EK-UDA50-SV-003

UDA50
Service Manual

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UDA50
Service Manual

Prepared by Educational Services
of
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VAX	IAS	VT
UDA50	MASSBUS	RA80
HSC50	RA60	RA81

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CHAPTER 1
INTRODUCTION

1.1 SCOPE OF MANUAL

The *UDA50 Service Manual* describes the maintenance and troubleshooting procedures needed to support the UDA50 Disk Controller. The manual covers both UDA50-resident diagnostic and UDA50 host-resident diagnostic operating procedures. The service manuals for individual disk products provide device-specific service information for troubleshooting disk subsystem problems.

1.2 UDA50 MAINTENANCE PHILOSOPHY

The maintenance philosophy planned for the UDA50 Disk Controller is module replacement. Field Service personnel should not attempt to replace or repair component parts within these modules.

1.3 UDA50 FIELD REPLACEABLE PARTS

The UDA50 Disk Controller consists of two hex modules, two flat ribbon intermodule cables, an unshielded standard disk interface (SDI) cable assembly, an I/O bulkhead assembly, and assorted hardware. Figure 1-1 illustrates the major field replaceable units (FRUs) in a UDA50 assembly.

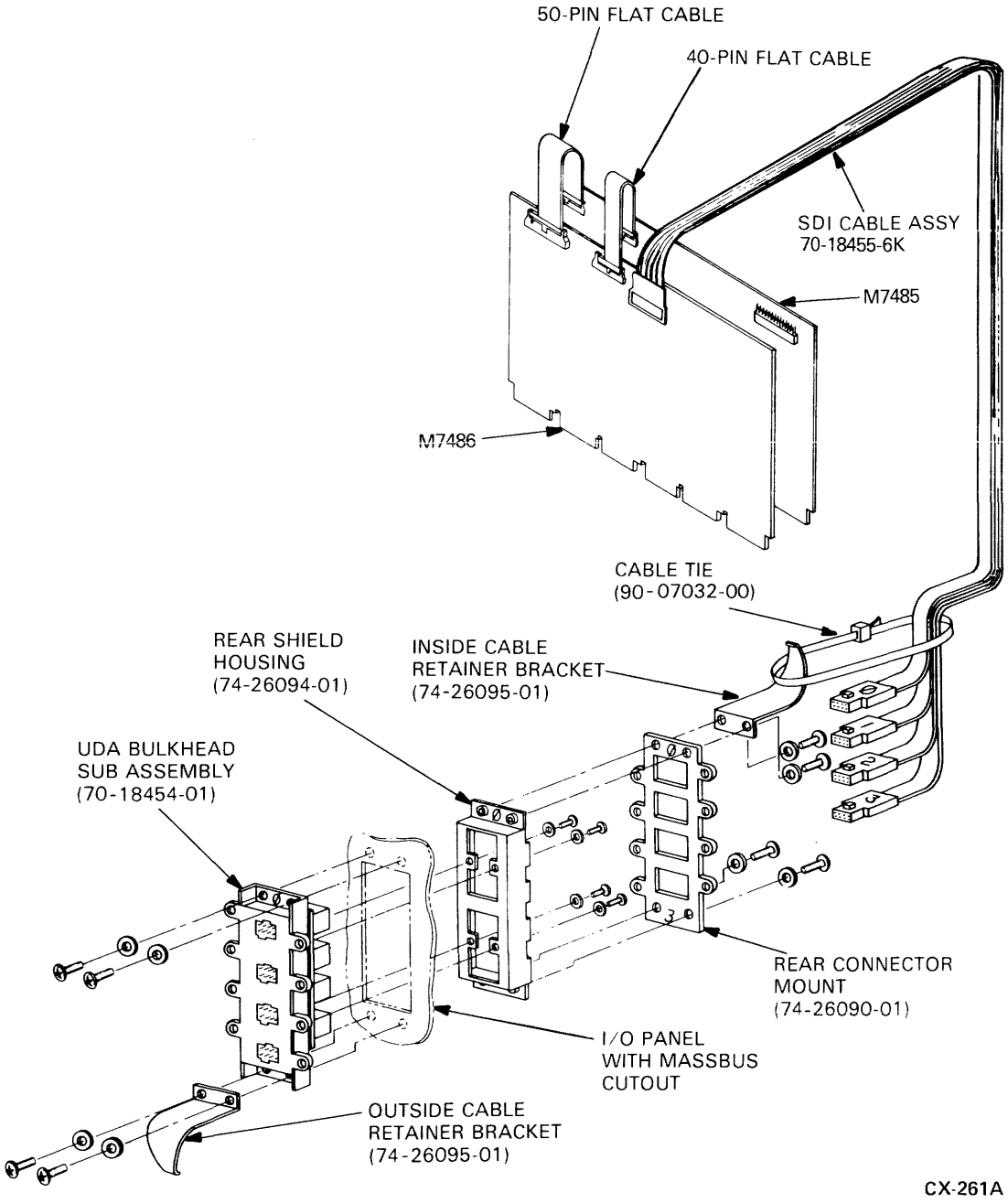


Figure 1-1 UDA50 Illustrated Parts

1.4 UDA50 MAINTENANCE FEATURES

The UDA50 Disk Controller has the following maintenance features:

- UDA50-resident diagnostics
- UDA50 LED maintenance displays
- UDA50 host-resident diagnostics

The UDA50-resident diagnostic is a PROM-based microcode program that performs UDA50 self diagnosis upon powerup or hard initialization.

A UDA50 maintenance display is located on each UDA50 module. Each display consists of four LEDs. These LEDs display current resident diagnostic activity and error codes caused by malfunctions. Figures 1-2 and 1-3 show the location of the maintenance LEDs on each module.

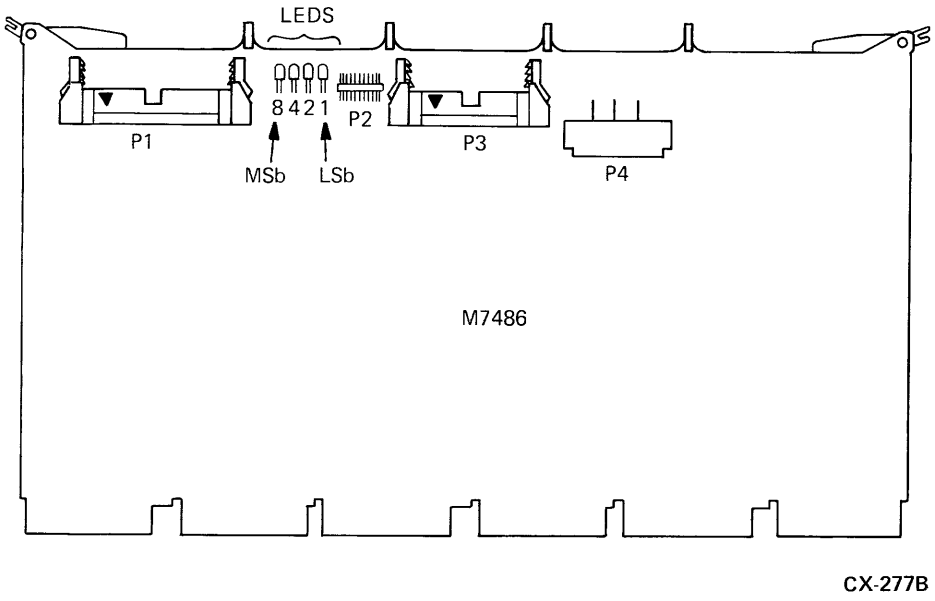


Figure 1-2 Diagnostic LED Locations on UDA50 Module M7486

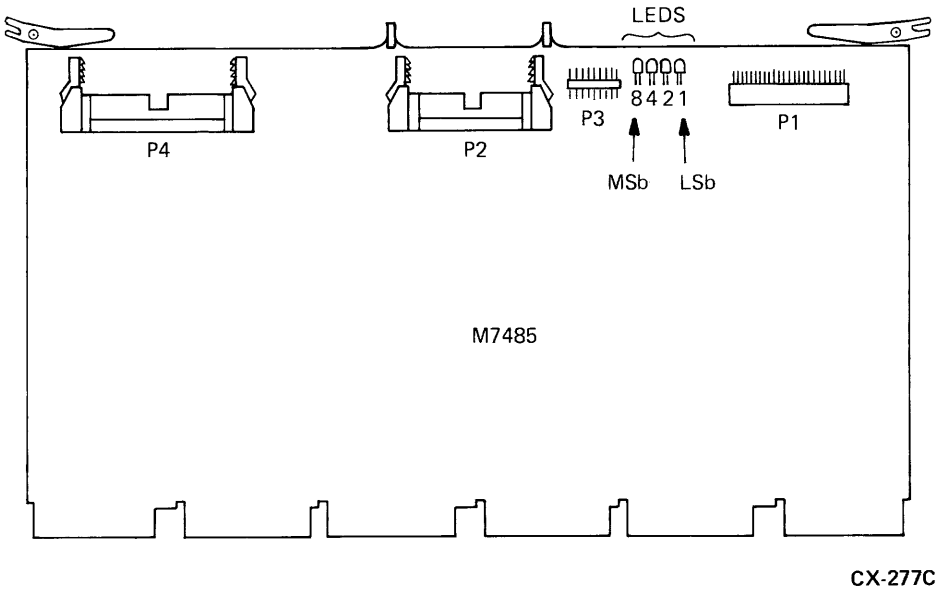


Figure 1-3 Diagnostic LED Locations on UDA50 Module M7485

The UDA50 host-resident diagnostics contain four tests that isolate subsystem faults to the UNIBUS or disk drives. A system exerciser program is also provided to test the performance of the entire disk subsystem.

1.5 UDA50 ADDRESS SWITCHES AND JUMPERS

The UDA50 Disk Controller contains two registers visible in the UNIBUS I/O page. They are the initializing and polling (IP) register and the status and address (SA) register. The IP and SA registers are assigned an octal UNIBUS address of 772150 and 772152, respectively.

The UNIBUS address selector switches and a jumper plug (W13) are used to set the UNIBUS address for the IP register. The location of these switches and jumper plug on UDA50 module M7485 is shown in Figure 1-4. Set the UNIBUS address switches and jumpers to the positions shown in Figure 1-5 to select UNIBUS address 772150. If 772150 (default address shipped with the UDA) cannot be used, alternate addresses are 760334 and 760340.

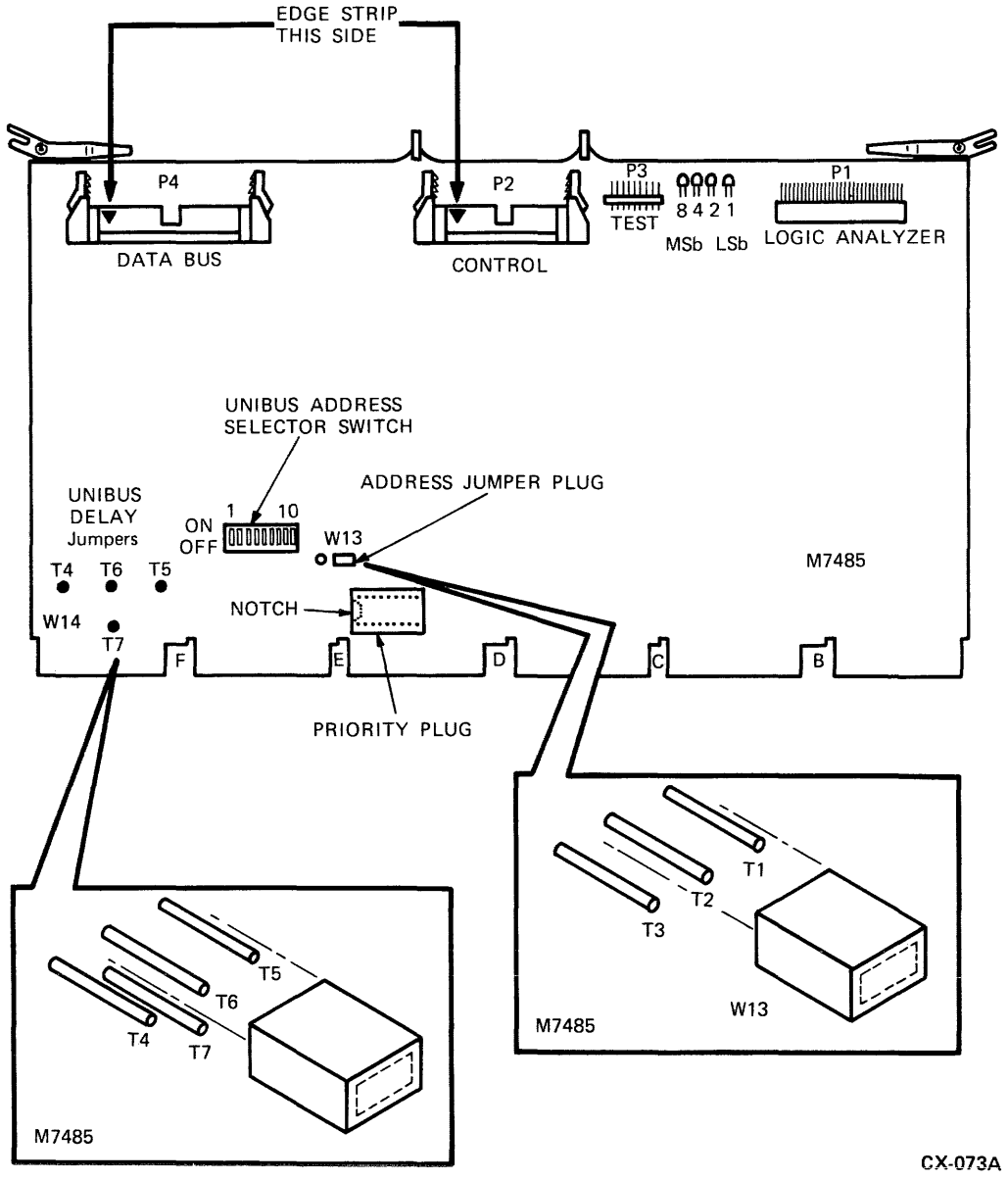
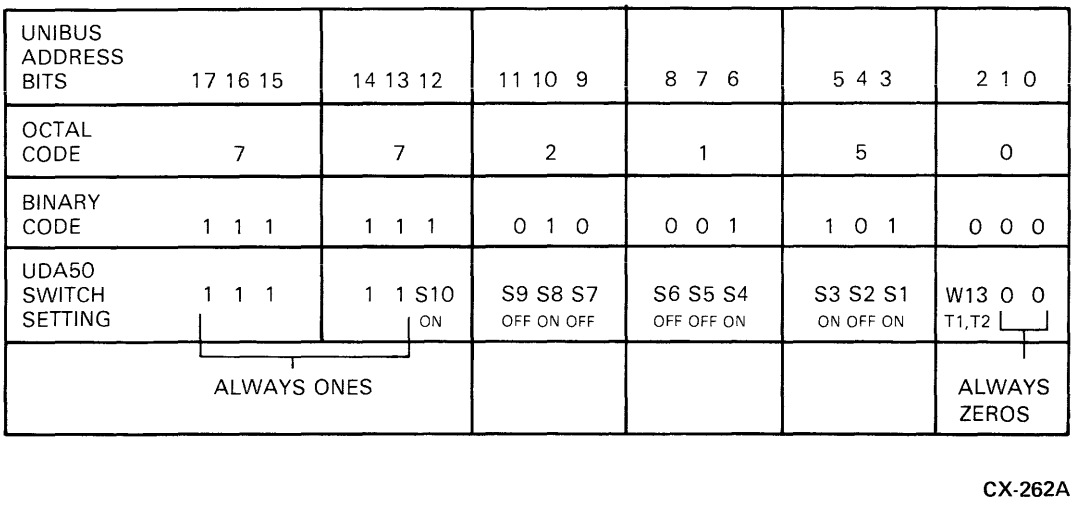


Figure 1-4 M7485 Address Switch and Jumper Locations



CX-262A

Figure 1-5 UDA50 Switch Setting for Address 772150

NOTE

The UNIBUS address switches and jumpers should be set for a floating address when a second UDA50 is installed on a system. Check the system configuration and UNIBUS addresses of all devices already installed. Common floating addresses are 760340 and 760330.

In past disk products, a vector address was also physically selectable. This is not true with the UDA50 Disk Controller. A vector address, typically 154 (octal), will be supplied by the software.

1.5.1 UNIBUS Tuning

A UNIBUS system may experience data late conditions that can be remedied by tuning the UNIBUS. This process involves changing the relative positions of the nonprocessor request (NPR) devices on the bus. The device at the front of the bus (near the host) will have the highest priority. The device at the end of the bus will have the lowest priority.

1.5.1.1 UNIBUS Device Positions – The UDA should be placed at the end of the UNIBUS (lowest NPR priority) because it is heavily buffered. Other NPR devices should be placed along the UNIBUS depending on their buffering. The NPR devices with the least amount of buffering should be placed at the front of the UNIBUS.

1.5.1.2 UDA NPR Priority Jumper – A jumper has been inserted on the M7485 module to help tune the UNIBUS system. The jumper changes the average number of UDA NPR requests over a given amount of time by delaying the request for 0, 6.2, or 10 microseconds. Table 1-1 shows the amount of delay and jumper configuration.

Table 1-1 UNIBUS Delay

Amount of Delay	Jumper Configuration
0 microseconds	T4-T6
6.2 microseconds	T5-T6
10 microseconds	T6-T7

If data late conditions are observed after setting the delay jumper to the 6.2 microseconds position, the jumper can be set to the 10 microseconds position (T6-T7).

On some systems it will not be possible to remedy data late errors by changing the UDA NPR Priority Jumper. The following is a list of systems that cannot use a UDA along with rules on how many UDAs can be installed on a system:

- The UDA/RK07/DMR11 configuration (on an 11/70 only) gives data late errors from the RK07 regardless of the UDA's jumper setting. Either an RK07 or a UDA, but not both, can be configured on the 11/70 when a 1 megabit per second DMR11 is present.
- On both PDP-11 and VAX systems, no more than two UDAs may be installed on a UNIBUS with nonbuffered UNIBUS peripheral devices.

NOTE

If a bus repeater is used, a greater possibility of data late errors exists. In general, the longer the UNIBUS, the greater the possibility of data late errors.

1.5.1.3 UDA Burst Parameter – The UDA burst parameter is a host software value that indicates how many long words (32 bits) the UDA will attempt to transfer when it accesses the UNIBUS. The default for this parameter is 1, but can range from 1 to 32.

