCSI drive formats with no errors, the controller will print a "Completed" message. Otherwise, if any errors occur, one of the SCSI DIRECT COMMAND error messages will be displayed. (See SCSI DIRECT COMMAND error message documentation for details.)

## SCSI UNIT MAPPING

Selection 7 of the Configuration Menu allows the user to select the SCSI unit map of the host adapter. The user can map up to 8 different host units, selecting each individual node and logical unit number (LUN) for each SCSI device. The user can also select the node at which the host adapter is to reside. The user should note that at this point, the controller expects inputs in decimal.

### NOTE

Logical mapping of units must be done for all possible devices. If it has not been mapped, a device cannot be used by the system. If another unit must be added, the map must be changed off-line and then the system rebooted.

Upon entering the SCSI UNIT MAPPING mode, the current SCSI unit map table is displayed, as determined by the contents of the NOVRAM. The display is as shown below:

SCSI UNIT MAPPING - Host Adapter is at Node XX

| SETUP # | HOST UNIT | NODE / LOGICAL UNIT # (LUN) | BYTE SWAP |
|---------|-----------|-----------------------------|-----------|
| 01      | XX        | XX                          | XX        |
| 02      | XX        | XX                          | XX        |
| 03      | XX        | XX                          | XX        |
| 04      | XX        | XX                          | XX        |
| 05      | XX        | XX                          | XX        |
| 06      | XX        | XX                          | XX        |
| 07      | XX        | XX                          | XX        |
| 08      | XX        | XX                          | XX        |

The HOST UNIT column defines the MSCP logical address assigned to the device node and logical unit # (LUN). For example, Host Unit 00 would be recognized by VMS as DUA0, DUB0, etc., depending on the adapter address. Additional logical devices connected to the adapter on the SCSI bus require a successive Host Logical Unit number, i.e., DUA1, DUA2, (DUB1, DUB2) etc. be assigned. The Node column defines the SCSI device (intelligent peripheral or controller) node address. The LOGICAL UNIT # (LUN) column defines the SCSI address from the peripheral attached to the mapped device NODE. Note that in the majority of cases, the LUN # will always be zero; the vast majority of peripherals connected to a node contain a built in controller. The master controller/peripheral with attached slave peripherals without controllers is rare.

The constraining factor is that there can never be more than eight (8) nodes on an SCSI bus (including the host adapter). The maximum number of peripheral device nodes and LUN's is defined by the MSCP driver, not the adapter, for the particular device (typically four for MSCP disk drives).

As seen above, the SCSI unit map displays the HOST (logical) UNIT, the peripheral device NODE / LOGICAL UNIT # (LUN), and BYTE SWAP configuration for 8 different setups available on the Host Adapter. In addition it specifies the Node that the Host Adapter occupies. The xx's in the table above represent the current configuration numbers for each setup. The default SCSI unit set at the factory is shown on the next page, followed by an example of the SCSI unit map for adding additional peripheral devices to the adapter. shown below.

SCSI UNIT MAPPING - Host Adapter is at Node 07

```
-----  
SETUP #   HOST UNIT           NODE / LOGICAL UNIT # (LUN)  
  01      00                00      00  
  02      No current setup  
  03      No current setup  
  04      No current setup  
  05      No current setup  
  06      No current setup  
  07      No current setup  
  08      No current setup
```

Example SCSI UNIT MAP for a three, intelligent peripheral system:

SCSI UNIT MAPPING - Host Adapter is at Node 07

```
-----  
SETUP #   HOST UNIT           NODE / LOGICAL UNIT # (LUN)  
  01      00                00      00  
  02      02                01      00  
  03      02                02      00  
  04      No current setup  
  05      No current setup  
  06      No current setup  
  07      No current setup  
  08      No current setup
```

The default setting of the host adapter does not setup the last seven available SCSI units. As seen above, when a SCSI unit has not been setup, the "No current setup" message will appear.

