EK–DSAEL–MN–002

DSA Error Log Manual

FOR INTERNAL USE ONLY

digital

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Class A Computing Devices:

NOTICE: This equipment generates, uses, and may emit radio frequency energy. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules for operation in a commercial environment. This equipment, when operated in a residential area, may cause interference to radio/TV communications. In such event the user (owner), at his own expense, may be required to take corrective measures.

The postpaid READER'S COMMENTS form requests the user's critical evaluation to assist in preparing future documentation.

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PREFACE

Structure of This Document

MSCP/TMSCP error log messages of various operating systems are explained in Chapters 1 through 13. Chapter 14 explain various fields contained in different MSCP/TMSCP error log messages. Chapters 15 through 28 explain decoding the status of various DSA hardware products.

Intended Audience

The user of this manual should have DSA level II and DSA product training.

CHAPTER 1
MSCP/TMSCP ERROR LOG

1.1 INTRODUCTION

Chapter 1 explains why error log messages are useful and explains how to use this manual to decode error log messages.

1.2 WHY ERROR LOG PACKET REPORTS ARE USEFUL

Each host operating system is responsible for putting the MSCP/TMSCP error log message in its error log file. Upon demand, the error log information is compiled and displayed. Error log messages are useful for the following reasons:

- Error log messages give error/status information gathered at the time the error occurred so it is not necessary to use diagnostics to recreate the error at a later time.
- Error log messages provide error/status information on intermittent errors that may not be duplicated with exercisers or diagnostics.
- Error log messages give error and status information, so it is not necessary to interrupt the customer's operation to run diagnostics or exercisers.

1.3 HOW TO USE SYSTEM ERROR LOG MESSAGES

Use the following steps to obtain and decode the MSCP/TMSCP error log messages.

- Invoke the error log utility using the directions given in each operating system chapter.
- Group the error log messages with the same command reference number together. More than one error log message may be generated for each command issued. See the chapter on the operating system you are working with to find the command reference number location.
- Check the format code in the error log message. The format code tells what type of error you are working with. There are ten different formats.
- Check the message flag in the error log message. The message flag reports the condition of the error.
- Check the status/event code in the error log message. The status/event code identifies a specific error or event reported by the error log message.
- Check the unique information field of the error log message. This field contains additional information to help determine if the problem is:
  - Controller dependent.
  - Disk dependent.
  - Tape dependent.

CHAPTER 2
VMS ERROR LOG MESSAGE

2.1 INTRODUCTION

Chapter 2 covers the VMS error log message. It explains how to invoke an error log utility and how to decode a VMS error log message.

2.2 HOW TO INVOKE VMS ERROR LOG UTILITY

Ask the operator to run the VMS error log utility or ask for permission to use the system. You need to use an account with SYSPRV.

For VMS, type the following DCL commands.

NOTE
Your input is bolded. [RET] is the return key.

$ ANALYZE/ERROR/OUTPUT=<FILENAME.EXT>

To print the full VMS error log message on hard copy:

$ PRINT/QUE=<DEVICE NAME> <FILE NAME.EXT>

2.3 DECODING VMS ERROR LOG MESSAGES

VMS error log messages appear in plain language, use hexadecimal and decimal numbering, and have unique fields depending on the type of VMS error log message. The examples of VMS error log messages shown in this chapter are listed below:

- VMS Disk Transfer error log message (Example 2-1)
- VMS STI Drive error log message (Example 2-2)
- VMS Bad Block Replacement log message (Example 2-3)
- VMS Controller error log message (Example 2-4)
- VMS TK50 Tape Transfer error log message (Example 2-5)

The numbers on the right-hand side of each example refer to the numbered list following each example. The list contains information to help interpret the VMS error log message. The VMS error log messages shown are explained in the following sections.

2.3.1 VMS Disk Transfer Error Log Message

The VMS Disk Transfer error shown in Example 2-1 reports errors detected while transferring data between the controller/drive. In this error log message, the line item MSLG$W_EVENT points to the problem. Also note, this is on an RA81, unit 0, serial number 4452. The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 2-1 VMS Disk Transfer Error Log Message

```
VAX/VMS       SYSTEM ERROR REPORT      COMPILED 26-MAR-1986 09:53
                                                        PAGE 235

*********************** ENTRY 2253 ******************************

ERROR SEQUENCE 427

ERL$LOGMESSAGE ENTRY 22-MAR-1986 10:46:26.54
                     KA785 REV# 1.0 SERIAL# 0.  MFG PLANT 5.

I/O SUB-SYSTEM, UNIT_LFILNG$DUAO:

MSLG$L_CMD_REF   OEAB0008                                      1
MSLG$W_UNIT          0000
                           UNIT #0                             2
MSLG$W_SEQ_NUM       0002                                      3
                           SEQUENCE #2
MSLG$B_FORMAT          02                                      4
                           DISK TRANSFER ERROR
MSLG$B_FLAGS           81                                      5
                           SEQUENCE NUMBER RESET
                           OPERATION SUCCESSFUL
MSLG$W_EVENT         00AB                                      6
                           DRIVE ERROR
                           DRIVE CLOCK DROPOUT
MSLG$Q_CNT_ID    2848FE01                                      7
                 01010000                                      8
                           UNIQUE IDENTIFIER, 00002848FE01
                           MASS STORAGE CONTROLLER
                           HSC50
MSLG$B_CNT_SVR         02                                      9
                           CONTROLLER SOFTWARE VERSION #2
MSLG$B_CNT_HVR         00                                      10
                           CONTROLLER HARDWARE REVISION #0
MSLG$W_MULT_UNT      0032                                      11
MSLG$Q_UNIT_ID   00004452                                      12
                 02050000                                      13
                           UNIQUE IDENTIFIER, 000000004452
                           DISK CLASS DEVICE
                           RA81
MSLG$B_UNIT_SVR        07                                      14
                           UNIT SOFTWARE VERSION #7
MSLG$B_UNIT_HVR        04                                      15
                           UNIT HARDWARE REVISION #4
MSLG$B_LEVEL           00                                      16
MSLG$B_RETRY           00                                      17
MSLG$L_VOL_SER   0000DD21                                      18
                           VOLUME SERIAL #56609
MSLG$L_HEADER    00064940                                      19
                           LBN #411968
                           GOOD LOGICAL SECTOR
MESSAGE TYPE         0001                                      20
                           DISK MSCP MESSAGE
```

(Continued on next page)

Example 2-1 (Cont.) VMS Disk Transfer Error Log Message

```
CONTROLLER DEPENDENT INFORMATION
ORIG ERR            0200                                  21
                            DRIVE CLOCK TIMEOUT
ERR RECOV FLGS      0002
                            ERR LOGGED TO CONSOLE AND HOST
LV1 A RETRY           00
LV1 B RETRY           01
```

1. Command reference number (Section 14.1.1).
2. Unit number (Section 14.1.2).
3. Sequence number (Section 14.1.3).
4. Format code (Section 14.1.4).
5. Message flag (Section 14.1.5).
6. Status/event code (Section 14.1.6).
7. Unique controller number (Section 14.1.7).
8. Controller model (Section 14.1.8) and controller class (Section 14.1.9)
9. Controller software version (Section 14.1.10).
10. Controller hardware version (Section 14.1.11).
11. Multiunit code (Section 14.1.12).
12. Drive serial number (Section 14.1.14).
13. Drive model (Section 14.1.15) and drive class (Section 14.1.16)
14. Drive software version (Section 14.1.17).
15. Drive hardware version (Section 14.1.18).
16. Level (Section 14.1.19).
17. Retry (Section 14.1.20).
18. Volume serial number (Section 14.1.21).
19. Header code (Section 14.1.22).
20. Message type (Section 14.1.23).
21. Controller dependent information (Section 14.1.33).

2.3.2 VMS STI Drive Error Log Message

The STI Drive error log message shown in Example 2-2 reports errors detected while transferring data between the controller and the drive. Notice, the get extended drive status and the drive extended sense information. The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 2-2 VMS STI Drive Error Log Message

```
VAX/VMS       SYSTEM ERROR REPORT       COMPILED 11-NOV-1985 09:57
                                                          PAGE 1

*********************** ENTRY 2282 ****************************

ERROR SEQUENCE 26631

ERL$LOGMESSAGE ENTRY 06-NOV-1985 10:14:45.56
                     KA780 REV# 7.0 SERIAL# 1356  MFG PLANT 0.

I/O SUB-SYSTEM, UNIT_HSC002$MUA0:

MSLG$L_CMD_REF  7218000D                                   1
MSLG$W_UNIT         0000                                   2
                            UNIT #0
MSLG$W_SEQ_NUM      0001                                   3
                            SEQUENCE #1
MSLG$B_FORMAT         07                                   4
                            STI DRIVER ERROR
MSLG$B_FLAGS          41                                   5
                            SEQUENCE NUMBER RESET
                            OPERATION CONTINUING
MSLG$W_EVENT        FF6B                                   6
                            DRIVE ERROR
                            TAPE DRIVE REQUESTED ERROR LOG
MSLG$Q_CNT_ID   0000FD02                                   7
                03010000                                   8
                            UNIQUE IDENTIFIER, 00000000FD02
                            TAPE CLASS DEVICE
                            HSC50
MSLG$B_CNT_SVR        00                                   9
                            CONTROLLER SOFTWARE VERSION #0
MSLG$B_CNT_HVR        00                                   10
                            CONTROLLER HARDWARE REVISION #0
MSLG$W_MULT_UNT     0062                                   11
MSLG$Q_UNIT_ID  00000001                                   12
                00000000                                   13
                            UNIQUE IDENTIFIER, 000000000001
MSLG$B_UNIT_SVR       00                                   14
                            UNIT SOFTWARE VERSION #0
MSLG$B_UNIT_HVR       00                                   15
                            UNIT HARDWARE REVISION #0
MSLG$L_GAP_CNT  00000009                                   16
                            GAP COUNT = 9
MSLG$B_FMTR_SVR       0A                                   17
                            FORMATTER SOFTWARE VERSION #10
MSLG$B_FMTR_HVR       FF                                   18
                            FORMATTER HARDWARE VERSION #255
GET EXTENDED DRIVE STS  (GEDS TEXT FIELD)                  19
```

(Continued on next page)

Example 2-2 (Cont.) VMS STI Drive Error Log Message

```
BYTE 1              19
                          25 IPS TAPE DRIVE
BYTE 2              04
                          6250 BPI GCR ENCODING
BYTE 3              00
BYTE 4              00
                          MSCP UNIT = 0
BYTE 5              02
BYTE 6              00
BYTE 7              00
BYTE 8              00
                          GAP COUNT = 2

TA81 TRANSFER DESCRIPTION INFORMATION                    20

BYTE 1              00
BYTE 2              00
BYTE 3              00
BYTE 4              00

TA81 DRIVE EXTENDED SENSE INFORMATION                    21

BYTE 1              0A
                         UNIT CHECK
                         DATA CHECK
BYTE 2              00
BYTE 3              00
BYTE 4              21
                         TAPE MOVED
                         READ DATA CHECK
BYTE 5              98
                         FRMTR CMD CODE = 98 (X)
BYTE 6              A6
                         VARIABLE GAP MODE (LONG)
                         START/STOP MODE
                         AUTO SPEED MODE
                         GCR MODE
BYTE 7              00
BYTE 8              05
                         EXCESSIVE POINTERS
                         UNCORRECTABLE DATA
BYTE 9              00
BYTE 10             03
                         TRACK IN ERROR PARITY BIT = 1
                         SINGLE TRACK CORRECTABLE
BYTE 11             30
                         TRACK IN ERROR = 3
                         TRACK IN ERROR = 5
BYTE 12             C0
                         ONLINE
                         READY
BYTE 13             5C
                         S/S MODE
                         VARIABLE LONG GAP
                         GCR
                         WRITE
```

(Continued on next page)

Example 2-2 (Cont.) VMS STI Drive Error Log Message

```
BYTE 14                 00
BYTE 15                 00
                             DEV COMMAND CODE
BYTE 16                 00
                             DEV MARGINAL CODE
BYTE 17                 00
                             DEV FLT/TEST COMPLETION CODE
BYTE 18                 00
                             DEV SUB-FLT/TEST COMPLETION CODE
BYTE 19                 00
```

1. Command reference number (Section 14.1.1).
2. Unit number (Section 14.1.2).
3. Sequence number (Section 14.1.3).
4. Format code (Section 14.1.4).
5. Message flag (Section 14.1.5).
6. Status/event code (Section 14.1.6).
7. Unique controller number (Section 14.1.7).
8. Controller model (Section 14.1.8) and controller class (Section 14.1.9).
9. Controller software version, (Section 14.1.10).
10. Controller hardware version (Section 14.1.11).
11. Multiunit code (Section 14.1.12).
12. Drive serial number (Section 14.1.14).
13. Drive model (Section 14.1.15) and drive class (Section 14.1.16).
14. Drive software version (Section 14.1.17).
15. Drive hardware version (Section 14.1.18).
16. Position (gap count) (Section 14.1.24).
17. Formatter software version (Section 14.1.25).
18. Formatter hardware version (Section 14.1.26).
19. Extended drive status (Section 14.1.37).
20. Transfer description code (Section 14.1.37).
21. Drive extended sense information (Section 14.1.37).

2.3.3 VMS Bad Block Replacement Log Message

Bad Block Replacement log message is shown in Example 2-3. The unit number indicates the drive where the replacement took place. The field MSLG$W_RPL_FLGS describes what took place. The field MSLG$W_CAUSE describes why the replacement took place. The field MSLG$B_FLAGS describes the success or failure of the operation. The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 2-3 VMS Bad Block Replacement Log Message

```
VAX/VMS      SYSTEM ERROR REPORT      COMPILED 06-DEC-1985 10:51
                                                         PAGE 25

*********************** ENTRY 6  ******************************

ERROR SEQUENCE 113

ERL$LOGMESSAGE ENTRY  6-DEC-1985 09:47:32.19
                     KA780 REV# 7.0 SERIAL# 2639  MFG PLANT 0

I/O SUB-SYSTEM, UNIT_HSC007$DUA127:

MSLG$L_CMD_REF  8AF0000F                                  1
MSLG$W_UNIT         007F                                  2
                           UNIT #127
MSLG$W_SEQ_NUM      0008                                  3
                           SEQUENCE #8
MSLG$B_FORMAT         09                                  4
                           BAD BLOCK REPLACEMENT
MSLG$B_FLAGS          80                                  5
                           OPERATION SUCCESSFUL
MSLG$W_EVENT        0014                                  6
                           BAD BLOCK REPLACEMENT
                           BAD BLOCK REPLACED
MSLG$Q_CNT_ID   3612F807                                  7
                01010000                                  8
                           UNIQUE IDENTIFIER, 00003612F807
                           MASS STORAGE CONTROLLER
                           HSC50
MSLG$B_CNT_SVR        02                                  9
                           CONTROLLER SOFTWARE VERSION #2
MSLG$B_CNT_HVR        00                                  10
                           CONTROLLER HARDWARE REVISION #0
MSLG$W_MULT_UNT     0051                                  11
MSLG$Q_UNIT_ID  00015E38                                  12
                02050000                                  13
                           UNIQUE IDENTIFIER, 000000015E38
                           DISK CLASS DEVICE
                           RA81
MSLG$B_UNIT_SVR       07                                  14
                           UNIT SOFTWARE VERSION #7
MSLG$B_UNIT_HVR       06                                  15
                           UNIT HARDWARE REVISION #6
MSLG$W_RPL_FLGS     8000                                  16
                           REPLACEMENT ATTEMPTED, BLOCK
                           VERIFIED BAD
MSLG$L_VOL_SER  00011A79                                  17
                           VOLUME SERIAL #72313
MSLG$L_BAD_LBN  0003136B                                  18
                           BAD LOGICAL BLOCK
                           NUMBER = 201579
MSLG$L_OLD_RBN  00000000                                  19
                           FORMER REPLACEMENT BLOCK
                           NUMBER = 0
MSLG$L_NEW_RBN  00000F70                                  20
                           NEW REPLACEMENT BLOCK
                           NUMBER = 3952
```

(Continued on next page)

Example 2-3 (Cont.) VMS Bad Block Replacement Log Message

```
MSLG$W_CAUSE         00E8                                  21
                             DATA ERROR
                             UNCORRECTABLE "ECC" ERROR

CONTROLLER OR DEVICE DEPENDENT INFORMATION                 22
LONGWORD 1       00000000
LONGWORD 2       00000000
LONGWORD 3       00000000
```

1. Command reference number (Section 14.1.1).
2. Unit number (Section 14.1.2).
3. Sequence number (Section 14.1.3).
4. Format code (Section 14.1.4).
5. Message flag (Section 14.1.5).
6. Status/event code (Section 14.1.6).
7. Unique controller number (Section 14.1.7).
8. Controller model (Section 14.1.8) and controller class (Section 14.1.9).
9. Controller software version (Section 14.1.10).
10. Controller hardware version (Section 14.1.11).
11. Multiunit code (Section 14.1.12).
12. Drive serial number (Section 14.1.14).
13. Drive model (Section 14.1.15) and drive class (Section 14.1.16).
14. Drive software version (Section 14.1.17).
15. Drive hardware version (Section 14.1.18).
16. Replace flag (Section 14.1.28).
17. Volume serial number (Section 14.1.21).
18. Bad logical block number (Section 14.1.29).
19. Former replacement block number (Section 14.1.30).
20. New replacement block number (Section 14.1.31).
21. Cause of replacement (Section 14.1.32).
22. This field is not formally defined, is extra buffer space, and is currently used.

2.3.4 VMS Controller Error Log Message

Example 2-4 shows a VMS Controller error log message.

Example 2-4 VMS Controller Error Log Message

```
VAX/VMS       SYSTEM ERROR REPORT      COMPILED  8-DEC-1986 08:29
                                                     PAGE   4

*********************** ENTRY     3 ******************************

ERROR SEQUENCE 1

ERL$LOGMESSAGE ENTRY 14-NOV-1986 15:42:45.79
                     KA630

"DSA" PORT SUB-SYSTEM, UNIT_ANON$PTAO:

MESSAGE TYPE         0004                                  1

MSLG$L_CMD_REF   00000000                                  2

MSLG$W_SEQ_NUM       0000                                  3
                                SEQUENCE #0

MSLG$B_FORMAT          00                                  4
                                CONTROLLER ERROR
MSLG$B_FLAGS           01                                  5
                                SEQUENCE NUMBER RESET

MSLG$W_EVENT         000A                                  6
                                CONTROLLER ERROR
                                UNKNOWN SUBCODE #0000(X)
MSLG$Q_CNT_ID    00000000                                  7
                 03090000                                  8
                                UNIQUE IDENTIFIER, 000000000000
                                TAPE CLASS DEVICE
                                TK50P
MSLG$B_CNT_SVR         04                                  9
                                CONTROLLER SOFTWARE VERSION #2
MSLG$B_CNT_HVR         06                                  10
                                CONTROLLER HARDWARE REVISION #0

"LASTFAIL" CODE      0001                                  11
                                "LASTFAIL" CODE
                                PACKET READ, PE/TIMEOUT
```

1. Message type (Section 14.1.23).
2. Command reference number (Section 14.1.1).
3. Sequence number (Section 14.1.3).
4. Format code (Section 14.1.4).
5. Message flag (Section 14.1.5).
6. Status/event code (Section 14.1.6).
7. Unique controller number (Section 14.1.7).
8. Controller model (Section 14.1.8) and controller class (Section 14.1.9).
9. Controller software version (Section 14.1.10).
10. Controller hardware version (Section 14.1.11).
11. Lastfail code (Section 14.1.33).

2.3.5 VMS TK50 Tape Transfer Error Log Message

Example 2-5 shows a VMS TK50 Tape Transfer error log message. This error log message reports errors detected while transferring data between the controller/drive and host. The numbers on the right-hand side of the example refer to the following list of explanations.

Example 2-5 VMS TK50 Tape Transfer Error Log Message

```
VAX/VMS       SYSTEM ERROR REPORT      COMPILED  8-DEC-1986 22:38
                                                           PAGE 1

*********************** ENTRY  290 ****************************

ERROR SEQUENCE   231

ERL$LOGMESSAGE ENTRY 26-NOV-1986 16:55:27.11
                     KA630

I/O SUB-SYSTEM, UNIT_NABETH$MUAO:

MESSAGE TYPE         0002                                  1
                                TAPE MSCP MESSAGE
MSLG$L_CMD_REF   C1850003                                  2
MSLG$W_UNIT          0000                                  3
                                UNIT #0
MSLG$W_SEQ_NUM       0000                                  4
                                SEQUENCE #0
MSLG$B_FORMAT          05                                  5
                                TAPE TRANSFER ERROR
MSLG$B_FLAGS           41                                  6
                                SEQUENCE NUMBER RESET
                                OPERATION CONTINUING
MSLG$W_EVENT         0068                                  7
                                DATA ERROR
                                READ DATA CHECK
MSLG$Q_CNT_ID    CCCCCCCC                                  8
                 0309CCCC                                  9
                                UNIQUE IDENTIFIER, CCCCCCCCCCCC
                                TAPE CLASS DEVICE
                                TK50P
MSLG$B_CNT_SVR         03                                  10
                                CONTROLLER SOFTWARE VERSION #3
MSLG$B_CNT_HVR         00                                  11
                                CONTROLLER HARDWARE REVISION #0
MSLG$W_MULT_UNT      0001                                  12
MSLG$Q_UNIT_ID   00000000                                  13
                 03030000                                  14
                                UNIQUE IDENTIFIER, 000000000001
                                TAPE CLASS DEVICE
                                            TK50*
```

(Continued on next page)

Example 2-5 (Cont.) VMS TK50 Tape Transfer Error Log Message

```
MSLG$B_UNIT_SVR       0A                                           15
                                UNIT SOFTWARE VERSION #A
MSLG$B_UNIT_HVR       04                                           16
                                UNIT HARDWARE REVISION #4
MSLG$B_LEVEL          00                                           17
MSLG$B_RETRY          01                                           18
MSLG$L_GAP_CNT  00000C31                                           19
                                GAP COUNT = 3121
MSLG$B_FMTR_SVR       03                                           20
                                FORMATTER SOFTWARE VERSION #3
MSLG$B_FMTR_HVR       00                                           21
                                FORMATTER HARDWARE VERSION #0
TK50 DEVICE/CONTROLLER DEPENDENT INFORMATION                       22
CONTRLR STATUS         6
                                ECC CORRECTION ON DATA
DRIVE ERR CODE        29
                                UNKNOWN DRV FAULT CODE = 41
DRIVE FLAGS           29
                                CARTRIDGE PRESENT
                                POSITIONED AT BOT
TRK NUMBER            06
                                LOGICAL TRACK NUMBER = 6
PHYSICAL BLK#         52
                                PHYSICAL BLOCK NUMBER = 52
LOGICAL BLK#          02
                                LOGICAL BLOCK NUMBER = 2

TAPE POSITION   000009E1
                                TAPE POSITION =2529
DRIVE STATE         0674
RD/WRT STATE        1506
OPERATION FLGS      1915
```

1. Message type (Section 14.1.23).
2. Command reference number (Section 14.1.1).
3. Unit number (Section 14.1.2).
4. Sequence number (Section 14.1.3).
5. Format code (Section 14.1.4).
6. Message flag (Section 14.1.5).
7. Status/event code (Section 14.1.6).
8. Unique controller number (Section 14.1.7).
9. Controller model (Section 14.1.8) and controller class (Section 14.1.9).
10. Controller software version (Section 14.1.10).
11. Controller hardware version (Section 14.1.11).
12. Multiunit code (Section 14.1.12).
13. Drive serial number (Section 14.1.14).
14. Drive model and drive class (Section 14.1.15) for drive model and (Section 14.1.16) for drive class.

15. Drive software version (Section 14.1.17).

16. Drive hardware version (Section 14.1.18).

17. Level (Section 14.1.19).

18. Retry (Section 14.1.20).

19. Position (gap count) (Section 14.1.24).

20. Formatter software version (Section 14.1.25).

21. Formatter hardware version (Section 14.1.26).

22. Drive dependent (Section 14.1.37).

CHAPTER 3
RSTS VERSION 8 ERROR LOG MESSAGE

3.1 INTRODUCTION

Chapter 3 covers the RSTS Version 8 error log message. It explains how to invoke the error log utility and how to decode the RSTS error log message.

3.2 INVOKING AN RSTS VERSION 8 ERROR LOG UTILITY

To change the binary format to an ASCII format for easy reading, ask the operator to invoke the RSTS Version 8 error log utility or ask for permission to use the system.

Use the following DCL commands to invoke a full report using RSTS Version 8.

NOTE
Your input is bolded. [RET] is the return key.

```
$ RUN ERROR$:ERRDIS[RET]
```

The printed response follows.

```
ERRDIS                    V8.0  RSTS V8.0 EDERE

Input File <[1,2]ERRLOG.FIL>? [RET]
Output to <KB:ERRDIS.OUT>? LPAO:ERRDIS.OUT [RET]
Help,Bad Blocks,Summary or Full Report <Summary>? FULL [RET]
Specific Error Type <All>? [RET]
Starting Date <First Error>? [RET]
Ending Date <Last Error>? [RET]
Zero Error File upon completion (Yes/No) <No>? [RET]
   ERRDIS Full Report (All Types) taken on 29-May_85,02:17 PM
      Input File: [1,2]ERRLOG>FIL     Output File: LPAO:ERRDIS.OUT
```

3.3 DECODING RSTS VERSION 8 ERROR LOG MESSAGES

Figure 3-1 shows a MSCP packet in an RSTS Version 8 error log message. The words in the figure have been numbered to help decode the MSCP packet.