Increasing the UDA burst parameter to a number greater than 1 increases the overall system efficiency. However, data late conditions are more likely to exist.

1.6 UDA50 PRIORITY PLUG

All UDA50 M7485 modules are shipped with a level 5 priority plug. Because this is the recommended priority level for UDA50 disk subsystems, the priority plug need not be changed for the majority of installations. If another priority level is required in some special circumstance, the current priority plug must be removed and the new one inserted. The location of the priority plug is shown in Figure 1-4. It should be inserted so the notch on the priority plug aligns with the hole on the module socket.

1.7 INSTALLATION OF BOOTSTRAP ROM

The proper bootstrap ROMs are shipped with the UDA50. Bootstrap ROM 23-767A9-00 must be installed on the PDP-11 bootstrap ROM module M9312. Bootstrap ROM 23-990A9-00 must be installed on the VAX 11/750.

1.8 RELATED DOCUMENTATION

DIGITAL customers can order the following list of UDA50 related manuals:

- *UDA50 USER GUIDE* (EK-UDA50-UG)
- *UDA50 SERVICE MANUAL* (EK-UDA50-SV)
- *UDA50 MAINTENANCE GUIDE* (AA-M185A-TC)
- *UDA50 FIELD MAINTENANCE PRINT SET* (MP-01331)
- *DSA CONTROLLER DOCUMENTATION KIT* (QP906-GZ)*
- *DSA DRIVES DOCUMENTATION KIT* (QP907-GZ)*

* The DSA Controller kit consists of a small looseleaf binder and the maintenance guides for all the DSA controllers. The DSA Drives Kit consists of the two small binders containing the current maintenance guides for disks that operate on the DSA controllers.

Employees: The *User Guide* and *Service Manual* can be ordered directly from Publication and Circulation Services, 10 Forbes Road, Northboro, Massachusetts 01532 (RCS Code: NR12, Mail Code: NR03/W3).

The *Maintenance Guide*, Maintenance Guide Looseleaf Binder, Maintenance Documentation Kit, and the Field Maintenance Print Set can be ordered directly from the Software Distribution Center, 444 Whitney Street, Northboro, Massachusetts 01532 (RCS Code: MSDC, Mail Code: NR02-1/J6).

Non-Employees: The above documents can be ordered directly from Digital Equipment Corporation, P.O. Box CS2008, Nashua, New Hampshire 03061, or by calling toll free: 800-258-1710.

Outside the United States, consult local DIGITAL offices.

CHAPTER 2
UDA50 FAULT ISOLATION

2.1 UDA50-RESIDENT DIAGNOSTICS

There are two ways of obtaining resident diagnostic information from the UDA50 Disk Controller. The first is through the UDA50 LED error codes. The second is by examining the contents of the UDA50 status/address (SA) register. The SA register contents are also supplied to the host CPU for error logs and diagnostic error reports.

2.1.1 UDA50 LED Error Codes

Table 2-1 lists the LED error codes and which FRU is most likely at fault.

Table 2-1 LED Error and Symptom Codes

M7485 LEDs 8 4 2 1	M7486 LEDs 8 4 2 1	Error Symptoms	Most Likely Failure
0 0 0 1	x x x x	Hex 1; undefined	Undefined
0 0 1 0	0 0 0 0	Hex 2; microcode stuck in init step 2	M7485 or software
0 0 1 1	0 0 0 0	Hex 3; microcode stuck in init step 3	M7485 or software
0 1 0 0	0 0 0 0	Hex 4; microcode stuck in init step 4 or UNIBUS timeout error	M7485 or host inactive
0 1 0 1 (BLINK)	0 0 0 0	Hex 4/5; test complete UDA50 communicating with host software	No problem
0 1 1 0 x x x x	x x x x 0 1 1 0	Hex 6; undefined	Undefined
0 1 1 1 x x x x	x x x x 0 1 1 1	Hex 7; undefined	Undefined
1 0 0 0	0 0 0 0	Hex 8; wrap bit 14 set in SA register	M7485 or software
1 0 0 1 0 0 0 0	0 0 0 0 1 0 0 1	Hex 9; board one error	M7485

Table 2-1 LED Error and Symptom Codes (Cont.)

M7485 LEDs 8 4 2 1	M7486 LEDs 8 4 2 1	Error Symptoms	Most Likely Failure
1 0 1 0 1 0 1 0	0 0 0 0 1 0 1 0	Hex A; board two error	M7486
1 0 1 1 x x x x	x x x x 1 0 1 1	Hex B; undefined	Undefined
x x x x 1 1 0 0	1 1 0 0 x x x x	Hex C; Timeout error, check error code in SA register	Many causes
1 1 0 1 x x x x	x x x x 1 1 0 1	Hex D; RAM parity error	M7486
1 1 1 0 x x x x	x x x x 1 1 1 0	Hex E; ROM parity error	M7485
1 1 1 1	1 1 1 1	Hex F; sequencer error	M7485
Cycling pattern	Cycling pattern	None	No problem *
Cycling pattern	Cycling pattern	The cycling pattern continues beyond the start of the host software initialization process. The UDA50 is not responding to the host CPU.	M7485

* The LEDs normally cycle while the UDA50 is waiting for the host to start the initialization process. At that time, it responds to the initialization and the cycling pattern stops. This normally occurs in about two seconds.

Note: 1 = LED ON 0 = LED OFF x = May be ON or OFF

When two codes are given for the same error, both indicate the same failure.

2.1.2 Status/Address Register Error Codes

More detailed information on UDA50 functional and diagnostic error codes is reported through the SA register. The contents of this register may be examined manually through the CPU console at the UDA50 UNIBUS address plus 2. This address is normally 772152. Table 2-2 lists the SA error codes and indicates the most likely FRU at fault.

Table 2-2 SA Register Error Codes

Error Code (Octal)	Error Description	Most Likely FRU Failed
100001	UNIBUS packet read error	M7485*
100002	UNIBUS packet write error	M7485*
100003	UDA ROM or RAM parity error	M7485 or M7486
100004	UDA RAM parity error	M7486
100005	UDA ROM parity error	M7485
100006	UNIBUS ring read error	M7485*
100007	UNIBUS ring write error	M7485*
100010	UNIBUS interrupt master failure	M7485
100011	Host access timeout error	M7485*
100012	Host exceeded command limit	M7485*
100013	UDA SI hardware fatal error	M7486
100014	DM XFC fatal error	M7486
100015	Hardware timeout of instruction loop	M7485*
100016	Invalid virtual circuit identifier	M7485*
100017	Interrupt write error on UNIBUS	M7485*
104000	Fatal sequence error	M7485
104040	D processor ALU	M7485
104041	D processor control ROM parity error	M7485
105102	D processor with no BD # 2, or RAM parity error	M7486
105105	D processor RAM buffer error	M7486
105152	D processor SDI error	M7486
105153	D processor write mode wrap serdes error	M7486
105154	D processor read mode serdes, RSGEN & ECC error	M7486
106040	U processor ALU error	M7485
106041	U processor control register error	M7485

* Possibly the host CPU is at fault.

Table 2-2 SA Register Error Codes (Cont.)

Error Code (Octal)	Error Description	Most Likely FRU Failed
106042	U processor DFAIL/control ROM parity/BD # 1 test CNT	M7485
106047	U processor constant PROM error with D processor running SDI test	M7485
106055	Unexpected trap found, abort diagnostic	M7485
106071	U processor constant PROM error	M7485
106072	U processor control ROM parity error	M7485
106200	Step 1 data error (MSB not set) or RE-INIT	M7485
107103	U processor RAM parity error	M7486
107107	U processor RAM buffer error	M7486
107115	Test count was wrong (BD __ 2)	M7486
112300	Step 2 error	M7485
122240	NPR error	M7485
122300	Step 3 error	M7485
142300	Step 4 error	M7485

* Possibly the host CPU is at fault.

2.2 HOST-RESIDENT DIAGNOSTICS

A different approach must be taken to isolate faults if no LED error code exists in the UDA50. The first step is to examine the customer error log to determine the source of the problem. The next step is to cycle the power off and back on, resetting much of the logic. The UDA50 then starts the initialization routine. Only the first phase will run as completion takes host software interaction. If the first phase passes, the next step is to run the available host-resident diagnostics.

Host-resident diagnostics available to diagnose UDA50 problems are the PDP-11 CZUDC and the VAX EVRLA. Both diagnostic programs have the same tests and error messages with the exception of the program name (CZUDC or EVRLA). The programs consist of the following four tests:

- Test 1: UNIBUS interrupt/address test (checks out UDA50 functionality).
- Test 2: Disk-resident diagnostic test (runs the drive resident diagnostics).
- Test 3: Disk function test (performs minimum drive functional tests).

- Test 4: Disk exerciser test (performs a limited read and write test in the diagnostic cylinder area – the diagnostic will not write in the customer data area unless specifically instructed to do so, and a warning message will be printed). There are two modes of operation for test 4.

    1. Default operation on the diagnostic cylinder or customer area with all parameters selected by the default answers shown below.
    2. Manual intervention to the test using new parameters that may include the customer data area. This manual intervention is referred to as a fifth test in test printouts.

2.2.1 PDP-11 Subsystem Diagnostics Preparation

The PDP-11 subsystem diagnostics CZUDC (UDA50 host-resident diagnostics) run on any disk drive cabled to the UDA50. The MSCP and SDI bus structure compensates for differences between disk drives. Also included with the PDP-11 subsystem diagnostic is a disk formatter program (CZUDE). The formatter (CZUDE) is not a diagnostic; do not run it unless specifically instructed.

The CZUDC diagnostic program asks both hardware and software questions of the user. A sample printout of these questions, when the default conditions are selected, is shown below:

```
CHANGE HW (L)? Y

 UNITS (D) ? 1

UNIT 0
UNIBUS ADDRESS OF UDA (0) 172150 ?
VECTOR (0) 154 ?
BR LEVEL (D) 5 ?
UNIBUS BURST RATE (D) 0 ?
DRIVE NUMBER (D) 0 ?
EXERCISE ON CUSTOMER DATA AREA IN TEST 4 (L) N ?

CHANGE SW (L) ? Y

ENTER MANUAL INTERVENTION MODE FOR SPECIAL DIAGNOSIS (S) N ?
```

The remaining software questions apply to test 4 only.

```
ERROR LIMIT (D) 32 ?
READ TRANSFER LIMIT IN MEGABYTES - 0 FOR NOLIMIT (D) 0 ?
SUPPRESS PRINTING SOFT ERRORS L) Y ?
DO INITIAL WRITE ON START (L) Y ?
ENABLE ERROR LOG (L) N ?
```

If the manual intervention question is answered yes, the following series of questions will be asked. Manual intervention should be used only to further isolate problems after running the test with the default answers shown above.

```
THE FOLLOWING QUESTIONS REFER TO UNIT XX UDA AT XXXXXX DRIVE XXX

NUMBER OF BAD BLOCKS (D) 0 ?

BAD BLOCK (A) ?

DO YOU WANT TO CHANGE TESTING PARAMETERS FOR THIS DRIVE (L) N ?
```

Answer this question "N" to bypass further questioning. A "Y" answer results in the following questions.

```
READ ONLY (L) N ?

WRITE ONLY (L) N ?

CHECK ALL WRITES BY READING (L) N ?

RANDOMLY CHECK WRITES BY READING (L) Y ?

DATA PATTERN - 0 FOR RANDOM SELECTION (D) 0 ?

ENABLE ECC DATA CORRECTION (L) Y ?

COMPARE ALL DATA READ (L) N ?

RANDOMLY COMPARE DATA READ (L) Y ?

ENABLE RETRIES? (L) Y ?

RANDOM ACCESS MODE (L) Y ?

DO YOU WISH TO:
 0 - TEST ENTIRE AREA SELECTED
 1 - SPECIFY BEGIN/END SETS TO TEST
 2 - SPECIFY TRACKS AND CYLINDERS TO TEST
 3 - SPECIFY GROUPS AND CYLINDERS TO TEST
 4 - SPECIFY CYLINDERS TO TEST
(D) 0 ?
```

If answered 1:

```
NUMBER OF BEGIN/END SETS (D) 1 ?
BEGIN BLOCK (A) 0 ?
END BLOCK (A) 0 ?
```

The last two questions will be asked one to four times, depending on the answer to the previous question.

If answered 2:

```
NUMBER OF TRACKS TO TEST (D) 1 ?
TRACK (D) 0 ?
```

The last question may be asked one to seven times, depending on the answer to the previous question.

If answered 3:

```
NUMBER OF GROUPS TO TEST (D) 1 ?
GROUP (D) 0 ?
```

The last question may be asked one to seven times, depending on the answer to the previous question.

The following question is asked only if options 2 or 3 were requested:

```
DO YOU WISH TO LIMIT THE CYLINDERS TESTED (L) N ?
```

The following question will be asked if the LIMIT THE CYLINDERS question was answered Y (within options 2 and 3) or if option 4 was selected for the area to test:

```
STARTING CYLINDER (A) 0 ?
ENDING CYLINDER (A) 0 ?
```

The following questions will be asked if data pattern 16 was selected:

```
NUMBER OF WORDS IN DATA PATTERN 16 (D) 1 ?
DATA WORD (O) 0 ?
```

2.2.2 VAX Subsystem Diagnostics Preparation

The VAX subsystem diagnostics consist of two programs: ZZ-EVRLA (UDA host-resident diagnostic) and ZZ-EVRLC (SDI generic disk exerciser). Also included with the diagnostic kit for the VAX subsystem is a disk formatter program (ZZ-EVRLB). The formatter (EVRLB) is not a diagnostic; do not run unless specifically instructed.

ZZ-EVRLC tests the read and write ability of any SDI disk drive and displays differences in the read and write data to the operator.

Before running the subsystem EVRLA diagnostic tests, the system must be set up and tested under the diagnostic supervisor. On a VAX, this requires a DW UNIBUS adapter, UDA50 disk controller, and an RAnn disk drive to be attached. The following printout shows how to attach these devices:

```
DS> AT
DEVICE TYPE ? DW780
DEVICE LINK? HUB
DEVICE NAME? DW0
TR? 3
BR? 4
DS> AT
DEVICE TYPE? UDA50
DEVICE LINK? DW0
DEVICE NAME? DUA
UDAIP? 772150
VECTOR? 154
BR? 5
BURST_RATE? 0
DS> AT
DEVICE TYPE? RANN    (SEE NOTE)
DEVICE LINK? DUA
DEVICE NAME? DUA0
DS>
```

NOTE

An RA60 must be attached by using the following sequence:

```
DS> AT
DEVICE TYPE? RA60
DEVICE LINK? DUA
DEVICE NAME? DJA0
```

Note the "J" instead of the "U". This is how VMS identifies the drive as removable.

2.3 RUNNING THE HOST-RESIDENT DIAGNOSTICS

Host-resident diagnostic CZUDC or EVRLA contains tests 1 through 4 linked together to run automatically in sequence. However, if an attempt to read or write on the customer data area is desired during test 4, manual intervention is necessary.

A detailed description of these diagnostics is available on microfiche under RA80 diagnostics (CZUDC).

If a printout of the test progress is wanted, type SET TRACE on a VAX prior to starting the test.

The following is a sample test printout:

```
DS> LOAD EVRLA
DS> SET TRACE
DS> START/TEST:1

.PROGRAM: EVRLA-UDA50 DISK SUBSYSTEM DIAGNOSTIC, REVISION 2.1.,5 TESTS AT
10:34:53:91.
TESTING: DUA DUA0

DIAGNOSTIC STARTED AT: 31-JAN-84 10:34:57:09

TEST 1:    UDA INTERRUPT/ADDRESS TEST
           SUBTEST 1: UDA ADDRESS SUBTEST
           SUBTEST 2: UDA DIAGNOSTIC LOOP MODE SUBTEST
           SUBTEST 3: UDA INTERRUPT SUBTEST
           SUBTEST 4: UDA INITIALIZATION-SM RING BUFFER SUBTEST
           SUBTEST 5: UDA INITIALIZATION-LG RING BUFFER SUBTEST
           SUBTEST 6: UDA DM PROGRAM ADDRESSING SUBTEST
TEST 2:    DISK RESIDENT DIAGNOSTIC TEST
TEST 3:    DISK FUNCTION TEST
TEST 4:    DISK EXERCISER
DRIVE DUA0 ON UDA AT ADDRESS 772150 (0)
INITIAL WRITE COMPLETE
```

The disk exerciser diagnostic in test 4 will continue to run until halted with a CTRL C. Type CTRL C to return to the diagnostic supervisor prompt (DS>), then type ABORT. If test 1 is successful the problem is probably drive related. Tests 2 through 4 should detect the failure.

2.4 INTERPRETING HOST-RESIDENT DIAGNOSTIC MESSAGES

The VAX and PDP-11 diagnostics display the same error messages. Error messages take on three distinct formats which provide SA register contents, data comparison error information, or real-time drive state and status. Consult the drive service manual or maintenance guide for interpretation of the status messages.

2.4.1 Status/Address (SA) Register Contents

The following sample error message gives the UDA50 SA register contents:

```
CZUDC DVC FTL ERR 00037 ON UNIT 00 TEST XXX SUB 000 PC: XXXXXX
HOST PROGRAM UDA AT 172150 RUNTIME X:XX:XX
UDA REPORTED FATAL ERROR IN UDASA REGISTER WHILE LOADING DM PROGRAM
 UDASA CONTAINS 100004
```

For a description of the error and a callout of the most likely faulty FRU, find the SA register contents (100004) in Table 2-2.