Following the display of the SCSI unit map, a menu of the available options for SCSI UNIT MAPPING mode is displayed.

- 0 - RETURN TO CONFIGURATION MENU
- 1 - CHANGE UNIT MAPPING
- 2 - CHANGE HOST ADAPTER NODE
- 3 - SAVE UNIT MAPPING IN NOV RAM
- 4 - RESTORE DEFAULT UNIT MAPPING

ENTER A SELECTION:

In order to choose an option, the user need simply type the number of the option he wishes to perform followed by a <CR>.

OPTION 0 will simply return the user to the Configuration Menu.

OPTION 1 will allow the user to change any of the current setups on the SCSI unit map. Upon entering this option, the user will be prompted for the setup # he wishes to change. The user need simply type the number of the setup he wishes to modify at the prompt followed by a <CR>. At this point, if the setup the user wishes to modify currently occupies a valid setup (i.e., the "No current setup" is NOT displayed), he will be prompted as to whether or not he wishes to remove the setup. If the user chooses to remove the setup by typing a "Y" at the prompt, the SCSI unit map will be redisplayed and the setup removed will display the "No current setup" message. If the user chooses not to remove the setup by typing an "N" at the prompt, he will then be prompted for the new host unit, node, and logical unit number he wishes to set. If the setup the user wishes to modify has no valid setup (i.e., the "No current setup" message is displayed), he will simply be prompted for the new setup consisting of the host unit, node, and logical unit number. In any case, at the completion of the prompting, the SCSI unit map will be redisplayed with the modifications made by the user.

OPTION 2 will allow the user to change the node occupied by the host adapter.

OPTION 3 will allow the user to save the currently displayed SCSI unit map in the NOVRAM. This will allow the particular map saved to remain as part of the configuration of the host adapter even when the board has no power applied. The map will be preserved for the life of the NOVRAM or until another map is saved in the NOVRAM. In order to save the map in the NOVRAM of the host adapter, the following specification must be met by the SCSI unit map.

The following specifications exclude those setups which are not valid.

1. All setups must occupy unique host unit numbers.
2. All setups must occupy a unique combination of node and logical unit number.
3. No setup can occupy the same node as the host adapter.

Unless the above specifications are met, the host adapter will not allow the SCSI unit map to be saved in the NOVRAM. If the SCSI map is not allowed to be saved, the following message will be displayed:

SCSI UNIT MAP NOT SAVED IN NOVRAM DUE TO OVERLAPPING  
OF HOST UNIT NUMBERS OR NODE/LOGICAL UNIT NUMBERS.

If the above specifications are met, the controller will then display a message saying that the map was saved in the NOVRAM. A <CR> at this point will redisplay the SCSI unit map.

OPTION 4 will allow the user to restore the default SCSI unit map as set by the factory. Upon entering this option, the user is prompted as to whether or not he wishes to save the default mapping in the NOVRAM. If he chooses to save the mapping in the NOVRAM, he need simply type a "Y" at the prompt followed by a <CR> at which point the default map will be saved and redisplayed. If the user chooses not to save the map in the NOVRAM, he need simply type an "N" at the prompt, at which point the default map will be displayed but not saved.

SECTION 4  
DIAGNOSTICS

Two DEC RC25 diagnostics may be used to test the controller. They are ZRCFB3, Front End Test, and ZRCDA1, Disk Exerciser. MicroVAX II, MDM KDA50-Q, diagnostics are also included.

SETUP AND SELF TEST

Install the controller as described in Section 2. Apply power to the system, and verify that both green LEDs light. Install the XXDP+ diagnostic floppy in the floppy drive and boot the system.

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 (O 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) N ? <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) N ? <CR>

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

CHECK ALL WRITES AT HOST BY READING (L) Y ? <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.

### NOTE

If MicroVAX Diagnostic Monitor (MDM) is to be run, unit mapping (NOVRAM) must have all devices connected.