Figure 3-1 MSCP Packet

0 004000	1 140234	2 000002	3 000000
4 040403	5 000053	6 000000	7 000000
8 000000	9 000415	10 000004	11 000000
12 000035	13 000000	14 000000	15 001004
16 107001	17 000000	18 000400	19 000004
20 000000	21 000000	22 002023	23 000000
24 013400	25 000005	26 001653	27 000000
28 000000	29 000000	30	31

CX–1292A

Because ten different message error formats exist, determine the format code. The format code is in word 4 of the MSCP packet. Figure 3-2 show how to determine the format code. The format determines the position of the words within the MSCP packet.

Figure 3-2 Word 4 Format

WORD 4 (OCTAL) = 040403

0 100 000 1	00 000 011
HIGH BYTE 101 OCTAL 41 HEX	LOW BYTE 003 OCTAL 03 HEX

CX–1293A

The high byte of word 4 is the message flag. The low byte of word 4 is the format code.

3.3.1 RSTS.V8 Controller Error Log Message

An example of an RSTS.V8 Controller error message is shown in Example 3-1. The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 3-1 RSTS.V8 Controller Error Log Message

```
***************************************************************

DU MSCP Disk Seq #2 Occurred on 25-Mar-86 at 08:20:04 AM

Detailed Description:
---------------------
I/O Status                 000                                 1
Timeout Indicator          377                                 2

CSR Address:               172150                              3
------------

Contents of Register:
---------------------
SA         000000          Controller On Line                  4

MSCP Description:
-----------------
MSCP Envelope              000030 000020                       5

MSCP Packet                000000 000000 000000 000000         6
                           000400 000012 005060 000000
                           000000 000406 000005 000013
                           000000 000000 000000 000000
                           000000 000000 000000 000000
                           000000 000000 000000 000000
                           000000 000000 000000 000000
                           000000 000000

Status Code of Packet      Controller Error                    7
MSCP Control Status Word   000102                              8
MSCP Unit Status Word      000000                              9
MSCP Error Code            000000                              10
BBR Flag Word              000000                              11
LBN Being Replaced         000000 000000                       12
Replacement Block Number   000000 000000                       13
RBN Being Replaced         000000 000000                       14
Command Reference Number   000000 000000                       15
Unit Number Field          000                                 16
Message Sequence Number    000000                              17
Message Format Field       000  Controller Error               18
Flag Field                 001  Sequence Number Reset          19
Controller I.D. (S/N)      48                                  20
Controller Model           006  UDA50-A                        21
Controller Class           001  Mass Storage                   22
Controller S/W Version     005                                 23
Controller H/W Version     000                                 24
Unit I.D. (S/N)            0                                   25
Unit Model                 000                                 26
Unit Class                 000                                 27
```

1. I/O status (Section 14.1.47).
2. Timeout indicator (Section 14.1.47). In this example, the I/O status and timeout indicator show there is a timeout.
3. Control Status register address. In this example, the address is 172150.
4. Contents of Control Status register. In this example, the contents are 000000.

5. MSCP envelope. The first word indicates the number of bytes in the MSCP packet. If the last two digits of the second MSCP envelope word are 20, as shown here, the MSCP packet contains error information. If the last two digits are 01, the MSCP message is an end packet and contains limited useful information. In this example, the number of bytes is 30, and the MSCP packet contains error information.

6. MSCP packet. Figure 3-1 numbering corresponds to the following list.

   0. High word of a command reference number (Section 14.1.1).
   1. Low word of a command reference number (Section 14.1.1). In this example, the command reference number is 0.
   2. Unit number (Section 14.1.2). In this example, the unit number is 0.
   3. Sequence number (Section 14.1.3). In this example, the sequence number is 0.
   4. Format and Message flag. The low byte word 4 is a format code (Section 14.1.4). The high byte word 4 is a message flag (Section 14.1.5). In this example, the format is 0, and the message flag indicates the sequence number has been reset.
   5. Status/Event code, see (Section 14.1.6). In this example, the status/event code indicates the command timeout expired.
   6. Low word of a unique controller number (Section 14.1.7).
   7. Middle word of a unique controller number (Section 14.1.7).
   8. High word of a unique controller number (Section 14.1.7). In this example, the controller serial number is 48.
   9. Controller class and controller model. The low byte is the controller model (Section 14.1.8). The high byte is the controller class, (Section 14.1.9). In this example, the controller class is a mass storage controller and the controller model is a UDA50-A.
   10. Controller hardware version and controller software version. The low byte is the controller software version (Section 14.1.10). The high byte is the controller hardware version, (Section 14.1.11). In this example, the software version of the controller is 5 and the hardware version is 0.
   11. Multiunit code, (Section 14.1.12). In this example, the path is 0.
   12. Low word of the drive serial number (Section 14.1.14).
   13. Middle word of the drive serial number (Section 14.1.14).
   14. High word of the drive serial number (Section 14.1.14). In this example, the drive serial number is 0.
   15. Drive model and drive class: The high byte is the drive class (Section 14.1.16). The low byte is the drive model, (Section 14.1.15). In this example, the drive class and model is 0.

7. Status code of the packet. It is the translation of MSCP packet word 5. In this example, the status code is a controller error.

8. Software interpretation of the perceived state of communication between the code and the controller or what is happening between the driver and the controller (Section 14.1.48). In this example, the flag bit for a controller requested service is set and the oldest command sent to the controller is timed out.

9. Perceived state between the unit and the driver (Section 14.1.49). In this example, the unit status word is 0.

10. Error code the driver sends to the error logger to indicate what the driver was trying to do when the error occurred. In this example, the command was successful, and an error log message was generated (Section 14.1.50).

11. Current state of the bad block replacement process (Section 14.1.51). In this example, the BBR process is 0.

12. LBN being replaced (Section 14.1.29). In this example, no LBN was replaced.

13. Replacement block number (Section 14.1.31). In this example, there is no replacement block.

14. RBN being replaced (Section 14.1.30). In this example, no RBN was replaced.

15. Command reference number (Section 14.1.1). In this example, the command reference number is 0.

16. Unit number of the drive being accessed (Section 14.1.2). In this example, the unit number is 0.

17. Sequence number assigned to the packet when it passes information to the host error logger (Section 14.1.3). In this example, the sequence number is 0.

18. Message format: indicates what type of error message you are working with (Section 14.1.4). In this example, the format is a controller error.

19. Message flag field (Section 14.1.5). In this example, the flag indicates the sequence number has been reset.

20. Controller number (Section 14.1.7). In this example, controller number is 48.

21. Controller model (Section 14.1.8). In this example, the controller model is a UDA50-A.

22. Controller class (Section 14.1.9). In this example, the controller class is a mass storage controller.

23. Controller software version (Section 14.1.10). In this example, the controller software is at level 5.

24. Controller hardware version (Section 14.1.11). In this example, the controller hardware version is at level 0.

25. Unit serial number (Section 14.1.14). In this example, the unit serial number is 0.

26. Unit model (Section 14.1.15). In this example, the model is 0.

27. Unit class (Section 14.1.16). In this example, the class is 0.

CHAPTER 4
RSTS VERSION 9 ERROR LOG MESSAGE

4.1 INTRODUCTION

Chapter 4 covers the RSTS Version 9 error log message. It explains how to invoke the error log utility and how to decode the RSTS error log message.

4.2 INVOKING RSTS VERSION 9 ERROR LOG UTILITY

To change the binary format to an ASCII format for easy reading, ask the operator to invoke the RSTS Version 9 error log utility or ask for permission to use the system.

Use the following DCL commands to invoke a full report using RSTS Version 9.

NOTE
Your input is bolded. [RET] is the return key.

```
$ RUN ERROR$:ERRDIS[RET]
```

The printed response follows:

```
ERRDIS                    V9.0  RSTS V9.0 EDERE

Input File <[0,3]ERRLOG.FIL>? [RET]
Output to <KB:ERRDIS.OUT>? LPA0:ERRDIS.OUT [RET]
Help,Bad Blocks,Summary or Full Report <Summary>? FULL [RET]
Specific Error Type <All>? [RET]
Starting Date <First Error>? [RET]
Ending Date <Last Error>? [RET]
Zero Error File upon completion (Yes/No) <No>? [RET]
   ERRDIS Full Report (All Types) taken on 29-May_85,02:17 PM
      Input File: [0,3]ERRLOG>FIL    Output File: LPA0:ERRDIS.OUT
```

4.3 DECODING RSTS VERSION 9 ERROR LOG MESSAGES

Figure 4-1 shows an MSCP packet for an RSTS Version 9 error log message. The words in the figure have been numbered to help decode the MSCP packet.

Figure 4-1 MSCP Packet

0 004000	1 140234	2 000002	3 000000
4 040403	5 000053	6 000000	7 000000
8 000000	9 000415	10 000004	11 000000
12 000035	13 000000	14 000000	15 001004
16 107001	17 000000	18 000400	19 000004
20 000000	21 000000	22 002023	23 000000
24 013400	25 000005	26 001653	27 000000
28 000000	29 000000	30	31

CX–1292A

Because ten different message error formats exist, determine the format code. The format code is in word 4 of the MSCP packet. Figure 4-2 explains how to determine the format code. The format determines the position of the words within the MSCP packet.

Figure 4-2 Word 4 Format

WORD 4 (OCTAL) = 040403

0 100 000 1	00 000 011
HIGH BYTE 101 OCTAL 41 HEX	LOW BYTE 003 OCTAL 03 HEX

CX–1293A

The high byte of word 4 is the message flag. The low byte of word 4 is the format code.

4.3.1 RSTS V9 SDI Error Log Message

Example 4-1 shows an SDI error message. The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 4-1 RSTS SDI Error Message

```
*****************************************************************

DU MSCP Disk Seq #5 Occurred on 03-Mar-85 at 04:56:10 PM

Detailed Description:
---------------------
I/O Status                000                               1
Timeout Indicator         377                               2

CSR Address:              172150                            3
------------

Contents of Register:
---------------------
SA        000000          Controller Online               4

MSCP Description:
-----------------
MSCP Packet Type          SDI Error Packet                  5

MSCP Envelope             000070 000020                     6

MSCP Packet               000000 000000 000002 000000       7
                          040403 000353 045504 141722
                          000201 000406 000004 000003
                          007151 000000 000000 001005
                          000406 000000 005424 000000
                          000000 000000 002013 000200
                          005000 147000 006004 017043
Command Reference Number  000000 000000                     8
Drive Number              000002                            9
Message Flag              101    Op Cont Seq Num Reset      10
Status/Event Code         000353 Drive det error            11
Drive Error Code          43                                12
Controller Class          001    Mass Storage               13
Controller Model          006    UDA50-A                    14
Controller HDW Ver        000                               15
Controller SFW Ver        004                               16
Drive Serial Number       3689                              17
Drive Class               002    DSA Disk                   18
Drive Model               005    RA81                       19
Drive HWD Ver             001                               20
Drive SFW Ver             006                               21
Pack/HDA Ser. Number      2836                              22
MSCP LBN                  0       Cyl 0 Trk 0 Sec 0         23
Byte 5,4 of Drive Status  002013  FO EL PS RU               24
Byte 7,6 of Drive Status  000200  DE                        25
Drive Status/Error Info   005000 147000 006004 017043       26

Driver Related Data:
--------------------
Internal Control Status Word  000300                        27
Internal Unit Status Word     000000                        28
Driver Error Code             000006  Online Command        29
                                      to Controller
                                      Failed
BBR Flag Word                 000000                        30
```

1. I/O status (Section 14.1.47).
2. Timeout indicator (Section 14.1.47). In this example, the I/O status and timeout indicator show there is a timeout.
3. Control status register address. In this example, the address is 172150.
4. Contents of control status register. In this example, the contents are 000000.
5. Decode of low byte of word 4. In this example, it is an SDI error.
6. MSCP envelope. The first word indicates the number of bytes in the MSCP packet. If the last two digits of the second MSCP envelope word are 20, as shown here, the MSCP packet contains error information. If the last two digits are 01, the MSCP message is an end packet and contains limited useful information. In this example, the number of bytes is 70 and the MSCP packet contains error information.
7. MSCP packet. Figure 4-1 numbering corresponds to the following list.
   0. High word of a command reference number (Section 14.1.1).
   1. Low word of a command reference number (Section 14.1.1). In this example, the command reference number is 0.
   2. Unit number (Section 14.1.2). In this example, the unit number is 2.
   3. Sequence number (Section 14.1.3). In this example, the sequence number is 0.
   4. Format and message flag. The low byte word 4 is a format code (Section 14.1.4). The high byte word 4 is a message flag (Section 14.1.5). In this example, the format is 3, and the flag indicates operation continuing and the sequence number has been reset.
   5. Status/Event code (Section 14.1.6). In this example, the status/event code indicates a drive detected error.
   6. Low word of a unique controller number (Section 14.1.7).
   7. Middle word of a unique controller number (Section 14.1.7).
   8. High word of a unique controller number (Section 14.1.7). In this example, the controller serial number is 8877953794800.
   9. Controller model and the controller class. The low byte is the controller model (Section 14.1.8). The high byte is the controller class (Section 14.1.9). In this example, the controller class is mass storage and the controller model is UDA50-A.
   10. Controller software version and the controller hardware version. The low byte is the controller software version (Section 14.1.10). The high byte is the controller hardware version (Section 14.1.11). In this example, the controller hardware version is 0, and the controller software version is 4.
   11. Multiunit code (Section 14.1.12). In this example, the path is 3.
   12. Low word of the drive serial number (Section 14.1.14).
   13. Middle word of the drive serial number (Section 14.1.14).
   14. High word of the drive serial number (Section 14.1.14). In this example, the drive serial number is 3689.
   15. Drive model and drive class. The low byte is the drive model (Section 14.1.15). The high byte is the drive class (Section 14.1.16). In this example, the drive class is DSA disk and the drive model is RA81.

16. Drive software and hardware version. The low byte is the drive software version (Section 14.1.17). The high byte is the drive hardware version (Section 14.1.18). In this example, the drive software version is 6, and the drive hardware version is 1.
17. Reserved.
18. Low word of the volume serial number (Section 14.1.21).
19. High word of the volume serial number (Section 14.1.21). In this example, the volume serial number is 2836.
20. Low word of the header code (LBN), (Section 14.1.22).
21. High word of the header code (LBN), (Section 14.1.22). In this example, the header code is the LBN is 0, and it is good.
22. Mode and request byte. The low byte is the request byte (Section 14.1.34). The high byte is the mode byte (Section 14.1.34). In this example, the drive can be formatted, information is available in the extended status area of drive memory, the drive select switch is pushed in (selected), and the run/stop switch is pushed in (run).
23. Controller and error byte. The low byte is the error byte (Section 14.1.34). The high byte is the controller byte (Section 14.1.34). In this example, a drive error has occurred.
24. Drive status bytes (Section 14.1.34). In this example, R/W Ready was not set while attempting a real-time command.

8. Command reference number (Section 14.1.1). In this example, the command reference number is 0.
9. Unit number of the drive being accessed (Section 14.1.2). In this example, the unit number is 2.
10. Message flag field (Section 14.1.5). In this example, the operation is continuing, and the sequence number has been reset.
11. Status code of packet and a translation of the MSCP packet word 5 (Section 14.1.6). In this example, there is a drive detected error.
12. Drive error code (Section 14.1.34).
13. Controller class (Section 14.1.9). In this example, the controller class is mass storage.
14. Controller model (Section 14.1.8). In this example, the controller model is UDA50-A.
15. Controller hardware version (Section 14.1.11). In this example, the controller hardware version is 0.
16. Controller software version (Section 14.1.10). In this example, the controller software version is 4.
17. Unit serial number (Section 14.1.14). In this example, the unit serial number is 3689.
18. Unit class (Section 14.1.16). In this example, the unit class is DSA disk drive.
19. Unit model (Section 14.1.15). In this example, the unit model is RA81.
20. Drive hardware version (Section 14.1.18). In this example, the drive hardware version is 1.
21. Drive software version (Section 14.1.17). In this example, the drive software version is 6.
22. Volume serial number (Section 14.1.21). In this example, the volume serial number is 2836.
23. LBN given in cylinder, track, and sector. In this example, the cylinder is 0, the track is 0, and the sector is 0.

24. Bytes 5 and 4 of the drive status (Section 14.1.34). In this example, the FO, EL PS RU bits are set.

25. Bytes 7 and 6 of the drive status (Section 14.1.34). In this example, the DE bit is set.

26. Words 24 through 27 are the drive status (Section 14.1.34).

27. Software interpretation of the perceived state of communication between the code and the controller, or what is happening between the driver and the controller (Section 14.1.48). In this example, the controller is online and communications are open.

28. Perceived state between the unit and the driver (Section 14.1.49). In this example, the unit status is 0.

29. Error code indicates what the driver was doing when the error occurred (Section 14.1.50). In this example, the online command to the controller failed.

30. This line describes the current state of BBR process (Section 14.1.51). In this example, there is no BBR action.

CHAPTER 5
RSX-11 ERROR LOG MESSAGE

5.1 INTRODUCTION

Chapter 5 covers the RSX-11 error log message. It explains how to invoke the error log utility and how to decode an RSX-11 error log message.

5.2 INVOKING RSX-11 ERROR LOG UTILITY

Ask the operator to run the RSX-11 error log utility, or ask for permission to use the system.

For RSX-11, type the following DCL commands:

NOTE
Your input is bolded. [RET] is the return key.

```
> INS$RPT
```

At the prompt type the following:

```
> RPT
RPT> LP0:/F:F=LB:[1,6]LOG.ERR
```

To exit type the following at the prompt:

```
RPT> ^Z
```

This prints out a full report.

5.3 DECODING RSX-11 ERROR LOG MESSAGES

Notice, the RSX-11 error log message is in plain language, uses hexadecimal and decimal numbering, and has unique fields depending on the type of RSX-11 error log message. The following RSX-11 error log messages are shown:

- RSX-11 SDI error log message (Example 5-1)
- RSX-11 Disk transfer error log message (Example 5-2)

5.3.1 RSX-11 SDI Error Log Message

An example of an RSX-11 SDI error log message follows. This example explains the various fields in the error log message. The numbers on the right-hand side of Example 5-1 refer to the list of definitions following the example.

Example 5-1 RSX-11 SDI Error Log Message

```
RSX-11M/M-Plus Error Logging System V2.00 da-mth-year hr:mn:sc

Entry    140.4  Sequence 30.       DU000:
Device Message (Spindle Motor Interlock Broken)
DD-MMM-YYYY HH:MM:SS                                       1

System Identification:
----------------------

System         Ident  Processor   Mapping  CPU  Format

RSX-11M-PLUS   15B    PDP-11/23+  22-Bit   CPA  1.

Device Identification Information:
----------------------------------

Device  Type  Volume Label Controller Unit Subunit

DU000:  RA81  USERCOMMON   DU  A       0     N/A           2

Pack SN  Drive SN       Hard Errors  Soft Errors

1BEE     CCE100000000   0.           0.                    3

I/O Count  Words Transferred    Cylinders Crossed

207399     137983572            0.


RSX-11M/M-PLUS Error Logging System V2.00
DD-MMM-YYYY HH:MM:SS

Entry    140.4     (CONTINUED)

I/O Operation Information:
--------------------------

Device Function           Type of Error

Set Unit Characteristic   Spindle Motor
                          Interlock Broken                 4

Device Error Position Information:
----------------------------------

      Cylinder  Group  Head  Sector  Block

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

(Continued on next page)

Example 5-1 (Cont.) RSX-11 SDI Error Log Message

```
Device Supplied Information:
----------------------------

Value           Interpretation

00004000070     MESSAGE ENVELOPE FIELD                          5
                [31:24] Connection I.D. = MSCP Disk
                [23:20] Message Type = Datagram Message
                [19:16] Credits = 0.
                [15: 0] Message Length = 28. words

00000000000     COMMAND REFERENCE NUMBER FIELD                  6
                [31: 0] Error does not relate to a
                command

000000          UNIT NUMBER FIELD                               7
                [15: 0] Unit number = 0.

000000          MESSAGE SEQUENCE NUMBER                         8
                [15: 0] Error packet is complete


RSX-11M/M-PLUS Error Logging System V2.00
DD-MMM-YYYY HH:MM:SS

     Entry      140.4     (CONTINUED)

003             MESSAGE FORMAT FIELD                            9
                [ 7: 0] SDI Error

101             FLAGS FIELD                                     10
                [ 6   ] Operation continuing
                [ 0   ] Sequence number reset

000353          EVENT CODE FIELD                                11
                [15: 5] Subcode = Drive Detected Error
                [ 4: 0] Major Status = Drive Error

441DA52D1800    CONTROLLER I.D.(S/N) = 441DA52D1800 (X)         12

013             CONTROLLER MODEL FIELD                          13
                [ 7: 0] Model = KDA50-Q

001             CONTROLLER CLASS FIELD                          14
                [ 7: 0] Class = Mass Storage Controllers

002             CONTROLLER SOFTWARE VERSION NUMBER              15
                [ 7: 0] KDA50-Q firmware version = 2.

000             CONTROLLER HARDWARE VERSION NUMBER              16
                [ 7: 0] KDA50-Q hardware version = 0.

000000          MULTIUNIT CODE FIELD                            17
                [ 7: 0] Access Path = 0.
                [15:12] Shared Spindle = 0.
```

(Continued on next page)

Example 5-1 (Cont.) RSX-11 SDI Error Log Message

```
CCE100000000  UNIT I.D.(S/N)=CCE100000000(X)                       18

005           UNIT MODEL FIELD                                     19
              [ 7: 0] Model = RA81

002           UNIT CLASS FIELD                                     20
              [ 7: 0] Class = Disk Class Device

007           UNIT SOFTWARE VERSION NUMBER                         21
              [ 7: 0] Firmware Version = 7.

RSX-11M/M-PLUS Error Logging System V2.00
DD-MMM-YYYY HH:MM:SS

     Entry    140.4      (CONTINUED)

004           UNIT HARDWARE VERSION NUMBER                         22
              [ 7: 0] Hardware Version = 4.

000000        GROUP FIELD                                          23
              [15: 0] Group = 0.

00000015756   VOLUME SERIAL NUMBER                                 24
              [31: 0] Volume serial number = 7150.

00000000000   HEADER VALUE                                         25
              [27: 0] LBN = 0.

002013        SDI SUPPLIED STATUS                                  26
              [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                                   27
             [11:8] Controller C flags=Normal Operation
             [ 7   ] Drive Error (drive fault)
             [ 6   ] Transmission Error

000          RA80/81 STATUS BYTE 8                                 28
             [7:0] Seek & Recal retry count = 0.

RSX-11M/M-PLUS Error Logging System V2.00
DD-MMM-YYYY HH:MM:SS

     Entry    140.4      (CONTINUED)

012    RA80/81 STATUS BYTE 9                                       29
       [7:0] Retried Op-code=Set Unit Characteristics
```

(Continued on next page)

Example 5-1 (Cont.) RSX-11 SDI Error Log Message

```
000   RA80/81 STATUS BYTE 10                                30

107   RA80/81 STATUS BYTE 11                                31
      [7:0] Cyl Addr low byte, printed in next field

000   RA80/81 STATUS BYTE 12                                32
      [ 7: 0] Cylinder address = 71.

001   RA80/81 STATUS BYTE 13                                33
      [ 7: 0] Current group = 1.

043   RA80/81 STATUS BYTE 14                                34
      [7:0] LED error code
      Spindle Mot. Interlock Broken

034   RA80/81 STATUS BYTE 15                                35
      [7:0] Control panel fault code = SDI Error
```

1. Device message—a good description of the failure and is a unique RSX-11 feature.
2. Device and Type field—a logical drive address and drive type information.
3. Pack Serial number and Drive Serial Number field.
4. Device function—describes what operation was being performed when the error occurred.
5. Two message types:
   - Datagram message—usually contains serious failure information.
   - Sequential message—usually contains status information.
6. Command Reference number (Section 14.1.1).
7. Unit number (Section 14.1.2).
8. Sequence number (Section 14.1.3).
9. Format code (Section 14.1.4).
10. Message flag (Section 14.1.5).
11. Status/Event code(Section 14.1.6).
12. Unique controller number (serial number) (Section 14.1.7).
13. Controller model (Section 14.1.8).
14. Controller class (Section 14.1.9).
15. Controller software version (Section 14.1.10).
16. Controller hardware version (Section 14.1.11).
17. Multiunit code (Section 14.1.12).
18. Unit serial number (Section 14.1.14).
19. Unit model (Section 14.1.15).
20. Unit class (Section 14.1.16).
21. Unit software version (Section 14.1.17).
22. Unit hardware version (Section 14.1.18).
23. Reserved field.

24. Volume serial number (Section 14.1.21).

25. Header code (logical block number) (Section 14.1.22).

26. Mode and request bytes of the drive status (Section 14.1.34).

27. Controller and error bytes of the drive status (Section 14.1.34).

28. Retry count byte (Section 14.1.34).

29. Initiate Seek (SDI opcode 012) (Section 14.1.34). The RSX-11 may interpret this field (RA80/81 Status Byte 9) incorrectly because it is decoding the field as an MSCP command. The field should be decoded as the last SDI command issued to the drive. For this example, the field should have been decoded as Initiate Seek.

30. SDI error byte (Section 14.1.34).

31. Low byte of the current cylinder (Section 14.1.34).

32. High byte of the current cylinder (Section 14.1.34).

33. Currently selected group byte (Section 14.1.34).

34. Drive LED code byte (Section 14.1.34).

35. Front panel fault code byte (Section 14.1.34).

5.3.2 RSX-11 Disk Transfer Error Log Message

An example of an RSX-11 disk transfer error log message follows. This example explains the various fields in the error log message. The numbers on the right-hand side of Example 5-2 refer to the list of definitions following the example.

Example 5-2 RSX-11 Disk Transfer Error Log Message

```
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                                          1

System Identification:
----------------------

System        Ident Processor  Mapping  CPU  Format

RSX-11M-PLUS  15B   PDP-11/23+ 22-Bit   CPA  1.