2.4.2 Data Comparison Errors

The UDA can be put into a mode where the UDASA acts as a wrap port. In this mode, any data being sent to the UDASA will be displayed within a small period of time. If the data in the UDASA does not match the data sent to it, the following error message is displayed. In some instances, a VAX error message prints the name of the failing FRU.

```
CZUDC DVC FTL ERR 00026 ON UNIT 00 TST XXX UB 000 PC: XXXXXX
HOST PROGRAM UDA AT 172150 RUNTIME X:XX:XX
DATA COMPARISON ERROR DURING DIAGNOSTIC PORT LOOP TEST
 DATA SENT TO UDASA 000001
 RECEIVED FROM UDASA 000000

REPLACE UDA50 MODULE M7485.
```

2.4.3 Real-Time Drive State And Status

In the following sample error message, the last two lines contain the real-time drive state as supplied by the drive and a status message:

```
CZUDC SFT ERR 04047 ON UNIT 00 TST 04 SUB 000 PC: [NNNN]
DISK EXERCISER DM PC: [NNNN] UDA AT [NNNN] DRIVE [NNNN] RUNTIME HH:MM:SS
DATA OR STATE CLOCK TIMEOUT DURING WRITE
ATTEMPT ATTEMPT
TYPE BM
SECTORS FROM INDEX [NNNN] TRK [NNNN] GRP [NNNN] CYL [NNNN]
ORIGIN OF SEEK: GRP [NNNN] CYL [NNNN]
REAL TIME STATE 0003
STATUS (R TO L): 0001 1100 0000 0A00 0000 0613 1020
```

The real-time drive state (RTDS) message consists of four hexadecimal digits. Only four state bits within these hexadecimal digits are of diagnostic value to the field service engineer. The rest of the bits are too transitory and are masked out before the RTDS message is printed. The following are the four important state bits:

- Read/write ready (R/W RDY)
- Drive available (AVAIL)
- Attention (ATTN)
- Receiver ready (RCVR RDY)

The location of these four state bits within the hexadecimal code is shown in Figure 2-1. The interpretation of the RTDS message requires an understanding of the causes and effects of each bit. It also requires an understanding of drive online, drive offline, drive available and drive unavailable. Definitions of each of the four RTDS message bits and the online and available states follow.

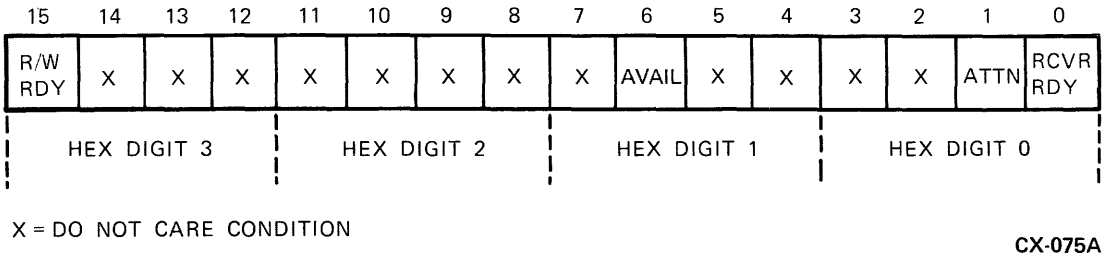


Figure 2-1 Real-Time Drive State Bits

The following four terms define the state of the drive as seen from the controller:

- Drive offline – The drive is not operational and may not communicate via the drive control protocol.
- Drive unavailable – The drive is operating, is visible to, and may at times communicate with the controller. However, the controller may not fully utilize the drive because it is online to the other controller.
- Drive available – The drive is visible to, capable of communicating with, and capable of executing an online command. However, the drive is not currently online to either controller.
- Drive online – The drive is dedicated to the exclusive use of one controller and is not available to the other.

The following paragraphs explain the causes, effects, and relationships among the four state bits within the RTDS message:

- RCVR RDY (receiver ready) – When asserted, this bit indicates the drive is ready to receive a command on the SDI interface write/command line. RCVR RDY is negated while the drive is processing a command.
- ATTN (attention) – This notifies the controller that a potentially significant status change has occurred in the drive.

  The drive asserts this signal in the online state whenever any of its generic status bits change. The following three cases are exceptions to this rule:

  1. A generic status bit changes as a direct consequence of the correct operation of a command.
  2. A generic status bit changes as the result of an error in the reception, validation, or execution of a command.
  3. The "RE" status bit changes due to a transmission error outside of a command. The "RE" bit is described in byte 6 of the drive status message.

  An online drive may assert ATTN regardless of whether a command is in progress or not. The drive will continue to assert this signal until it receives a valid GET STATUS command from the controller. At this point, the drive will negate the ATTN signal.

A spinning drive in the available state always asserts the ATTN signal. The ATTN signal is negated if any condition arises that would prevent the available drive from spinning up under controller command.

- R/W RDY (read/write ready) – This indicates the drive is capable of handling a data transfer to or from the disk surface.

  Upon receipt of the start frame of a command, the drive negates R/W RDY prior to reasserting RCVR RDY. The signal will remain negated until the drive has processed the command and has transmitted the end frame of the response (if required).

  Any head motion negates this signal until the operation is completed and the drive is again ready to perform I/O operations.

  The drive asserts R/W RDY after the successful completion of a seek operation. If the operation is unsuccessful, the drive will keep the R/W RDY signal negated and use ATTN to signal the problem.

- AVAIL (available) – When asserted, this bit indicates the drive has entered the drive available state. The signal is negated when the drive leaves the available state.

Table 2-3 describes the possible drive state codes. The error printout example 8001 indicates the signal R/W RDY is active and the drive is ready to receive. This represents the normal drive online state of a drive in a UDA50 subsystem.

Table 2-3 Real-Time Drive State Code Interpretation

RTDS Hex Code	Description
0000	The drive is either in initialization or in an offline state.
0001	The drive is online. Possibly an error state was recently cleared, or the drive spun down with the RUN/STOP switch out.
0002	This code indicates an invalid drive state. ATTN is asserted and the drive cannot receive controller commands with RCVR RDY negated.
0003	The drive is online and one of two conditions exist: 1. The disks are spinning, and there is an error state. 2. The disks are not spinning, and there is a switch change active.
0040	This code indicates an invalid drive state. RCVR RDY should be asserted if the drive is in the available state.
0041	The drive is available but cannot be spun up. The RUN/STOP switch is not pushed in, or there could be an open module interlock preventing spinup.
0042	This code indicates an invalid drive state. ATTN is asserted and the drive cannot receive controller commands with RCVR RDY negated.
0043	The drive is available and capable of being spun up.
8000	This code indicates an invalid drive state. R/W RDY should not be asserted with RCVR RDY negated.

Table 2-3 Real-Time Drive State Code Interpretation (Cont.)

RTDS Hex Code	Description
8001	This is the normal drive online state.
8002	This code indicates an invalid drive state. ATTN is asserted and RCVR RDY is negated, preventing the drive from receiving controller commands.
8003	The drive is online and one of two conditions exist: 1. One of the switches on the drive operator control panel has been pushed. 2. The drive is reporting a successful retry of a seek with recalibration.
8040	This code indicates an invalid drive state. R/W RDY and AVAIL should never be asserted together. Also, ATTN should be asserted when the drive is available and capable of being spun up.
8041	This code indicates an invalid drive state. R/W RDY and AVAIL should never be asserted together. Also, ATTN should be asserted when the drive is available and capable of being spun up.
8042	This code indicates an invalid drive state. R/W RDY and AVAIl should never be asserted together. Also, ATTN is asserted and the drive cannot receive controller commands with RCVR RDY negated.
8043	This code indicates an invalid drive state. R/W RDY and AVAIL should never be asserted together.
FFFF	The controller is unable to get a valid drive state.

2.4.4 Status Message Bytes

The status line information found in the error message above is the result of the diagnostic performing a GET STATUS command. Fourteen of fifteen possible status bytes are printed in the error message. Figure 2-2 shows the breakdown of the fifteen status bytes. The first byte is not printed because it is a UDA50 response code to the GET STATUS command. Bytes 9 through 15 contain drive-specific status bits. The drive service manual or maintenance guide should be consulted for interpretation.

Table A-1, in the appendix, describes status bytes 1 through 8 as shown in Figure 2-2.

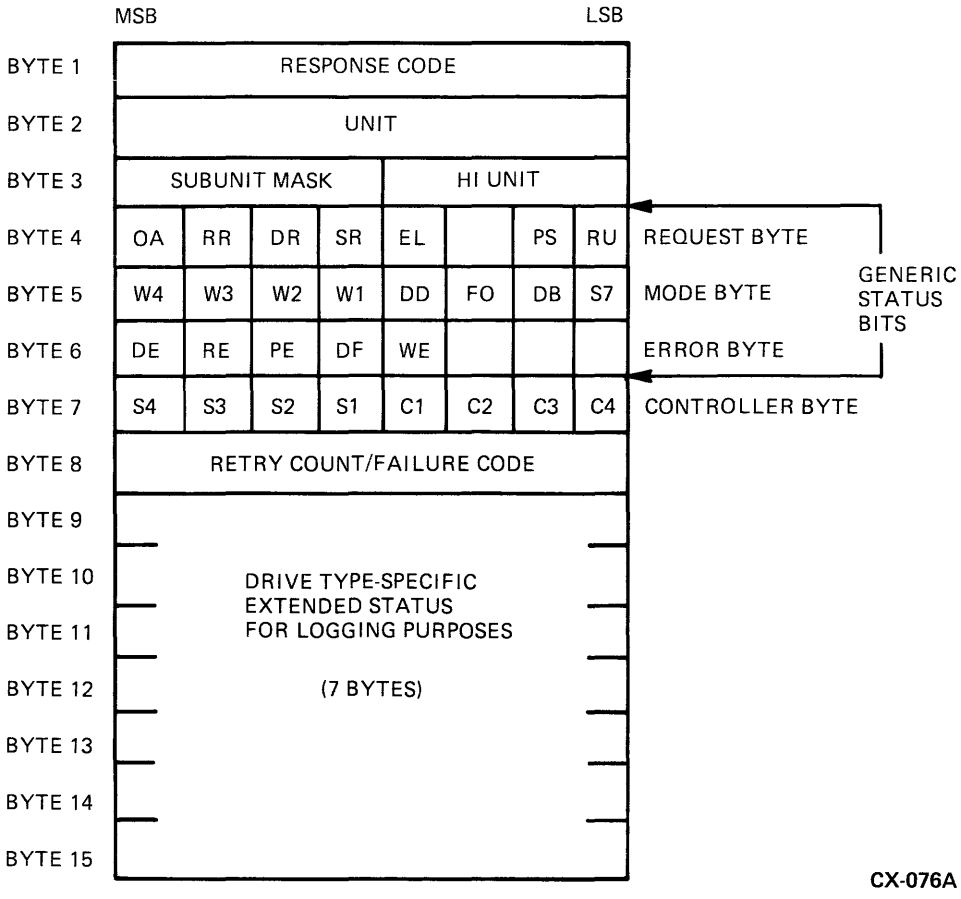


Figure 2-2 Drive Status Bytes

2.4.5 Status Message Interpretation

Figure 2-3 shows the breakdown of the status results from the real-time drive state and status sample error message.

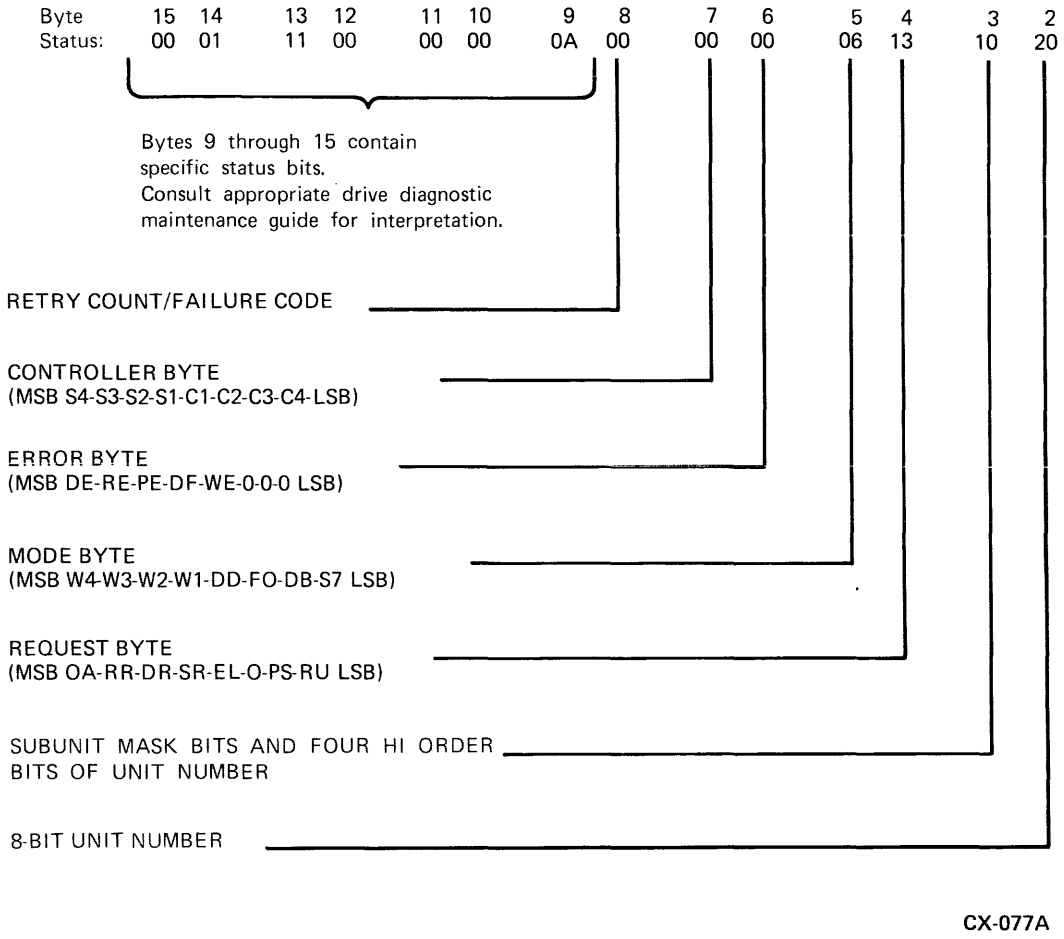


Figure 2-3 Status Message Interpretation

- Byte 1 is the GET STATUS response code and is not printed out.
- Byte 2 and the lower half of byte 3 comprise a three-digit hexadecimal unit number. In the example, the unit number is 020 (hexadecimal) or 32 (decimal).
- Byte 3 (upper half) reflects the subunit mask and indicates the drive sending the status is subunit zero (0001).

- Byte 4 is the request byte and breaks down as follows:

0 0 0 1	0 0 1 1	(13H)
OA RR DR SR	EL 0 PS RU	

  - The RU bit is set indicating the drive RUN switch is depressed.
  - The PS bit is set indicating the port select switch for the UDA requesting the status is depressed. (The drive is available to the UDA50.)
  - The SR bit is set indicating the drive spindle is up to speed.
  - The OA bit is not set indicating the drive is at a drive available state. If it had been set, it would indicate online.
  - The RR bit is not set indicating the selected drive does not need an internal adjustment.
  - The DR bit is not set indicating the selected drive has no request for an external diagnostic to be loaded into it.

- Byte 5 is the mode byte and breaks down as follows:

0 0 0 0	0 1 1 0	(06H)
W4 W3 W2 W1	DD FU DB S7	

  - The DB bit is set indicating it is possible for the host to use a diagnostic cylinder on the drive.
  - The FO bit is set indicating the drive can be formatted.
  - No bits set in the W4 to W1 field indicate no subunit is write protected.
  - The DD bit is not set indicating the drive has not been disabled by a controller due to some error or diagnostic routine.
  - The S7 bit is not set indicating the 512 byte/ sector format is selected for the drive.

- Byte 6 is the error byte, and for this example none of the above errors have occurred. (DE-RE-PE-DF-WE).
- Byte 7 is the controller byte, and for this example a normal drive status is observed (C1-C4 = zeros). The S4 to S1 bits being cleared indicate that the UDA50 is to interrupt the host CPU whenever any drive on the subsystem raises its available line to the UDA50.
- Byte 8 is the retry count/failure code, and for this example no retries by the diagnostic have been attempted.

2.5 SUBSYSTEM ERROR MESSAGES

In addition to the three error messages above, the subsystem diagnostic tests may also print out one of the following:

- Host error message
- UDA initialization error message
- Interrupt handler error message
- Diagnostic machine error message

A sample printout of each of these four types of subsystem error messages is given here for the EVRLA diagnostics. Each error message contains a number and a description of the cause of the error.

1. Sample printout of a host error message:

```
EVRL? - UDA50 DISK SUBSYSTEM DIAGNOSTIC -
PASS [PASS NO.], TEXT 2, SUBTEST 0, ERROR 5 [DATE] [TIME]
SYSTEM FATAL ERROR WHEN TESTING [DEVICE NAME]: CHANNEL
SERVICES INTERRUPT DISABLE FAILURE - ABORTING.
```

2. Sample printout of a UDA initialization error message:

```
EVRL? - UDA50 DISK SUBSYSTEM DIAGNOSTIC - [REV]
PASS [PASS NO.], TEST [TEST NO.], SUBTEST [TEST NO]
ERROR 107 [DATE] [TIME]
DEVICE FATAL ERROR WHEN TESTING [DEVICE NAME]: UDA DID
NOT RETURN CORRECT DATA IN UDASA REGISTER DURING
INITIALIZATION

FOR UDA AT ADDRESS [ADDRESS] (0)
   UDASA EXPECTED: [EXPECTED] (X)
   UDASA RECEIVED: [RECEIVED] [SET BITS]
   XOR:          [XOR VALUE]
REPLACE UDA MODULE [MODULE NUMBER]
```

3. Sample printout of an interrupt handler error message:

```
EVRL? - UDA50 DISK SUBSYSTEM DIAGNOSTIC - [REV]
PASS [PASS NO.], TEST [TEST NO.], SUBTEST [TEST NO.],
ERROR 802 [DATE] [TIME]
SYSTEM FATAL ERROR WHEN TESTING [DEVICE NAME]:
UNEXPECTED INTERRUPT ENCOUNTERED
```

4. Sample printout of a diagnostic machine (DM) error message:

```
EVRL? - UDA50 DISK SUBSYSTEM DIAGNOSTIC - [REV]
PASS [PASS NO.], TEST 2, SUBTEST 0, ERROR 02005 [DATE] [TIME]
HARD ERROR WHEN TESTING [DEVICE NAME]: DM PROGRAM
REPORTING AN ERROR

DISK RESIDENT DM PC: [PC ADDRESS] UDA AT ADDRESS [ADDRESS]
DRIVE [NAME] ERROR DURING RECEIVE OF ECHO RESPONSE FROM DRIVE
ECHO DATA [DATA]
```

Each of the above subsystem error messages gives an error number in the printout. For example, in the DM error message sample printout, an error number of 02005 is given. A description of the error may be found in Table A-2 in the appendix.

2.6 HOST ERROR LOG EXAMINATION

This section assumes you already know how to run the error log program or you have access to an operator who can run error log reports for you. Training courses are available on this topic.