## 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 NOVRAM selectable and was set to 5. The test will pass if the NOVRAM is set to interrupt priority 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.

## SECTION 5

### ERRORS AND TROUBLESHOOTING

#### GENERAL

The SCSI cable that connects the host adapter to the drives must be terminated at both ends. Since the host adapter is already terminated, this must be one end of the cable. If several drives are attached to the cable, the drive at the end of the cable must be the only drive with termination.

If you are experiencing problems, Option 5 of the Configuration Menu allows a single SCSI command to be given directly to the drive. This is documented in Section 3, "SCSI Direct Command."

For example, a SCSI Test Unit Ready command is as follows:

6 bytes - 0,0,0,0,0,0

Enter and execute this command. If it cannot be executed, the system may return SCSI Request Sense command information. Consult the drive manual to decode this information. NOTE: After a bus reset, the SCSI Test Unit Ready command will usually return an error indicating that the bus was reset. Execute the command again to clear the error.

Another example is a SCSI Read command. This is as follows:

6 bytes - 8,0,0,0,1,0

This will read Logical Block 0 and display it on the screen. If not successful, the SCSI Request Sense command information may appear on the screen. Consult the drive manual to decode this information.

The SCSI Request Sense command information returned from a SCSI command that failed, is error status returned from the drive. This allows drive vendors to give general SCSI status and vendor unique information. General SCSI status is summarized in the four bits of word three of the returned information. This is as follows (called the Sense Key):

- 0 - NO SENSE. No specific information to return.
- 1 - RECOVERED ERROR. Last command completed successfully but with some drive recovery action.
- 2 - NOT READY. Drive not ready.
- 3 - MEDIUM ERROR. Media error.
- 4 - HARDWARE ERROR.
- 5 - ILLEGAL REQUEST.
- 6 - UNIT ATTENTION. Drive reset or media changed.
- 7 - DATA PROTECT.

Consult the drive manual for additional Request Sense information.

ERROR LOGS

Host Memory Access, Disk Transfer, and SDI error logs and their formats are listed below. Also listed are fatal errors as posted in the SA register.

ERRORS - SCSI HOST ADAPTER

```

-----
                        HOST MEMORY ACCESS ERROR LOG
-----
31          16 15          8 7          0
+-----+-----+-----+-----+
|          COMMAND REFERENCE NUMBER          | 0
+-----+-----+-----+-----+
| SEQUENCE NUMBER |          UNIT NUMBER          | 4
+-----+-----+-----+-----+
| EVENT CODE     |     FLAGS     |     FORMAT     | 8
+-----+-----+-----+-----+
|          CONTROLLER ID          | 12
+-----+-----+-----+-----+
| UNDEFINED     | UNDEFINED | ADAPTER REV    | 20
+-----+-----+-----+-----+
|          HOST MEMORY ADDRESS          | 24
+-----+-----+-----+-----+

                        CONTROLLER DEPENDENT INFORMATION
+-----+-----+-----+-----+
|          DMA ADDRESS          | QBUS STATUS | 28
+-----+-----+-----+-----+
| BUFFER LO |          BYTE COUNT          | MODIFIERS | 32
+-----+-----+-----+-----+
| UNDEFINED | BURST | DWELL | BUFFER HI | 36
+-----+-----+-----+-----+

```

Flags = 0 (sequence number reset)  
Format = 1 (host memory access error)  
Event Code = 29H (odd transfer address in DU command)  
              49H (odd byte count in DU command)  
              69H (nonexistent memory error)