Device Identification Information:
----------------------------------

Device   Type  Volume Label  Controller  Unit  Subunit

DU000:   RA81  <null lable   DU  A       0     N/A            2

Pack SN    Drive SN       Hard Errors  Soft Errors

N/A        CCE100000000   0.           0.                     3

I/O Count   Words Transferred  Cylinders Crossed

286185      146524672          0.


RSX-11M/M-PLUS Error Logging System V2.00
DD-MMM-YYYY HH:MM:SS

     Entry    108.4     (CONTINUED)

I/O Operation Information:
--------------------------

Device Function            Type of Error

N/A                        Six Symbol ECC Error               4

Device Error Position Information:                            5
----------------------------------

Cylinder  Group  Head  Sector  Block


N/A       N/A    N/A   N/A     37541
```

(Continued on next page)

Example 5-2 (Cont.) RSX-11 Disk Transfer Error Log Message

```
Device Supplied Information:
----------------------------

Value        Interpretation
00004000054  MESSAGE ENVELOPE FIELD                                6
             [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                        7
             [31: 0] Command reference number

000000       UNIT NUMBER FIELD                                     8
             [15: 0] Unit number = 0.


RSX-11M/M-PLUS Error Logging System V2.00
DD-MMM-YYYY HH:MM:SS

     Entry    108.4     (CONTINUED)

000000    MESSAGE SEQUENCE NUMBER                                  9
          [15: 0] Error packet is complete
003       MESSAGE FORMAT FIELD                                     10
          [ 7: 0] Disk Transfer error

101       FLAGS FIELD                                              11
          [ 7   ] Operation successful
          [ 0   ] Sequence number reset
                  (end of logged packet)

000353    EVENT CODE FIELD                                         12
          [15: 5] Subcode = Six Symbol ECC error
          [ 4: 0] Major Status = Data Error

441DA52D1800 CONTROLLER I.D.(S/N)=441DA52D1800(X)                  13

013     CONTROLLER MODEL FIELD                                     14
        [ 7: 0] Model = KDA50-Q

001     CONTROLLER CLASS FIELD                                     15
        [ 7: 0] Class = Mass Storage Controllers

002     CONTROLLER SOFTWARE VERSION NUMBER                         16
        [ 7: 0] KDA50-Q firmware version = 2.

000     CONTROLLER HARDWARE VERSION NUMBER FIELD                   17
        [ 7: 0] KDA50-Q hardware version = 0.

000000  MULTIUNIT CODE FIELD                                       18
        [ 7: 0] Access Path = 0.
        [15:12] Shared Spindle = 0.
```

(Continued on next page)

Example 5-2 (Cont.) RSX-11 Disk Transfer Error Log Message

```
CCE100000000  UNIT I.D. (S/N) = CCE100000000 (X)              19

005           UNIT MODEL FIELD                                20
              [ 7: 0] Model = RA81

002           UNIT CLASS FIELD                                21
              [ 7: 0] Class = Disk Class Device

RSX-11M/M-PLUS Error Logging System V2.00
DD-MMM-YYYY HH:MM:SS

     Entry    108.4     (CONTINUED)

007  UNIT SOFTWARE VERSION NUMBER FIELD                       22
     [ 7: 0] Firmware Version = 7.

004  UNIT HARDWARE VERSION NUMBER FIELD                       23
     [ 7: 0] Hardware Version = 4.

000000  RETRY LEVEL & COUNT FIELD                             24
        [14: 8] Running Retry Count = 0.
        [ 7: 0] Error Recovery Level = 0.

00000015756  VOLUME SERIAL NUMBER                             25
             [31: 0] Volume serial number = 7150.

00000111245  HEADER VALUE                                     26
             [27: 0] LBN = 111245  (0)
```

1. Device message—a good description of the failure and is a unique RSX-11 feature.
2. Device and type field—a logical drive address and drive type information.
3. Pack serial number and drive serial number field.
4. Device function—describes what operation was being performed when the error occurred.
5. Block number shown in decimal format for transfer errors.
6. There are two message types:
   - Datagram message—usually contains serious failure information.
   - Sequential message—usually contains status information.
7. Command reference number (Section 14.1.1).
8. Unit number (Section 14.1.2).
9. Sequence number (Section 14.1.3).
10. Format code (Section 14.1.4).
11. Message flag (Section 14.1.5).
12. Status/event code (Section 14.1.6).
13. Unique controller number (serial number) (Section 14.1.7).
14. Controller model (Section 14.1.8).
15. Controller class (Section 14.1.9).
16. Controller software version (Section 14.1.10).
17. Controller hardware version (Section 14.1.11).
18. Multiunit code (Section 14.1.12).

19. Unit serial number (Section 14.1.14).

20. Unit model (Section 14.1.15).

21. Unit class (Section 14.1.16).

22. Unit software version (Section 14.1.17).

23. Unit hardware version (Section 14.1.18).

24. Retry (Section 14.1.20), and level count field (Section 14.1.19).

25. Volume serial number (Section 14.1.21).

26. Header code (LBN) (Section 14.1.22).

CHAPTER 6
TOPS-10 SPEAR ERROR LOG MESSAGE

6.1 INTRODUCTION

Chapter 6 covers the TOPS-10 SPEAR error log message. It explains how to invoke the error log utility and how to decode a TOPS-10 SPEAR error log message.

6.2 INVOKING TOPS-10 SPEAR ERROR LOG UTILITY

Ask the operator to run the error log, or ask for permission to use the system.

At the prompt, type the following to get the SPEAR prompt:

NOTE
Your input is bolded. [RET] is the return key.

```
R SPEAR
```

Then type the following:

```
SPEAR> RETRIEVE

Event or packet file (SYS:ERROR.SYS): [RET]
Selection to be (INCLUDED): [RET]
Selection type (ALL): [RET]
Time from (EARLIEST): -1 DAY [RET]
Time to (LATEST): [RET]
Output mode(ASCII): [RET]
Report format (SHORT): FULL [RET]
Output to (DSK:RETRIE.RPT): [RET]
SPEAR> EXIT [RET]
```

To print the log, type the following at the system prompt:

```
PRINT RETRIE.RPT
```

6.3 DECODING TOPS-10 SPEAR ERROR LOG MESSAGE

Example 6-1 explains how to decode the information in a TOPS-10 SPEAR error log message. The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 6-1 TOPS-10 SDI Error Log Message

```
*****************************************************
HSC50 ERROR LOG

LOGGED ON 21-MAR-86 08:38:16-MST
MONITOR UPTIME WAS 0 DAY (S) 23:34:20
       DETECTED ON SYSTEM #2759
       RECORDED SEQUENCE NUMBER: 3125
*****************************************************

COMMON DATA

COMMAND REF #:         00000000   HOST COMMAND #: 0           1
CI20 PORT #:                  7                               2
NODE #:                       1                               3
SEQUENCE #:                  39                               4
FORMAT :                     03   SDI ERROR                   5
FLAGS :                      40   Operation Continuing        6
EVENT :                    016B   Drive Error                 7
CNTLR DEVICE #:    00001798FE01                               8
CNTLR CLASS:                 01   Mass Storage Controller     9
CNTLR MODEL:                 01   HSC50                       10
CNTLR SOFTWARE VER:          02                               11
CNTLR HARDWARE VER:          00                               12

UNIT IDENTIFICATION DATA

UNIT NUMBER:                  2                               13
MULTI-UNIT CODE:           0032                               14
UNIT DEVICE #:     000000001653                               15
UNIT CLASS:                  02   DEC Std 166 Disk            16
UNIT MODEL:                  04   RA60                        17
UNIT SOFTWARE VER:           03                               18
UNIT HARDWARE VER:           01                               19
VOLUME S/N:            7EBCB78F                               20

SDI DATA

HEADER:                00000000   Logical block               21
                                  BLOCK AT ERROR WAS 0

CONTROLLER DATA

REQUEST BYTE:                13   Drive online or             22
                                  available,
                                  Port switch in,
                                  Run/Stop switch in
```

(Continued on next page)

Example 6-1 (Cont.) TOPS-10 SDI Error Log Message

```
MODE BYTE:                    01   Formatting disabled,    23
                                   Diag Cyl access
                                   disabled
ERROR BYTE:                   00                           24
CONTROLLER BYTE:              00                           25
RETRY COUNT/FAILURE CODE:     00                           26

RA60 DEVICE DATA

PREVIOUS CYLINDER:          031C                           27
PREVIOUS HEAD NUMBER:          4                           28
CURRENT CYLINDER:           031F                           29
CURRENT HEAD NUMBER:           4                           30
ERROR CODE:                   00                           31

EXTRANEOUS DATA IN 8 BIT OCTAL BYTES                       32
(UNUSED RIGHT 4 BITS IN 36-BIT WORD)

BYTES 63 - 60  003 002 000 000  (00)
BYTES 67 - 64  000 000 000 000  (00)
BYTES 71 - 68  000 000 000 000  (00)
BYTES 75 - 72  000 000 000 000  (00)
BYTES 79 - 76  000 000 000 000  (00)
```

1. Command reference number (Section 14.1.1).
2. Controller interface to which the HSC is attached.
3. Node number of the HSC attached to the controller interface.
4. Sequence number (Section 14.1.3).
5. Format code (Section 14.1.4).
6. Message flag (Section 14.1.5).
7. Status/event code (Section 14.1.6).
8. Unique controller number (Section 14.1.7).
9. Controller class (Section 14.1.9).
10. Controller model (Section 14.1.8).
11. Controller software version (Section 14.1.10).
12. Controller hardware version (Section 14.1.11).
13. Unit number (Section 14.1.2).
14. Multiunit code (Section 14.1.12).
15. Drive serial number (Section 14.1.14).
16. Drive class (Section 14.1.16).
17. Drive model (Section 14.1.15).
18. Drive software version (Section 14.1.17).
19. Drive hardware version (Section 14.1.18).
20. Volume serial number (Section 14.1.21).
21. Header code (Section 14.1.22).

22. Request byte (Section 14.1.34).

23. Mode byte (Section 14.1.34).

24. Error byte (Section 14.1.34).

25. Controller byte (Section 14.1.34).

26. Retry and failure code (Section 14.1.34).

27. Previous cylinder (Section 14.1.34).

28. Previous head (Section 14.1.34).

29. Current cylinder (Section 14.1.34).

30. Current head (Section 14.1.34).

31. Drive error code (Section 14.1.34).

32. Unused.

CHAPTER 7
TOPS-20 SPEAR ERROR LOG MESSAGE

7.1 INTRODUCTION

Chapter 7 covers the TOPS-20 SPEAR error log message. It explains how to invoke the error log utility and how to decode an TOPS-20 SPEAR error log message.

7.2 INVOKING TOPS-20 SPEAR ERROR LOG UTILITY

Ask the operator to run the error log or ask for permission to use the system.

At the prompt, type the following to get the SPEAR prompt.

NOTE
Your input is bolded. [RET] is the return key.

R SPEAR

Then type the following:

SPEAR> **RETRIEVE**

```
Event or packet file(SERR:ERROR.SYS): [RET]
Selection to be (INCLUDED): [RET]
Selection type (ALL): [RET]
Time from (EARLIEST): -1 DAY [RET]
Time to (LATEST): [RET]
Output mode(ASCII): [RET]
Report format (SHORT): FULL [RET]
Output to (DSK:RETRIE.RPT): [RET]
SPEAR> EXIT [RET]
```

To print the log, type the following at the system prompt:

PRINT RETRIE.RPT

7.3 DECODING TOPS-20 SPEAR ERROR LOG MESSAGES

Example 7-1shows a TOPS-20 SPEAR error log message. The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 7-1 TOPS-20 SDI Error Log Message

```
*****************************************************
HSC50 ERROR LOG

LOGGED ON 21-MAR-86 08:38:16-MST
MONITOR UPTIME WAS 0 DAY (S) 23:34:20
       DETECTED ON SYSTEM #2759
       RECORDED SEQUENCE NUMBER: 3125
*****************************************************

COMMON DATA

COMMAND REF #:          00000000   HOST COMMAND #: 0          1
CI20 PORT #:                   7                              2
NODE #:                        1                              3
SEQUENCE #:                   39                              4
FORMAT :                      03   SDI ERROR                  5
FLAGS :                       40   Operation Continuing       6
EVENT :                     016B   Drive Error                7
CNTLR DEVICE #:     00001798FE01                              8
CNTLR CLASS:                  01   Mass Storage Controller    9
CNTLR MODEL:                  01   HSC50                      10
CNTLR SOFTWARE VER:           02                              11
CNTLR HARDWARE VER:           00                              12

UNIT IDENTIFICATION DATA

UNIT NUMBER:                   2                              13
MULTI-UNIT CODE:            0032                              14
UNIT DEVICE #:      000000001653                              15
UNIT CLASS:                   02   DEC Std 166 Disk           16
UNIT MODEL:                   04   RA60                       17
UNIT SOFTWARE VER:            03                              18
UNIT HARDWARE VER:            01                              19
VOLUME S/N:             7EBCB78F                              20

SDI DATA

HEADER:                 00000000   Logical block              21
                                   BLOCK AT ERROR WAS 0

CONTROLLER DATA

REQUEST BYTE:                 13   Drive-online or            22
                                   available,
                                   Port switch in,
                                   Run/Stop switch in
MODE BYTE:                    01   Formatting disabled,       23
                                   Diag Cyl access
                                   disabled
ERROR BYTE:                   00                              24
CONTROLLER BYTE:              00                              25
RETRY COUNT/FAILURE CODE:     00                              26
```

(Continued on next page)

Example 7-1 (Cont.) TOPS-20 SDI Error Log Message

```
RA60 DEVICE DATA

PREVIOUS CYLINDER:          031C                    27
PREVIOUS HEAD NUMBER:          4                    28
CURRENT CYLINDER:           031F                    29
CURRENT HEAD NUMBER:           4                    30
ERROR CODE:                   00                    31

EXTRANEOUS DATA IN 8 BIT OCTAL BYTES                32
(UNUSED RIGHT 4 BITS IN 36-BIT WORD)

BYTES 63 - 60  003 002 000 000  (00)
BYTES 67 - 64  000 000 000 000  (00)
BYTES 71 - 68  000 000 000 000  (00)
BYTES 75 - 72  000 000 000 000  (00)
BYTES 79 - 76  000 000 000 000  (00)
```

1. Command Reference number (Section 14.1.1).
2. Controller interface to which the HSC is attached.
3. Node number of the HSC attached to the controller interface.
4. Sequence number (Section 14.1.3).
5. Format code (Section 14.1.4).
6. Message flag (Section 14.1.5).
7. Status/Event code (Section 14.1.6).
8. Unique controller number (Section 14.1.7).
9. Controller class (Section 14.1.9).
10. Controller model (Section 14.1.8).
11. Controller software version (Section 14.1.10).
12. Controller hardware version (Section 14.1.11).
13. Unit number (Section 14.1.2).
14. Multiunit code (Section 14.1.12).
15. Drive serial number (Section 14.1.14).
16. Drive class (Section 14.1.16).
17. Drive model (Section 14.1.15).
18. Drive software version (Section 14.1.17).
19. Drive hardware version (Section 14.1.18).
20. Volume serial number (Section 14.1.21).
21. Header code (Section 14.1.22).
22. Request byte (Section 14.1.34).
23. Mode byte (Section 14.1.34).
24. Error byte (Section 14.1.34).
25. Controller byte (Section 14.1.34).

26. Retry and failure code (Section 14.1.34).
27. Previous cylinder (Section 14.1.34).
28. Previous head (Section 14.1.34).
29. Current cylinder (Section 14.1.34).
30. Current head (Section 14.1.34).
31. Drive error code (Section 14.1.34).
32. Unused.

CHAPTER 8
DSM-11 ERROR LOG MESSAGES

8.1 INTRODUCTION

Chapter 8 covers the DSM-11 error log messages. It explains how to invoke and how to decode a DSM-11 error log message.

8.2 INVOKING DSM-11 ERROR LOG UTILITY

Ask the operator to run the DSM-11 error log utility or ask for for permission to use the system.

At the prompt type

D ^KTR

This is the caretaker utility.

You should get the following responses:

NOTE

Your input is bolded. [RET] is the return key.

```
Print errors for devices <*> ? *

Output Device ? <0> LPO

Starting date (DD-MMM-YY) <First entry> [RET]

Starting time HH:MM <First entry> [RET]
```

8.3 DECODING DSM-11 ERROR LOG MESSAGES

Figure 8-1 shows the MSCP error log packet of a DSM-11 error log message. The words are numbered to help decode the MSCP error log message. The following DSM-11 error log message examples are shown:

- DSM-11 SDI error log message (Example 8-1)
- DSM-11 Disk Transfer error log message (Example 8-2)

Figure 8-1 MSCP Error Log Packet Map

WORD N+3	WORD N+2	WORD N+1	WORD N	BYTE OFFSET
3 000000	2 000000	1 000000	0 000000	0
7 000000	6 000000	5 000000	4 000000	10
11 000000	10 000000	9 000000	8 000000	20
15 00000	14 000000	13 000000	12 000000	30
19 00000	18 000000	17 000000	16 000000	40
23 00000	22 000000	21 000000	20 000000	50
27 00000	26 000000	25 000000	24 000000	60

NOTE: VALUES ARE IN OCTAL.

CX–1294A

Because ten different message error formats exist, determine the format. The format code is in word 4 of the MSCP error log packet. The structure of word 4 is shown in Figure 8-2. The format determines the position of the words within the MSCP error log packet.

Figure 8-2 Word 4 Format

WORD 4 (OCTAL) = 040403

0 100 000 1	00 000 011

HIGH BYTE	LOW BYTE
101 OCTAL	003 OCTAL
41 HEX	03 HEX

CX–1293A

The high byte of word 4 is the message flag. The low byte of word 4 is the format code. Knowing this helps decode MSCP error log packets.

8.3.1 DSM-11 SDI Error Log Message

DSM-11 error log message reports SDI errors detected by the drive and by the controller. An example of an SDI error message (Example 8-1) follows. The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 8-1 DSM-11 SDI Error Log Message

```
-----------------------------------------------------
Error on device DU0 at 10:32 on 4/14/1986
dsm block number: 1500 (Decimal)
-----------------------------------------------------
MSCP ERROR LOG PACKET
     (values are in octal)
WORD N+3  WORD N+2  WORD N+1  WORD N  BYTE OFFSET        1
000000    000000    000000    001337  0
000000    000000    000353    040403  10
000002    000004    000406    000000  20
001005    000000    000000    032171  30
000000    000000    000000    002006  40
000200    00203     000000    000000  50
010445    001404    161000    005000  60

TYPE OF PACKET = SDI Error Packet                        2
Command Reference Number = 1337(OCT)  735(DEC)           3
Drive Number = 0(OCT)  0(DEC)                            4
Status/Event Code = Drive detected error                 5
                    (drive had error)
UDA Controller Software Version = 4(OCT) 4(DEC)          6
Drive Serial Number = 32171(OCT) 13433(DEC)              7
Drive Model = RA81                                       8
DSA Logical Block Number = 0(OCT) 0(DEC)                 9
DSA Block Type = Logical Block within host area          10
RU bit set in Request byte                               11
PS bit set in Request byte
EL bit set in Request byte
SR bit set in Request byte
FO bit set in Mode byte
DE bit set in Error byte
4-bit  drive status code = Drive normal                  12
RA8x LED Error Code = 45 (OCT)  37 (DEC)  25 (HEX)       13
RA8x Front Panel Fault Code = 21(OCT) 17(DEC) 11(HEX)    14
```

1. MSCP error log packet describes the decoding of the following words (Figure 8-1).

   0. Low word of a command reference number (Section 14.1.1). In this example, the command reference number is 1337 (Octal).
   1. High word of a command reference number (Section 14.1.1).
   2. Unit number (Section 14.1.2). In this example, the unit number is 0.
   3. Sequence number (Section 14.1.3). In this example, the sequence number is 0.
   4. Format and Message flag. The low byte of word 4 is a format code (Section 14.1.4). The high byte of word 4 is a message flag (Section 14.1.5). In this example, the format is 3, the flag indicates operation continuing, and the sequence number has been reset.
   5. Status/Event code (Section 14.1.6). In this example, the status/event code indicates a drive-detected error.

   6. Low word of a unique controller number (Section 14.1.7).
   7. Middle word of a unique controller number (Section 14.1.7).
   8. High word of a unique controller number (Section 14.1.7). In this example, the controller serial number is 0.
   9. Controller model and controller class. The low byte is the controller model (Section 14.1.8). The high byte is the controller class (Section 14.1.9). In this example, the controller class is mass storage, and the controller model is UDA50-A.
   10. Controller software version and the controller hardware version. The low byte is the controller software version (Section 14.1.10). The high byte is the controller hardware version (Section 14.1.11). In this example, the controller hardware version is 0, and the controller software version is 4.
   11. Multiunit code (Section 14.1.12). In this example, the path is 2.
   12. Low word of the drive serial number (Section 14.1.14).
   13. Middle word of the drive serial number (Section 14.1.14).
   14. High word of the drive serial number (Section 14.1.14). In this example, the drive serial number is 32171 (Octal).
   15. Drive model and drive class. The low byte is the drive model (Section 14.1.15). The high byte is the drive class (Section 14.1.16). In this example, the drive class is a DSA disk, and the drive model is RA81.
   16. Drive software and hardware version. The low byte is the drive software version (Section 14.1.17). The high byte is the drive hardware version (Section 14.1.18). In this example, the drive software version is 6, and the drive hardware version is 4.
   17. Reserved.
   18. Low word of the volume serial number (Section 14.1.21).
   19. High word of the volume serial number (Section 14.1.21). In this example, the volume serial number is 0.
   20. Low word of the header code (LBN) (Section 14.1.22).
   21. High word of the header code (LBN) (Section 14.1.22). In this example, the header code of the LBN is 0, and it is good.
   22. Request and mode bytes. The low byte is the request byte (Section 14.1.34). The high byte is the mode byte (Section 14.1.34). In this example, the drive can be formatted, information is available in the extended status area of drive memory, the drive select switch is pushed in (selected), the Run/Stop switch is pushed in (run), and the drive spindle is up to speed.
   23. Error and controller bytes. The low byte is the error byte (Section 14.1.34). The high byte is the controller byte (Section 14.1.34). In this example, a drive error has occurred.
   24. Drive status bytes (Section 14.1.34).

2. Packet type. In this example, the packet type is SDI error.

3. Command reference number (Section 14.1.1). In this example, the command reference number is 0.

4. Unit number of the drive being accessed (Section 14.1.2). In this example, the unit number is 0.

5. Packet status code. It is a translation of the MSCP packet word 5 (Section 14.1.6). In this example, there is a drive detected error.

6. Controller software version (Section 14.1.10). In this example, the controller software version is 4.

7. Unit serial number (Section 14.1.14). In this example, the unit serial number is 13433.

8. Unit model (Section 14.1.15). In this example, the unit model is RA81.

9. LBN. In this example, the LBN is 0.

10. DSA block type. In this example, the LBN is in the host area.

11. The bits set in the request (Section 14.1.34), mode (Section 14.1.34), and error bytes (Section 14.1.34).

12. Drive status code (Section 14.1.34).

13. Drive LED error code. (Section 14.1.34).

14. Drive front panel code. (Section 14.1.34).

8.3.2 DSM-11 Disk Transfer Error Log Message

The DSM-11 Disk Transfer error log message is used to report errors detected while transferring data between the controller and drive. Following is an example of a disk transfer error message (Example 8-2). The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 8-2 DSM-11 Disk Transfer Error Log Message

```
----------------------------------------------------
Error on device DUO at 09:59 on 4/14/1986
dsm block number:     0 (Decimal
----------------------------------------------------
MSCP ERROR LOG PACKET
     (values are in octal)
WORD N+3  WORD N+2  WORD N+1  WORD N  BYTE OFFSET
000000    000000    000000    000361  0                 1
000000    000000    000410    100402  10
000002    000004    000406    000000  20
001005    000000    000000    005674  30
000000    000000    000000    007406  40
002001    001375    000015    114357  50
000000    000000    000000    000000  60