This section focuses on how to interpret error log reports you might encounter for MSCP/SDI devices. Sample error log printouts for both VMS (SYE) and RSTS (ERRDIS) are examined. They report similar information but in different formats. Therefore, decoding charts are provided. Select the error log format that applies to your operating system.

2.7 COMMON ERROR LOG MESSAGE DEFINITIONS

Even though the error log printouts on different operating systems vary in appearance, there is common message information. Read the following definitions before examining the individual sample printouts:

1. Command reference number – A command reference number is given for each error log event message. It is the MSCP command number that caused the error message to be reported. The command reference number is zero if the error message is not related to an outstanding MSCP command. When a seek command is issued, the drive attempts a number of retries. Each retry for that seek command has the same command reference number.
2. Drive number (logical unit address) – A unit message number refers to the logical unit number of the device. The unit number may be zero if the error message does not refer to a specific device or unit.
3. Sequence number – A sequence number is assigned to an MSCP packet when it is passing information to the host error logger. The use of the sequence number is dependent on the MSCP server in the controller microcode. If the sequence number is zero, the controller does not support the use of this feature.
4. Message format – A format code associated with each error log event determines the error message format. It is important to determine the format code first to interpret the remainder of the error message correctly. The format code will reveal whether the error event is reporting a controller error (code 0), a host memory access error (code 1), a disk transfer error (code 2), or an SDI error (code 3). Use Table A-3 in the appendix to decode the format of each error log event.
5. Message Flags – The error log message flags report which of the following three operating conditions apply:
   - Operation successful flag – If set, this flag indicates the operation causing this error log message has been successfully completed. If clear, this flag indicates the operation is not yet successfully completed.
   - Operation continuing flag – If set, this flag indicates the retry sequence for this operation is continuing. If clear, the retry sequence for this operation has terminated. Ignore this flag status if the operation successful flag is set. If the "operation successful" and the "operation continuing" flags are both clear, the error log message is reporting a hard (unrecoverable) error.
   - Sequence number reset flag – If set, this flag indicates the MSCP command sequence number has been reset by the MSCP server since the last error log message sent. Note, this bit is always set if the MSCP server does not implement the error log sequence number feature. If clear, this flag indicates the command sequence number has not been reset, implying it may be used to detect missing error log messages. Refer to A-4 in the appendix to decode these message flags.

6. Status/Event code – The status/event code identifies a specific error or event being reported by this error log message. Refer to A-5 in the appendix for a list of all the UDA MSCP status/event error log codes.

7. Controller identification – The controller identification message provides the controller unique number, controller class, and the controller model. The controller unique number is blasted into ROM. The controller class refers to whether it is a mass storage controller or some other disk or tape device. Refer to A-6 in the appendix for controller class values and A-7 for the controller model values.

8. Drive identification – The drive identification message contains a drive unique number blasted into ROM which is not necessarily the drive serial number etched on the drive S/N tag. It also contains a controller class number shown previously in A-6 and a drive model number given in A-8.

9. Hardware and software revisions – These revision levels are given for both the controller and the drive. The values are blasted into ROM for each device.

10. Pack or HDA serial number – This is the low order 32 bits of the serial number of the HDA mounted on the drive. This serial number is written on the media at the factory. The bit field is zero if the format of the media does not provide for a media serial number. The bit field is an undefined number if the media is not mounted or the serial number cannot be read.

11. Header or logical block number – This message gives the logical block number (LBN) of the physical sector where the error occurred. If the high four bits are 0000 (binary), then the low 28 bits are the logical block number where the error occurred. If the high four bits are 0110 (binary), the low 28 bits are the replacement block number where the error occurred.

12. Error recovery level – The error recovery level reflects the most recent attempt at a data transfer. Each device has a specified number of error recovery levels that corresponds to the mechanisms it has available to attempt an error recovery. For example, if data cannot be read, the drive might try offsetting its head position slightly in case it had been altered since the data was written. For each such attempt, the error recovery level will be incremented. The values zero and 255 (all ones) indicate no special error recovery procedures are used.

13. Error retry count – This message gives the retry count within the current error recovery level of the most recent transfer attempt. This value starts at one and increments for each subsequent attempt at the same error recovery level. It continues until a drive dependent maximum number is reached, then the retry count is set to one and the next error recovery level (if any) is tried.

14. Host memory address – This message gives the host memory address being used at the time the error was detected. For a UDA50 on a RSTS system, the maximum address will occupy 18 bits (0-17). Host memory access errors include UNIBUS parity errors (PA/PB lines) and UNIBUS timeouts (SSyn timeout), etc.

15. MSCP error code – This message is printed out at the bottom of the ERRDIS error log printout only. It tells why the MSCP communications between the host and controller failed. Refer to Table A-9 in the appendix for a list of the MSCP error codes.

16. Status code of packet – The status code of the packet is a summary statement of the condition which prompted the error log entry. The condition statement is obtained from an analysis of the status/event field. This statement is very general and does not give a detailed cause for the error. Refer to table A-10 in the appendix for a list of status codes for the packet.

17. SDI status message – An SDI status message is received when the error log is reporting an SDI error event (message format 03). In a VMS/SYE error log report, this message is given in the form of three 8 character fields. This message contains the contents of bytes 4 through 15 of the drive status message shown in Figure 2-2. Bytes 4 through 8 contain controller specific information and bytes 9 through 15 contain drive specific information. Status byte 15 contains the same drive error code normally obtained through the hand-held terminal. In the RSTS ERRDIS error log, the SDI status information is found in words 22 through 27 of the MSCP packet. This packet is printed out in the form of 37 character groups. Refer to the sample printout of the ERRDIS error log report.

2.8 DECODING VMS ERROR LOG REPORTS

This section shows how to decode the information in a VAX/VMS error log report. Two sample VAX/VMS error log printouts are given with note numbers on the right hand side. These numbered notes after each sample printout show how to interpret the error log messages.

2.8.1 Sample Printout Of VMS Error Report Sequence 1

```
I/O SUB-SYSTEM, UNIT _DUA208:

MSLG_$L_CMD_REF       B23B0000                                    [NOTE 1]
MSLG_$W_UNIT              00D0                                    [NOTE 2]
                                  UNIT 208.

MSLG_$W_SEQ_NUM           0000                                    [NOTE 3]
                                  SEQUENCE 0

MSLG_$B_FORMAT              02                                    [NOTE 4]
                                  DISK TRANSFER ERROR

MSLG_$B_FLAGS               41                                    [NOTE 5]
                                  SEQUENCE NUMBER RESET OPERATION
                                  CONTINUING

MSLG_$W_EVENT             00CB                                    [NOTE 6]
                                  DRIVE ERROR LOST DRIVE RECEIVER READY
                                  DURING TRANSFER

MSLG_$Q_CNT_ID        00000000                                    [NOTE 7]
                      01060000
                                  UNIQUE IDENTIFIER, 000000000000 MASS
                                  STORAGE CONTROLLER UDA50

MSLG_$B_CNT_SVR             04                                    [NOTE 8]
                                  CONTROLLER SOFTWARE VERSION 4.

MSLG_$W_CNT_HVR             00                                    [NOTE 9]
                                  CONTROLLER HARDWARE REVISION 0.

MSLG_$W_MULT_UNT          0003                                    [NOTE 10]
```

```
MSLG_$Q_UNIT_ID      00000482                                          [NOTE 11]
                     02040000
                              UNIQUE IDENTIFIER: 000000000482 DISK
                              CLASS DEVICE RA60

MSLG_$B_UNIT_SVR          01
                              UNIT SOFTWARE VERSION 1.

MSLG_$B_UNIT_HVR          8E
                              UNIT HARDWARE REVISION 142.

MSLG_$B_LEVEL             00                                          [NOTE 12]

MSLG_$B_RETRY             00                                          [NOTE 13]

MSLG_$L_VOL_SER      18232096                                         [NOTE 14]
                              VOLUME SERIAL 404955286

MSLG_$L_HEADER       00003A2C                                         [NOTE 15]
                              LBN 14B92 GOOD LOGICAL SECTOR
```

2.8.2 Notes For VMS Error Report Sequence 1

- Note 1: This is the command number which caused this error to be reported. It will be zero if no host command is associated with this error.
- Note 2: This drive unit number relates to the error log message.
- Note 3: Presently unused. Will be zero.
- Note 4: The (02) indicates the format of this message is that of a disk transfer error. Refer to A-3 in the appendix.
- Note 5: The (41) indicates the sequence number reset flag (01) and the operation continuing flag (40) are set. Refer to A-4 in the appendix.
- Note 6: The (00CB) identifies a specific error or event being reported by this error log message. The error is LOST RECEIVER READY DURING TRANSFER. Refer to A-5 in the appendix.
- Note 7: The controller identification message decodes as shown in Figure 2-4. Use Tables A-6 and A-7 to decode the controller class and controller model.

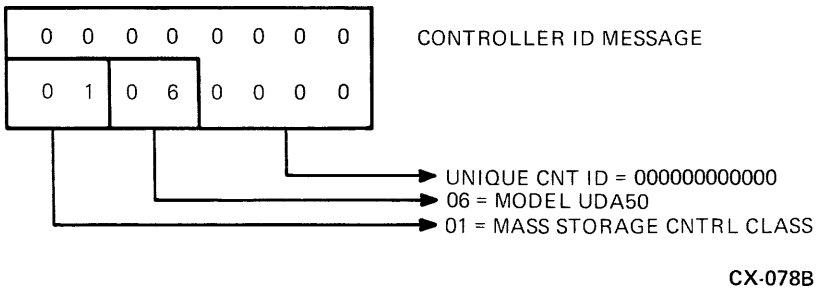


Figure 2-4 Decode of Controller Identification Message

- Note 8: This is the microcode version from the UDA. Listed below are the possible codes:
  - 02 = OLD – UDA needs upgrade.
  - 03 = Y09 microcode.
  - 04 = U21 microcode.
- Note 9: Not used. Will be zero.
- Note 10: For a UDA50 the LSB is the port number (0-3). All other bits are zero.
- Note 11: The unit identification message gives the drive unique device number (serial number for RA80/RA81 but a unique number for RA60), the device class, and the drive model. Figure 2-5 shows how to decode the unit identification message. Refer to Tables A-6 and A-8 for the controller class and drive model.

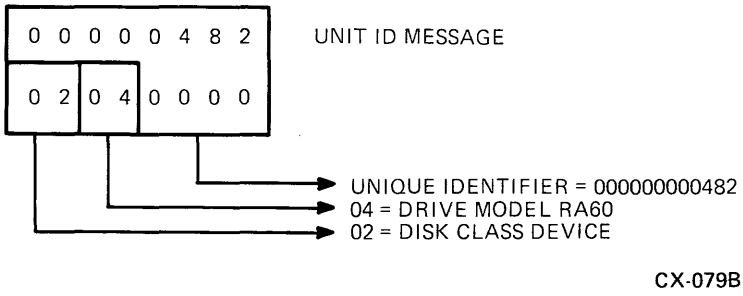


Figure 2-5 Decode of Unit Identification Message

- Note 12: This message indicates the error recovery procedure used. Codes of zero and 255 indicate no special error recovery is used.
- Note 13: This message indicates the number of retries attempted under the error recovery procedure given in note 11.
- Note 14: The volume serial number gives the serial number of the disk media.
- Note 15: The header message gives the physical location where the error occured. If the MSB is a 0, the header is from LBN space. If the MSB is a B, the header is from RBN space.

2.8.3 Sample Printout Of VMS Error Report Sequence 2

```
I/O SUB-SYSTEM, UNIT _DUA208:

MSLG_$L_CMD_REF      B23B0000                                          [NOTE 1]
MSLG_$W_UNIT             00D0
                                 UNIT 208.

MSLG_$W_SEQ_NUM          0000
                                 SEQUENCE 0

MSLG_$B_FORMAT             03                                          [NOTE 2]
                                 SDI ERROR

MSLG_$B_FLAGS              41
                                 SEQUENCE NUMBER RESET OPERATION
                                 CONTINUING

MSLG_$W_EVENT            00EB                                          [NOTE 3]
                                 DRIVE ERROR DRIVE DETECTED ERROR

MSLG_$Q_CNT_ID       00000000
                     01060000
                                 UNIQUE IDENTIFIER, 00000000000 MASS
                                 STORAGE CONTROLLER UDA50

MSLG_$B_CNT_SVR            04
                                 CONTROLLER SOFTWARE VERSION 4.

MSLG_$W_CNT_HVR            00
                                 CONTROLLER HARDWARE REVISION 0.

MSLG_$W_MULT_UNT         0003

MSLG_$QUNIT_ID       00000482
                     02040000
                                 UNIQUE IDENTIFIER, 000000000482 DISK
                                 CLASS DEVICE RA60

MSLG_$B_UNIT_SVR           01
                                 UNIT SOFTWARE VERSION 1.

MSLG_$B_UNIT_HVR           BE
                                 UNIT HARDWARE REVISION 142.

MSLG_$L_VOL_SER      18232096
                                 VOLUME SERIAL 404955286

MSLG_$L_HEADER       00000000
                                 LBN 0 GOOD LOGICAL SECTOR

MSLG_$Z_SDI          0040041B
                     0303ED00                                          [NOTE 4]
                     A104003A
```

2.8.4 Notes for VMS Error Report Sequence 2

- Note 1: The command reference number for error sequence 2 is the same as error sequence 1. This means both error events are related to the same MSCP command.
- Note 2: This error report has a message format code of (03). A-3 in the appendix shows code 03 is an SDI error report message format. The last message on this report (MSLG__$Z__) gives three lines of SDI error code information interpreted in note 4.
- Note 3: The MSLG__$W__EVENT message is reporting a hexadecimal status/event code of (00EB). Refer to A-5 in the appendix. A-5 shows a drive detected error. This information is also given in the verbal description on the right side of the VMS error log printout. It is important to learn how to check these status/event codes because not all error log reports may give this English interpretation on the printout.
- Note 4: The MSLG__$Z__SDI message gives valuable controller-specific and drive-specific troubleshooting information. This information comes in three lines of hexadecimal characters shown in Figure 2-6, the Decoding VAX/VMS Error Report SDI Message.

Figure 2-6 shows the information contained in each byte of the VAX/VMS error report SDI message. Each byte contains two hexadecimal characters that must be decoded further. In this example, there is controller specific information available in bytes 4 through 8. Use the bit map on the right side of Figure 2-6 for interpretation. Then use Table A-1 to decode the meaning of each controller bit mnemonic.

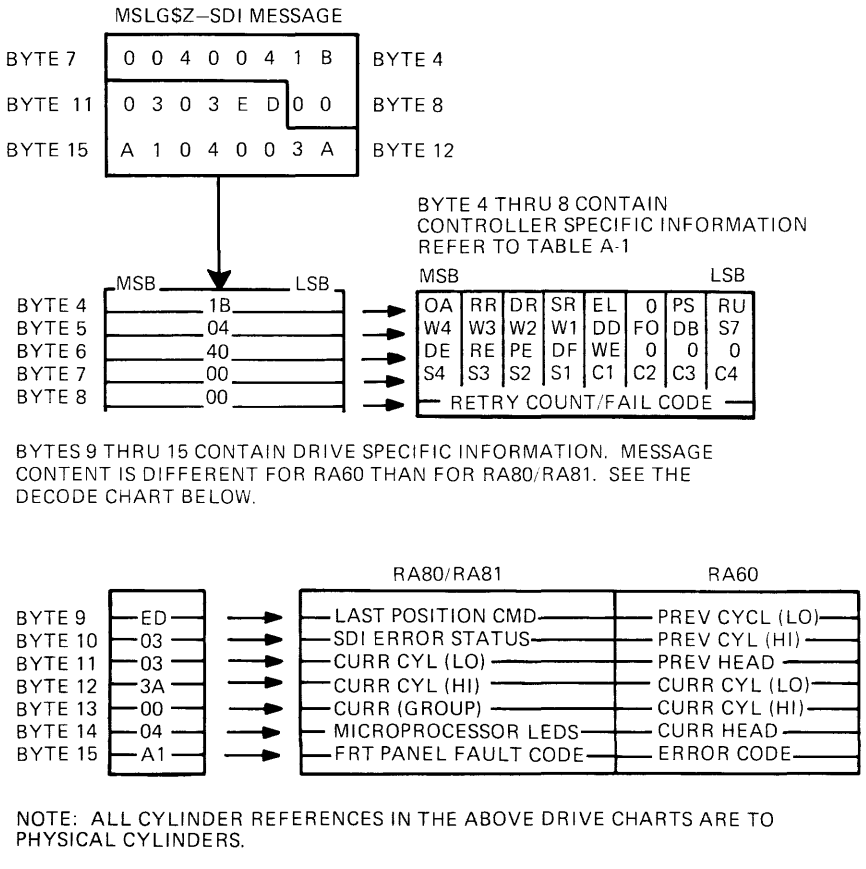


Figure 2-6 Decoding VAX/VMS Error Report SDI Message

Figure 2-6 also shows the drive-specific information contained in bytes 9 through 15. Determine which model drive unit is reporting this error message before you decode the extended status area information found in bytes 9 through 15.

2.9 DECODING RSTS/E ERROR LOGS

The RSTS/E ERRDIS error log report is not as sophisticated as the VMS error log report. Instead of giving separate error log messages with verbal descriptions, the RSTS/E error log prints out the contents of an MSCP packet that must be decoded.

For the following example, it is easier to convert the MSCP messages from their octal format to hexadecimal format.

This section shows how to decode the information in a RSTS/E ERRDIS error log report. A sample RSTS/E error log report is given with note numbers on the right-hand side. Refer to the numbered notes following the sample printout to interpret the error log message.