-----  
 DISK TRANSFER ERROR LOG  
 -----

| 31                                    | 16 15 | 8 7         | 0           |    |
|---------------------------------------|-------|-------------|-------------|----|
| COMMAND REFERENCE NUMBER              |       |             | 0           |    |
| SEQUENCE NUMBER                       |       | UNIT NUMBER |             | 4  |
| EVENT CODE                            |       | FLAGS       | FORMAT      | 8  |
| CONTROLLER ID                         |       |             | 12          |    |
| UNDEFINED                             |       | CDB SIZE    | ADAPTER REV | 16 |
| BYTES 0 TO 5 OF THE CURRENT SCSI CDB  |       |             | 20          |    |
| UNIT ID                               |       |             | 24          |    |
| BYTES 6 TO 9 OF THE CURRENT SCSI CDB  |       |             | 28          |    |
| SCSI INQUIRY COMMAND (BYTES 16 TO 19) |       |             | 32          |    |
| LOGICAL BLOCK NUMBER                  |       |             | 36          |    |
| LOGICAL BLOCK NUMBER                  |       |             | 40          |    |

CONTROLLER DEPENDENT INFORMATION

(Taken from the request sense command executed after error)

|               |                      |               |         |    |
|---------------|----------------------|---------------|---------|----|
| FRU FAILED    | ADDITIONAL SENSE KEY | SENSE KEY     | 44      |    |
| BYTE 15       | BYTE 14              | BYTE 12       | BYTE 2  |    |
| VENDOR UNIQUE |                      | FIELD POINTER |         | 48 |
| BYTE 19       | BYTE 18              | BYTE 17       | BYTE 16 |    |
| VENDOR UNIQUE |                      | VENDOR UNIQUE |         | 52 |
| BYTE 23       | BYTE 22              | BYTE 21       | BYTE 20 |    |
| VENDOR UNIQUE |                      | VENDOR UNIQUE |         | 56 |
| BYTE 27       | BYTE 26              | BYTE 25       | BYTE 24 |    |

Flags = 0 (sequence number reset)  
 Format = 2 (disk transfer error)  
 Event Code = 48H (LBN too large)  
               68H (inconsistent internal control structure)  
               E8H (SCSI bus reset)  
               108H (recovered (soft) error)  
               148H (reselection timeout error)

-----  
SDI ERROR LOG  
-----

|                                       |    |          |             |   |    |
|---------------------------------------|----|----------|-------------|---|----|
| 31                                    | 16 | 15       | 8           | 7 | 0  |
| COMMAND REFERENCE NUMBER              |    |          |             |   | 0  |
| SEQUENCE NUMBER                       |    |          | UNIT NUMBER |   | 4  |
| EVENT CODE                            |    | FLAGS    | FORMAT      |   | 8  |
| CONTROLLER ID                         |    |          |             |   | 12 |
| UNDEFINED                             |    |          |             |   | 16 |
| UNDEFINED                             |    | CBD SIZE | ADAPTER REV |   | 20 |
| BYTES 0 TO 5 OF THE CURRENT SCSI CDB  |    |          |             |   | 24 |
| UNIT ID                               |    |          |             |   | 28 |
| BYTES 6 TO 9 OF THE CURRENT SCSI CDB  |    |          |             |   | 32 |
| SCSI INQUIRY COMMAND (BYTES 16 TO 19) |    |          |             |   | 36 |
| LOGICAL BLOCK NUMBER                  |    |          |             |   | 40 |

CONTROLLER DEPENDENT INFORMATION

(Taken from the request sense command executed after error)

|               |         |                      |         |           |
|---------------|---------|----------------------|---------|-----------|
| FRU FAILED    |         | ADDITIONAL SENSE KEY |         | SENSE KEY |
| BYTE 15       | BYTE 14 | BYTE 12              | BYTE 2  | 44        |
| VENDOR UNIQUE |         | FIELD POINTER        |         |           |
| BYTE 19       | BYTE 18 | BYTE 17              | BYTE 16 | 48        |
| VENDOR UNIQUE |         |                      |         |           |
| BYTE 23       | BYTE 22 | BYTE 21              | BYTE 20 | 52        |
| VENDOR UNIQUE |         |                      |         |           |
| BYTE 27       | BYTE 26 | BYTE 25              | BYTE 24 | 56        |