TYPE OF PACKET = Disk Transfer Error Packet             2
Command Reference Number = 361 (OCT)  241(DEC)          3
Drive Number = 0(OCT)  0(DEC)                           4
Status/Event Code = One Symbol ECC error                5
UDA Controller Software Version = 4(OCT) 4(DEC)         6
Drive Serial Number =  5674(OCT)  3004(DEC)             7
Drive Model = RA81                                      8
DSA Logical Block Number = 3314357(OCT)  891119(DEC)    9
DSA Block Type = Logical Block within host area         10
```

1. MSCP error log packet describe the decoding of the following words (Figure 8-1).

   0. Low word of a command reference number (Section 14.1.1). In this example, the command reference number is 361 (Octal).

   1. High word of a command reference number (Section 14.1.1).

2. Unit number (Section 14.1.2). In this example, the unit number is 0.
3. Sequence number (Section 14.1.3). In this example, the sequence number is 0.
4. Format and the message flag. The low byte of word 4 is a format code (Section 14.1.4). The high byte of word 4 is a message flag (Section 14.1.5). In this example, the format is 2, the message flag indicates it has been completed successfully, and the sequence number has been reset.
5. Status/Event code (Section 14.1.6). In this example, the status event code indicates a one symbol ECC error occurred.
6. Low word of a unique controller number (Section 14.1.7). In this example, the controller serial number is 0.
7. Middle word of a unique controller number (Section 14.1.7).
8. High word of a unique controller number (Section 14.1.7).
9. Controller model and controller class. The low byte is the controller model (Section 14.1.8). The high byte is the controller class (Section 14.1.9). In this example, the controller class is mass storage and the controller model is a UDA50-A.
10. Controller software version and the controller hardware version. The low byte is the controller software version (Section 14.1.10). The high byte is the controller hardware version (Section 14.1.11). In this example, the hardware version is 0 and the software version is 4.
11. Multiunit code (Section 14.1.12). In this example, the path is 2.
12. Low word of the drive serial number (Section 14.1.14). In this example, the drive serial number is 5674 (Octal).
13. Middle word of the drive serial number (Section 14.1.14).
14. High word of the drive serial number (Section 14.1.14).
15. Drive class and drive model. The high byte is the drive class (Section 14.1.16). The low byte is the drive model (Section 14.1.15). In this example, the drive class is DSA and the drive model is RA81.
16. Drive hardware version and drive software version. The high byte is the drive hardware version (Section 14.1.18). The low byte is the drive software version (Section 14.1.17). In this example, the software version is 6 and the hardware version is 4.
17. Level and retry. The low byte is the level (Section 14.1.19). The high byte is the retry (Section 14.1.20). In this example, the level and retry are 0.
18. Low word of the volume serial number (Section 14.1.21). In this example, the volume serial number is 0.
19. High word of the volume serial number (Section 14.1.21).
20. Low word of the header code (LBN) (Section 14.1.22). In this example, the low word of the header code is 114357.
21. High word of the header code (LBN) (Section 14.1.22). In this example, the high word of the header code is 15.
22. Request and mode byte. The low byte is the request byte (Section 14.1.34)). The high byte is the mode byte (Section 14.1.34). In this example, the word is 01375.
23. Error and controller byte. The low byte is the error byte (Section 14.1.34)). The high byte is the controller byte (Section 14.1.34). In this example, the word is 002001.

2. Packet type. In this example, the packet type is a disk transfer error.
3. Command reference number (Section 14.1.1). In this example, the command reference number is 361 (Octal).
4. Unit number of the drive being accessed (Section 14.1.2). In this example, the unit number is 0.
5. Packet status code and is also a translation of the MSCP packet word 5 (Section 14.1.6). In this example, there is a one-symbol ECC error.
6. Controller software version (Section 14.1.10). In this example, the controller software version is 4.
7. Unit serial number (Section 14.1.14). In this example, the unit serial number is 3004.
8. Unit model (Section 14.1.15). In this example, the unit model is RA81.
9. LBN. In this example, the LBN is 891119.
10. DSA block type. In this example, the LBN is in the host area.

CHAPTER 9
UNIX (BERKLEY) ERROR LOG MESSAGE

9.1 INTRODUCTION
Chapter 9 covers the UNIX error log message. It explains how to invoke the error log utility and how to decode the UNIX error log message.

9.2 INVOKING UNIX ERROR LOG UTILITY
Ask the operator to invoke the UNIX error log utility or ask for permission to use the system.

To display the error message on the video terminal one screen at a time, type the following at the prompt:

```
% more /usr/adm/messages
```

Press the space bar to get the next screen.

To read messages logged during the previous 10 minutes, type the following at the prompt:

```
% /etc/dmesg |more
```

9.3 DECODING UNIX ERROR LOG MESSAGE
Notice, the UNIX error log message has unique fields depending on the type of UNIX error log message.

9.3.1 UNIX SDI Error Log Message
A UNIX SDI error message is shown in Example 9-1. Each field of the error message is explained in Table 9-1.

Example 9-1 UNIX SDI Error

```
uda0 hard error sdi error unit 1 event 353 hdr 0

1b 00 20 00 00 0a 00 45 00 02 42 1c
```

9.3.1.1 UNIX SDI Decode
Table 9-1 explains the UNIX SDI error message fields.

Table 9-1 UNIX SDI Decode

Field	Description
uda0	UDA50 reporting the error. In this example, the UDA50 is 0.
hard error	Hard or soft error. In this example, the error is hard.
sdi error	Format field. In this example, it is an SDI error.
unit 1	Unit field. In this example, the unit is 1.
event 353	Status/Event code. In this example, the Status/Event code is 353 (Section 14.1.6).
hdr 0	Header. In this example, the header is LBN 0 (Section 14.1.22).
1b	Low byte of word 22. In this example, the low byte of word 22 is 1b (Section 14.1.34).
00	High byte of word 22. In this example, the high byte of word 22 is 0 (Section 14.1.34).
20	Low byte of word 23. In this example, the low byte of word 23 is 20 (Section 14.1.34).
00	High byte of word 23. In this example, the high byte of word 23 is 0 (Section 14.1.34).
00	Low byte of word 24. In this example, the low byte of word 24 is 0 (Section 14.1.34).
0a	High byte of word 24. In this example, the high byte of word 24 is 0a (Section 14.1.34).
00	Low byte of word 25. In this example, the low byte of word 25 is 0 (Section 14.1.34).
45	High byte of word 25. In this example, the high byte of word 25 is 45 (Section 14.1.34).
00	Low byte of word 26. In this example, the low byte of word 26 is 0 (Section 14.1.34).
02	High byte of word 26. In this example, the high byte of word 26 is 02 (Section 14.1.34).
42	Low byte of word 27. In this example, the low byte of word 27 is 42 (Section 14.1.34).
1c	High byte of word 27. In this example, the high byte of word 27 is 1c (Section 14.1.34).

CHAPTER 10
UNIX (SYSTEM V) ERROR LOG MESSAGE

10.1 INTRODUCTION
Chapter 10 covers the UNIX (SYSTEM V) error log message. It explains how to invoke the error log utility and how to decode a UNIX (SYSTEM V) error log message.

10.2 INVOKING UNIX (SYSTEM V) ERROR LOG UTILITY
Ask the operater to run the UNIX (SYSTEMV) error log utility or ask for permission to use the system.

For UNIX (SYSTEM V) type the following shell command:

```
derrpt --h /usr/adm/errfile
```

This prints only the hard errors. There are other options that print before and after dates and summary data. See the manual on DERRPT for UNIX SYSTEM V (DEC only—VAX).

10.3 DECODING UNIX (SYSTEM V) ERROR LOG MESSAGE
The UNIX (SYSTEM V) error log message is in plain language, uses hexadecimal and decimal numbering, and has unique fields depending on the type of UNIX (SYSTEM V) error log message. The following UNIX (SYSTEM V) error log messages are shown:

- UNIX (SYSTEM V) SDI error log message (Section 10.3.1).
- UNIX (SYSTEM V) Disk transfer error log message (Section 10.3.2).
- UNIX (SYSTEM V) STI drive error log message (Section 10.3.3).

10.3.1 UNIX (SYSTEM V) SDI Error Log Message
Example 10-1 shows UNIX (SYSTEM V) SDI error message This example is shown to explain the various fields in the error message. The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 10-1 UNIX (SYSTEM V) SDI Error Log Message

```
LOGGED Fri May 10 15:45:41 1985, SID 020062DD, 11/750 REV 221. MIC# 98

NODE "HJUXA", DISK CLASS GENERATED ERROR, "HSC1$D"

NO. OF UNLOG ERRORS  35
       "HSC1$D -- Sdi Error No. 10 Unit 241 Volumne 27D3"

TYPE:  ERROR LOG MESSAGE - SDI ERROR
       COMMAND REF      00000000                                1
       UNIT                  241                                2
       SEQUENCE NO            10                                3
       FORMAT                 03                                4
       FLAGS                  40                                5
                                 OPERATION CONTINUING
       EVENT CODE           OOEB                                6
                                 DRIVE ERROR
                                 <DRIVE DETECTED ERROR>
       CONTROLLER ID    ABCDFF04                                7
                        01010000
                                 CLASS: MASS STORAGE CONTROLLER
                                 MODEL: HSC50
       CNTRLR SVER            02                                8
       CNTRLR HVER            00                                9
       MULTI-UNIT       00000030                                10
       UNIT ID          0C003D2D                                11
                        02050000
                                 CLASS: DISK
                                 MODEL: RA81
       UNIT SVER              07                                12
       UNIT HVER              04                                13
       VOLUME SERIAL #  0C0027D3                                14
       HEADER CODE      00000000                                15
       SDI STATUS       0C00001B                                16
                        4A008800
                        1C070004
                                 DRIVE NORMAL
                                 RUN/STOP SWITCH IN
                                 PORT SWITCH
                                 LOG INFO IN EXTENDED AREA
                                 SPINDLE READY
                                 NO DIAGNOSTIC REQUESTED
                                 AVAILABLE
                                 512 BYTE SECTORS
                                 DIAGNOSTIC CYLINDERS NOT ACCESSIBLE
                                 FORMATTING COMMANDS DISABLED
                                 DRIVE ENABLED
                                 RETRY COUNT(0)
                                         = 0.
                                 LAST POSITIONAL COMMAND(88)
                                         = GET SUBUNIT CHARACTERISITCS
                                 CURRENT CYLINDER(44A)
                                         = 1098.
                                 MIRCOPROCESSOR STATUS/ERROR(7)
                                         = LEVEL 2 MESSAGE FRAME SEQUENCING ERROR
                                 FRONT PANEL FAULT(1C)
                                         = SDI ERROR
```

1. Command reference number (Section 14.1.1).
2. Unit number (Section 14.1.2).
3. Sequence number (Section 14.1.3).
4. Format code (Section 14.1.4).
5. Message flag (Section 14.1.5).
6. Status/Event code (Section 14.1.6).
7. Unique controller number (Section 14.1.7), controller model, (Section 14.1.8) and controller class (Section 14.1.9).
8. Controller software version (Section 14.1.10).
9. Controller hardware version (Section 14.1.11).
10. Multiunit code (Section 14.1.12).
11. Drive serial number (Section 14.1.14), drive class (Section 14.1.16), and drive model (Section 14.1.15).
12. Drive software version (Section 14.1.17).
13. Drive hardware version (Section 14.1.18).
14. Volume serial number (Section 14.1.21).
15. Header code (Section 14.1.22).
16. SDI status for the RA81 (Section 14.1.34).

10.3.2 UNIX (SYSTEM V) Disk Transfer Error Log Message

Example 10-2 shows a UNIX (SYSTEM V) Disk Transfer error message. This example explains the various fields it contains. The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 10-2 UNIX (SYSTEM V) Disk Transfer Error Message

```
LOGGED Mon May 6  16:13:09 1985, SID 020062DD, 11/750 REV 221. MIC# 98

NODE "HJUXA", DISK CLASS GENERATED ERROR, "HSC1$D"

NO. OF UNLOG ERRORS  27
       "HSC1$D -- Disk Transfer Error No. 9 Unit 1 Volumne 2768"

TYPE:  ERROR LOG MESSAGE - DISK TRANSFER ERROR
       COMMAND REF      D0130042                              1
       UNIT                    1                              2
       SEQUENCE NO             9                              3
       FORMAT                 02                              4
       FLAGS                  80                              5
                                 OPERATION SUCCESSFUL
       EVENT CODE           008B                              6
                                 DRIVE ERROR
                                 <LOST READ/WRITE READY DURING OR
                                  BETWEEN TRANSFER>
       CONTROLLER ID    0000FF00                              7
                        01010000
                                 CLASS: MASS STORAGE CONTROLLER
                                 MODEL: HSC50
       CNTRLR SVER            02                              8
       CNTRLR HVER            00                              9
       MULTI-UNIT       00000041                              10
       UNIT ID          0C003D24                              11
                        02050000
                                 CLASS: DISK
                                 MODEL: RA81
       UNIT SVER              07                              12
       UNIT HVER              04                              13
       VOLUME SERIAL #  0000276B                              14
       LEVEL                  00                              15
       RETRY COUNT            00                              16
       HEADER CODE      0001EC50                              17
                                 LBN:    126032.
```

1. Command reference number (Section 14.1.1).
2. Unit number (Section 14.1.2).
3. Sequence number (Section 14.1.3).
4. Format code (Section 14.1.4).
5. Message flag (Section 14.1.5).
6. Status/Event code (Section 14.1.6).
7. Unique controller number (Section 14.1.7), controller model, (Section 14.1.8) and controller class (Section 14.1.9).
8. Controller software version (Section 14.1.10).
9. Controller hardware version (Section 14.1.11).
10. Multiunit code (Section 14.1.12).
11. Drive serial number (Section 14.1.14), drive class (Section 14.1.16), and drive model (Section 14.1.15).

12. Drive software version (Section 14.1.17).

13. Drive hardware version (Section 14.1.18).

14. Volume serial number (Section 14.1.21).

15. Level (Section 14.1.19).

16. Retry (Section 14.1.20).

17. Header code (Section 14.1.22).

10.3.3 UNIX (SYSTEM V) STI Drive Error Log Message

Example 10-3 shows a UNIX (SYSTEM V) STI Drive error log message. This example explains the various fields it contains. The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 10-3 UNIX (SYSTEM V) STI Drive Error Log Message

```
LOGGED Mon Jun 2 15:27:37 1986, SID 04827595, 8600 REV 260. SERIAL# 1429
NODE "HJUXA", TAPE CLASS GENERATED ERROR, "BUTCH"
NO. OF UNLOG ERRORS  13
        "BUTCH" -- Sti Error No. 20 Unit 1
TYPE:   ERROR LOG MESSAGE - STI DRIVE ERROR
       COMMAND REF       5CD70066                               1
       UNIT                     1                               2
       SEQUENCE NO             20                               3
       FORMAT                  07                               4
       FLAGS                   40                               5
                                  OPERATION CONTINUING
       EVENT CODE            FF6B                               6
                                  DRIVE ERROR
                                  <TAPE DRIVE RQSTED ERROR LOG>
       CONTROLLER ID     0000FE01                               7
                         03200000
                                  CLASS: TAPE CLASS DEVICE
                                  MODEL: RESERVED
       CNTRLR SVER             00                               8
       CNTRLR HVER             00                               9
       MULTI-UNIT        00000070                               10
       UNIT ID           00003544                               11
                         03010000
                                  CLASS: TAPE
                                  MODEL: TA78
       UNIT SVER               00                               12
       UNIT HVER               00                               13
       OBJECT COUNT      0C000389                               14
       FORMATTER SVR     00000003                               15
       FORMATTER HVR     0C0000FF                               16
GET EXTENDED DRIVE STATUS BYTES                                 17
       DRIVE SPEED =          125 IPS
       DENSITY     =           04
                                  6250 BPI GCR ENCODING
       MSCP UNIT # =            1
       GAP COUNT   =          905.
TA78 EXTENDED DRIVE STATUS INFORMATION                          18
       DIAGNOSTIC STS BYTE 1 00
       DIAGNOSTIC STS BYTE 2 00
       RESERVED              00
       RESERVED              00
       LAST LEVEL 2 OPCODE   55
                                  DATA ERROR RECOVERY
       ERROR ID NUMBER =   0436
                                  OPERATIONAL ERROR
                                  FAULT NUMBER INDICATES
                                  PROBABLE CAUSE IS
                                  UNKNOWN FAULT NUMBER
       RMC WRIT FAIL BITS    04
```

(Continued on next page)

Example 10-3 (Cont.) UNIX (SYSTEM V) STI Drive Error Log Message

```
READ PATH STATUS       46
                          STATISTICS SELECT
                          CLOCK STOPPED
                          STATUS VALID
RMC STATUS BYTE        B2
                          POSTAMBLE SHORT
RMC COMMAND LOOP BACK 07
                          NORMAL NON - BOT READ
READ CHAN AMTIE STS    FF
READ CHAN DONE STS     00
READ CHAN ILLEGAL STS 00
READ CHAN MARK 2 STS   00
READ CHAN END STS      00
READ CHAN PARITY ERR   81
                          WEAK AMPLITUDE ON PARITY BIT
                          ECC CORRECTED OUTPUT (PARITY BIT)
READ CHAN PE
 POSTAMBLE DETECT      00
DATA FROM READ
 CHANNEL TO ECC        00
CRC CHECKER
 OUTPUT BITS           00
CORRECTED DATA
 (ECC TO CRC)          FF
ECC STATUS BYTE        21
READ CHAN 0/1 TIE      00
READ CHAN 2/3 TIE      0C
                          CH2 TIE BUS 2
                          CH2 TIE BUS 3
READ CHAN 4/5 TIE      00
READ CHAN 6/7 TIE      00
READ CHAN P AND
 TIE BUS               80
                          TIE BUS 8
TAPE UNIT BUS LINE
 AMTIE 7:0             FF
TAPE UNIT PORT STS     17
                          AMTIE PARITY
                          READ PARITY
                          WCS PARITY
                          TAPE UNIT PRESENT
TU BUS LINE
 READ DATA 7:0         E5
STI BUS ERROR          00
```

1. Command reference number (Section 14.1.1).
2. Unit number (Section 14.1.2).
3. Sequence number (Section 14.1.3).
4. Format code (Section 14.1.4).
5. Message flag (Section 14.1.5).
6. Status/Event code (Section 14.1.6).

7. Unique controller number (Section 14.1.7), controller model (Section 14.1.8), and controller class (Section 14.1.9)
8. Controller software version (Section 14.1.10).
9. Controller hardware version (Section 14.1.11).
10. Multiunit code (Section 14.1.12).
11. Drive serial number (Section 14.1.14), drive class (Section 14.1.16), and drive model (Section 14.1.15).
12. Drive software version (Section 14.1.17).
13. Drive hardware version (Section 14.1.18).
14. Position (gap count) (Section 14.1.24).
15. Formatter software version (Section 14.1.25).
16. Formatter hardware version (Section 14.1.26).
17. Get extended drive status bytes (Section 14.1.37).
18. Extended drive status information (Section 14.1.37).

CHAPTER 11
RT-11 ERROR LOG MESSAGE

11.1 INTRODUCTION

Chapter 11 covers the RT-11 error log message, explains how to invoke the error log utility, and explains how to decode the RT-11 error log message.

RT-11 is generally run on systems with limited memory so the error logger may not be running. In that case, there is no an error log.

11.2 HOW TO INVOKE RT-11 ERROR LOG UTILITY

Ask the operator to invoke the RT-11 error log utility or ask for permission to use the system.

```
. SHOW ERROR/ALL
```

This goes to the terminal.

```
. SHOW ERROR/ALL/PRINTER
```

This goes to the printer.

11.3 HOW TO DECODE RT-11 ERROR LOG MESSAGE

Example 11-1 is used to explain how to decode the information in a RT-11 error log message. The numbers on the right-hand side of the example refer to the list of definitions following the example.

Example 11-1 RT11 End Message

```
*********************************************************************
DISK DEVICE ERROR
LOGGED 8-DEC-83 11:06:21
*********************************************************************

UNIT IDENTIFICATION                                                1
        PHYSICAL UNIT NUMBER                                       000001
        TYPE                                                       DU/MSCP

SOFTWARE STATUS INFORMATION:
        MAXIMUM RETRIES    8.
        REMAINING RETRIES  0.
        OCCURRENCES OF THIS ERROR WITH IDENTICAL REGISTERS  1.

DEVICE INFORMATION
        REGISTERS:
        DU1            000000                                    2
        DU2            000000                                    3
        DU3            000241                                    4
        DU4            000011                                    5
        DU5            000000                                    6
        DU6            000000                                    7
        DU7            000000                                    8
        DU8            000000
        DU9            000000
        DU10           000000
        DU11           000000
        DU12           000000
        DU13           000000
        DU14           000000
        DU15           000000
        DU16           000000
        DU17           117234
        DU18           000003
        DU19           046271
        DU20           000000

        ACTIVE FUNCTION                  READ                    9
        BLOCK                          063254
        PHYSICAL BUFFER ADDRESS START  002000
        TRANSFER SIZE IN BYTES          12564

ERROR LOG REPORT RT11 V05.00 - COMPILED 9-DEC-83 12:22:38
```

1. Information in this field is false. Ignore.
2. Unit number (Section 14.1.2).
3. Reserved.
4. Endcode and flag. The low byte is the endcode (Section 14.1.40). The high byte is the flag (Section 14.1.42).
5. Status (Section 14.1.6).
6. Word count.
7. Word count
8. DU7 through DU20 have no meaning in this example.
9. The active function at the time of the error.

CHAPTER 12
ULTRIX 32 ERROR LOG MESSAGE

12.1 INTRODUCTION

Chapter 12 covers the ULTRIX error log message, explains how to invoke the error log utility, and explains how to decode the ULTRIX error log message.

12.2 HOW TO INVOKE ULTRIX ERROR LOG UTILITY

Ask the operator to invoke the ULTRIX error log utility for you, or ask for permission to use the system.

To display the last 200 lines of the error message file on the video terminal, type the following at the prompt:

```
% tail -200 /usr/adm/messages
```

For different line numbers, type the subtitute value for 200 in the example above.

12.3 HOW TO DECODE ULTRIX ERROR LOG MESSAGE

Notice the information in an ULTRIX error log message is displayed in both octal and hexadecimal format.

Example 12-1 shows an ULTRIX SDI error message. Each field of the error message is explained in Table 12-1.

Example 12-1 ULTRIX SDI Error Log Message

```
uda0 hard error sdi error unit 1 event 353 hdr 0

1b 00 20 00 00 0a 00 45 00 02 42 1c

10003c 80043f98 1 eb4103 cc595344 1060081 10004 697e 2050000

407 511f 0 20001b 45000a00 1c420200
```

12.3.0.1 ULTRIX SDI Error Log Message Decode

Table 12-1 explains the ULTRIX SDI error message fields.

Table 12-1 ULTRIX SDI Error Log Message Decode

Field	Description
uda0	Device reporting the error. In this example, the UDA50 is 0.
hard error	Hard or soft error. In this example, the error is hard.
sdi error	Format field (Section 14.1.4). In this example, it is an SDI error.
unit 1	Unit field (Section 14.1.2). In this example, the unit is 1.
event 353	Status/event code (Section 14.1.6). In this example, the status/event code is 353.
hdr 0	Header (Section 14.1.22). In this example, the header is LBN 0.
1b	Low byte of Word 22. In this example, the low byte of Word 22 is 1b (Section 14.1.34).
00	High byte of Word 22. In this example, the high byte of Word 22 is 0 (Section 14.1.34).
20	Low byte of Word 23. In this example, the low byte of Word 23 is 20 (Section 14.1.34).
00	High byte of Word 23. In this example, the high byte of Word 23 is 0 (Section 14.1.34).
00	Low byte of Word 24. In this example, the low byte of Word 24 is 0 (Section 14.1.34).
0a	High byte of Word 24. In this example, the high byte of Word 24 is 0a (Section 14.1.34).
00	Low byte of Word 25. In this example, the low byte of Word 25 is 0 (Section 14.1.34).
45	High byte of Word 25. In this example, the high byte of Word 25 is 45 (Section 14.1.34).
00	Low byte of Word 26. In this example, the low byte of Word 26 is 0 (Section 14.1.34).
02	High byte of Word 26. In this example, the high byte of Word 26 is 02 (Section 14.1.34).
42	Low byte of Word 27. In this example, the low byte of Word 27 is 42 (Section 14.1.34).
1c	High byte of Word 27. In this example, the high byte of Word 27 is 1c (Section 14.1.34).
10003c	This is not part of the SDI error. It contains information for the host driver: 10 = message credits 00 = virtual cricuit number 003c = message length
80043f98	Words 0 and 1 of the command reference number (Section 14.1.1).
1	Words 2 and 3. Word 2 is the unit number (Section 14.1.2). Word 3 is the sequence number, see (Section 14.1.3).
eb4103	Words 4 and 5. Word 4 low byte is the format byte (Section 14.1.4). Word 4 high byte is the flag byte (Section 14.1.5). Word 5 is the status/event code (Section 14.1.6).

Table 12-1 (Cont.) ULTRIX SDI Error Log Message Decode

Field	Description
cc595344	Words 6 and 7 and are the low and middle words of the controller serial number (Section 14.1.7).
1060081	Words 8 and 9. Word 8 is the high word of the controller serial number (Section 14.1.7). Word 9 low byte is the controller model (Section 14.1.8). Word 9 high byte is the controller class (Section 14.1.9).
10004	Words 10 and 11. Word 10 high byte is the controller hardware version (Section 14.1.11). Word 10 low byte is the controller software version (Section 14.1.10) Word 11 is reserved.
697e	Word 12 and 13 of the low and middle words of the drive serial number (Section 14.1.14).
2050000	Word 14 and 15. Word 14 is the high word of the drive serial number (Section 14.1.14). Word 15 high byte is the drive class (Section 14.1.16). Word 15 low byte is the drive model (Section 14.1.15).
407	Word 16 and 17. Word 16 high byte is the drive hardware version (Section 14.1.18). Word 16 low byte is the drive software version (Section 14.1.17). Word 17 is reserved.
511f	Word 18 and 19. These two words contain the pack/HDA serial number (Section 14.1.21).
0	Word 20 and 21. These two words contain the logical block number (Section 14.1.22).
20001b	Word 22 and 23. These two words contain the drive status words (Section 14.1.34).
45000a00	Word 24 and 25. These two words contain the drive status/error information (Section 14.1.34).
1c420200	Word 26 and 27. These two words contain the drive status/error information (Section 14.1.34).

CHAPTER 13
MISCELLANEOUS ERROR LOG MESSAGES

13.1 INTRODUCTION

Chapter 13 covers various error log messages that do not fall under the general MSCP/TMSCP formats including:

- Last Fail error log message (Section 13.2).
- BIIC error log message (Section 13.3).
- Remanufactured MSCP control message (Section 13.4).
- Unexpected End message (Section 13.5).
- SA Register Reported error (Section 13.6).

13.2 LAST FAIL ERROR LOG MESSAGE

Last fail messages are used when the severity or type of error is such that the controller MSCP server microcode must go unavailable to the class driver, thereby, ending the current MSCP connection. When a valid MSCP connection is reestablished (by controller reinitialization), the controller sends the last fail message to the host. This message reports the error that caused the previous connection to fail. It does not report the existence of an error with the current connection.

Last fail messages look similar to controller error log messages and BIIC error log messages. Some of their differences are:

- Command reference numbers of 0.
- Format code of 0 and status/event code of A (Hex).
- The occur after reinitialization only.
- Message type field of 4. Message type 4 is a UDA port message (The UDA50, KDA50-Q, and KDB50 use the same port specification.)

13.2.1 How To Decode Initialization and Last Fail Message

Last fail message (Example 13-1) shows an initialization sequence followed by a last fail error log message.

The initialization sequence progresses through the four initialization steps. The controller then sends the host a last fail message. Four rules for identifying a last fail message follow:

- The message occurs immediately following initialization.
- The format code is 00 (controller format).
- The status/event code is A (hex) indicating controller error.
- The message type field is 4 (UDA port message).

For error analysis, the most important field in the last fail message is the last fail code. In Example 13-1, it is 000B-bus master error.

Example 13-1 Initialization and Last Fail Message