2.9.1 Sample Printout Of RSTS/E Error Log Report

```
DU MSCP DISKS SEQ 44 OCCURRED ON 17-DEC-83 AT 00:15:42 [NOTE 1]

**************************************************************************
SOFTWARE INFORMATION EXCLUDED
**************************************************************************

MSCP DESCRIPTION:

MSCP ENVELOPE      000070      000020                                [NOTE 2]

MSCP PACKET        004000      140234      000002      000000
                   040403      000053      000000      000000
                   000000      000406      000004      000000
                   000035      000000      000000      001004      [NOTE 5]
                   107001      000000      000400      000004
                   000000      000000      002023      000000
                   013400      000005      001653      000000
                   000000      000000

STATUS CODE OF PACKET       DRIVE ERROR                             [NOTE 3]
MSCP INTNL CTRL STTUS WD    000300 <-UNDEFINED
MSCP INTNL UNIT STTUS WD    100004 <-UNDEFINED
MSCP ERROR CODE             000000                                  [NOTE 4]
BBR FLAG WORD               000000
LBN BEING REPLACED          000000 000000
REPLACEMENT BLOCK NUMBER    000000 000000<--UNDEFINED
RBN BEING REPLACED          000000 000000
```

2.9.2 Notes For RSTS/E Error Log Report

- Note 1: This line of the sample error log printout reads RA80 for all RA80, RA81, and RA60 drive errors.
- Note 2: Note the last two digits of the second MSCP envelope word (000020). If they read 20, as shown here, the following MSCP packet contains error information. If the last two digits read 01, the MSCP message is an end packet and contains limited useful information. Do not use this document when the envelope word indicates this is an end packet.
- Note 3: The status code of the packet message is reporting the specific error or event that causes this error log report. If a coded message is given instead of a verbal description (for example, drive error), refer to Table A-5 in the appendix to interpret the message.
- Note 4: The MSCP error code reports conditions that cause a failure in MSCP communications. Refer to A-9 in the appendix for the list of possible causes.
- Note 5: If the second word of the MSCP envelope ends in 20 (note 2), the 30 octal words in the MSCP packet contain useful error information. Figure 2-7 shows how the MSCP packet message is organized into words. Word 4 should be decoded to determine the error message format before the error information is decoded. The next paragraph shows you how to determine the message format.

	0	1	2	3	
MSCP PACKET	004000	140234	000002	000000	WORDS 0 - 3
	040403	000053	000000	000000	WORDS 4 - 7
	000000	000406	000004	000000	WORDS 8 - 11
	000035	000000	000000	001004	WORDS 12 - 15
	107001	000000	000400	000004	WORDS 16 - 19
	000000	000000	002023	000000	WORDS 20 - 23
	013400	000005	001653	000000	WORDS 24 - 27
	000000	000000	TWO WORDS ALWAYS ZERO		WORDS 28 - 29

CX-081B

Figure 2-7 MSCP Packet Word Organization

2.9.3 Decoding MSCP Packet Message Format

The error information in the MSCP message packet may come in one of four kinds of formats. It is important to determine the format of the message first. The four error message formats are:

- Controller error format (code 0)
- Host memory access error format (code 1)
- Disk transfer error format (code 2)
- SDI error format (code 3)

The error message format codes are found in the low byte of word 4 of the MSCP packet. Figure 2-8 shows how to interpret the format code from word 4 in the sample RSTS/E error log printout given previously. This procedure involves converting the octal coded message into its hexadecimal equivalent. Remember the message only provides useful information if the second word of the MSCP envelope equals 20 (hex).

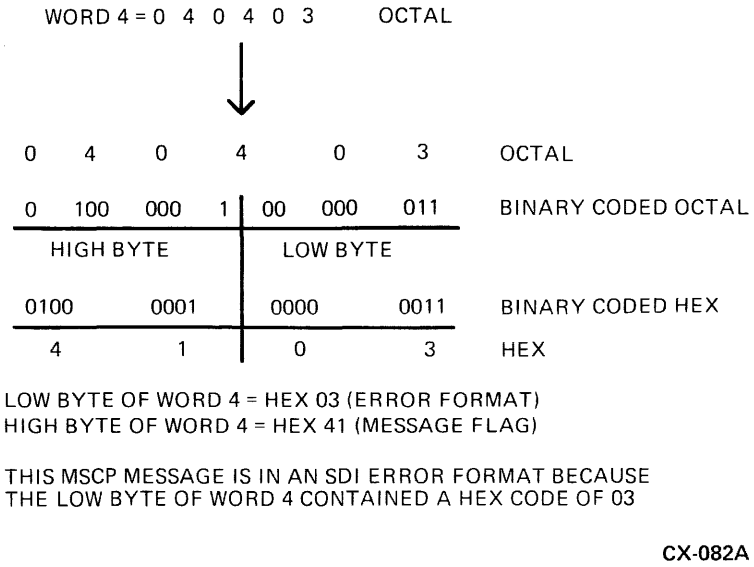


Figure 2-8 Decoding MSCP Message Error Format

2.9.4 Recovering Error Information In MSCP Packet

After the error format of the MSCP packet is determined, one of the following four error format charts is used to interpret the rest of the message. The contents of each word may be decoded and found in the appendix tables. If the tables do not give the octal code, convert the octal word to its hexadecimal equivalent.

2.9.4.1 SDI Error Format Chart – The SDI error format, as determined from the low byte of word 4, is used by the SDI-type disk controllers to report drive detected errors and SDI communication (drive bus) errors. Since the controller may retry a failed command, separate error log entries are recorded for each attempt. Each retry for the same command has the same command reference number (words 0 and 1). If recovery from the error condition is unsuccessful, the controller may declare the drive inoperative and mark it offline. The number of retries are different for each disk drive.

The chart in Figure 2-9 is used to interpret the MSCP packet for the SDI error format. The tables in the appendix show how to decode the packet words.

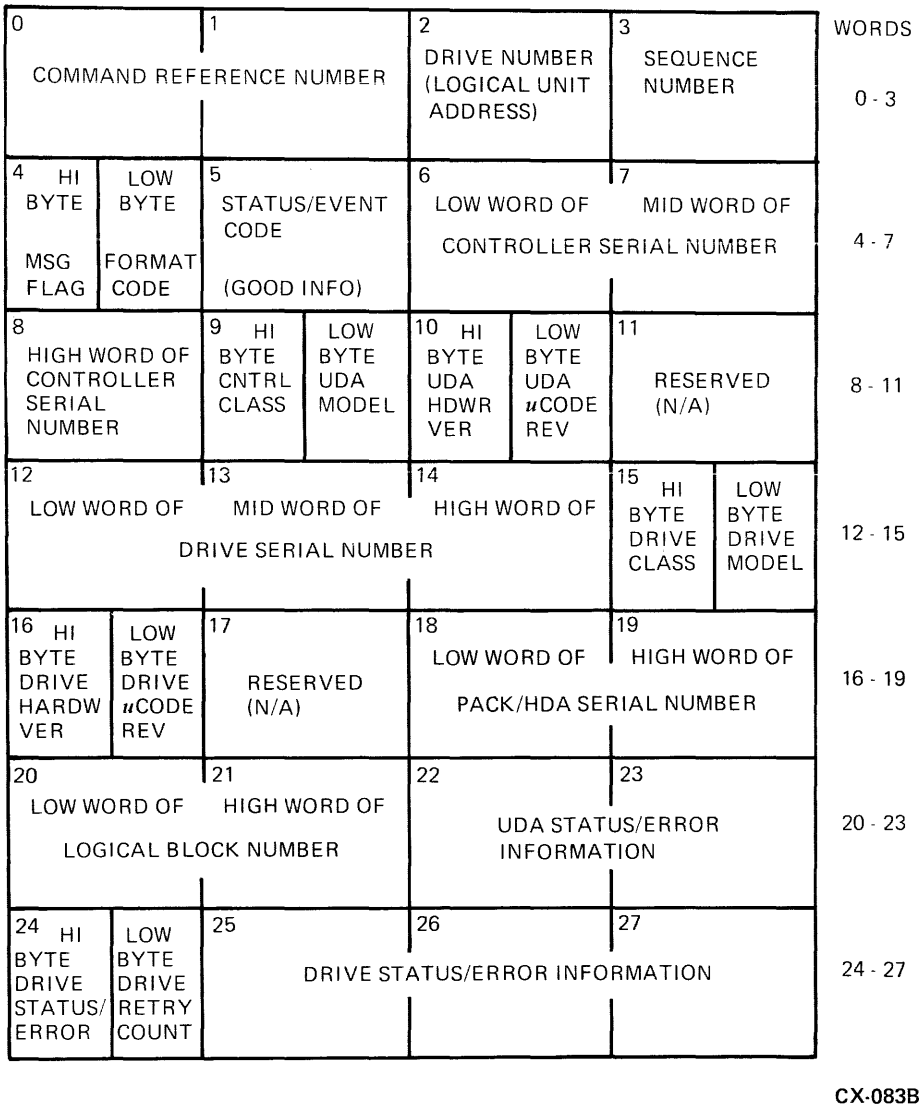


Figure 2-9 MSCP Packet for SDI Error Format

2.9.4.2 Disk Transfer Error Format Chart – The disk transfer error format, as determined from the low byte of word 4, is used by the SDI-type disk controllers to report errors that occur during a disk transfer. This format is generally used to report the results of a series of retries. Each retry is recorded by the error log program with the same command reference number. If the retries are unsuccessful, the controller may declare the drive inoperative and mark it offline. The chart in Figure 2-10 shows how to interpret the MSCP packet for the disk transfer error format. The tables in the appendix show how to decode the packet words.

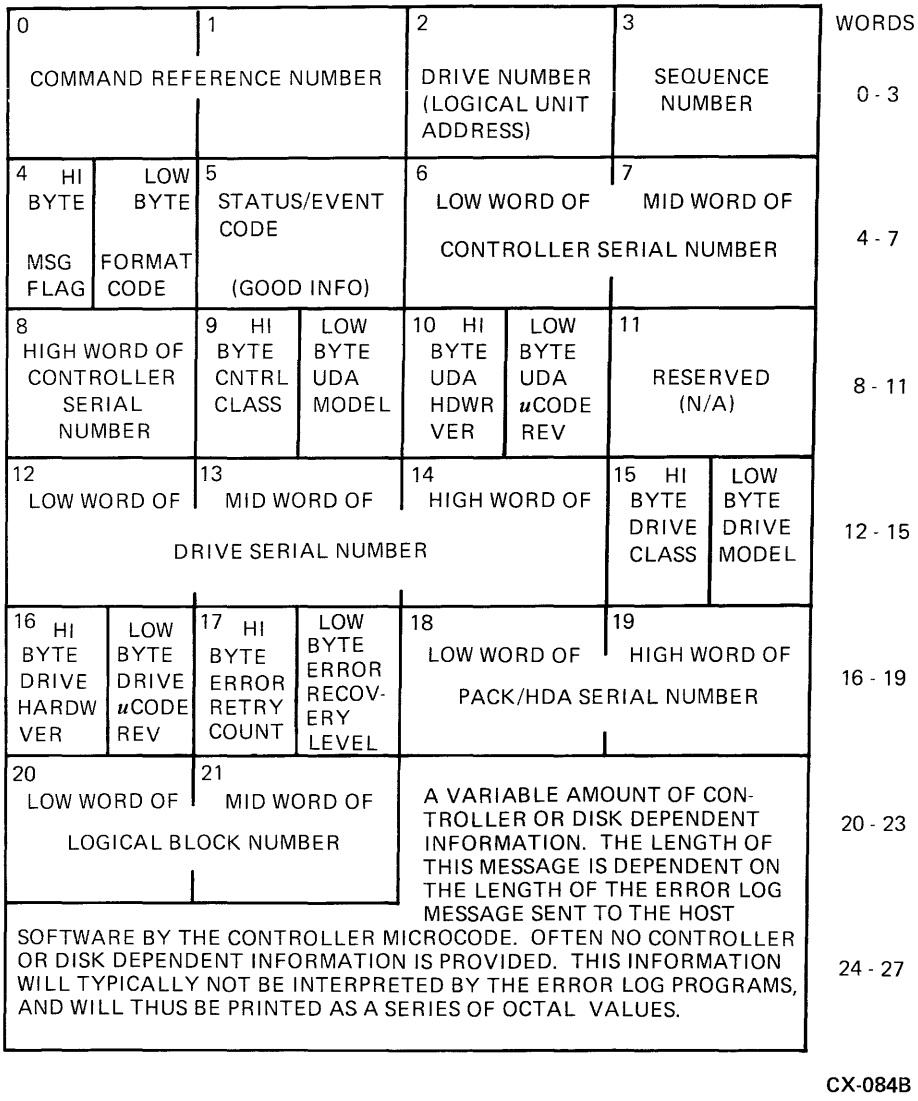


Figure 2-10 MSCP Packet for Disk Transfer Error Format

2.9.4.3 Controller Error Format Chart – The controller error format, as determined from the low byte of word 4, is used by the SDI-type disk controllers to report errors that occur within the controller. The failing operation may be retried. The number of retries is a function of the type of error, the type of drive, and the type of controller. The results of each retry will be logged by the error log program with the same command reference number (words 0 and 1). The chart in Figure 2-11 shows how to interpret the MSCP packet for the controller error format. The tables in the appendix show how to decode the packet words.

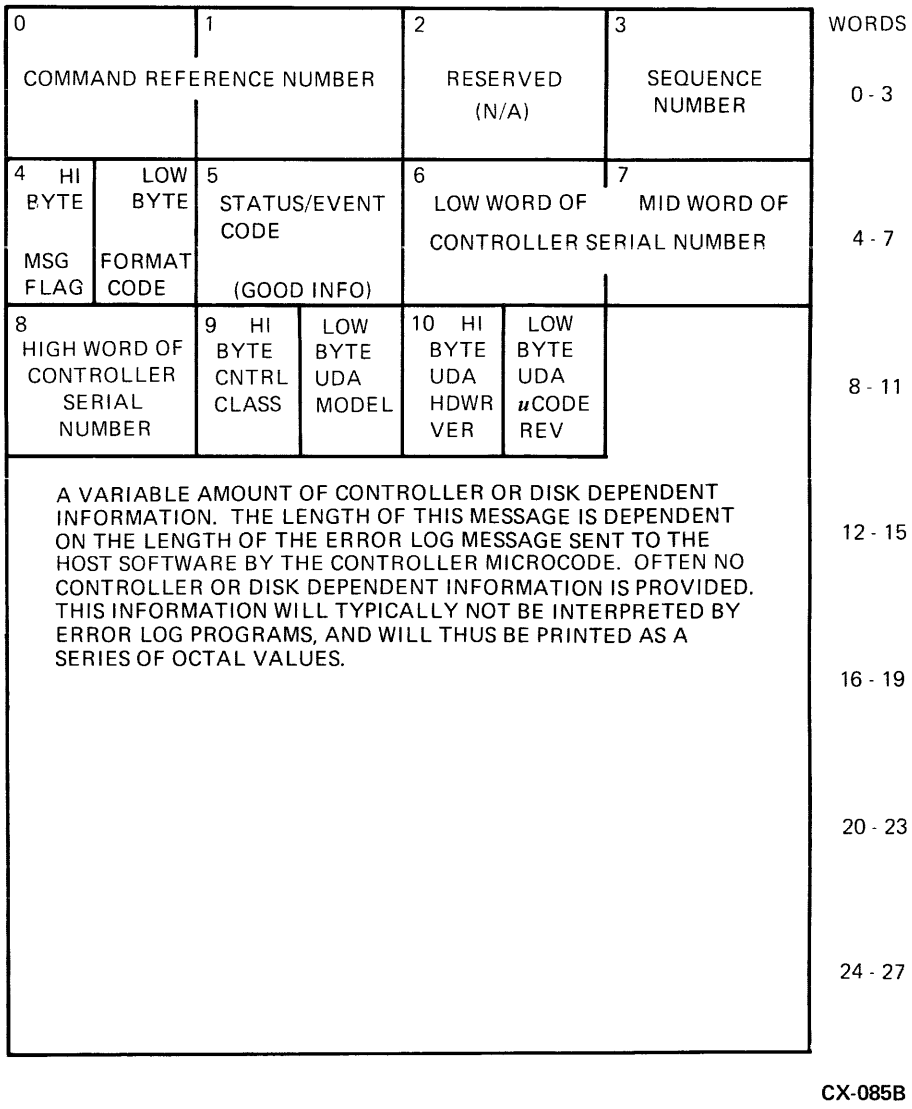


Figure 2-11 MSCP Packet for Controller Error Format

2.9.4.4 Host Memory Access Error Format Chart – The host memory access error format, determined from the low byte of word 4, is used by the SDI-type disk controllers to report errors that occur while attempting to access host memory. The failing operation may be retried. The number of retries is a function of the controller. The results of each retry are logged by the error log program with the same command sequence number (words 0 and 1). Use the chart in Figure 2-12 to interpret the MSCP packet for the host memory access error format. Refer to the tables in the appendix to decode the packet words.

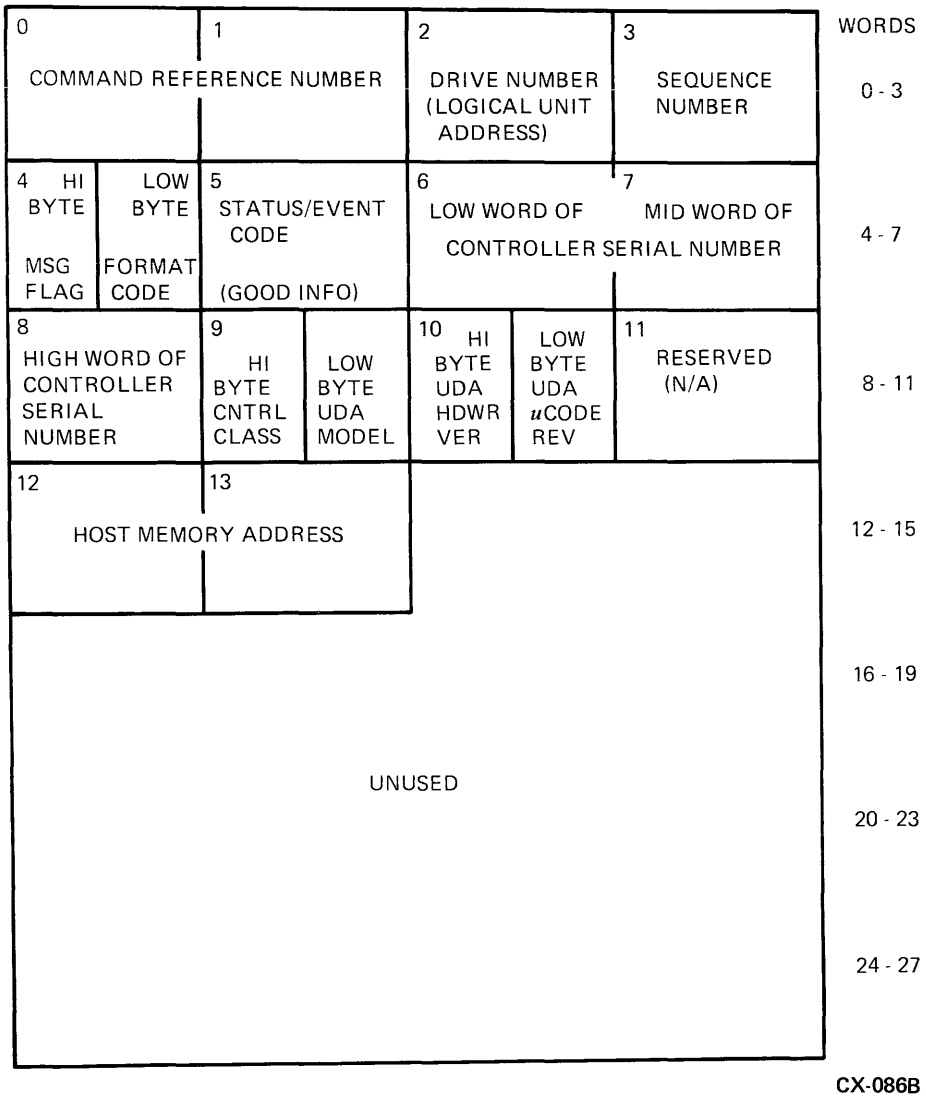


Figure 2-12 MSCP Packet for Host Memory Access Error Format

2.9.5 Status Word Availability

The status words contain important controller status, drive status and error information. These status words are only available when the error log program is reporting an SDI error format message (format code 03). The availability of the status words is determined by checking which error format code the error log event is reporting. In the VMS error log report, this is determined by reading the MLSG__$B__FORMAT line. In a RSTS/E error log report, word 4 of the MSCP packet must first be decoded as shown in Figure 2-9.