Flags = 0 (sequence number reset)  
 Format = 3 (SDI error)  
 Event Code = 2B (command timeout)  
               4B (buffer overrun)  
               6BH (target not responding to selection)  
               CBH (parity error - retry successful)  
               EBH (drive error)  
               10BH (parity error - retry unsuccessful)  
               23H (removable media not mounted)  
               6H (write protected)  
               5H (media format error)

-----  
 SELF-DETECTED FATAL PORT/CONTROLLER ERRORS  
 -----

Fatal Error Code Definitions - Error will be posted in the SA Register bits 7 to 0. Errors 1 to 31 decimal will be flashed with the activity LED (L2) MSB first, 1 = long and 0 = short flash.

| DEC | HEX | OCT | DESCRIPTION                                                      |
|-----|-----|-----|------------------------------------------------------------------|
| 001 | 01  | 01  | ; [QBUS Command Packet Read]                                     |
| 002 | 02  | 02  | ; [QBUS Command Packet Write]                                    |
| 003 | 03  | 03  | ; [Buffer RAM parity error]                                      |
| 004 | 04  | 04  | ; [Buffer RAM data error]                                        |
| 005 | 05  | 05  | ; [EPROM Checksum]                                               |
| 006 | 06  | 06  | ; [QBUS Command/Response Ring Read]                              |
| 007 | 07  | 07  | ; [QBUS Command/Response Ring Write]                             |
| 008 | 08  | 10  | ; [QBUS Interrupt] (NOT USED)                                    |
| 009 | 09  | 11  | RESERVED                                                         |
| 010 | 0A  | 12  | RESERVED                                                         |
| 011 | 0B  | 13  | ; [QBUS DMA] (NOT USED)                                          |
| 012 | 0C  | 14  | ; [CPU Failure]                                                  |
| 013 | 0D  | 15  | ; [Watchdog Timer]                                               |
| 014 | 0E  | 16  | RESERVED                                                         |
| 015 | 0F  | 17  | ; Interrupt Write (NOT USED)                                     |
| 016 | 10  | 20  | ; MAINTENANCE READ/WRITE Invalid Region; Identifier [DU Driver]  |
| 017 | 11  | 21  | ; MAINTENANCE WRITE Load to Non-Loadable; Controller [DU Driver] |
| 018 | 12  | 22  | ; Controller RAM Error (non-parity)                              |
| 019 | 13  | 23  | ; INIT Sequence Error [DU Driver Initialization]                 |
| 020 | 14  | 24  | RESERVED                                                         |

-----  
 SELF-DETECTED FATAL PORT/CONTROLLER ERRORS (cont.)  
 -----

| DEC | HEX      | OCT | DESCRIPTION                                                    |
|-----|----------|-----|----------------------------------------------------------------|
| 021 | 15       | 25  | ; [DU Driver Initialization Diagnostic Failure]                |
| 022 | 16       | 26  | ; EEPROM Checksum Failure                                      |
| 023 | 17       | 27  | ; SBIC Register Error                                          |
| 024 | 18       | 30  | ; DMA Controller Error                                         |
| 025 | 19       | 31  | ; QBIC Error                                                   |
| 026 | 1A       | 32  | ; QBUS DMA Error                                               |
| 027 | 1B       | 33  | ; QBUS Power Failure                                           |
| 028 | 1C       | 34  | ; Nonexistent Memory Detected during Host/<br>Controller DMA's |
| 029 | 1D       | 35  | ; Parity Error Detected during Host/Controller<br>DMA's        |
| 030 | 1E       | 36  | ; QBIC Data Compare error during Host/Controller<br>DMA's      |
| 031 | 1F       | 37  | ; port b parity error detected                                 |
| 032 | 20       | 40  | ; port c parity error detected                                 |
| 033 | 21       | 41  | RESERVED                                                       |
| 034 | 22       | 42  | ; port a parity error detected                                 |
| 035 | 23       | 43  | NOT USED                                                       |
| 255 | to<br>FF | 377 |                                                                |