```
***************************** ENTRY      NN. *******************************
ERROR SEQUENCE nnn                                      LOGGED ON SID nnnnnnnn

INIT SEQUENCE         dd-mmm-yyyy hh:mm:ss.ss
                      KA820  REV# n  PATCH REV# n.  UCODE REV# n.
                      SECONDARY PATCHES ARE LOADED

      UCB$W_PORTSTEP1      0B60                                          1
                                   PORT SUPPORTS ADDRESS MAPPING
                                   ENHANCED DIAGNOSTICS IMPLEMENTED
                                   22-BIT HOST ADDRESSING SUPPORTED
                                   STEP1
      UCB$W_HOSTSTEP1      A480
                                   INTERRUPT VECTOR 0 (OCTAL)
                                   INTERRUPT ENABLE
                                   16. RING RESPONSE SLOTS
                                   16. COMMAND RING SLOTS
      UCB$W_PORTSTEP2      10A4
                                   16. RING RESPONSE SLOTS
                                   16. COMMAND RING SLOTS
                                   STEP 2
      UCB$W_HOSTSTEP2      0408
      UCB$W_PORTSTEP3      2080
                                   INTERRUPT VECTOR 000000 (OCTAL)
                                   INTERRUPT ENABLE
                                   STEP 3
      UCB$W_HOSTSTEP3      0000
      UCB$W_PORTSTEP4      4125
                                   CONTROLLER MICROCODE #5.
                                   PORT IS KDB50
                                   STEP4
      UCB$W_HOSTSTEP4      0003
                                   GO
                                   HOST REQUESTS "LAST FAIL"
                                   "BURST", 2. 16-BIT TRANSFER(S)

MAPPING ALLOCATION INFORMATION

      VEC$L_MAPREG     00000000                                          2
      ORB$L_OWNER      00000000                                          3
                                   OWNER UIC [000,000]
      UCB$L_CHAR       0C450000                                          4
                                   SHARABLE
                                   AVAILABLE
                                   ERROR LOGGING
                                   CAPABLE OF INPUT
                                   CAPABLE OF OUTPUT
     UCB$W_STS             0800                                          5
                                   SOFTWARE VALID
     UCB$W_OPCNT       00000000                                          6
                                   0. QIO'S THIS UNIT
     UCB$W_ERRCNT          0006                                          7
                                   6. ERRORS THIS UNIT
     UCB$W_NUMBINITS       0005                                          8
                                   5. INIT SEQUENCE(S)
```

(Continued on next page)

Example 13-1 (Cont.) Initialization and Last Fail Message

```
****************************** ENTRY      n. ****************************
ERROR SEQUENCE nnn                                         LOGGED ON SID nnnnnnnn

ERL$LOGMESSAGE ENTRY    DD-MMM-YYYY   hh:mm:ss.ss
                        KA820 REV# n  PATCH REV# n.    UCODE REV# n.
                        SECONDARY PATCHES ARE LOADED

"DSA" PORT SUB-SYSTEM, UNIT _BOHICA$PUBO:

MSLG$L_CMD_REF    00000000                                          9
MSLG$W_SEQ_NUM        0000                                          10
                                  SEQUENCE #0.
MSLG$B_FORMAT           00                                          11
                                  CONTROLLER ERROR
MSLG$B_FLAGS            01                                          12
                                  SEQUENCE NUMBER RESET
MSLG$W_EVENT          000A                                          13
                                  CONTROLLER ERROR
                                  UNKNOWN SUBCODE #0000(X)
MSLG$Q_CNT_ID     00000000                                          14
                  01120000                                          15
                                  UNIQUE IDENTIFIER, 000000000000
                                  MASS STORAGE CONTROLLER
                                  KDB50
MSLG$B_CNT_SVR          05                                          16
                                  CONTROLLER SOFTWARE VERSION #5.
MSLG$B_CNT_HVR          12                                          17
                                  CONTROLLER HARDWARE REVISION #18.
MESSAGE TYPE          0004                                          18
                                  UDA PORT MESSAGE
"LAST-FAIL" CODE      000B                                          19
                                  "LAST-FAIL" CODE
                                  BUS MASTER ERROR
```

1. Data from controller initialization handshake sequence. See controller dependent information (Section 14.1.33).
2. Information on Map registers and Data path used for this transfer.
3. Volume owner (UIC).
4. Characteristics for UCB (Section 14.1.38).
5. Unit status (Section 14.1.39).
6. Number of I/O operations performed by this unit since last bootstrap.
7. Number of device errors detected by the unit since last bootstrap.
8. Number of times controller has been initialized since last bootstrap.
9. Command reference number (Section 14.1.1).
10. Sequence number (Section 14.1.3).
11. Format code (Section 14.1.4).
12. Message flags (Section 14.1.5).
13. Status/Event code (Section 14.1.6).
14. Controller serial number (Section 14.1.7).
15. Controller model (Section 14.1.8) and the controller class (Section 14.1.9).

16. Controller software version (Section 14.1.10).

17. Controller hardware version (Section 14.1.11).

18. VMS message type (Section 14.1.23).

19. Last fail code (Section 14.1.33).

13.3 BIIC ERROR LOG MESSAGE

For the KDB50, BIIC error log messages are generated by the host whenever the BIIC on the KDB50 issues an error interrupt. This occurs when a hard error bit sets in the BER register. BIIC messages are comprised of data the host reads from the KDB50 BIIC registers.

Because some errors flagged by a bit in the BER are also detected by the BPROC microcode stream, two messages describing the same error can be received.

13.3.1 How To Decode BIIC Error Log Message

The BIIC message looks very similar to the controller error log message and the last fail message. However, the message type field for a BIIC error log entry is 0D (hex). See Example 13-2.

Example 13-2 BIIC Error Log Message

```
***************************** ENTRY      nnn *****************************
ERROR SEQUENCE nnn                                  LOGGED ON SID nnnnnnnn

ERL$LOGMESSAGE ENTRY     dd-mmm-yyyy hh:mm:ss.ss
                         KA820 REV# n  PATCH REV# n.  UCODE REV# n.
                         SECONDARY PATCHES ARE LOADED

MSLG$L_CMD_REF    00000000                                    1
MSLG$W_SEQ_NUM        0000                                    2
                                  SEQUENCE #0.
MSLG$B_FORMAT           00                                    3
                                  CONTROLLER ERROR
MSLG$B_FLAGS            00                                    4
MSLG$W_EVENT          000A                                    5
                                  CONTROLLER ERROR
                                  UNKNOWN SUBCODE #0000(X)
MSLG$Q_CNT_ID     00000000                                    6
                  00000000                                    7
                                  UNIQUE IDENTIFIER, 000000000000
MSLG$B_CNT_SVR          00                                    8
                                  CONTROLLER SOFTWARE VERSION #0.
MSLG$B_CNT_HVR          00                                    9
                                  CONTROLLER HARDWARE REVISION #0.
MESSAGE TYPE          000D                                    10
                                  KDB50 ERROR DETECTED
DTYPE             0512010E                                    11
                                  KDB50
                                  T1002 (PROC) HRDWRE REV = 2
                                  T1003 (SDI) HRDWRE REV = 1
                                  KDB50 (UCODE) SFTWRE REV = 5.
VAXBICSR          01018886
                                  NODE ID = 6
                                  ARB CONTROL = DUAL ROUND ROBIN
                                  HARD ERROR INTR ENABLE
                                  SELF-TEST STATUS
                                  HARD ERROR SUMMARY
                                  BI INTERFACE TYPE = 01
                                  BI INTERFACE REV = 01
BER               00040008
                                  USER PARITY ENABLED
                                  BUS TIMEOUT
EINTRCSR          00820158
                                  INTERRUPT VECTOR = 0158
                                  BR LEVEL ENABLE 5
                                  INTR COMPLETE
INTRDES           00000004
BCICSR            00002080
                                  BIIC CSR SPACE ENABLE
                                  STOP ENABLE
UINTRCSR          00000118
GPR0              00000000
                                  INITIALIZATION/POLLING REGISTER
GPR1              00038006
                                  RING READ PARITY ERROR/TIMEOUT
                                  ERROR
```

1. Command reference number (Section 14.1.1).
2. Sequence number (Section 14.1.3).
3. Format code (Section 14.1.4).
4. Message flags (Section 14.1.5).
5. Status/Event code (Section 14.1.6).
6. Controller serial number (Section 14.1.7).
7. Controller model (Section 14.1.8) and the controller class (Section 14.1.9).
8. Controller software version (Section 14.1.10).
9. Controller hardware version (Section 14.1.11).
10. VMS message type (Section 14.1.23).
11. Register call outs of the KDB50 controller.

13.4 REMANUFACTURED MSCP CONTROL MESSAGE

The remanufactured MSCP control message occurs when the controller returns an end message with an invalid command status code. After receiving this end message from the controller, the class driver appends what it sent to the controller to the message. As a result, the error log entry reflects what the controller thought it received and what the class driver thought it sent.

13.4.1 How To Decode Remanufactured MSCP Control Message

The remanufactured MSCP control message shows that the controller thought the class driver sent an MSCP command containing an invalid field. See Example 13-3.

Example 13-3 Remanufactured MSCP Control Message

```
****************************** ENTRY     n. *****************************
ERROR SEQUENCE nnn.                                  LOGGED ON SID nnnnnnnn

ERL$LOGMESSAGE ENTRY    dd-mmm-yyyy hh:mm:ss.ss
                        KA820  REV# n  PATCH RE# n.  UCODE REV# n.
                        SECONDARY PATCHES ARE LOADED

I/O SUB-SYSTEM, UNIT _BOHICA$DUBO:

"INVALID COMMAND" MSCP END MESSAGE

      MSCP$L_CMD_REF  D1D10000                                   1
      MSCP$W_UNIT         0000                                   2
                                      UNIT #0.
      RESERVED            0000
      MSCP$B_ENDCODE        80                                   3
                                      CONTROL MESSAGE TYPE, #128.
      MSCP$B_FLAGS          00                                   4
      MSCP$W_STATUS       1001                                   5
                                      INVALID COMMAND
                                      UNKNOWN SUBCODE #0080(X)
      MSCP$L_BYTE_CNT 00000000                                   6
      RESERVED        00000004                                   7
                      00000000
                      00000000
      MSCP$L_LBN      00061D7D                                   8
REMANUFACTURED "MSCP" CONTROL MESSAGE

      MSCP$L_CMD_REF  D1D10000                                   9
      MSCP$W_UNIT         0000                                   10
                                      UNIT #0.
      RESERVED            0000
      MSCP$B_OPCODE         12                                   11
                                      ERASE
      RESERVED              00
      MSCP$W_MODIFIER     0000                                   12
      MSCP$L_BYTE_CNT 00000200                                   13
                                      BYTE COUNT, 512. BYTE(S)
      RESERVED        00000000
                      00000000
                      00000000
      MSCP$L_LBN      00061D7D                                   14
                                      LOGICAL BLOCK #400765.
****************************************************************************
```

1. Command reference number (Section 14.1.1).
2. Unit number (Section 14.1.2).
3. End code (Section 14.1.40).
4. End flag (Section 14.1.42).
5. Status (Section 14.1.6).
6. Byte count (Section 14.1.43).
7. This field should contain zero. The 4 in this example caused the remanufactured message.
8. First bad block (Section 14.1.44).

9. Command reference number (Section 14.1.1).
10. Unit number (Section 14.1.2).
11. Command sent to the unit (Section 14.1.40).
12. Command modifier of the command sent to the unit (Section 14.1.45).
13. Byte count (Section 14.1.43).
14. First bad block (Section 14.1.44).

13.5 UNEXPECTED END MESSAGE

An Unexpected End message points out fields that help in troubleshooting (Example 13-4).

Example 13-4 Unexpected End Message

```
****************************** ENTRY      n. *****************************
ERROR SEQUENCE nnn.                                    LOGGED ON SID nnnnnnnn

ERL$LOGMSCP ENTRY    dd-mmm-yyyy hh:mm:ss.ss
                     KA820  REV# n  PATCH REV# n.  UCODE REV# nn.
                     SECONDARY PATCHES ARE LOADED

      CLASS DRIVER    4B534944                                         1
                                      /DISK/

      CDDB$Q_CNTRLID  00000000                                         2
                      01120000                                         3
                                      UNIQUE IDENTIFIER, 000000000000
                                      MASS STORAGE CONTROLLER
                                      KDB50

      CDDB$B_SYSTEMID 80039400                                         4
                          8004

      UNEXPECTED END MESSAGE "MSCP$W_STATUS"                           5
                                                                       6
      MSCP$L_CMD_REF  D2550004                                         7
      MSCP$W_UNIT         0000                                         8
                                     UNIT #0.

      RESERVED            0000
      MSCP$B_ENDCODE        A2                                         9
                                     CONTROL MESSAGE TYPE, #162.

      MSCP$B_FLAGS          00                                         10
      MSCP$W_STATUS       00A9                                         11
                                     HOST BUFFER ACCESS ERROR
                                     INVALID PAGE TABLE ENTRY

      MSCP$L_BYTE_CNT 00000000                                         12
                                     BYTE COUNT, 0. BYTE(S)

      RESERVED        00000000
                      00000000
                      00000000

      MSCP$L_LBN      00000000                                         13
**************************************************************************
```

1. Driver identification.
2. Controller serial number (Section 14.1.7).
3. Controller model and controller class (Sections 14.1.8 and 14.1.9).
4. System ID (Section 14.1.41).

5. What the driver saw as incorrect.
6. A dump of the message received by the driver.
7. Command reference number (Section 14.1.1).
8. Unit number (Section 14.1.2).
9. Command sent to the unit (Section 14.1.40).
10. End flag (Section 14.1.42).
11. Status (Section 14.1.6).
12. Byte count (Section 14.1.43).
13. First bad block (Section 14.1.44).

13.6 SA REGISTER REPORTED ERROR

The SA register is used to report serious errors that prevent the controller from providing the host with a normal error log message.

Example 13-5 is an SA register reported error message. The SA register reported error message is followed by an initialization sequence. Initialization is covered in Section 13.2.1.

Example 13-5 SA Register Reported Error Message

```
***************************** ENTRY        n. ****************************
ERROR SEQUENCE nnn.                                  LOGGED ON SID nnnnnnnn

DEVICE ATTENTION    dd-mmm-yyy hh:mm:ss.ss
                        KA820  REV# n  PATCH REV# n.  UCODE REV# n.
                        SECONDARY PATCHES ARE LOADED