2.9.6 Decode Status Words

Decode the error log report as an SDI error format type (format code 03). SDI error format reports contain useful information on the UDA and disk drive in the SDI status message.

For VMS error log reports, the SDI status word information is found on the MSLG__$Z__SDI line. It is reported as three lines of hexadecimal data and shown in decoded form in Figure 2-6.

For RSTS/E error log reports, the SDI status word information is given in words 22 through 27 of the MSCP packet. This information is given in an octal word format and is decoded as shown in Figures 2-7, 2-8, and 2-13.

After the SDI status information is decoded, the table codes found in the appendix determine the failing FRU to replace.

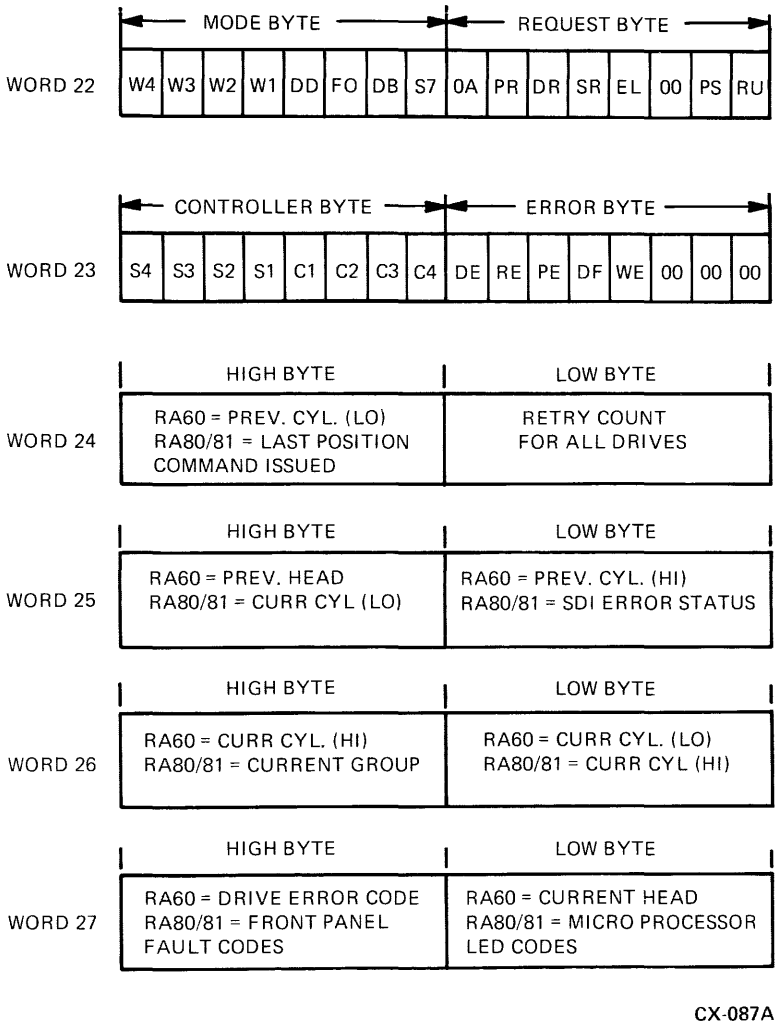


Figure 2-13 UDA and Drive Status/Error Words 22 through 27

2.10 DECODING RSX ERROR LOGS

This section shows how to decode the information in an RSX-11 error log report. Two samples of RSX-11 error log printouts are given with note numbers on the right hand side. These numbered notes show how to interpret the error log messages after each sample printout.

The first example is of an SDI error format and the second is of a disk transfer error format. The controller error MSCP error log packet format and the host memory access MSCP error log packet format are not shown as examples; rather, the differences between them and the examples are pointed out.

2.10.1 Sample Printout Of RSX-11 Error Log Report (SDI Error Format)

```
RSX-11M/M-PLUS ERROR LOGGING SYSTEM V2.00 DD-MMM-YYYY HH:MM:SS

ENTRY 140.4 SEQUENCE 30. DU000:
DEVICE MESSAGE (SPINDLE MOTOR INTERLOCK BRKEN) DD-MMM-YYYY HH:MM:SS        [NOTE 1]

SYSTEM IDENTIFICATION:

    SYSTEM          IDENT     PROCESSOR     MAPPING     CPU      FORMAT

    RSX-11M-PLUS    15B       PDP-11/70     22-BIT      CPA 1.

DEVICE IDENTIFICATION INFORMATION:

    DEVICE      TYPE      VOLUME LABEL  CONTROLLER    UNIT    SUBUNIT
    DU000:      RA81      USERCOMMON    DU A          0       N/A        [NOTE 2]

    PACK SN     DRIVE SN              HARD ERRORS         SOFT ERRORS
    1BEE        CCE100000000          0.                  0.             [NOTE 3]

    I/O COUNT   WORDS TRANSFERRED     CYLINDERS CROSSED
    207399      137983572             0.

I/O OPERATION INFORMATION:

   DEVICE FUNCTION          TYPE OF ERROR

   SET UNIT CHARACTERISTIC  SPINDLE MOTOR INTERLOCK BRKEN  [NOTE 4]

DEVICE ERROR POSITION INFORMATION:

    CYLINDER   GROUP     HEAD     SECTOR     BLOCK

       N/A       N/A       N/A       N/A        0

    RSX-11M/M-PLUS ERROR LOGGING SYSTEM V2.00 DD-MMM-YYYY HH:MM:SS

  ENTRY  140.4  (CONTINUED)
```

```
DEVICE SUPPLIED INFORMATION:

VALUE                                                                  INTERPRE-
                                                                       TATION

00004000070   MESSAGE ENVELOPE FIELD
              [31:24] CONNECTION I.D. = MSCP DISK
              [23:20] MESSAGE TYPE = DATAGRAM MESSAGE                  [NOTE 5]
              [19:16] CREDITS = 0.
              [15: 0] MESSAGE LENGTH = 28. WORDS

00000000000   COMMAND REFERENCE NUMBER FIELD                           [NOTE 6]
              [31: 0] ERROR DOES NOT RELATE TO A COMMAND

000000        UNIT NUMBER FIELD
              [15: 0] UNIT NUMBER = 0.

000000        MESSAGE SEQUENCE NUMBER
              [15: 0] ERROR PACKET IS COMPLETE

003           MESSAGE FORMAT FIELD                                     [NOTE 7]
              *[ 7: 0] SDI ERROR

101           FLAGS FIELD                                              [NOTE 8]
              [ 6  ] OPERATION CONTINUING
              [ 0  ] SEQUENCE NUMBER RESET

000353        EVENT CODE FIELD                                         [NOTE 9]
              *[15: 5] SUBCODE = DRIVE DETECTED ERROR
              *[ 4: 0] MAJOR STATUS = DRIVE ERROR

441DA52D18    CONTROLLER I.D. (S/N) = 441DA52D1800 (X)

006           CONTROLLER MODEL FIELD
              [ 7: 0] MODEL = UDA50

001           CONTROLLER CLASS FIELD
              [ 7: 0] CLASS = MASS STORAGE CONTROLLERS

004           CONTROLLER SOFTWARE VERSION NUMBER FIELD                 [NOTE 10]
              [ 7: 0] UDA50 FIRMWARE VERSION = 4.

000           CONTROLLER HARDWARE VERSION NUMBER FIELD
              [ 7: 0] UDA50 HARDWARE VERSION = 0.

000000        MULTIUNIT CODE FIELD
              [ 7: 0] ACCESS PATH = 0.
              [15:12] SHARED SPINDLE = 0.

CCE1000000    UNIT I.D. (S/N) = CCE100000000 (X)                       [NOTE 11]

005           UNIT MODEL FIELD                                         [NOTE 12]
              [ 7: 0] MODEL = RA81
```

```
RSX-11M/M-PLUS ERROR LOGGING SYSTEM V2.00 DD-MMM-YYYY HH:MM:SS

   ENTRY  104.4  (CONTINUED)

002            UNIT CLASS FIELD                                        [NOTE 13]
               [ 7: 0] CLASS = DISK CLASS DEVICE

007            UNIT SOFTWARE VERSION NUMBER FIELD                      [NOTE 14]
               [ 7: 0] FIRMWARE VERSION = 7.

004            UNIT HARDWARE VERSION NUMBER FIELD                      [NOTE 15]
               [ 7: 0] HARDWARE VERSION = 4.

000000         GROUP FIELD                                             [NOTE 16]
               [15: 0] GROUP = 0.

00000015756    VOLUME SERIAL NUMBER FIELD                              [NOTE 17]
               [31: 0] VOLUME SERIAL NUMBER = 7150.

00000000000    HEADER VALUE FIELD                                      [NOTE 18]
               [27: 0] LBN = 0.
```

NOTE: The following bytes are entered into the error log entry from information provided from the drive. This information is obtained from the drive via a host GET STATUS command.

```
002013         SDI SUPPLIED STATUS FIELD                               [NOTE 19]
               [10  ] FORMAT OPERATION ENABLED
               [ 8  ] 512 SECTOR FORMAT
               *[ 4  ] SPINDLE NOT READY
               [ 3  ] EL BIT SET
               [ 1  ] PORT SWITCH IN
               [ 0  ] RUN SWITCH ON

000300         SDI SUPPLIED STATUS FIELD                               [NOTE 20]
               [11: 8] CONTROLLER C FLAGS = NORMAL OPERATION
               *[ 7  ] DRIVE ERROR (DRIVE FAULT)
               *[ 6  ] TRANSMISSION ERROR

000            RA80/81 STATUS BYTE 8                                   [NOTE 21]
               [ 7: 0] SEEK & RECAL RETRY COUNT = 0.

012            RA80/81 STATUS BYTE 9  [BAD, SEE NOTE A BELOW]
               [ 7: 0] RETRIED OP-CODE = SET UNIT CHARACTERISTICS

000            RA80/81 STATUS BYTE 10                                  [NOTE 22]
107            RA80/81 STATUS BYTE 11
               [ 7: 0] CYL ADDR LOW BYTE, PRINTED IN NEXT FIELD

000            RA80/81 STATUS BYTE 12
               [ 7: 0] CYLINDER ADDRESS = 71.

001            RA80/81 STATUS BYTE 13
               [ 7: 0] CURRENT GROUP = 1.
```

```
043          RA80/81 STATUS BYTE 14                                    [NOTE 23]
             [ 7: 0] LED ERROR CODE = SPINDLE MOT. INTERLOCK BRKN

034          RA80/81 STATUS BYTE 15                                    [NOTE 24]
             [ 7: 0] CONTROL PANEL FAULT CODE = SDI ERROR
```

NOTE A:

RSX interprets this field (RA80/81 Status Byte 9) incorrectly. The field should display the last SDI command issued to the drive. Instead, RSX is decoding it as an MSCP Command. It should have been decoded SEEK (SDI opcode 012). The proper decoding for byte 9 is shown in Table 2-4.

Table 2-4 RA80/81 Status Byte 9 Decode

Octal	Hex	Command	Octal	Hex	Command
003	03	Diagnose	207	87	Get Common
005	05	Drive Clear			Characteristics
006	06	Error Recovery	210	88	Get Subunit
012	0A	Initiate Seek			Characteristics
014	0C	Run	213	8B	On-Line
017	0F	Write Memory	215	8D	Read Memory
201	81	Change Mode	216	8E	Recalibrate
202	82	Mod Ctl Flags	220	90	Topology
204	84	Disconnect	777	FF	Select Group

2.10.2 Notes For RSX-11 Error Log Report (SDI Error Format)

- Note 1: The DEVICE MESSAGE is a unique RSX feature that gives a good description of the failure.
- Note 2: The DEVICE and TYPE fields supply Logical drive address and drive type information.
- Note 3: The PACK S/N and DRIVE S/N fields give the Pack/HDA serial number and drive serial number.
- Note 4: DEVICE FUNCTION describes what operation was being performed when the error occurred. The TYPE OF ERROR field is the same information previously decoded in the DEVICE MESSAGE (see note 1).
- Note 5: There are two message types:
  - Datagram message – These usually contain serious failure information.
  - Sequential message – These usually contain status information.
- Note 6: A COMMAND REFERENCE NUMBER is given to each command the host issues the UDA. It is possible to have the same number in multiple error log entries if the command caused more than one error or if the UDA did retries.
- Note 7: The MESSAGE FORMAT defines the type of MSCP error log entry this entry decribes. It also specifies how the host is to interpret the various message fields (see Figure 2-8).
- Note 8: See Table A-4 (Error Log Message Flags) in the appendix.
- Note 9: The EVENT CODE gives a good description of a controller detected error. However, if the error is drive detected, the drive specific information in the SDI SUPPLIED STATUS FIELD will be the best source of information.

- Note 10: The UDA50 firmware version must be 003 or higher.
- Note 11: The Unit I.D. is the drive serial number. Note that RSX prints the serial number in HEX.
- Note 12: The UNIT MODEL FIELD is the drive type, i.e. RA81, RA60, etc.
- Note 13: In general, the UNIT CLASS is either a disk drive or a tape. However, the UDA50 supports only disk drives. Therefore, for the UDA50, the UNIT CLASS has to be a disk class device.
- Note 14: The UNIT SOFTWARE VERSION NUMBER FIELD is the drive microcode version.
- Note 15: The UNIT HARDWARE VERSION NUMBER FIELD is the drive hardware version.
- Note 16: N/A (reserved).
- Note 17: Pack/HDA serial number.
- Note 18: The HEADER VALUE FIELD is the Logical Block Number (LBN) of the sector being accessed when the error occurred.
- Note 19: The SDI SUPPLIED STATUS FIELD represents the state of the drive when the error occurred (word 22 of Drive Status/Error). (See Table A-1 in the appendix along with Figure 2-13.)
- Note 20: More state of the drive information (word 23 of Drive Status/Error).
- Note 21: STATUS BYTE 8 is the retry count for drive initiated retries.
- Note 22: STATUS BYTES 10 through 13 represent the drive detected SDI errors (see Figure 2-13).
- Note 23: This is the best information for drive detected errors. Note that the error is listed as 043 octal. The drive error code charts are published in hexadecimal, so it's easier to convert the octal number to hexadecimal and then look up the error in the relevant drive maintenance guide. In this case, 043 octal = 23 hexadecimal.
- Note 24: This is the error code displayed on the front panel switches.

2.10.3 Sample Printout Of RSX-11 Error Log Report (Disk Transfer Format)

The UDA50 uses the DISK TRANSFER ERROR log format to report transfer (data) errors. The controller may attempt to retry the failing command, so multiple entries with the same Command Reference Number and possibily the same error may occur.

NOTE

This example assumes the previous example (RSX SDI error format) has been reviewed. All the fields in this example are not explained. The previous example contains additional information for fields that you need more information on.

```
RSX-11M/M-PLUS ERROR LOGGING SYSTEM V2.00 DD-MMM-YYYY HH:MM:SS

ENTRY 108.4 SEQUENCE 1.   DU000:
DEVICE MESSAGE (SIX SYMBOL ECC ERROR)   DD-MMM-YYYY HH:MM:SS

SYSTEM IDENTIFICATION:

    SYSTEM          IDENT     PROCESSOR     MAPPING     CPU       FORMAT

    RSX-11M-PLUS    15B       PDP-11/70     22-BIT      CPA 1.
```

DEVICE IDENTIFICATION INFORMATION:

DEVICE	TYPE	VOLUME LABEL	CONTROLLER	UNIT	SUBUNIT
DU000:	RA81	<NULL LABEL>	DU A	0	N/A

PACK SN	DRIVE SN	HARD ERRORS	SOFT ERRORS
N/A	CCE100000000	0.	0.

I/O COUNT	WORDS TRANSFERRED	CYLINDERS CROSSED
286185	146524672	0.

I/O OPERATION INFORMATION:

DEVICE FUNCTION	TYPE OF ERROR
N/A	SIX SYMBOL ECC ERROR

DEVICE ERROR POSITION INFORMATION: [NOTE 1]

CYLINDER	GROUP	HEAD	SECTOR	BLOCK
N/A	N/A	N/A	N/A	37541

RSX-11M/M-PLUS ERROR LOGGING SYSTEM V2.00 DD-MMM-YYYY HH:MM:SS

ENTRY 108.4 (CONTINUED)

DEVICE SUPPLIED INFORMATION:

VALUE	INTERPRETATION
00004000054	MESSAGE ENVELOPE FIELD [31:24] CONNECTION I.D. = MSCP DISK [23:20] MESSAGE TYPE = DATAGRAM MESSAGE [19:16] CREDITS = 0. [15: 0] MESSAGE LENGTH = 22. WORDS
11135030454	COMMAND REFERENCE NUMBER FIELD [31: 0] COMMAND REFERENCE NUMBER
000000	UNIT NUMBER FIELD [15: 0] UNIT NUMBER = 0.
000000	MESSAGE SEQUENCE NUMBER [15: 0] ERROR PACKET IS COMPLETE

```
003             MESSAGE FORMAT FIELD                                    [NOTE 2]
                *[ 7: 0] DISK TRANSFER ERROR

101             FLAGS FIELD
                [ 7  ] OPERATION SUCCESSFUL
                [ 0  ] SEQUENCE NUMBER RESET (END OF LOGGED PACKET)

000353          EVENT CODE FIELD                                        [NOTE 3]
                *[15: 5] SUBCODE = SIX SYMBOL ECC ERROR
                *[ 4: 0] MAJOR STATUS = DATA ERROR

441DA52D1800    CONTROLLER I.D. (S/N) = 441DA52D1800 (X)

006             CONTROLLER MODEL FIELD
                [ 7: 0] MODEL = UDA50

001             CONTROLLER CLASS FIELD
                [ 7: 0] CLASS = MASS STORAGE CONTROLLERS

004             CONTROLLER SOFTWARE VERSION NUMBER FIELD                [NOTE 4]
                [ 7: 0] UDA50 FIRMWARE VERSION = 4.

000             CONTROLLER HARDWARE VERSION NUMBER FIELD
                [ 7: 0] UDA50 HARDWARE VERSION = 0.

000000          MULTIUNIT CODE FIELD

                [ 7: 0] ACCESS PATH = 0.
                [15:12] SHARED SPINDLE = 0.

CCE100000000    UNIT I.D. (S/N) = CCE100000000 (X)

005             UNIT MODEL FIELD

                [ 7: 0] MODEL = RA81

002             UNIT CLASS FIELD
                [ 7: 0] CLASS = DISK CLASS DEVICE

007             UNIT SOFTWARE VERSION NUMBER FIELD
                [ 7: 0] FIRMWARE VERSION = 7.

004             UNIT HARDWARE VERSION NUMBER FIELD
                [ 7: 0] HARDWARE VERSION = 4.

000000          RETRY LEVEL & COUNT FIELD
                [14: 8] RUNNING RETRY COUNT = 0.
                [ 7: 0] ERROR RECOVERY LEVEL = 0.
```

```
00000015756   VOLUME SERIAL NUMBER FIELD                              [NOTE 5]
              [31:0] VOLUME SERIAL NUMBER = 7150.

00000111245   HEADER VALUE FIELD                                      [NOTE 6]
              [27:0] LBN = 111245 (0)
```

2.10.4 Notes For RSX-11 Error Log Report (DISK TRANSFER Error Format)

- Note 1: For Transfer errors the block number (decimal) is given here. Note that it converts to the HEADER VALUE FIELD.
- Note 2: The MESSAGE FORMAT FIELD in this case, is a Disk Transfer Error Log Format.
- Note 3: The EVENT CODE always gives the UDA50 interpretation of the error.
- Note 4: The CONTROLLER SOFTWARE VERSION NUMBER must be 3 or higher.
- Note 5: Pack/HDA serial number. This is good to make note of on data transfer errors.
- Note 6: This is the LBN address of the error sector. This converts to 37541 Decimal which is the same number RSX indicated for the block number. (See Note 1 above.)

2.10.5 Remaining Error Log Packet Formats

The two remaining packet formats are the CONTROLLER ERROR MSCP PACKET FORMAT and the HOST MEMORY ACCESS ERROR PACKET FORMAT. These formats are not shown as examples, but the following section will highlight what is unique about them.

2.10.5.1 Controller Error Packet Format – The UDA50 uses the controller error packet format to report controller errors to the host. This error log entry will look similar to the previous two examples, except it will be shorter than either.

The first field to examine closely is the EVENT CODE FIELD because it is the first item that should indicate the problem. The list of various codes for this field can be found in the appendix Table A-5.

If the event code is 12 (controller error), the field following the controller hardware version number should be examined. This field is then called the UDA50 INTERNAL ERROR CODE FIELD and can be decoded by looking at the appendix Table A-11.

2.10.5.2 Host Memory Access Packet Format – The UDA50 uses the Host Memory Access Error Log Packet Format to report host memory access problems. Although this entry will look very similar to the other examples, there are a couple of key items to look at closely:

- The EVENT CODE FIELD should give a good indication of the kind of problem the UDA is experiencing. The event code should be looked up in appendix Table A-5.
- The last item displayed should be a field showing the Host Memory Address. This address is valuable since it may indicate what host memory address (or if there are several of these entries, what sequence of addresses) the UDA is having trouble with.

2.11 INTRODUCTION TO SPEAR

The SPEAR (Standard Package for Error Analysis and Reporting) program should be run if it is available on the operating system. SPEAR goes beyond the typical error log capabilities. It not only accumulates data, but it has the capability of analyzing and predicting which FRU is at fault. SPEAR is a library of functions that sorts, evaluates, and reports on events recorded in the local system event file. SPEAR is currently used on TOPS-10, TOPS-20, and VMS operating systems. Plans are underway to incorporate RAnn drives under its diagnostic analysis.

SPEAR Reference Cards may be ordered from Printing and Circulation Services under part number (EK-SPEAR-RC). This reference card summarizes the SPEAR function codes, system event codes, and provides other useful information.

If SPEAR is not available to you, permission should be obtained from the operating system manager to run the subsystem diagnostics. This requires customers to give up their operating system temporarily.

2.11.1 Faulty FRU Selection

If SPEAR did not pick out the faulty FRU, then consult with the system manager to see if the suspect disk drive can be taken offline to run the drive-resident diagnostics. It is important to consult with the system manager first since the operating system may depend on the disk pack for a system image or back-up file.

With the system manager's approval, place the suspect disk offline and run the drive-resident diagnostics.

2.11.2 Replace The FRU Suggested By SPEAR

Again, consult with the system manager before placing the disk drive offline. If the drive is already offline, there is no danger of bringing down the customer's operating system. Use the appropriate drive service manual to see how to replace the FRU.

2.12 SUMMARY

UDA50 problems generally appear in diagnostic printouts as SA register error codes. Drive problems appear in the error report without SA register error codes. Instead, the error report will print the real-time drive state code and the general status. When this happens, the drive maintenance guide or service manual should be consulted. These manuals give instructions on how to run the drive-specific diagnostics to identify the drive failure.

APPENDIX A
TABLES

Listed below are Tables A-1 through A-11:

Table A-1 Bit Description of Status Message Bytes

Status Byte	Bit Description
Byte 1	Response Code Field – Byte 1 is the response code to a controller command.
Byte 2	Unit Number – The unit number consists of two hexadecimal digits representing the unit number of the selected disk drive returning the status (0-254).
Byte 3	Subunit Mask – The subunit mask is a four-bit representation of the subunit that is returning the status message. The right-most bit position represents subunit 0. The left-most bit position represents subunit 3. Only one bit can be set at a time. UDA50 subsystems can handle only drives that contain no subunits. Therefore, the only valid number in this status Bite is a hexadecimal 1. Figure 2-4 shows the bit layout. For drives that contain no subunits (e.g. the RA80), the right-most bit position is always set to a 1 indicating subunit 0.
Byte 3	High Unit Number – Byte 3 contains the upper four bits to a 12-bit (3 hexadecimal digits) unit number.
Byte 4	OA – A binary one in this position indicates the drive is unavailable to the UDA50. A binary zero indicates the drive is available to the UDA50.
Byte 4	RR – A binary one in this position indicates the drive requires an internal readjustment. Some drives do not use this bit.
Byte 4	DR – A binary one in this position indicates there is a request for a diagnostic to be loaded in the drive microprocessor memory. A binary zero indicates that no diagnostic is being requested of the host system.
Byte 4	SR – A binary one in this position indicates the drive spindle is up to speed. A binary zero indicates the drive spindle is not up to speed.
Byte 4	EL – A binary one in this bit position indicates that there is loggable information in the extended status area (Bytes 9-15). A binary zero indicates that no information is available in the extended status area.
Byte 4	PS – A binary one in this bit position indicates the drive port select switch for this controller is pushed in (selected). A binary zero indicates the switch is out.
Byte 4	RU – A binary one in this position indicates the RUN/STOP switch is pushed in (RUN). A binary zero indicates the switch is out (STOP).

Table A-1 Bit Description of Status Message Bytes (Cont.)

Status Byte	Bit Description
Byte 5	W4-W1 – Binary ones in any of these four bit positions represent the write-protect status for the sub-unit represented. (e.g., a 0001 indicates subunit 0 within the selected drive is write-protected.)
Byte 5	DD – A binary one in this bit position indicates the drive has been disabled by a controller error routine or diagnostic. The FAULT light is on when this bit is set. A binary 0 indicates the drive was enabled by a controller error routine or diagnostic.
Byte 5	FO – A binary one in this position indicates the drive can be formatted.
Byte 5	DB – A binary one in this position indicates the diagnostic cylinders on the drive can be accessed.
Byte 5	S7 – A binary one in this bit position indicates the 576 Byte sector format is selected. A binary zero indicates that the 512 Byte sector format is selected. The UDA50 does not support 576 byte format.
Byte 6	DE – A binary one in this position indicates a drive error has occurred and the drive FAULT lamp may be on.
Byte 6	RE – A binary one in this position indicates an error occurred in the transmission of a command between the drive and the UDA50. The error could be a checksum error or an incorrectly formatted command string.
Byte 6	PE – A binary one in this position indicates improper command codes or parameters were issued to the drive.
Byte 6	DF – A binary one in this postion indicates a failure in the initialization routine of the drive.
Byte 6	WE – A binary one in this position indicates a write lock error has occurred.
Byte 7	S4-S1 – This is a four-bit representation of the sub-units that have their attention available messages suppressed in the UDA50. The right-most bit position represents sub-unit 0. The left-most bit position represents sub-unit 3. If one of the bits is set, it indicates the controller is not to interrupt the host CPU with an attention available message when the specified sub-unit raises its available real-time drive status line to the UDA50. The S4-S1 bits reflect the result of a change controller flags command where attention-available messages are not desired for certain sub-units.
Byte 7	C1-C4 – This is a four-bit drive status code indicating various states of drive operation. At the present time only three codes are valid. A code of 0000 = drive normal operation. A code of 1000 = the drive is offline due to being under control of a diagnostic. A code of 1001 = the drive is offline due to another drive having the same unit identifier (e.g. serial number, drive type, class etc.).

Table A-1 Bit Description of Status Message Bytes (Cont.)

Status Byte	Bit Description
Byte 8	RETRY COUNT/FAILURE CODE – This 8-bit Byte contains one of two types of information depending upon the status of the DF bit (Byte 6). The DF bit monitors the drive initialization process. The DF bit remains a zero if initialization is successful. In this case, Byte 8 contains the retry count from the previous operation, i.e., a seek operation required fourteen retries to be successful. If a get status command is initiated, Byte 8 contains the number 14. The DF bit being set indicates the drive initialization failed, and Byte 8 now contains a specific drive error code. This error code can be looked up in the appropriate drive service manual.

Table A-2 Subsystem Diagnostic Error Code List

Decimal Error Number	Description
EVRLA Host Error Messages	
	EVRLA Initialization Error Messages
1	Failed GETBUF routine
2	Error trying to read DM data file
3	Invalid program name found
4	Invalid DM program version
5	Failed RELBUF routine
6	Failed GETBUF routine
7	Error trying to read DM data file
8	Error trying to read DM data file
9	Failed to read P table
10	Invalid controller encountered
11	Invalid controller encountered
12	Invalid UBA/UBI encountered
13	Selected devices are on multiple UNIBUS adapters
14	Duplicate controller address found
15	Duplicate controller vectors found

Table A-2 Subsystem Diagnostic Error Code List (Cont.)

Decimal Error Number	Description
16	Failed to initialize channel adapter
17	Failed to clear UBA/UBI status
18	Failed to initialize device bus (UBA/UBI)
19	Failed to clear UNIBUS status
20	Not enough memory to test units
21	Failed GETBUF routine
22	Failed SETMAP routine
	EVRLA Test 1 Host Error Messages
1	Failed to initialize device bus (UBA/UBI)
2	Failed to clear UBA/UBI status
3	Failed while checking UBA/UBI status
4	Error trying to address UDAIP
5	Failed while checking UBA/UBI status
6	Error trying to address UDASA
7	Failed to initialize device bus (UBA/UBI)
8	Failed to clear UBA/UBI status
9	Step bit did not set UDASA register during initialization
10	UDA resident diagnostic detected a failure
11	UDASA register failed to change during port loop diagnostic
12	Data comparison error during port loop test diagnostic
13	UDASA register failed to change during port loop diagnostic
14	Data comparison error during port loop test diagnostic
15	Failed to initialize device bus (UBA/UBI)
16	Failed to clear UBA/UBI status
17	Step bit did not set UDASA register during initialization
18	UDA resident diagnostic detected a failure

Table A-2 Subsystem Diagnostic Error Code List (Cont.)

Decimal Error Number	Description
19	Channel services interrupt enable failure
20	Channel services interrupt disable failure
21	UDA failed to interrupt
22	Unexpected interrupt encountered
23	Unknown interrupt encountered
24	Expected/received bus request (BR) levels do not match
25	Expected/received vectors do not match
26	Failed to initialize device bus (UBA/UBI)
27	Failed to clear UBA/UBI status
28	Failed to initialize device bus (UBA/UBI)
29	Failed to clear UBA/UBI status
30	Failed to initialize device bus (UBA/UBI)
31	Failed to clear UBA/UBI status
32	Channel services interrupt enable failure
33	Channel services interrupt disable failure
	EVRLA Test 2 Host Error Messages
1	Failed setmap routine
2	Failed to initialize device bus
3	Failed to clear UBA/UBI status
4	Channel services interrupt enable failure
5	Channel services interrupt disable failure

Table A-2 Subsystem Diagnostic Error Code List (Cont.)

Decimal Error Number	Description
	EVRLA Test 3 Host Error Messages
1	Failed setmap routine
2	Failed to initialize device bus (UBA/UBI)
3	Failed to clear UBA/UBI status
4	Channel services interrupt enable failure
5	Channel services interrupt disable failure
	EVRLA Test 4 Host Error Messages
1	Failed setmap routine
2	Failed to initialize device bus (UBA/UBI)
3	Failed to clear UBA/UBI status
4	Channel services interrupt enable failure
5	Channel services interrupt disable failure
	EVRLA UDA Initialization error messages
100	Not enough free memory to test units selected
101	Step bit did not set in UDASA register during initialization
102	UDA resident diagnostics detected a failure
103	UDA did not return correct data in UDASA register during initialization
104	UDASA register did not go to zero after step 3 write of initialization
105	Step bit did not set in UDASA register during initialization
106	UDA resident diagnostics detected a failure
107	UDA did not return correct data in UDASA register during initialization
108	UDA did not clear ring structure in host memory

Table A-2 Subsystem Diagnostic Error Code List (Cont.)

Decimal Error Number	Description
	EVRLA DUP Protocol Errors
200	Diagnostic machine (DM) program asked for data from unknown drive
300	Response packet from UDA does not contain expected data
401	Microcode reported M7485, M7486 that did not match get status response
402	Microcode reported unknown controller model
403	Response packet from UDA does not contain expected data
500	UDA reported a fatal error while loading DM program
501	UDA failed to interrupt
502	UDA reported a fatal error while waiting for get status response
503	UDA failed to interrupt
601	Unknown request received from DM program
602	DM program asked for data from unknown drive
603	Same as 602
604	Same as 602
605	Same as 602
606	Same as 602
607	Same as 602
608	Same as 602
609	Same as 602
610	No interrupt received from DM program
611	Fatal error while running DM program
612	Failed RELBUF routine
700	Failed GETBUF routine
701	Failed SETMAP routine
750	Failed GETBUF routine

Table A-2 Subsystem Diagnostic Error Code List (Cont.)

Decimal Error Number	Description
	EVRLA Interrupt Handler Error Messages
800	Unknown interrupt encountered
801	Same as 800
802	Unexpected interrupt encountered
CZUDC Host Error Messages	
00001	The program does not like the way you answered the hardware questions, or the UDA50 was given more than 1 vector, or BR level, or burst rate
00002	The program does not like the way you answered the hardware questions, two units select the same drive
00003	The program does not like the way you answered the hardware question, more than eight drives selected on UDA
00004	Not enough room in memory to test the units selected
00005	Checksum error in DM program file
00006	Table inconsistency error, reload program
00007	Error in DM program file, DM program not found
00008	Two UDAs use the same vector
00009	Illegal configuration for test 4
00010	Wrong APT diagnostic is being used with this controller, use CIUDX
00013	Microcode reports controller model that did not match get status response
00020	Memory error trying to read UDA registers, check UNIBUS selection switches on UDA module M7485 or UNIBUS
00021	UDA resident diagnostic failure, replace M7486
00022	Step bit did not set in UDASA register, replace M7485
00023	UDA did not clear ring structure in host memory during initialization, replace M7485
00024	UDASA register did not go to zero after step 3 write of initialization, suspect either M7485 or the UNIBUS
00025	UDA did not return correct UDASA register information, replace M7485
00026	Data compare error port loop test, replace M7485

Table A-2 Subsystem Diagnostic Error Code List (Cont.)

Decimal Error Number	Description
00027	Could not write to UDASA register, replace M7485
00028	UDA did not interrupt the host, replace M7485
00029	UDA interrupted at different BR level, replace M7485
00030	UDA reported error in UDASA register list of UDASA codes
00031	Assume DM program hung
00032	Unknown request number in DM message buffer, suspect UNIBUS UDA or corrupted DM program
00033	Response packet from UDA does not contain expected data
00036	No interrupt received from UDA for 30 seconds
00037	UDA reports error in UDASA register
00038	Memory error trying to read UDASA register, check UNIBUS select switches on M7486, or UNIBUS, or replace M7485
Common EVRLA and CZUDC DM Program Error Messages	
	TEST 1 DM Error Messages
01000	A nonexistent host memory error
01001	Parity error on read from UNIBUS
01002	Memory location did not contain own address
01003	Nonexistent memory error trying to read from UNIBUS buffer
01004	Parity error on read from UNIBUS within buffer
01005	Data compare failed after read then write from UNIBUS
01006	UNIBUS addressing error
	Test 2 DM Error Messages
02000	Host specified unit number can not be found
02001	Cannot receive valid drive state, check drive power
02002	Drive state received with bad parity
02003	Drive not asserting receiver ready
02004	Timeout on send of echo command to drive

Table A-2 Subsystem Diagnostic Error Code List (Cont.)