"DSA" PORT SUB-SYSTEM, UNIT _BOHICA$PUBO:,"SA" ERROR BIT SET

      SA                   8003                                       1
                                         CONTROLLER "ROM" OR "RAM" PE
                                         ERROR
                                .
                                .
                                .
                                .
                                .
                                .
**************************************************************************
```

1. SA register error code (Section 14.1.33).

CHAPTER 14
ERROR LOG MESSAGE FIELDS

14.1 INTRODUCTION

Even though the error log message printouts vary in appearance on different operating systems, they contain some or all of the same error log message fields. The following field definitions help explain the message and obtain the information needed.

14.1.1 Command Reference Number

A command reference number identifies which MSCP/TMSCP Command Packet was being executed at the time the error was detected. The command reference number is zero if the error message is not related to an outstanding MSCP/TMSCP command, or if the operating system does not use this feature. If several errors are reported while executing a particular command, those error log messages all have the same number in this position.

14.1.2 Drive Unit Number

The logical unit number is reflected on the operator control panel of a drive. This number is programmed by clipping tabs from the drive ready plug, set by switches, or various other methods. If the error message does not refer to a specific device or unit, the number is zero. Because customers may change the ready plugs after the error is logged, this number may not determine which drive is defective. Check the drive serial number provided in the error log message.

14.1.3 Sequence Number

The sequence number is assigned to an error log message when passing information to the host error logger. The use of the sequence number is dependent on the MSCP/TMSCP server in the controller microcode. If the sequence number is zero, the controller does not support use of this feature.

14.1.4 Format Code

A number in the format code field indicates which of the ten types of error log messages is being used. Knowing the type of error log message is *CRITICAL* to accurately define the fields within the packet. Table 14-1 contains the error log message format codes.

Table 14-1 Error Log Message Types

Format	Type	Description
0	Controller error	Reports controller errors. The error may not be in the controller; however, the controller detects the error and reports it by this type of message. This message also reports errors the controller detects within itself such as RAM or ROM parity errors. If an error within the controller is severe enough to prevent further communication with the host, the controller provides a last fail message to the host upon reinitializing and resumes communication with the host. Last fail messages can be identified by a format code of 0 (controller error log message) and the Status/Event code of 12 (Octal) or A (Hex) (controller error). If this condition is true, the message is a last fail message and not a controller error log message. After the initializing process is complete, the controller delivers a last fail message to the host detailing any errors that need reporting.
1	Memory error	Reports errors detected by the controller relating to the controller's access of host memory or controller memory. The controller uses the host memory to transfer data, to retrieve command messages, and to deposit response and error log messages. Thus, a quality path to host memory is critical to proper operation of a controller. If the controller detects a memory problem, it assembles a memory error message and attempts to deposit the message in the response and error log message area of host memory.
2	Disk transfer error	Reports errors detected by the controller that occur during a disk data transfer between the controller and drive. A common error log message reports a controller-detected error occurring during a data transfer. For instance, this message type reports ECC errors and informs the host when error correction is used to correct the data. ECC errors reported by this message type are used when the amount of ECC correction needed exceeds a predetermined threshold as defined by each type of drive. The header code will provide information on the LBNs or RBNs.
3	SDI error	Reports SDI errors detected in the drive and errors that occur within the drive. After an SDI error is detected, the controller may retry a failed command. A separate error log message is generated for each attempt that failed.
4	Small disk error	Reports drive-detected errors for disks with less than 65535 cylinders.
5	Tape data transfer error	Reports errors detected while transferring data between the controller and drive.

Table 14-1 (Cont.) Error Log Message Types

Format	Type	Description
6	STI communication or command failures	Reports STI communication problems with the formatter or relating to the execution of TMSCP commands. The controller may attempt several retries, and a separate error log message is generated for each failed attempt. The 12-byte field of an STI unsuccessful response is specific to the STI communications or command failure message.
7	STI drive requested error log	Reports STI errors detected in the drive and errors that occur within the drive. The driver sets the EL bit requesting the controller to issue a GET STATUS command. The 62-byte STI Get Extended Drive Status response field is specific to the STI drive requested error log.
8	STI formatter requested error log	Reports errors the formatter detects. The formatter sets the EL bit requesting the controller to issue a GET STATUS command. The STI Get Extended Formatter Status Response field is specific to the STI formatter requested error log.
9	Bad block replacement attempt	Reports completion of a bad block replacement attempt. A message is always generated regardless of the success or failure of the replacement attempt. The Bad Block Replacement message is generated by the host software if the host software is responsible for doing the block replacement. Examples are the UDA50A, KDA50, KDB50 controller based systems. For HSC50/70 and RQDX controller based systems, the controller is responsible for doing block replacement, generating the message, and delivering the message to the host.

14.1.5 Message Flags

The error log message flag reports the various attributes of the error. See Table 14-2.

Table 14-2 Error Log Message Flag

Bit Number	Bit Mask Hex	Format Description
7	80	The operation causing this error log message has been successfully completed. The error log message summarizes the retry sequence required to complete the operation.
6	40	The retry sequence for this operation is continued. This error log message reports unsuccessful completion of one or more retries.
5	20	The identified logical block number (LBN) needs to be replaced.

Table 14-2 (Cont.) Error Log Message Flag

Bit Number	Bit Mask Hex	Format Description
4	10	The reported error occurred during a disk access initiated by the controller bad block replacement process.
0	1	The error log sequence number has been reset by the MSCP server.

NOTE
If Operation Successful (Bit 7) and Operation Continuing (Bit 6) are both clear, a hard unrecoverable error exists.

Bits 4 and 5 are only used in the BBR error log message.

The XDA controllers have no control over the use of the BBR error log message. The host operating system has control of the BBR error log message if the XDA controller is used. Examples of these controllers are UDA50-A and KDA50-A.

All operating systems do not use the BBR error log message the same way VMS does. Bits 4 and 5 may or may not be used.

14.1.6 Status/Event Code

The Status/Event code provides the controller's interpretation of the problem. In many cases, this code is the only indication of what is wrong. A specific error or event is reported by this error log message. Table 14-3 contains the Status/Event codes and their meanings.

Table 14-3 Status/Event Code

Event Code			
Hex	Octal	Class	Description
0000	000000	Success	Normal.
0001	000001	Invalid command	Invalid message length.
0002	000002	Command aborted	Command aborted.
0003	000003	Unit offline	Unit unknown or online to another controller.
0004	000004	Unit available	Unit available.
0007	000007	Compare error	Data compare error.
0008	000010	Data	Disk—Sector was written with Force Error modifier.
			Tape—Long gap encountered.

Table 14-3 (Cont.) Status/Event Code

Event Code Hex	Octal	Class	Description
0009	000011	Host buffer	Host buffer access error; cause not available. The controller was unable to access a host buffer to perform a transfer.
000A	000012	Disk Tape	Host command timeout expired. Command timeout/Retry limit exceeded.
000B	000013	Tape	Device response check.
000C	000014	Shadow set status has changed	Shadow set status has changed.
000D	000015	BOT encountered	BOT encountered.
000E	000016	Tape mark encountered	Tape mark encountered.
0010	000020	Record data truncated	Record data truncated, data transfer operation.
0011	000021	Tape	Position lost error.
0013	000023	LEOT detected	LEOT detected.
0014	000024	Bad block replacement	Bad block successfully replaced.
0016	000026	Access denied	Access denied.
0020	000040	Success	Spindown ignored.
0023	000043	Unit offline	Disk—No volume mounted or drive disabled via RUN/STOP switch. Tape—No media mounted or disabled via switch setting.
0026	000046	Unit available	No members are in shadow set.
0028	000050	TU81 TK	AGC fault. Data sync not found.
0029	000051	Host buffer	Odd transfer address.
002A	000052	Controller TU81 TK	SERDES overrun or underrun error. Data late. Communication channel timeout data or control.

Table 14-3 (Cont.) Status/Event Code

Event Code Hex	Octal	Class	Description
002B	000053	Disk	Drive command timeout.
		TU81	Device hardware check.
		TK	Command timeout.
002C	000054	Tape	Equipment check.
0034	000064	Bad block replacement	Block verified OK—Not a bad block.
0035	000065	Invalid parameter	Invalid key length. The key length is too short for the specified key type.
0040	000100	Success	Still connected.
0043	000103	Unit offline	Unit is inoperative. For SI drives, the controller has marked the drive inoperative due to an unrecoverable error in a previous Level 2 exchange, the drive C1 flag is set, or the drive has a duplicate unit identifier.
0044	000104	Unit available	Shadow set copy in progress.
0048	000110	Disk data	Invalid header.
		TU81	ID fault.
		TK	Write lost data error.
0049	000111	Host buffer	Odd byte count.
004A	000112	Controller	EDC error.
		TU81	Invalid command.
004B	000113	Disk drive	Controller-detected transmission error.
		TU81	Velocity check.
		TK	Controller-detected transmission error.
004C	000114	TU81	Intervention required.
0054	000124	Bad block replacement	Replacement failure—REPLACE command or its analogue failed.
0055	000125	Invalid Parameter	Invalid key type—The controller does not implement the specified key type.
0068	000150	Disk data	Data sync not found (data sync timeout).
		TU81	Read data check.
		TK	Recoverable read data error.
0069	000151	Host buffer	Nonexistent memory error.

Table 14-3 (Cont.) Status/Event Code

Event Code Hex	Event Code Octal	Class	Description
006A	000152	Controller TU81 TK	Inconsistent internal control structure. Formatter timeout. Internal inconsistency.
006B	000153	Disk drive TU81 TK	Positioner error Device command check. Recoverable drive fault.
006C	000154	TU81	Command reject.
0074	000164	Bad block replacement	Replacement failure—Inconsistent RCT.
0075	000165	Invalid parameter	Invalid key value—A checksum or similar means indicates the key value is internally inconsistent.
0080	000200	Success	Duplicate unit number.
0083	000203	Unit offline	Duplicate unit number.
0085	000205	Media format	Characteristics or protection mismatch for shadow member.
0088	000210	Disk data TU81	Correctable error in ECC field. Unit exception.
0089	000211	Host buffer	Host memory parity error.
008A	000212	Controller	Internal EDC error. A low-level check detected an inconsistent data structure. For example, a microcode-implemented checksum or vertical parity (hardware parity is horizontal) associated with internal sector data was inconsistent. This error usually implies a fault in the memory addressing logic of one or more controller processing elements. It can also result from a double bit error or other error exceeding the error detection capability of the controller hardware memory checking circuitry.
008B	000213	Disk drive TU81 TK	Lost R/W Ready during or between transfers. Airflow/Temperature check. Unrecoverable drive fault.
008C	000214	TU81	Formatter response check.
0094	000224	Bad block replacement	Replacement failure—drive access failure. One or more transfers specified by the replacement algorithm failed.

Table 14-3 (Cont.) Status/Event Code

Event Code Hex	Octal	Class	Description
00A5	000245	Disk media	Disk not formatted with 512-byte sectors. The disk, FCT, indicates it is formatted with 576-byte sectors, although both the controller and the drive support only 512-byte sectors.
00A8	000250	TU81	Buffer overflow.
00A9	000251	Host buffer	Invalid page table entry. See Unibus/Q-bus Storage Systems Port Specifications for additional detail.
00AA	000252	Controller	LESI Adapter Card parity error on input (adapter to controller).
00AB	000253	Disk drive	Drive clock dropout. For SI drives, either data or state clock was missing when it should have been present. This is usually detected by means of a timeout.
00AC	000254	TU81	Formatter read sense error.
00B4	000264	Bad block replacement	Replacement failure; no replacement block available. Replacement was attempted for a bad block, but a replacement block could not be allocated. For example, the volume's RCT is full.
00C5	000305	Disk media	Disk not formatted or FCT corrupt. The disk, FCT, indicates the disk is not formatted in either 512 or 576-byte mode.
00C8	000310	TU81	Buffer in parity error.
00C9	000311	Host buffer	Invalid buffer name. The key in the buffer name does not match the key in the buffer descriptor, the B bit in the buffer descriptor is clear, or the index into the buffer descriptor table is too large.
00CA	000312	Controller	LESI Adapter Card parity error on output (controller to adapter).

Table 14-3 (Cont.) Status/Event Code

Event Code Hex	Event Code Octal	Class	Description
00CB	000313	Disk drive	Lost receiver ready for transfer. For SI drives, Receiver Ready was negated when the controller attempted to initiate a transfer, or Receiver Ready was not asserted at the completion of a transfer. This includes all cases of the controller timeout expiring for a transfer operation (Level 1 Real-time command).
00D4	000324	Bad block replacement	Replacement failure. Two successive RBNs were bad.
00E8	000350	Data	Disk—Uncorrectable ECC error. A transfer without the Suppress Error Correction modifier encountered an ECC error exceeding the correction capability of the subsystem error correction algorithms; or, a transfer with the Suppress Error Correction modifier encountered an ECC error of any severity. Tape—Unrecoverable read error.
00E9	000351	Host buffer	Buffer length violation. The number of bytes requested in the MSCP command exceeds the buffer length as specified in the buffer descriptor.
00EA	000352	Controller	LESI Adapter Card cable is not in place.
00EB	000353	Disk drive	Drive-detected error. For SI drives, the controller received a GET STATUS or unsuccessful response with EL set, or the controller received a response with the DR flag set and does not support automatic diagnosis for that drive type.
0100	000400	Success	Already online.
0103	000403	Unit offline TU81	Unit disabled by field service or diagnostic. Unit disabled by F.S. or diagnostic.
0105	000405	Disk media	RCT corrupted. The RCT search algorithm encountered an invalid RCT entry. The subcode may be returned under the following conditions:

Table 14-3 (Cont.) Status/Event Code

Event Code Hex	Octal	Class	Description
			-During replacement of a block. -Revectoring a faulty block. -When a unit is brought online.
0106	000406	Write protected	Unit is data safety write protected.
0108	000410	Disk data TU81	One-symbol ECC error. Buffer out parity error.
0109	000411	Host buffer	Access control violation. The access mode specified in the buffer descriptor is protected against the PROT field in the PTE.
010A	000412	Controller	Controller overrun or underrun. The controller attempted to perform too many concurrent transfers causing one or more of them to fail due to a data overrun or underrun.
010B	000413	Disk drive	Controller-detected pulse or state parity error. For SI drives, the controller detected a pulse error on either the state or data line, or the controller detected a parity error in a state frame.
0125	000445	Disk media	No replacement block available. Replacement of a faulty block was attempted but a replacement block could not be allocated (the RCT is full). This subcode may be returned during actual replacement, and when an interrupted replacement is completed when a unit is brought online.
0128	000450	Disk data TU81	Two-symbol ECC error. Interface parity error.

Table 14-3 (Cont.) Status/Event Code

Event Code Hex	Octal	Class	Description
012A	000452	Controller	Controller memory error. The controller detected an error in an internal memory such as a parity error or nonresponding address. This subcode applies only to errors not affecting the ability of the HSC70 to properly generate end message and error log messages. Errors affecting end message and error log messages are not reported via MSCP. For most controllers, this subcode is returned only 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.
012B	000453	Disk drive	Drive-requested error log (EL bit set).
0148	000510	Disk data TU81	Three-symbol ECC error. LESI parity error.
014A	000512	Controller	PLI reception buffer parity error.
014B	000513	Disk drive	Controller-detected protocol error. For SI drives, a Level 2 response from the drive had correct framing codes and checksum but was not a valid response within the constraints of the SI protocol. The response had an invalid opcode, was an improper length, or was not a possible response in the context of the exchange.
0168	000550	Disk data TU81	Four-symbol ECC error. Airflow/temperature check.
016A	000552	Controller	PLI transmission buffer parity error.
016B	000553	Disk drive	Drive failed initialization. For SI drives, the drive clock did not resume following a controller attempt to initialize the drive. This implies the drive encountered a fatal initialization error.
0188	000610	Disk data	Five-symbol ECC error. Buffer underflow.
018B	000613	Disk drive	Drive ignored initialization. For SI drives, the drive clock did not cease following a controller attempt to initialize the drive. This implies the drive did not recognize the initialization attempt.

Table 14-3 (Cont.) Status/Event Code

Event Code Hex	Octal	Class	Description
01A8	000650	Disk data TU81	Six-symbol ECC error. CRC mismatch.
01AB	000653	Disk drive	Receiver Ready collision. For SI drives, the controller attempts to assert its RECEIVER READY when the RECEIVER READY of the drive is asserted.
01C8	000710	Disk data	Seven-symbol ECC error.
01CB	000713	Disk drive	Response overflow. A drive sent back more frames than the reception buffer could hold. This can be caused by a hung drive microdiagnostic or a malfunctioning K.sdi.
01E8	000750	Disk data	Eight-symbol ECC error. A transfer encountered a correctable ECC error with the specified number of ECC symbols in error. The number of symbols in error roughly corresponds to the severity of the error.
0200	001000	Success	Still online.
0203	001003	Unit offline	Exclusive use.
0208	001010	Disk data	Nine-symbol ECC error.
0220	001040	Success	Still online/unload ignored.
0228	001050	Disk data	Ten-symbol ECC error.
0248	001110	Disk data	Eleven-symbol ECC error.
0268	001150	Disk data	Twelve-symbol ECC error.
0288	001210	Disk data	Thirteen-symbol ECC error.
02A8	001250	Disk data	Fourteen-symbol ECC error.
02C8	001310	Disk data	Fifteen-symbol ECC error.
0400	002000	Success	Disk—Incomplete replacement. Tape—EOT encountered.
0404	002004	Unit available	Already in use.

Table 14-3 (Cont.) Status/Event Code

Event Code Hex	Event Code Octal	Class	Description
044B	002113	Tape drive	Drive error.
			Controller retry limit exhausted.
0800	004000	Success	Invalid RCT.
1000	010000	Success	Read only volume format.
1006	010006	Write protected	Unit is software write protected.
2006	020006	Write protected	Unit is hardware write protected.
F3AA	171652	Controller	Unknown K.tape error.
FCAA	176252	Controller	Word rate clock timeout—The K.sti detected the loss of clocks from a drive during a transfer.
FCEA	176352	Controller	Receiver Ready not asserted at start of transfer. The HSC70 is ready to start a transfer by sending the formatter a Level 1 command, and the formatter does not have Receiver Ready asserted.
FD2A	176452	Controller	Data Ready timeout. The controller did not detect DATA READY from the formatter within 5ms after sending it a Level 1 command.
FD6A	176552	Controller	Acknowledge not asserted at start of transfer. The HSC70 is ready to start a transfer by sending the formatter a Level 1 command, and the formatter does not have Acknowledge asserted.
FDEC	176754	Tape formatter	Extended drive status not available.
FE0C	177014	Tape formatter	Formatter summary status not available while trying to restore tape position.
FE2A	177052	Controller	Record EDC error. On a read from tape operation the EDC calculated by the K.sti did not match the EDC generated by the tape formatter.
FE2B	177053	Tape drive	Byte count not set.
FE4B	177113	Tape drive	Tape mark not written.
FE6B	177153	Tape drive	Unit characteristics not set.
FE8A	177212	Controller	Lower processor timeout. The upper processor in the K.sti detected the lower processor had stopped then restarted it.

Table 14-3 (Cont.) Status/Event Code

Event Code Hex	Octal	Class	Description
FE8B	177213	Tape drive	Unable to position to before LEOT.
FEAB	177253	Tape drive	Rewind failure.
FECB	177313	Tape drive	Online sequence not completed.
FEEB	177353	Tape drive	Erase gap failed.
FF0B	177413	Tape drive	ERASE command failed.
FF0C	177414	Tape formatter	TOPOLOGY command failed.
FF31	177461	Tape drive position lost	Retry limit exceeded while attempting to restore tape position.
FF68	177550	Tape data	Formatter retry sequence exhausted.
FF6A	177552	Controller	Lower processor error. A bit was set in the lower processor error register. Bits included in the lower processor error register are Data Bus NXM, Data SERDES Overrun, Data Bus Overrun, Data Bus Parity Error, Data Pulse Missing, and Sync Real Time Parity Error.
FF6B	177553	Tape drive	Tape drive requested error log.
FF6C	177554	Tape formatter	Formatter requested error log.
FF71	177561	Tape drive position lost	Formatter-detected position lost.
FF88	177610	Tape data	Controller transfer retry limit exceeded.
FF8A	177612	Controller	Buffer EDC error. The K.sti detected an EDC error on the data buffer it read from memory on a write operation.
FFA8	177650	Tape Data	Host requested retry suppression on a K.sti-detected error.
FFAA	177652	Controller	Data overflow due to pipeline error. No data buffers in HSC70 data memory were available during a data transfer.
FFC8	177710	Tape data	Reverse retry currently not supported.
FFCB	177713	Tape drive	Tape not in position for formatter retry.

Table 14-3 (Cont.) Status/Event Code

Event Code Hex	Octal	Class	Description
FFCC	177714	Tape formatter	Formatter errors not cleared.
FFD1	177721	Tape drive position lost	Formatter and HSC70 disagree on tape position.
FFE8	177750	Tape data	Host requested retry suppression on a formatter-detected error.
FFEB	177753	Tape drive	Drive errors not cleared.
FFEC	177754	Tape formatter	Formatter summary status during transfer error recovery not available.
FFF1	177761	Tape drive position lost	Controller-detected position lost.

NOTE

Codes 53/2B, 113/4B, 213/8B and 313/CB (Octal/Hex) occur most often as the result of a Drive-detected Error (S/E code 353(Octal) EB(Hex)). If you have an S/E Code 353(Octal) or EB(Hex) with the same Command Reference Number as an error log message entry with one of these codes, then troubleshoot the 353/EB not the 53/2B, 113/4B, 213/8B and 313/CB (Octal/Hex).

14.1.7 Unique Controller Number

Unique controller number is the serial number assigned to the controller. In the UDA50 this is always zero.

14.1.8 Controller Model

The Controller Model identifies the type or model of controller that delivered the error log packet to the host. The controller model values are shown in Table 14-4.

Table 14-4 Mass Storage Controller Model Values

Model Byte Octal	Hex	Controller Type
0	0	Reserved
1	1	HSC50
2	2	UDA50
3	3	RC25 (KLESI)

Table 14-4 (Cont.) Mass Storage Controller Model Values

Model Byte Octal	Hex	Controller Type
4	4	VMS (software MSCP server)
5	5	TU81 integrated controller
6	6	UDA50A
7	7	RQDX 1/2
10	8	TOPS 10/20 (software MSCP server)
11	9	TQK50, TUK50 (TK50)
12	A	RUX50
15	D	KDA50-Q
20	10	RRD50
23	13	RQDX3
40	20	HSC70

14.1.9 Controller Class

The Controller Class identifies the class of controller that delivered the error packet to the host. The Controller Class values are shown in Table 14-5.

Table 14-5 Mass Storage Controller Class Values

Class Byte Octal	Hex	Subsystem Type
0	0	Reserved
1	1	Mass storage controller
2	2	Disk class device—DEC Standard 166 disk
3	3	Tape class device
4	4	Disk class device—DEC Standard 144 disk

14.1.10 Controller Software Version

Controller software version provides the software (or microcode) version being used in the controller.

14.1.11 Controller Hardware Version

Controller hardware version provides the hardware revision of the controller reporting the error log packet. For example, the UDA50 always reports a 0 since the UDA50 cannot sense its current hardware revision. In this case, look at the C/S revision stamped on the modules.

14.1.12 Multiunit Code

The low byte of the multiunit code field contains a controller dependent encoding of the access path between the controller and the unit. The high byte contains a controller dependent encoding of the unit on an access path chosen by the controller. Controllers may use any encoding if each access path and each unit within an access path has a unique value.

14.1.13 Memory Address

The Memory Address error log message field provides the memory address where access was attempted when the error was detected. This is the address the host loads into the controller and MAY NOT be the actual PHYSICAL memory location that gets accessed. This could be very useful in troubleshooting bus or system type problems affecting the system.

The Memory Address field contains the controller memory where the error occurred. Errors that do not effect the controllers ability to properly generate End and Error Log Messages are reported by MSCP and Memory Error error log messages. Errors that might effect End and Error Log Messages are reported by some mechanism other than MSCP. Units of Memory Address are those natural to the memory where the error occurred.

14.1.14 Drive Serial Number

The drive serial number is included in the error log message, if the error being reported relates to a drive being accessed at the time the error.

14.1.15 Drive Model

Drive model identifies the type or model of drive being accessed when the error was detected. For disks, see Table 14-6; for tapes, see Table 14-7.

Table 14-6 Disk Identifier Values

Model Byte			
Octal	Hex	Device	Media
0	0	Reserved	
1	1	DU	RA80
2	2	DA	RC25
4	4	DJ	RA60
5	5	DU	RA81
6	6	DU	RD51
7	7	DU	RX50
10	8	DU	RD52

Table 14-6 (Cont.) Disk Identifier Values

Model Byte Octal	Hex	Device	Media
11	9	DU	RD53
13	B	DU	RA82
16	E	DU	RRD50
17	F	DU	RD31
20	10	DU	RD32

Table 14-7 Tape Identifier Values

Model Byte Octal	Hex	Device	Media
0	0	Reserved	
1	1	MU	TA78
3	3	MU	TK50
4	4	MU	TA81

14.1.16 Drive Class

Drive Class identifies the class (tape or disk) of the drive. See Table 14-8.

Table 14-8 Drive Class Values

Class Byte Octal	Hex	Subsystem Type
0	0	Reserved
2	2	Disk class devices—DSA drives
3	3	Tape class devices—TA drives

14.1.17 Drive Software Version

The software (or microcode) version being used on the drive microprocessor module. The number associated with the version of the software comes from a location in the microprocessor ROM. As such, the software version number cannot be changed unless new ROM chips are installed, or the microprocessor module (with ROMs) is replaced. The version changes as a result of ECOs.

14.1.18 Drive Hardware Version

The hardware version of the drive as determined by the revision of the various field replaceable units (FRUs).

14.1.19 Error Recovery Level

The error recovery level, used for the most recent attempt at a transfer is a device dependent encoding of the special error recovery procedures, such as offset head positioning, used for the most recent transfer attempt. The values 0 and 255 (all ones) are reserved to indicate no special error recovery procedures were used.

14.1.20 Retry

Retry count, within the current error recovery level of the most recent attempt at a transfer, starts at one for the first attempt and increments by one for each subsequent attempt. This continues up to some drive dependent maximum when the retry count is reset to one, and the next error recovery level (if any) is tried.

14.1.21 Volume Serial Number

The Volume Serial Number is the low order 32 bits of the serial number of the volume mounted on the unit. This field is only present for errors that relate to a specific disk unit. The information is not valid if the following conditions exist:

- 0 if the unit's format does not provide for a volume serial number.
- Undefined (garbage).
  - If there is no volume mounted in the unit.
  - If area of the volume containing the serial number cannot be read successfully.
  - If the error occurred before the volume serial number could be determined while bringing the unit on line.
  - If the unit is not on line to any host.
  - If the Ignore Media Format Error modifier was specified in the ONLINE command that first brought the unit online.

14.1.22 Header Code (Logical Block Number)

The header code (logical block number) is a representation of the header read from the block being accessed when the error was detected. The header code contains more than the LBN address: it also contains a code of 4 bits in the high order position defining the logical area where the block exists. The low order 28 bits are the block number. The header codes you may see are listed in Table 14-9.

Table 14-9 Header Code

Code	Description
0	Good logical block (LBN)
6	Good replacement block (RBN)
C	Good block residing in the format control table (FCT)
E	Good block residing in the diagnostic blocks (DBN)

14.1.23 Message Type

The message type field is reported starting with VMS V4.3A. It indicates the type of message generating this error log. Table 14-10 lists the current message-type values.

Table 14-10 Error Log Message Type Field

VMS Mnemonic	Number (hex)	Meaning
EMB$C_DM	1	Disk MSCP message
EMB$C_TM	2	Tape MSCP message
EMB$C_PM	3	Port (CI) message
EMB$C_UM	4	Port (UDA) message
EMB$C_AVATN	5	Available attention message
EMB$C_DUPUN	6	Duplicate unit attention message
EMB$C_IVCMD	7	Invalid command log message
EMB$C_ACPTH	8	Access path attention message
EMB$C_INVSTS	9	Invalid status in end message
EMB$C_INVATT	A	Invalid attention message
EMB$C_NOUNIT_DG	B	No unit in datagram
EMB$C_SSTFAIL	C	Self-test failed
EMB$C_KDB50	D	KDB50 error detected

14.1.24 Position (Gap Count)

The Position (Gap Count) field reports the last known tape position the formatter received. This is given in gap counts from BOT

14.1.25 Formatter Software Version

The formatter software version field provides the software (or microcode) version being used in the formatter.

14.1.26 Formatter Hardware Version

The formatter hardware version field provides the hardware version being used in the formatter.