Decimal Error Number	Description
02005	Echo during receive of echo response from drive
02006	Echo command responded with different data
02007	Error bit set in get status response after drive clear
02008	Timeout on send of online command to drive
02009	Error during receive of online response from drive
02010	Online command was unsuccessful
02011	Online command did not return expected response code
02012	Timeout on send of get unit characteristics command to drive
02013	Error during receive of get unit characteristics command
02014	Get unit characteristics command was unsuccessful
02015	Get unit characteristics command did not return expected response code
02016	Host program gave DM code improper data
02017	Timeout on send of diagnose command to drive
02018	Error during receive of diagnose command response from drive
02019	Diagnose command was unsuccessful
02020	Diagnose command did not return expected response code
02021	Drive diagnostic reports a hard error
02022	Host program downline loaded a diagnostic with zero byte count
02023	Diagnostic requested by drive could not be supplied by host
02024	Timeout on send of memory read command to drive
02025	Error during receive of memory read response from drive
02026	Memory read command was unsuccessful
02027	Memory read command did not return expected response code
02028	Timeout on send of memory write command to drive
02029	Error during receive of memory write command response from drive
02030	Memory write command was unsuccessful

Table A-2 Subsystem Diagnostic Error Code List (Cont.)

Decimal Error Number	Description
02031	Memory write command did not return expected response code
02032	Timeout on send of run command to drive
02033	Error during receive of run command response from drive
02034	Run command was unsuccessful
02035	Run command did not return expected response code
02036	Timeout on send of recalibrate command to drive
02037	Error during receive of recalibrate response from drive
02038	Recalibrate command was unsuccessful
02039	Recalibrate command did not return expected response code
02040	Timeout on send of get status command to drive
02041	Error during receive of get status response from drive
02042	Get status command was unsuccessful
02043	Get status command did not return expected response code
02044	Timeout on send of drive clear command to drive
02045	Error during receive of drive clear command from drive
02046	Drive clear command was unsuccessful
02047	Drive clear command did not return expected response code
05000	Unable to find requested drive for testing
	Test 3 DM Error Messages
03001	Timeout on send of a level 2 command
03002	Timeout of receive on get common characteristics command
03003	First word received was not a start frame
03004	Framing error on level 0 response
03005	Checksum error on level 0 response
03006	Response longer than expected
03007	Code received from subsystem unintelligible

Table A-2 Subsystem Diagnostic Error Code List (Cont.)

Decimal Error Number	Description
03008	Command did not return expected response code
03009	Drive not asserting receiver ready in drive state
03010	Failed to receive valid drive state
03011	Can not receive drive state from drive check power
03012	Drive state received with bad parity
03013	No valid state from drive
03014	Subunit characteristics say there are zero read only groups in diagnostic area
03015	Subunit characteristics say less than 1 read/write groups in diagnostic area
03016	Neither read/write ready nor attention set after recalibration command
03017	Subunit characteristics say less than 1 diagnostic cylinder
03018	Read/write ready dropped before format operation
03019	Format operation reported timeout failure
03020	After recalibration, error bits were set
03022	Read/write ready dropped before write operation
03023	Could not read or write any block on this track, write operation failure
03024	Read/write ready dropped before read operation
03025	Could not read or write any block on track, read operation failure
03026	Could not read or write any block on track, data compare word failure
03027	Seek complete time-out, read/write ready did not set
03028	No block on this track can be read, last block tried
03029	Available was not asserted after disconnect
03030	Invalid command [aaaa] was successful
03031	Command with type length = A was successful
03032	Unit did not report transmission error
03033	Unit accepted an invalid group number from group select level 1
03034	Unable to correctly read overlay

Table A-2 Subsystem Diagnostic Error Code List (Cont.)

Decimal Error Number	Description
03035	Successfully wrote in DBN area while drive was write protected
05000	Unable to find requested drive for testing
	Test 4 DM Error Messages
04001	Attention asserted during seek error or loggable information
04002	Attention asserted unexpectedly, asynchronous drive error or log
04003	Seek did not complete, neither attention nor read/write ready asserted
04004	RCT area corrupted, could not find replacement for RCT LBN
04005	Header not found during write
04006	Select track and write level 1 command not executed
04007	ECC detected error
04008	ECC detected error, but correction failed
04009	ECC corrections exceeded threshold
04010	ECC correction succeeded, but EDC detects error
04011	Error recovery tried all levels without success
04012	Data comparison failed, whether detected by ECC or EDC or not
04013	Drive not on line to UDA and not spinable
04014	Unable to complete seek, tried three times
04015	Seek required [nnn] retries before completing
04016	Errors during drive initialization and setup
04017	No valid states from drive, no drive clocks
04018	Attempt to write on write protected drive error code from UDA
04019	Header not found during read
04020	Select track and read level 1 command not executed
04021	Drive not formatted in 512 byte mode
04023	Unable to continue testing, port switch out, or run/stop switch out, or spindle dropped ready
04024	EDC detected error, but ECC did not

Table A-2 Subsystem Diagnostic Error Code List (Cont.)

Decimal Error Number	Description
04025	Write attempted maximum times
04026	Read attempted maximum times
04028	Both read only and write only bits set-host error
04033	Unable to correctly read overlay
04034	SERDES overrun error during read
04035	Data or state clock timeout during read
04036	Data synchronization timeout during read
04037	Read/write ready dropped during read
04038	Receiver ready dropped during read
04040	All copies of RCT read with errors, LBN with header not found
04041	Could not find replacement for LBN that was revectored
04042	Time-out waiting for sector or index pulse
04044	Seek or head select error detected during write
04045	Seek or head select error detected during read
04047	Data or state clock timeout during write
04048	Read/write ready dropped during write
04049	Receiver ready dropped during write
04050	Operator error-beginning block number greater than ending number
04051	Operator error, the begin/end sets overlap
04052	Operator error, begin/end block number exceeds maximum
04053	Operator error, duplicate bad blocks
04054	Operator error, bad block number exceeds maximum
04055	Operator error, start cylinder greater than ending cylinder
04056	Operator error, random and sequential seek cannot be mixed
04057	Operator error, overflow calculating the LBN/DBN from cylinder
04058	Operator error, track exceeds maximum for device, or group exceeds maximum for device.

Table A-2 Subsystem Diagnostic Error Code List (Cont.)

Decimal Error Number	Description
04059	Operator error, two identical tracks or groups
04062	Operator error, cylinder too large DBN/LBN exceeds maximum
04063	Real-time state received error during write
04064	Real-time state received error during read
04068	Unknown error code during write
04069	Unknown error code during read
04070	Timeout of send
04071	Timeout of receive
04072	First word received was not a start frame
04073	Framing error on level 0 receive
04074	Checksum error on level 0 receive
04075	Buffer size smaller than receive
04076	Response level 2 command not as expected
04077	Drive never deasserted receiver ready after send
04078	Unknown error code returned from level 2 receive
05000	Unable to find requested drive for testing

Table A-3 Error Log Event Format Codes

Format code (Dec.)	Format Code (Octal)	Format Code (Hex)	Format Description
0	0	0	Controller errors
1	1	1	Host memory access errors
2	2	2	Disk transfer errors
3	3	3	SDI errors

Table A-4 Error Log Message Flags

Bit set in high byte of word 4	Octal	Hex	Error Message Flag Description
7	200	80	Operation successful flag
6	100	40	Operation continuing flag
0	1	1	Sequence number reset flag

Table A-5 Error Log Status Event Codes

Hex Code	Octal Code	Description
The first list in this table is a group of codes that determine the major status or event being reported such as a media format error or a drive error, etc. Within these major categories are more specialized subcodes that break down the major category further. For example, if a hex code of (B) is a drive error, a hex code of (AB) reveals there is also a drive clock dropout. A separate list is given for each of the subcode values.		
0	0	Success
1	1	Invalid command
2	2	Command aborted
3	3	Unit offline
4	4	Unit available
5	5	Media format error
6	6	Write protected
7	7	Compare error
8	10	Data error
9	11	Host buffer access error
A	12	Controller error
B	13	Drive error
1F	37	Status/event code mask
Success Subcode (Hex 0)		
20	40	Spindown ignored
40	100	Still connected
80	200	Duplicate unit number
100	400	Already online
200	1000	Still online
Invalid Command Subcode (Hex 1)		
1	1	Invalid message length
Command Aborted Subcode (Hex 2)		NOT USED
Unit Offline Subcode (Hex 3)		
3	3	Unit unknown or online to another controller
23	43	No volume mounted or drive disabled via RUN/STOP switch

Table A-5 Error Log Status Event Codes (Cont.)

Hex Code	Octal Code	Description
43	103	Unit inoperative – For SDI drives, the controller has marked the drive inoperative due to an unrecoverable error in a previous level 2 exchange, or the drive has a duplicate unit identifier.
83	203	Duplicate unit number
103	403	Unit disabled by field service or diagnostic. For SDI drives, the DD bit is set.
Unit Available Subcode (Hex 4)		NOT USED
Media Format Error Subcode (Hex 5)		
A5	245	Format mismatch – Disk is not formatted with 512 byte sectors. The disk's FCT indicates it is formatted with 576 byte sectors, and either the controller or the drive only supports 512 byte sectors.
C5	305	FCT corrupted – Disk is not formatted or the FCT is corrupted.
105	405	RCT corrupted – The RCT search algorithm encounters an invalid RCT enter.
125	445	No replacement block available
Write-Protected Subcode (Hex 6)		
1006	10006	Unit is software write protected.
2006	20006	Unit is hardware write protected.
Compare Error Subcode (Hex 7)		NOT USED
Data Error Subcode (Hex 8)		
8	10	Sector written with "Force Error" modifier.
48	110	Invalid header – The subsystem reads an invalid or inconsistent header for the requested sector. Causes of an invalid header include header mis-sync, header sync time-out, or an inconsistent header.
68	150	Data sync time-out – Data sync is not found.
88	210	Correctable error in ECC field – A transfer encounters a correctable error in which only the ECC field is affected.
E8	350	Uncorrectable ECC error – A transfer encounters an ECC error that exceeds the correction capability of the subsystem's error correction algorithm.
108	410	One symbol ECC error
128	450	Two symbol ECC error
148	510	Three symbol ECC error

Table A-5 Error Log Status Event Codes (Cont.)

Hex Code	Octal Code	Description
168	550	Four symbol ECC error
188	610	Five symbol ECC error
1A8	650	Six symbol ECC error
1C8	710	Seven symbol ECC error
1E8	750	Eight symbol ECC error – A transfer encounters a correctable ECC error with the specified number of ECC symbols in error. The number of symbols in error corresponds to the severity of the error.
Host Buffer Access Error Subcode (Hex 9)		
9	11	Host buffer access error – The controller is unable to access a host buffer to perform a transfer and has no visibility into the cause of the error.
29	51	Odd transfer address
49	111	Odd byte count
69	151	Nonexistent memory error
89	211	Host memory parity error
Controller Error Subcode (Hex A)		
A	12	Reserved for host command timeout expired
2A	52	SERDES overrun or underrun error – Either the drive is too fast for the controller, or a controller hardware fault has prevented the controller microcode from being able to keep up with the data transfer to or from the drive.
4A	112	EDC error – The sector is read with correct or correctable ECC and an invalid EDC. There is most likely a fault in the ECC logic of this controller or the controller that last wrote the sector.
6A	152	Inconsistent internal control structure – Some high level check detects an inconsistent data structure. For example, a reserved field contains a nonzero value, or the value in a field is outside its valid range. This error usually implies the existence of a microcode bug.
8A	212	Internal EDC error – Some low level check detects an inconsistent data structure. For example, a microcode implemented checksum or vertical parity (hardware parity is horizontal) associated with internal sector data is inconsistent. This error usually implies a fault in the memory addressing logic of one or more of the controller's processing elements. It may also result from a double bit error or other error that exceeds the error detection capability of the controller's hardware memory checking circuitry.
10A	412	Data bus overrun – The controller attempts to perform too many concurrent transfers, causing one or more of them to fail due to a data overrun or underrun.

Table A-5 Error Log Status Event Codes (Cont.)

Hex Code	Octal Code	Description
12A	452	Data memory error – The controller detects an error in an internal memory, such as a parity error or a nonresponding address. This subcode only applies to errors not reported via MSCP. These errors do not affect the controller's ability to properly generate end and error log messages. For most controllers, this subcode is only returned for controller memory errors in data or buffer memory and noncritical control structures. If the controller has several such memories, the specific memory involved is reported as part of the error address in the error log message.
14A	512	PLI reception buffer parity error (N/A for UDA)
16A	552	PLI transmission buffer parity error (N/A for UDA)
Drive Error Subcode (Hex B)		
2B	53	Drive command timeout – For SDI drives, the controller's timeout expires for either a level two exchange or the assertion of read/write ready after an initiate seek.
4B	113	Controller-detected transmission error – For SDI drives, the controller detects an invalid framing code or a checksum error in a level two response from the drive. The UDA50 also returns this subcode for controller detected protocol errors. All other SDI controllers return subcode 9 for protocol errors.
6B	153	Positioner error (mis-seek) – The drive reports a seek operation is successful, but the controller has determined the drive has positioned itself to an incorrect cylinder.
8B	213	Lost read/write ready during or between transfers – For SDI drives, read/write ready is negated when the controller attempts to initiate a transfer or at the completion of a transfer. Read/write ready is previously asserted indicating the completion of the previous seek. This usually results from a drive detected transfer error, in which case an additional error log message may be generated containing the "drive detected error" subcode.
AB	253	Drive clock dropout – For SDI drives, either data clock or state clock is missing when it should be present. This is usually detected by a timeout.
CB	313	Lost receiver ready for transfer – For SDI drives, receiver ready is negated when the controller attempts to initiate a transfer or does not assert at the completion of a transfer. This includes all cases of the controller's time-out expiring for a transfer operation (level one real-time command).
EB	353	Drive-detected error – For SDI drives, the controller receives a get status or unsuccessful response with the EL flag set. The controller may also receive this response with the DR flag set. It does not support automatic diagnosis for that drive type.
10B	413	Controller-detected pulse or data parity error – For SDI drives, the controller detects a pulse error on either the state or data line, or the controller detects a parity error in a state frame.
12B	453	Drive-requested error log (EL bit set)

Table A-5 Error Log Status Event Codes (Cont.)

Hex Code	Octal Code	Description
14B	513	Response length or opcode error – For SDI drives, a level two response from the drive has an invalid opcode, an improper length, or is not a possible response in the context of the exchange.
16B	553	Clock resumption fails after initialization – For SDI drives, the drive clock does not start after a controller attempt to initialize the drive.
18B	613	Clock persists after initialization – For SDI drives, the drive clock continues beyond drive initialization.
1AB	653	Receiver-ready collision – For SDI drives, the controller attempts to assert its receiver ready (to receive a response) and the drive's receiver ready is still asserted (to receive a command).
1CB	713	Response overflow

Table A-6 Controller Class Values

Class Byte (Decimal)	Subsystem Type
0	Reserved
1	Mass storage controllers
2	Disk class device – DEC Standard 166 format
3	Tape class device
4	Disk class device – DEC Standard 144 format

Table A-7 Controller Model Values

Model Byte (Decimal)	Controller Type
0	Reserved
1	HSC50
4	VMS MSCP server
5	TU81
6	UDA50

Table A-8 Drive Model Number Values

Model Byte (Decimal)	Device Model
1	RA80 fixed media disk drive
4	RA60 removable media disk drive
5	RA81 fixed media disk drive

Table A-9 MSCP Error Codes

Octal Code	Definition
1	Error is logged by the bad block replacement module
2	Driver is sending a command at the time of the error
3	Driver can not find a free command packet
4	Driver determined the unit is hung
5	Disk unit size is too big (over pack cluster size 16)
6	Controller is offline
7	Unit is not functional
10	Command timed out
12	Data error during read/write command

Table A-10 Status Code of the MSCP Packet

Packet Code	MSCP Packet Status
Success	The command or retry of a failed command is unsuccessfully completed.
Invalid command	An invalid command or command parameters are received by the controller.
Command aborted	The controller aborts a command in progress.
Unit 0ff-line	The unit identified in the ''unit number'' field is in the off-line state.
Unit available	The unit identified in the ''unit number'' field is in the available state.
Media format error	The pack or HDA mounted in the drive appears to be formatted incorrectly.
Write protected	A command requiring a write operation is attempted on a write-protected unit.
Compare error	A compare host data command finds a difference in the data that is written and the data in host memory like a write check command.
Data error	Invalid or uncorrectable data is obtained from the drive.

Table A-10 Status Code of the MSCP Packet (Cont.)

Packet Code	MSCP Packet Status
Host buffer access buffer	The controller encounters an error, like UNIBUS timeout, when trying to access host memory.
Controller error	The controller encounters an internal controller error.
Drive error	The controller discovers an error within a drive. Such errors are usually mechanical in nature since they are reported as data errors.

Table A-11 UDA50 Internal Error Code

Internal Error Code (HEX)	Description
1	ER.PRD – UNIBUS packet read error. This error can occur when the U.RECV routine fails to get the MSCP packet from host memory.
2	ER.PWR – UNIBUS packet write error. This error is set if the UNIBUS write (UNB-WR) times out while attempting to send a packet to the host.
3	ER.RRP – UDA50 ROM and RAM parity error.
4	ER.RAP – UDA50 RAM parity error. This error can be corrected by changing UDA50 module M7486.
5	ER.ROP – UDA50 ROM parity error. This error can be corrected by changing UDA50 module M7485.
6	ER.RRD – UNIBUS ring read error. Set if the UNIBUS read times out while reading the host command or response ring.
7	ER.RWR – UNIBUS ring write error. Set if the UNIBUS write to update the command or response ring descriptor fails.
8	ER.INT – UNIBUS interrupt master failure. Set if the UDA50 fails to become interrupt master. This is a long timeout.
9	ER.HTO – Host access timeout error. This error occurs if the host timer is not reset and times out. The timer is reset by the U.SEND, U.RECV, or U.BFSV routines.
A	ER.NIM – Host exceeded command limit. Set if a nonimmediate command is loaded in LOG PKT space.
B	ER.MST – Bus master error. Set if the UDA50 fails to become bus master during the start up of a UNIBUS read or a UNIBUS write

Table A-11 UDA50 Internal Error Code (Cont.)

Internal Error Code (HEX)	Description
C	ER.DMX – Diagnostic mode XFC error.
E	ER.VCI – Invalid virtual circuit identifier. The UDA50 is trying to execute an MSCP command in the wrong mode.
F	ER.IWR – Interrupt write error on UNIBUS. Set if the UDA cannot write to the host and set the Response ring not zero.
17	ER.SUN – Too many subunits on the UDA50.

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