14.1.27 Cylinder

This field is the cylinder to which the current transfer is directed. This field is only used in the small disk error format.

14.1.28 Replace Flags

The replace flags report in detail the outcome of the bad block replacement attempt. See Table 14-11.

Table 14-11 Replace Flags Bit Description

Octal	Hex	Replace Flag Bit Definition
100000	8000	Replacement attempt This bit is set if the suspected bad block indeed tested bad during the initial stages of the replacement process. If not set, then the suspect block did not check bad and no replacement was completed.
40000	4000	Forced error The data from the suspected bad block could not be corrected or obtained without error. The Forced Error Indicator is written to the replacement block along with the bad data from the block that was replaced. The user data from the bad block reads with a forced error when accessed. If this condition is frequently noted on a specific drive, it indicates drive problems.
20000	2000	Nonprimary revector This bit is set if the replacement process was accomplished but the data was put into a replacement block that was not the primary RBN.
10000	1000	Replace command failure This bit is set during the replacement process if the status coming back from the execution of the MSCP REPLACE command is not successful. If this occurs, the drive should be reformatted before being used.
4000	800	RCT inconsistent This bit is set if the Replacement Control Tables are not usable. The drive should be reformatted before being used.
2000	400	Bad replacement block This bit is set if the bad block reported is a replacement block. The replacement block can be replaced just like any LBN.

14.1.29 Bad LBN

Bad LBN is the logical block number (LBN) was the target of the replacement attempt.

14.1.30 Old RBN

Old RBN is the replacement block number (RBN) address of the block being replaced. Replacement blocks can be replaced, just like user Logical Blocks (LBN). If this field is zero, the block being replaced may be an LBN.

14.1.31 New RBN

New RBN is the replacement block number (RBN) address of the block that is used to replace the bad LBN or RBN. The user data should end up residing in this replacement block, and revectoring mechanisms should access this replacement block automatically upon user request.

14.1.32 Cause

The Cause field is the Status/Event code of the original error that caused the replacement attempt. It is zero if that Status/Event code is not available.

14.1.33 Controller Dependent Information

Controller Dependent Information field is a variable (controller dependent) amount of information. Controller dependent information is not always provided. The length of this information is implied by the total length of the error log message passed to the class driver by the port driver. This information will typically not be interpreted by error log formatting programs. Instead, it will be printed as a series of octal values. The following controllers provide for controller dependent information:

- UDA50 (Chapter 22)
- KDA50-Q (Chapter 23)
- KDB50 (Chapter 24)
- RC25 (Chapter 27)
- HSC50 (Chapter 25)
- HSC70 (Chapter 26)
- RQDX3 (Chapter 28)
- TK50P (Chapter 21)

14.1.34 SDI Unsuccessful Response

The 12 bytes of status information returned by the SDI GET STATUS command or by the SDI Unsuccessful response includes all of the SDI status information except the unit number. The decoding information is available in the following:

- RA60 (Chapter 15)
- RA80 (Chapter 16)
- RA81 (Chapter 17)
- RA82 (Chapter 18)

14.1.35 STI Unsuccessful Response

There are 12 bytes of information received from the formatter as an Unsuccessful response or in response to a GET SUMMARY STATUS command. These 12 bytes are used by the STI tape controller to report STI communication or command failure. The decoding information is available in the following:

- TA78 (Chapter 20)
- TA81 (Chapter 19)
- TK50 (Chapter 21)

14.1.36 Get Extended Formatter Status Response

There are 24 bytes of information received from the formatter as a response to a GET EXTENDED FORMATTER STATUS command. The information format is formatter and error type dependent and varies in length and content. If the information received from the formatter is less then 24 bytes, the controller zero fills the remaining unused bytes of the error log message. The decoding information is available in the following:

- TA78 (Chapter 20)
- TA81 (Chapter 19)
- TK50 (Chapter 21)

14.1.37 Get Extended Drive Status Response

There are 62 bytes of information received from the drive as a response to a GET EXTENDED DRIVE STATUS command. The information format is drive and error type dependent and varies in length and content. If the information received from the drive is less then 62 bytes, the controller zero fills the remaining unused bytes of the error log message. The decoding information is available in the following:

- TA78 (Chapter 20)
- TA81 (Chapter 19)
- TK50 (Chapter 21)

14.1.38 Unit Control Block

The Unit Control Block (UCB) contains unit characteristics and unit control information. The UCB is displayed as UCB$L_CHAR in VMS error log messages. See Table 14-12.

Table 14-12 Unit Control Block

Bit	Description
31	Data check performed on all writes (write with compare modifier).
30	Data check performed on all reads (read with compare modifier).
29	Real time device.
28	Random access.
27	Capable of output.
26	Capable of input.
25	Software write locked.
24	Device mounted foreign.
23	Device allocated.
22	Error—Logging enabled on the device.
21	Device marked for dismount.
20	Mailbox device.

Table 14-12 (Cont.) Unit Control Block

Bit	Description
19	Device mounted.
18	Device available for use.
17	Generic device.
16	Shared device (used by more then one program simultaneously).
15	Dual ported disk.
14	File orientated device.
13	Network device.
12	Undefined.
11	Undefined.
10	Undefined.
9	Undefined.
8	Replacement active (HIRT).
7	Operator mailbox.
6	Device being spooled.
5	Sequential block orientated device (magtape).
4	Single directory structured device.
3	Directory structured device.
2	Terminal device.
1	Carriage control device.
0	Record orientated device.

14.1.39 Unit Control Block Status Word

The Unit Control Block Status Word is displayed as UCB$W_STS in the VMS error log message. See Table 14-13.

Table 14-13 Unit Control Block Status Word

Bit	Description
15	Volume name does not match name in Volume Control Block.
14	Mount verification in progress.
13	If set, new UCBs are created from this template.
12	Unload volume at dismount.
11	Software believes volume is valid.
10	Deallocate device at dismount.
9	Device is being mounted.
8	Unit is busy.
7	Receiver interrupt.
6	Unit is timed out.
5	Power has failed while unit is busy.
4	Device is online.
3	Cancel I/O on unit.
2	Error log in progress.
1	Interrupts expected.
0	Timeout enabled.

14.1.40 End Code

End code identifies an end message and the type of command (opcode) this message is for. End codes are formed by adding the end message flag, 200 Octal, or 80 Hex, to the original opcode. See Table 14-14 for opcodes.

Table 14-14 Control Message Opcodes

Opcode Value (hex)	Mnemonic	Control Message Type
1	MSCP$K_OP_ABORT	ABORT command
2	MSCP$K_OP_GTCMD	GET COMMAND STATUS command
3	MSCP$K_OP_GTUNT	GET UNIT STATUS command
4	MSCP$K_OP_STCON	SET CONTROLLER CHARACTERISTICS command
7	MSCP$K_OP_SEREX	Serious Exception end message
8	MSCP$K_OP_AVAIL	AVAILABLE command
9	MSCP$K_OP_ONLIN	ONLINE command
A	MSCP$K_OP_STUNT	SET UNIT CHARACTERISTICS command
B	MSCP$K_OP_DTACP	DETERMINE ACCESS PATHS command
10	MSCP$K_OP_ACCES	ACCESS command
11	MSCP$K_OP_CMPCD	COMPARE CONTROLLER DATA command
12	MSCP$K_OP_ERASE	ERASE command
13	MSCP$K_OP_FLUSH	FLUSH command
14	MSCP$K_OP_REPLC	REPLACE command
16	MSCP$K_OP_ERGAP	ERASE GAP command
20	MSCP$K_OP_COMP	COMPARE HOST DATA command
21	MSCP$K_OP_READ	READ command
22	MSCP$K_OP_WRITE	WRITE command
24	MSCP$K_OP_WRITM	WRITE TAPE MARK command
25	MSCP$K_OP_REPOS	REPOSITION command
40	MSCP$K_OP_AVATN	AVAILABLE attention message
41	MSCP$K_OP_DUPUN	DUPLICATE UNIT NUMBER attention message
43	MSCP$K_OP_ACPTH	ACCESS PATH attention message
80	MSCP$K_OP_END	End message flag

14.1.41 System ID

The LSB of this field provides the node ID of the failing device.

14.1.42 End Flags

End flags are used to report various conditions detected due to a command but not directly related to success or failure. See Table 14-15.

Table 14-15 End Message Flags

Bit Number	Bit Mask Octal	Hex	End Message Flag
7	200	80	Bad block reported.
6	100	40	Bad block unreported.
5	40	20	Error log generated.
4	20	10	Serious exception.
3	10	8	End of tape encountered.
2	4	4	Position lost (subject to change).

14.1.43 Byte Count

The byte count is a 32-bit integer of the actual number of bytes transferred to or from the process buffer.

14.1.44 First Bad Block

In Disk Transfer Command end messages, this field contains the logical block number of the first bad block detected during the transfer. Only valid if the Bad Block Reported flag is set. It is undefined if the Bad Block Reported flag is clear.

14.1.45 Modifiers

The modifier field contains bits that modified the operation that took place. See Table 14-16.

Table 14-16 Command Modifiers

Bit Number	Bit Mask Octal	Hex	Command Modifier
			Generic Command Modifiers:
13	20000	2000	Clear serious exception
14	40000	4000	Compare
15	100000	8000	Express request
12	10000	1000	Force error

Table 14-16 (Cont.) Command Modifiers

Bit Number	Bit Mask Octal	Hex	Command Modifier
11	4000	800	Suppress caching (high speed)
10	2000	400	Suppress caching (low speed)
9	1000	200	Suppress error correction
8	400	100	Suppress error recovery
7	200	80	Suppress shadowing
6	100	40	Write-back (nonvolatile)
5	40	20	Write-back (volatile)
4	20	10	Write shadow set one unit at a time
			AVAILABLE Command Modifiers:
1	2	2	All class drivers
0	1	1	Spin down
			FLUSH Command Modifiers:
0	1	1	Flush entire unit
1	2	2	Volatile only
			GET UNIT STATUS Command Modifiers:
0	1	1	Next unit
			ONLINE Command Modifiers:
0	1	1	Allow self-destruction
1	2	2	Ignore media format error
			ONLINE and SET UNIT CHARACTERISTICS Command Modifiers:
3	10	8	Clear write-back data lost

Table 14-16 (Cont.) Command Modifiers

Bit Number	Bit Mask Octal	Hex	Command Modifier
2	4	4	Enable set write protect
4	20	10	Shadow unit specified
			REPLACE Command Modifiers:
0	1	1	Primary replacement block
			TAPE Command Modifiers:
1	2	2	Rewind
2	4	4	Object count
3	10	8	Reverse
4	20	10	Unload
5	40	20	Exclusive access
6	100	40	Immediate completion
7	200	80	Detect LEOT

14.1.46 DSM-11 BBR Status

DSM-11 BBR Status field contains codes reported by the caretaker as the BBR status in general or that occurred during a bad block replacement. See Table 14-17.

Table 14-17 DSM-11 BBR Status

Code	BBR Status Message.
10	GET UNIT STATUS command failed.
11	Failed to read sector 0 (RCT Status Block) of RCT.
12	Failed to read sector 1 of the RCT.
13	BBR already in progress on another controller.
15	The bad sector could not be read.
16	Multicopy write failed in BBR step 5.
17	Device or controller error in BBR step 5.

Table 14-17 (Cont.) DSM-11 BBR Status

Code	BBR Status Message.
20	Multicopy write failed in BBR step 6.
21	Multicopy write failed in BBR step 6.
22	Device or controller error in BBR step 7.
23	Device or controller error in BBR step 8.
24	Search procedure failed in step 9.
25	Bad block OK and not replaced.
26	The replacement blocks also bad-stopped after 2 attempts.
27	Multicopy write failed in BBR step 10.
30	Device or controller error in BBR step 10.
31	Multicopy write failed in BBR step 11.
32	Device or controller error in BBR step 12.
33	Multicopy write failed in BBR step 13.
34	Device or controller error in BBR step 13.
35	Successful bad block replacement.
36	Bad data could not be written back.
37	Couldn't clear sector 0.
40	Device or controller error in BBR step 11.
41	Replace command failed in BBR step 12.
42	WARNING—recommend drive reformat using existing bad sector information.
43	The replacement block found to be bad.
44	The RBN could not be deallocated.
45	The original RBN not restored.
46	BBR flag returned, but device has BBR displaced.
47	BBR initialization discovered BBR disabled.

14.1.47 I/O Status and Timeout Indicator

I/O status and timeout indicator field is the status of the driver. See Table 14-18.

Table 14-18 I/O Status and Timeout Indicator

Timeout Indicator	I/O Status	Meaning
0	0	Idle
X	1	Seek in progress
0	1	Waiting for R/W
1	X	Timeout
X	0	Busy

0 = all zeros

1 = all ones

X = any thing other than zero

14.1.48 RSTS MSCP Control Status Word

RSTS MSCP Control Status Word field is the software perceived state of communication between the driver and the controller. See Table 14-19.

Table 14-19 RSTS MSCP Control Status Word

Status Word	Description
000001	The oldest command to the controller times out.
000002	A set controller characteristics command is in progress.
000004	The controller is being initialized.
000010	Controller request for service.
000020	The controller has timed out.
000040	The controller is verifying the units. This state is used to free up UCBs whose units have gone away.
000100	Communication with the controller is open.
000200	The controller is online.

14.1.49 RSTS MSCP Unit Status Word

RSTS MSCP unit status word is the perceived state between the unit (drive) and the driver. See Table 14-20.

Table 14-20 RSTS MSCP Unit Status Word

Error Code	Description
000000	Execution of the command was successful and an error log message was generated.
000001	Bad block replacement (BBR) code is controlling the error logging. Examination of the BBR Flag word may indicate the current state of the BBR process.
000002	Fatal controller error occurred when the driver was trying to send it a command.
000003	Command packet slots should have been available to the driver in the ring buffer. After a two-second wait, the controller did not free up any slots.
000004	Driver received an end packet which indicates the drive being referenced may be hung.
000005	Disk unit size is too big. Cluster size may be incorrect.
000006	Driver sent an online command, and it failed.
000007	GET UNIT STATUS command was sent to a drive, and it failed.
000010	Command was sent to the controller or drive, and the response to the command was not received within the timeout interval.
000011	Online command to the controller failed.
000012	R/W command had a data error.

14.1.50 RSTS MSCP Error Code

RSTS MSCP error code indicates what the driver was trying to do when the error occurred. See Table 14-21.

Table 14-21 RSTS MSCP Error Code

Error Code	Description
000000	Execution of the command was successful, and an error log message was generated.
000001	Bad block replacement (BBR) code is controlling the error logging. Examination of the BBR Flag word may indicate the current state of the BBR process.
000002	Fatal controller error occurred when the driver was trying to send it a command.
000003	Driver thought it should have command packet slots available to it in the ring buffer. After a two-second wait, the controller did not free up any slots.
000004	Driver received an end packet which indicates the drive being referenced may be hung.
000005	Disk unit size is too big. Cluster size may be incorrect.

Table 14-21 (Cont.) RSTS MSCP Error Code

Error Code	Description
000006	Driver sent an online command and it failed.
000007	GET UNIT STATUS command was sent to a drive and it failed.
000010	Command was sent to the controller or drive, and the response to the command was not received within the timeout interval.
000011	Online command to the controller failed.
000012	R/W command had a data error.

14.1.51 RSTS BBR Flag Word

RSTS BBR flag word indicates the current state of the bad block replacement process. See Table 14-22.

Table 14-22 RSTS BBR Flag Word

Bit	Flag	Description
1	VP	Volume should be software write protected upon bringing it online.
7	FE	Replacement process should set the forced error indicator in the target RBN.
13	BR	Replacement in progress was caused by a bad RBN.
14	P2	Replacement process is in phase 2 of the replacement algorithm.
15	P1	Replacement process is in phase 1 of the replacement algorithms.

CHAPTER 15
RA60 DRIVE STATUS

15.1 INTRODUCTION

Chapter 15 explains the RA60 disk status portion of the Standard Disk Interconnect Error Log message. Standard Disk Interconnect is hereafter referred to as SDI.

The SDI error log message contains 12 bytes of drive status information. The SDI error log message reports SDI errors detected by the drive and any errors that occured within the drive. The SDI error information comes directly from the drive as drive status information. The drive status information provides the details of the problem reported by the drive.

15.2 RA60 STATUS BYTES

The following is drive status information for the RA60. Byte refers to drive status bytes in the SDI packet. See Figure 15-1.

Figure 15-1 RA60 Status Bytes

WORD 23		WORD 22	
HIGH BYTE CONTROLLER BYTE	LOW BYTE ERROR BYTE	HIGH BYTE MODE BYTE	LOW BYTE REQUEST BYTE

WORD 25		WORD 24	
HIGH BYTE PREVIOUSLY SELECTED HEAD	LOW BYTE PREVIOUS CYL HIGH WORD	HIGH BYTE PREVIOUS CYL. LOW WORD	LOW BYTE RETRY COUNT

WORD 27		WORD 26	
HIGH BYTE DRIVE ERROR CODE	LOW BYTE CURRENTLY SELECTED HEAD	HIGH BYTE CURRENT CYL HIGH WORD	LOW BYTE CURRENT CYL LOW WORD

CX–1295A

NOTE
The DSA Error Log is the only place to obtain the drive error code. The RA60 does not have microprocessor error LED display. The drive error code is in byte 15 of the SDI status.

15.2.1 RA60 Request Byte

Request byte is the low byte of word 22. The request byte contains general drive status information. See Figure 15-2 and Table 15-1.

Figure 15-2 RA60 Request Byte

7							0
OA	RR	DR	SR	EL	PB	PS	RU

CX–1297A

Table 15-1 RA60 Request Byte

Bit	Bit Name	
0	**DRIVE RUNNING (RU)**	
	State	**Description**
	1	The RUN/STOP switch is pushed in (RUN).
	0	The switch is out (STOP). The HDA may not actually be spinning when the switch is pushed in. See the SR bit described below.
1	**PORT SELECTED (PS)**	
	State	**Description**
	1	The Drive Port Select switch is pushed in (selected).
	0	The Port switch is out (not selected).
2	**PORT B SELECTED (PB)**	
	State	**Description**
	1	The controller is accessing the drive through Port B.
	0	The controller is accessing the drive through Port A.

Table 15-1 (Cont.) RA60 Request Byte

Bit	Name / State	Description
3	ERROR LOG REQUEST (EL)	
	State	Description
	1	Drive specific information is available in the extended status area of drive memory.
	0	No information is available in the extended status area.
4	SPINDLE READY (SR)	
	State	Description
	1	The drive spindle is up to speed.
	0	The drive spindle is not up to speed.
5	DIAGNOSTIC REQUEST (DR)	
	State	Description
	1	There is a request for a diagnostic to be loaded in the drive microprocessor memory.
	0	No diagnostic is being requested of the host system. Drive diagnostics can be down-line loaded into the drive by the controller.
6	RECALIBRATE/READJUST REQUEST (RR)	
	State	Description
	1	The drive requires an internal readjustment (servo head positioning system needs to be recalibrated).
	0	The drive does not require an internal readjustment.
7	ONLINE TO ANOTHER CONTROLLER (OA)	
	State	Description
	1	The drive is unavailable to the controller making the GET STATUS REQUEST (online to another controller).
	0	The drive is available and not online to the controller.

15.2.2 RA60 Mode Byte

Mode byte is the high byte of word 22. The mode byte contains write protect and media-related status information. See Figure 15-3 and Table 15-2.

Figure 15-3 RA60 Mode Byte

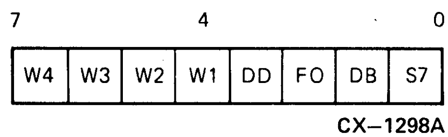

Table 15-2 RA60 Mode Byte

Bit	Bit Name	
0	SECTOR FORMAT (S7)	
	State	**Description**
	1	A 576-byte sector format (18 bit words) pack is installed in the drive.
	0	A 512-byte sector format (16 bit words) pack is installed. For example, RSTS/E and VMS have 512 bytes per sector format and must have a 16 bit format pack installed in the drive.
1	DIAGNOSTIC BLOCK ACCESS (DB)	
	State	**Description**
	1	The diagnostic blocks on the drive can be accessed (DBN access enabled).
	0	The DBNs cannot be accessed.
2	FORMAT OPERATION (FO)	
	State	**Description**
	1	The drive can be formatted.
	0	Formatting operations are disabled in this drive.
3	DISABLE DRIVE (DD)	
	State	**Description**
	1	The drive has been disabled by a controller error routine or diagnostic. The FAULT light is on when this bit is set.

Table 15-2 (Cont.) RA60 Mode Byte

	State	Description
	0	The drive is enabled by a controller error routine or diagnostic (normal operation).
4	**WRITE-PROTECT STATUS (W1)**	
	State	**Description**
	1	The drive is write protected.
	0	The drive is not write protected.
5-7	**WRITE-PROTECT STATUS (W2-W4)**	
	State	**Description**
	1	Not used
	0	Not used

15.2.3 RA60 Error Byte

Error byte is the low byte of word 23. The error byte contains general error status information. See Figure 15-4 and Table 15-3.

Figure 15-4 RA60 Error Byte

7							0
DE	RE	PE	DF	WE	0	0	0

CX–1299A

Table 15-3 RA60 Error Byte

Bit	Description
0	Not used
1	Not used
2	Not used
3	WRITE-LOCK ERROR (WE)—A write-lock error has occurred.
4	DIAGNOSTIC FAILURE (DF)—A failure in the initialization routine of the drive. A drive error code should be present in the high byte of word 27 of the RA60 Status Bytes.

Table 15-3 (Cont.) RA60 Error Byte

Bit	Description
5	PROTOCOL ERROR (PE)—Improper command codes or parameters were issued to the drive.
6	TRANSMISSION ERROR (RE)—An error occurred in the transmission of a command from the controller to the drive. The error can be a checksum error or an incorrectly formatted command string. It is most likely an SDI cabling problem.
7	DRIVE ERROR (DE)—A drive error has occurred and the drive FAULT light may be on.

15.2.4 RA60 Controller Byte

Controller byte is the high byte of word 23 and contains general status information. See Figure 15-5 and Table 15-4.

Figure 15-5 RA60 Controller Byte

7							0
S4	S3	S2	S1	C1	C2	C3	C4

CX–1300A

Table 15-4 RA60 Controller Byte

Bit	Description
0-3	**C4—C1** This is a 4-bit drive status code indicating various states of a drive operation. At the present time, only three codes are valid. **State** **Code Description** 0000 Normal operation. 1000 The drive is offline due to being under control of a diagnostic. 1001 The drive is offline because another drive has the same unit identifier.
4-7	**SUPPRESS (S1—S4)** This indicates the drive suppression of the attention-available messages. These messages may be suppressed and are sent to the controller when the drive is in the available state.

15.2.5 RA60 Retry Count

Retry count is the low byte of word 24. Some errors are retried several times before a failure is declared. The retry count is the number of retries attempted from the previous operation.

15.2.6 RA60 Previous Cylinder Low Byte

Previous cylinder low byte is the high byte of word 24. The previous cylinder low byte is the low order address bits of the previous seek operation.

15.2.7 RA60 Previous Cylinder High Byte

Previous cylinder high byte is the low byte of word 25. The previous cylinder high byte is the high order bits of the previous seek operation.

15.2.8 RA60 Previous Selected Head

Previous selected head is the high byte of word 25.

15.2.9 RA60 Current Cylinder Low Byte

Current cylinder low byte is the low byte of word 26. Current cylinder low byte is the low order address bits of the last seek operation.

15.2.10 RA60 Current Cylinder High Byte

Current cylinder high byte is the high byte of word 26. Current cylinder high byte is the high order address bits of the last seek operation.

15.2.11 RA60 Current Selected Head

Current selected head is the low byte of word 27.

15.2.12 RA60 Drive Error Code

Drive error code is the high byte of word 27 and is the microprocessor error code. The following is a list of these errors:

Heads were not home when a RUN command was issued

Drive/LED Error Code: 08

Error Description: A RUN command was issued to a drive from the Front Panel Run/Stop switch or from a system MOUNT command. The master processor issued a SPIN-UP command to the slave processor. The slave processor checked the Heads Home switch and found it open. This could indicate the heads are loaded or some other malfunction has occurred to make it appear as though the heads are loaded. Any of the following FRUs may be responsible for the failure.

Heads Home switch opened during spin-up

Drive/LED Error Code: 09

Error Description: The Heads Home switch opened before the drive asserted DRIVE UP TO SPEED. Indications are the heads are (or appear to be) loaded.

Heads Home switch would not close during UNLOAD.

Drive/LED Error Code: 0A

Error Description: The master processor issued an UNLOAD command to the slave processor. The slave then removed power from the spindle motor and attempted to remove the heads from the pack. No Heads Home signal was received. Location of the heads is not known.

SPIN-UP LOW is not active during spinup.

Drive/LED Error Code: 0C

Error Description: The spindle motor was turning and SPINUP LOW was not asserted. SPINUP LOW enables the motor control module to apply power to the spindle motor. SPINUP LOW is asserted by the slave when it receives a RUN command. The RUN command can come from the controller or the Front Panel Run/Stop switch.

Lid lock open during spinup.

Drive/LED Error Code: 10

Error Description: The front panel solenoid was energized when a RUN command was received by the slave processor. The front cover is open, and the pack does not spin up.

Front cover open during spinup.

Drive/LED Error Code: 11

Error Description: The Front Cover Optical switch was open while the pack was spinning. This condition was detected by the slave processor, and the drive was spun down.

Front cover or lid lock opened during a head load.

Drive/LED Error Code: 12

Error Description: The Front Cover Optical switch opened or the front cover solenoid energized when the heads were being loaded onto the pack. Either condition means the front cover can be opened while the heads are loaded. This causes the slave processor to issue commands to unload the heads and spin the pack down.

Front cover not locked when a RUN command was issued.

Drive/LED Error Code: 13

Error Description: The slave processor detected the front panel solenoid was still energized preventing the drive from spinning up. The solenoid being energized indicates the front cover is open.

Spinup timed-out.

Drive/LED Error Code: 18

Error Description: The spindle motor did not reach proper operating speed (3600 rpm) within 60 seconds, or it did not spinup at all. Spindle motor rotation is monitored by the drive logic module and controlled by the motor control module, a part of the power module assembly.

Motor sample did not change during spinup.

Drive/LED Error Code: 19

Error Description: During a normal spinup, the slave processor monitors the state of the spindle motor. This error is displayed when there is no signal output (over the S1 line) to the slave for six seconds which indicates the spindle is not turning.

Too long to acquire spindle speed control on head load.

Drive/LED Error Code: 24

Error Description: After the heads are loaded, the slave processor has 800 milliseconds to maintain spindle motor speed control at a rate of 3600 rpm. If the spindle motor speed cannot be maintained by the motor control module (located on the drive logic module), the heads are unloaded, power is removed from the spindle, and the pack is allowed to spin down.

Heads misaligned.

Drive/LED Error Code: 25

Error Description: Head zero is the reference head. The RA60 head offset table is built by comparing the other five heads to head zero. The offset table represents the distance the heads have to be moved to put the heads over cylinder centerline. If any head is offset from head zero by more than ten tracks, this error is asserted. This error occurs at head load time only and usually indicates that a head screw is loose, or the head is not positioned all the way back in the head tail stock lot. Refer to the offset table description at the end of this section.

More than 32 sectors to settle on track.

Drive/LED Error Code: 26

Error Description: Upon receipt of a SEEK command, the servo system in the drive could not place the heads on the centerline of the desired cylinder within 32 sector times (12.384 milliseconds). The slave processor retries the command one time in order to try to recover from this error.

More than 32 sectors to settle on track and RETRY failed.

Drive/LED Error Code: 27

Error Description: After a SEEK command was received, the drive servo system could not place the heads on the centerline of the desired cylinder within 32 sector times (12.384 milliseconds). A RETRY by the master/slave processors to centerline the heads failed. When the RETRY command fails, the heads are unloaded, and the drive spins down.

Too many bad servo samples during RTZ.

Drive/LED Error Code: 28

Error Description: While executing a RETURN TO ZERO (RTZ) command, the drive encountered two or more bad embedded servo bursts. RTZ is issued at head load time from the hand-held terminal or during a controller RECOVERY/RETRY scheme.

Too long to acquire good servo sample on a head load.

Drive/LED Error Code: 29

Error Description: The heads were loaded onto the pack, and no embedded servo data has been detected for 800 milliseconds. The slave processor cannot determine position without servo data. The heads are unloaded, and the drive spins down.

Bad servo sample during RTZ on a head load.

Drive/LED Error Code: 2C

Error Description: A normal RA60 head load moves the heads from the head load ramp across the data area to the inner guard band. Embedded servo information is sampled as the heads move from cylinder zero to the inner guard band. When the inner guard band is detected, the slave processor is commanded to SEEK to cylinder 256. Head zero is selected as the reference head and then centerlined at cylinder 256. The rest of the heads are centered on the centerline of cylinder 256. An offset table is built using information gathered during the centering process. After the offset table is built, the slave carries out a RTZ command. When cylinder zero is reached, head zero is used to sample embedded servo information again. If any of the servo samples are not read correctly, the heads are unloaded, the drive is spun down, and the fault light is lit.

Bad samples during linear mode.

Drive/LED Error Code: 2D

Error Description: After a successful SEEK to a cylinder, the servo system goes to linear mode and centers the selected head on centerline of the desired cylinder. If a Bad Sync Burst(s) or a No DC Erase Gap is detected, this error is displayed. The heads are not unloaded, and if a command was in progress during the error, the controller retries the command.

Off track when in linear mode.

Drive/LED Error Code: 2F

Error Description: After a SEEK, and the servo system is in linear mode, the selected head is centered over the cylinder centerline. The drive servo system samples the embedded servo data and the inner and outer burst signals. This allows the cylinder centerline to be tracked. If, after three sectors have passed, the servo system indicates the head is off cylinder by 163 micro inches or more, this error is displayed.

Spinup required too short a time.

Drive/LED Error Code: 30

Error Description: Spindle motor speed is monitored for six seconds following a spinup command. If the rate of spinup is too fast, no pack is in place. This takes the place of the Pack-in-Place switch. Power is removed from the spindle, and the fault light is lit.

Retry on seek due to bad servo sample.

Drive/LED Error Code: 40

Error Description: In response to a SEEK command, the slave processor moves the heads toward the desired cylinder. As the heads move across the pack, servo information is read and interpreted by the slave processor. This embedded servo information tells the positioner how far and at what speed to move. If a sector pulse is missed, a signal from the drive logic module (Burst Error) informs the slave processor. The drive microcode attempts a retry by doing a RTZ (RETURN TO ZERO) command. The slave processor attempts to retry the SEEK command. If the retry on a seek fails, another seek retry is performed.

Retry on seek due to bad servo sample, retry failed.

Drive/LED Error Code: 41

Error Description: Retry by the drive on a failed SEEK command (Error Code 40) failed. The heads will stay at cylinder zero as a result of the retry failure. The heads remain loaded and the drive continues to spin. At this point, the controller initiates its retry mechanism in an attempt to complete the SEEK command.

Retry on seek due to bad guard band flags.

Drive/LED Error Code: 42

Error Description: Two guard band bits are embedded in each sector interval. The inner and outer guard bands border the data areas on a pack. The inner guard band area is 35 cylinders wide, and the outer guard band is 42 cylinders wide. If the two guard band bits are read during a seek, the heads are not in a legal data area and are positioned over the inner or outer guard band area. This tells the drive processor the positioner was allowed to travel too far.

Retry on seek due to bad guard band flags, Retry failed.

Drive/LED Error Code: 43

Error Description: The heads were sent to a guard band area during a SEEK command (error 42). The slave processor executed a RTZ to recalibrate the drive, retried the SEEK command, and the same failure occurred. The positioner is returned to zero, and the error is reported to the controller. The controller initiates a failure retry.

Retry on seek due to bad position polarity.

Drive/LED Error Code: 44

Error Description: A SEEK command failed. The slave processor detected the heads were not on the desired cylinder when switching from seek mode to linear mode. Cylinder position is determined by the master processor monitoring the polarity of the position signal on the drive logic module. The polarity of the position signal indicates an odd or even cylinder.

- Odd Cylinder = Negative position signal polarity
- Even Cylinder = Positive position signal polarity

Retry on seek due to bad position polarity, Retry failed.

Drive/LED Error Code: 45

Error Description: A SEEK command failed. This is a retry on a failure code 44 (above). At this point the RA60 has tried to complete the SEEK command three times and failed three times. These retries are attempted by the drive without controller intervention.

Gray code indicates bad cylinder seek.

Drive/LED Error Code: 46

Error Description: Cylinder number calculations performed by the slave processor, to arrive at a cylinder, did not agree with the gray code found at the cylinder. The gray code embedded servo information contains cylinder numbers. The drive processor initiates a retry to complete the seek.

Retry on seek due to wrong gray code, retry failed.

Drive/LED Error Code: 47

Error Description: The retry initiated as a result of Error Code 46 failed. The heads are repositioned to cylinder zero, and the controller is notified of the failure. The controller initiates a retry on the SEEK command in an attempt to complete the command.

Lost servo samples.

Drive/LED Error Code: 48

Error Description: The Sector Pulse is generated by the Servo Sync Pulse. The Sector Pulse is written at the beginning of each sector on every cylinder and is used to cause a slave processor trap. This trap causes the slave to perform its housekeeping routine. The housekeeping routine times the frequency of the traps. One trap can be missed (sector time is 381 microseconds) without an error. However, when two consecutive traps are missed (762 microseconds) without a sector pulse, this error is displayed. The heads are unloaded, and the drive is spun down. This error can be detected any time the heads are loaded.

NOTE

DLM C/S Revision L1 (S/W Microcode Revision 2 or 3) and before indicate loss of servo sample but do not call out a specific head. However, DLM M1 (S/W Revision 4) and following revisions have corrected this, and each head has an associated error code for loss of servo sample errors.

Lost servo sample on Head #1.

Drive/LED Error Code: 49

Error Description: See Error 48, lost servo sample on Head #0, for a detailed explanation.

Lost servo sample on Head #2.

Drive/LED Error Code: 4A

Error Description: See Error 48, lost servo sample on Head #0, for a detailed explanation.

Lost servo sample on Head #3.

Drive/LED Error Code: 4B

Error Description: See Error 48, lost servo samplé on Head #0, for a detailed explanation.

Lost servo sample on Head #4.

Drive/LED Error Code: 4C

Error Description: See Error 48, lost servo sample on Head #0, for a detailed explanation.

Lost servo sample on Head #5

Drive/LED Error Code: 4D

Error Description: See Error 48, lost servo sample on Head #0, for a detailed explanation.

Too long for Heads home switch to open on a head load.

Drive/LED Error Code: 50

Error Description: The Heads Home switch did not open within 200 milliseconds (0.2 second) after power is applied to the linear motor to move the heads forward. The slave processor times this event and monitors the state of the Heads Home switch.

Command cannot be executed because of current drive state.

Drive/LED Error Code: 61

Error Description: The master processor issued a command to the slave processor the slave processor could not execute due to a conflicting state within the drive.

Nonexistent head or cylinder selected during seek.

Drive/LED Error Code: 62

Error Description: A SEEK command was issued by the controller. The master processor passed a command to the slave processor with a head select value greater than five. Only heads numbered 0 through 5 may be selected. The cylinder range falls within 0 to 2832 logical cylinders.

Invalid opcode received by slave processor.

Drive/LED Error Code: 63

Error Description: The master processor issued an illegal opcode to the slave processor. GET STATUS, SEEK, RETURN TO ZERO (RTZ), RUN, UNLOAD, and DIAGNOSE are the six legal opcodes that the slave processor can execute.

Front cover was open when a RUN command was issued.

Drive/LED Error Code: 64

Error Description: The master processor issued a RUN command to the slave processor, and the slave detected the front cover lid was open. The RA60 cannot spin up if the front cover is open.

Power-up diagnostic test failure.

Drive/LED Error Code: 81

Error Description: The master processor asserts all bits high (FF) over a cable to the front panel. It then reads the bits back into the ROM I/O port and compares these bits to what it sent. If the bits don't match, a power-up diagnostic test failure occurred.

Processor register check during power up fails.

Drive/LED Error Code: 82

Error Description: The Master processor (8085) registers are written with a known pattern, and that pattern is read back for comparison. If the compare fails, this power-up diagnostic fails, and the error is declared. All processor registers are on the drive logic module.

RAM #0 test fails during powerup.

Drive/LED Error Code: 83

Error Description: Master RAM #0 locations are tested by writing a pattern to the RAM and then reading that pattern back. If the pattern read does not compare with the pattern written this power-up diagnostic fails and the error is declared. This RAM is located on the drive logic module.

ROM #0 test failed during powerup.

Drive/LED Error Code: 84

Error Description: The ROM test consists of reading location 07FF (Hex). This location contains the ROM data checksum character. If the ROM #0 checksum character does not compare, this power-up test fails. This ROM is located on the drive logic module.

ROM #1 Test.

Drive/LED Error Code: 85

Error Description: This test reads master ROM #1, location 07FF (Hex). This location contains the checksum character for the data contained in ROM #1. If the compare on the checksum character fails, this error is displayed. ROM #1 is located on the drive logic module.

ROM #2 test.

Drive/LED Error Code: 86

Error Description: Location 7FF (Hex) is read from master ROM #2. This location contains the checksum character for the ROM. If the checksum character does not compare with the known value, the power-up diagnostic fails, and this error is displayed. ROM #2 is located on the drive logic module.

Verify ROM version numbers.

Drive/LED Error Code: 87

Error Description: Master ROMs 0, 1, and 2 have version numbers stored in location 07FB (Hex). These version numbers are read and compared for this diagnostic. If the compare fails, this error code is displayed. This test prevents mixing different versions of RA60 microcode. These ROMs are located on the drive logic module.

Test the SDI Control/Status register.

Drive/LED Error Code: 89

Error Description: The SDI Control and Status register contains the following bits: Nontransfer Command Ready, Error, Send, and Send In Progress. This test clears the bits at powerup and then reads the register for stuck bits. The Control and Status register is located on the SDI module.

Front panel communications and serial number ROM test.

Drive/LED Error Code: 8A

Error Description: This power-up diagnostic tests the cable connection between the front panel and the backplane module as well as the front panel itself. The serial number ROM is read for a special character (5C Hex), and then this character is transferred to the processor for comparison. If the data read from the ROM does not compare, this error is displayed.

Test the UART.

Drive/LED Error Code: 8B

Error Description: The UART chip on the drive logic module enables the hand-held terminal to run the RA60 internal diagnostic tests. This power-up diagnostic initializes the UART and checks functionality. TRANSMIT READY is set, wrapped back and read at the DATA SET READY input to the UART.

Test the SDI error register.

Drive/LED Error Code: 8C

Error Description: The SDI error register (located on the SDI module) is cleared by master reset when power is applied to the drive. This error is asserted if the power-up diagnostic finds the SDI error register was not cleared by master reset.

Test the 8155 timer.

Drive/LED Error Code: 8D

Error Description: The 8155 timer is used as a one second interrupt device for the microcode functions. This power-up diagnostic tests the functionality of the 8155 timer. The timer is set to time out one second after powerup; otherwise, this error is displayed.

Test the slave control port.

Drive/LED Error Code: 8E

Error Description: This test verifies the master processor's ability to function using the ROM 0 I/O control port. The master processor sends a signal called SLAVE RESET to the slave processor. COMMAND AVAILABLE allows ROM 0 to be read. COMMAND AVAILABLE and SLAVE RESET are then complemented by the microcode with the result that COMMAND AVAILABLE, SLAVE RESET, MASTER SANITY, and DISASTER should all be low. If any of these four signals is not low, this error is displayed.

COMMAND AVAILABLE/SLAVE DONE set when a new slave command was issued.

Drive/LED Error Code: 90

Error Description: The master processor issued a command to the slave before the housekeeping routine could clear COMMAND AVAILABLE or the slave's SLAVE DONE. The slave has one millisecond to acknowledge receipt of commands from the master processor.

Slave command received timeout on opcode.

Drive/LED Error Code: 91

Error Description: The slave processor must acknowledge receipt of commands from the master processor within one millisecond, as part of the two processors handshaking routine. If the slave does not respond within one millisecond, a Slave Timeout error is displayed.

Slave Attention timeout.

Drive/LED Error Code: 92

Error Description: The slave pulls the heads from the pack and removes power from the spindle upon the receipt of an UNLOAD command. The spindle must come to complete stop within 45 seconds; otherwise, a Slave Attention Timeout error is displayed. The RA60 has no brake and must instead rely on back EMF (electromagnetic force) from the motor rotation for a breaking action.

Slave Done timeout to slave STOP command.

Drive/LED Error Code: 93

Error Description: The slave acknowledged receiving a STOP command from the master processor but did not reply with SLAVE DONE. The heads are still loaded and power is still applied to the spindle. The slave has three seconds to acknowledge the STOP command.

SLAVE DONE timeout to GET STATUS command.

Drive/LED Error Code: 94

Error Description: The slave has one millisecond to acknowledge commands from the master processor by asserting COMMAND RECEIVED. In this case, the slave did not acknowledge a GET STATUS command from the master processor.

Slave Done timeout to a RUN command.

Drive/LED Error Code: 95

Error Description: The slave acknowledges the receipt of a RUN command from the master processor but does not assert SLAVE DONE. SLAVE DONE must be asserted within four seconds after receiving the RUN command.

SLAVE ATTENTION timeout to a RUN command.

Drive/LED Error Code: 96

Error Description: The slave failed to assert SLAVE ATTENTION within 100 seconds after being issued a RUN command from the master processor. SLAVE ATTENTION, when asserted, indicates the heads have loaded over the pack.

Solenoid release time out.

Drive/LED Error Code: 97

Error Description: The front cover solenoid did not release within 200 milliseconds after the Run/Stop light was lit. This indicates the front cover is still open.

Watchdog timer detects master insane.

Drive/LED Error Code: 98

Error Description: The master processor checked the master sanity byte during the watchdog timer routine and found it had not been cleared. A RUN, SEEK or a RETURN TO ZERO command was in progress and the corresponding flag routine had not been executed since the last watchdog interrupt. This implies the program counter (PC) is not at the correct count. The watchdog timer (drive logic module) is used for code housekeeping and for code synchronization.

Watchdog timer detects Slave Insane.

Drive/LED Error Code: 99

Error Description: Both the slave and master processor have bits called sanity bits. Every 13.3 milliseconds, the master processor toggles its sanity bit and, in response, the slave toggles its sanity bit. If the slave fails to toggle its sanity bit within 32 interrupts of the watchdog timer routine, this error is displayed.

Run switch or cover invalid at spin-up.

Drive/LED Error Code: 9A

Error Description: The drive received a RUN command by a MOUNT command from the system. This error occurred because either the Run/Stop switch had not been depressed prior to the MOUNT command, or the front cover was not closed.

Spindle not ready during RECALIBRATE command.

Drive/LED Error Code: 9B

Error Description: The spindle loses speed, and the spindle ready bit in the status register is cleared during a RECALIBRATE command.

SDI transfer error from DC703.

Drive/LED Error Code: 9C

Error Description: The SDI encoder/decoder chips (SDI module) monitor data, command or control information between the controller and the drive. If the drive detects a dropped or picked pulse on the Write/Command data line or the Real-time Controller state line, or if bad parity is detected during deserialization of the RTCS information, this error is displayed.

A WRITE/FORMAT command issued to a write protected drive.

Drive/LED Error Code: 9D

Error Description: SELECT TRACK AND WRITE, SELECT TRACK AND FORMAT ON INDEX, and a FORMAT ON SECTOR OR INDEX are all write commands issued by the controller to a drive. This error occurs if one of these commands was issued by the controller to a write protected drive.

FORMAT command issued to a format protected drive.

Drive/LED Error Code: 9E

Error Description: A SELECT TRACK AND FORMAT ON INDEX or a FORMAT ON SECTOR OR INDEX command was issued before a CHANGE MODE command. The format enable bit (bit 2 of the mode byte in the GET STATUS RESPONSE) must be set by the CHANGE MODE command before a drive can be formatted.

TRANSFER command issued after drive error set.

Drive/LED Error Code: 9F

Error Description: A R/W command was issued to a drive with its drive error (DE) bit already set. The DE bit is set in the drive extended status byte whenever the drive detects a fatal error. The drive condition is sent to the controller during a GET STATUS command to indicate the controller should not send any commands until the error condition is cleared.

Sector R/W overrun error.

Drive/LED Error Code: A0

Error Description: The drive was issued a R/W command (transfer) by the controller before WRITE GATE or READ GATE is deasserted. This means the transfer of data was not completed before the next sector pulse. If R/W GATE is not dropped at the end of a sector, data in the next sector can be corrupted by being written over, or unwanted data can be read from the next sector. Servo data could also be overwritten if WRITE GATE is not dropped. Timing for R/W gate is controlled by the program logic array chip on the SDI module.

CAUTION

This error may require the pack to be reformatted.

Transfer command issued without R/W ready.

Drive/LED Error Code: A1

Error Description: A R/W (transfer) command was issued to a drive by the controller and R/W Ready is not asserted. R/W Ready tells the controller the heads are loaded, no transfer is in progress, and there is no error condition in the drive that would prevent data transfers. This error usually occurs when R/W Ready is dropped in the middle of a data transfer as a result of a drive detected error. R/W Ready is transmitted to the controller over the Real-time Drive Status (RTDS) line.

SDI command checksum error.

Drive/LED Error Code: A2

Error Description: A Level Two SDI command (from the controller to the drive) End Frame Check Sum character does not match the sum of the data bytes in the command message. This means some bits in the message received by the drive were in error, or the drive circuitry garbled the message data.

SDI frame error.

Drive/LED Error Code: A3

Error Description: The drive detected Continue Frame or an End Frame without detecting a Start Frame since the last End Frame. The normal sequence of a Level 2 message is: Start Frame followed by data, a Continue Frame which is followed by more and finally, an End Frame, and checksum character.

SDI command parity error.

Drive/LED Error Code: A4

Error Description: All operation codes, including Level 1 and 2 commands, have an even number of bits. The drive checks parity on the opcode when the command is shifted into the Drive Input Shift register. If the opcode parity is not even, this error is declared.

SDI command out of range.

Drive/LED Error Code: A5

Error Description: The opcode sent by the controller as part of a Level 1 or a Level 2 command sequence is not recognized by the RA60 as a legal opcode.

SDI command length error.

Drive/LED Error Code: A6

Error Description: A nontransfer command was issued by the controller to the drive without associated parameters (such as, a SEEK command without a cylinder number byte or a SELECT GROUP without a group number byte). A nontransfer command (GET STATUS or SEEK) does not transfer data to or from the pack.

SDI error status byte was nonzero.

Drive/LED Error Code: A7

Error Description: A drive with bits set in the Status Byte register indicates an error condition exists in the drive. The controller must handle this error condition before it issues any commands to the drive. If the controller issues commands to the drive before attempting to handle the error condition, this error is asserted.

Slave Done timeout to a SEEK command.

Drive/LED Error Code: A8

Error Description: The slave processor did not raise SLAVE DONE within seven seconds after being issued a SEEK command. SLAVE DONE lets the master processor know the SEEK command is successfully completed.

Slave Done timeout to a RETURN TO ZERO command.

Drive/LED Error Code: A9

Error Description: The master processor issued a RUN command to the slave processor. The slave raises COMMAND RECEIVED but fails to raise SLAVE DONE. SLAVE DONE must be asserted within one millisecond after COMMAND RECEIVED, or this error is displayed.

Slave response error to a RETURN TO ZERO command.

Drive/LED Error Code: AA

Error Description: The RTZ command is used to recalibrate the drive in the event the drive must retry a failed command. The RTZ sets the heads to cylinder zero, and the slave attempts to run the failed command. This error indicates the heads have not returned to zero at the completion of the RTZ command.

Slave Done timeout during first pass.

Drive/LED Error Code: AB

Error Description: SLAVE DONE shows successful completion of the DIAGNOSE command. This error occurs when the slave processor does not raise SLAVE DONE within 13.3 milliseconds (one watchdog timer count) to the master's DIAGNOSE command.

Command Received timeout during DIAGNOSE, STOP, or ASCII port command.

Drive/LED Error Code: AC

Error Description: The slave processor failed to raise COMMAND RECEIVED to the master processor's DIAGNOSE or STOP command or to a command input from the ASCII port (hand-held terminal).

Slave Done timeout during Diagnostic Stop or ASCII Port command.

Drive/LED Error Code: AD

Error Description: The slave must raise SLAVE DONE within one millisecond of a diagnostic STOP command or an ASCII port command.

Drive not online.

Drive/LED Error Code: AE

Error Description: The controller issued a SEEK command to the drive without first sending a DRIVE ONLINE command. The online bit (bit 3) in the master status byte is set by the DRIVE ONLINE command.

Command byte four and five are not zero.

Drive/LED Error Code: AF

Error Description: The controller issued a SEEK command to the drive and gave a physical cylinder greater than 65,535 decimal. Bytes four and five of the SEEK command are used for high density drives and should always be zero for the RA60.

Invalid group number.

Drive/LED Error Code: B0

Error Description: A controller issued a SELECT GROUP command (a SEEK command) with a group number greater than three. The RA60 has only four groups numbered zero through three.

Invalid head selected.

Drive/LED Error Code: B1

Error Description: A controller-issued SEEK command resulted in the selection of a nonexistent head. Legal heads are numbered zero through five.

Invalid cylinder range.

Drive/LED Error Code: B2

Error Description: This error occurs when the controller issued a SEEK command to the drive that specified a physical cylinder greater than its range (063F Hex). The RA60 has 1600 physical cylinders.

Spindle not ready.

Drive/LED Error Code: B3

Error Description: A SEEK command was issued to a drive before it was up-to-speed. Up-to-Speed (bit four in the Drive Status register) must be set before the controller can issue SEEK commands.

Controller timeout = 0.

Drive/LED Error Code: B4

Error Description: When the controller specifies a Command Timeout value, it is expressed in seconds and sent in the DRIVE ONLINE command. This error is asserted if the controller specifies a timeout value equal to zero. The timeout value is used by the drive to monitor controller presence and activity. If the drive times out, it goes to the DRIVE OFFLINE state and considers the controller to be nonexistent. Whenever an online drive is ready to transmit the Message Start frame of a response message, assert the attention bit, or complete a data transfer operation, the drive timer is started and times out if the RECEIVER READY signal is not received from the controller within 15 seconds. Receipt of controller RECEIVER READY indicates to the drive, the controller received the drive transmission successfully. Timeout values sent by the controller are:

- UDA50—15 seconds
- KDA50—15 seconds
- BDA50—15 seconds
- HSC50—25 seconds
- HSC70—25 seconds

Spindle not ready.

Drive/LED Error Code: B5

Error Description: The controller issued a RECALIBRATE command to the drive, and the spindle motor is not up-to-speed (3600 rpm). Status register bit 4 in the SDI Status Byte is zero.

Illegal memory region.

Drive/LED Error Code: B6

Error Description: An invalid master ROM address was specified by the controller in a READ MEMORY command. Either the memory address specified is out of the legal address range for the drive, or the drive corrupted that portion of the command and read a location in its own memory where functional microcode is located.

Drive Error (DE) bit set.

Drive/LED Error Code: B7

Error Description: The controller issued a DRIVE CLEAR command to a disabled drive. The drive error (DE) bit reports internal drive errors that require explicit controller recovery intervention. A retransmission of the failed command by the controller will not clear this problem. If the DE bit is set, then PE and RE bits are not be set in the Get Status information returned to the controller. The following list explain the DE, PE, and RE bits.

- DE bit (Drive Error)—Potentially recoverable when the controller issues a DRIVE CLEAR command. This error is a drive detected error.
- PE bit (Protocol Error)—Potentially recoverable by a DRIVE CLEAR command. It is caused by a Level 2 protocol error and detected by the drive.
- RE bit (Transmission Error)—Transmission error detected by the drive before execution. It is cleared by the controller retransmitting the failed command.

Attempt to clear a hard fault failed.

Drive/LED Error Code: B8

Error Description: The controller issued a DRIVE CLEAR command to a drive with a hard fault condition.

Slave Done timeout to a GET STATUS command.

Drive/LED Error Code: B9

Error Description: The master processor issued a SLAVE STATUS command, and the slave asserts COMMAND RECEIVED but not SLAVE DONE within one millisecond thereafter.

Illegal Error Recovery command level.

Drive/LED Error Code: BA

Error Description: An illegal ERROR RECOVERY command was issued by the controller to the RA60. The RA60 has an error recovery level of zero.

Wrong subunit code requested by controller.

Drive/LED Error Code: BB

Error Description: The controller issued a GET SUBUNIT CHARACTERISTIC command which specifies a subunit number greater than one. Subunit refers to drives with multiple HDAs or storage units. The RA60 is a single unit device. This command is intended for future device development.

DIAGNOSE command specified illegal memory address.

Drive/LED Error Code: BC

Error Description: The DIAGNOSE command directs a drive to execute resident diagnostics. The DIAGNOSE command format consists of three bytes of information:

- Byte one is the opcode.
- Byte two is the low order memory address bits. Addresses range from 0 to 255 memory regions.
- Byte three is the high order memory address bits. Addresses range above 255 memory regions. Currently no DSA drives range above 255 memory regions.
- Byte three (high order memory) is not zero. See error code BD.

Controller issued DIAGNOSE command with invalid parameters.

Drive/LED Error Code: BD

Error Description: Because the RA60 does not have enough internal memory space, it does not run diagnostics when a DIAGNOSE command is issued by the controller. Instead, the RA60 sends a successful response back to the controller (within 128 seconds) as if it had run diagnostics. If bytes 2 or 3 (in the DIAGNOSE command) are not zero, the controller is trying to force the RA60 to access memory it does not have, and this error is displayed.

Attempt to write enable a write protected drive.

Drive/LED Error Code: BE

Error Description: The controller issued a CHANGE MODE command to write enable a write-protected drive. The drive is write protected from the Front Panel Write Protect switch. The CHANGE MODE command only works with a software write-protected drive.

Illegal attempt to set drive to 18-bit mode.

Drive/LED Error Code: BF

Error Description: The controller issued a CHANGE MODE command in an attempt to change the drive from 16-bit mode to 18-bit mode when the drive is only capable of supporting 16-bit mode.

Slave Done timeout from GET STATUS command.

Drive/LED Error Code: C0

Error Description: Upon receipt of a DIAGNOSE command from the master processor, the slave processor asserted COMMAND RECEIVED but did not assert SLAVE DONE within one millisecond thereafter.

Error response to a GET STATUS command.

Drive/LED Error Code: C1

Error Description: The master processor issued a GET STATUS command to the slave processor. The slave returned an invalid response.

Invalid group number.

Drive/LED Error Code: C2

Error Description: The controller issued a SELECT GROUP command with a group number greater than three. The RA60 has only four groups numbered zero through three.

Microcode fault errors.

Drive/LED Error Code: C3

Error Description: This is a drive software or microcode error and happens when the drive program counter (PC) is pointing to an illegal location in the RA60 ROM or RAM memory.

No watchdog timer interrupt (processor halted).

Drive/LED Error Code: C4

Error Description: A halted master processor is normally reactivated by the trap interrupt. The trap interrupt is initiated by the watchdog timer routine every 13.3 milliseconds. This error occurs when the watchdog circuitry (on the drive logic module) is disabled.

Invalid TT bit.

Drive/LED Error Code: C7

Error Description: The TT bit is a controller bit in the controller command byte. The OA bit is a drive bit in the drive status register. This error occurs if the controller issues a DISCONNECT or a TOPOLOGY command to a drive and the TT bit and the OA bit are not equal. See below for TT and OA bit definitions.

- TT bit = 1 tells an unavailable drive in the process of executing a TOPOLOGY command that the controller is finished. The drive can now look at the other port.
- TT bit = 0 tells an online drive to enter the available state.
- OA bit = 1 tells the controller that the drive is unavailable.
- OA bit = 0 tells the controller that the drive is available.

Multiple head selected or no write transition error.

Drive/LED Error Code: C8

Error Description: The controller issued a R/W command to the drive, and more than one head was selected to do the R/W. Only one head at a time can be selected on the RA60. Head selection is performed by circuitry on the drive logic module. The R/W preamp module detects this error and deposits it in the SDI Module Error register. NO WRITE transition is asserted when WRITE GATE is asserted, but no data signals are sent to the selected head. The R/W Preamp module detects this error and deposits it in the SDI Module Error register.

Master processor is insane.

Drive/LED Error Code: N/A

Error Description: The front panel lights are turned on as part of the power-up diagnostic routine. Next, the diagnostics attempt to turn the front panel lights off. If the master processor is not functioning, the front panel lights remains lit. This indicates the master processor cannot respond to the controller commands. There is not a system error log entry for this error.

CHAPTER 16
RA80 DRIVE STATUS

16.1 INTRODUCTION

Chapter 16 explains the RA80 disk status portion of the Standard Disk Interconnect Error Log Message. Standard Disk Interconnect is hereafter referred to as SDI.

The SDI error log message contains 12 bytes of drive status information. The SDI error log message reports SDI errors detected by the drive and any errors that occurred within the drive. The SDI error information comes directly from the drive as drive status information. The drive status information provides the details of the problem reported by the drive.

16.2 RA80 STATUS BYTES

The following is drive status information for the RA80. Byte references refer to drive status bytes in the SDI packet. See Figure 16-1.

Figure 16-1 RA80 Status Bytes

WORD 23		WORD 22	
HIGH BYTE CONTROLLER BYTE	LOW BYTE ERROR BYTE	HIGH BYTE MODE BYTE	LOW BYTE REQUEST BYTE

WORD 25		WORD 24	
HIGH BYTE CURRENT CYL LOW WORD	LOW BYTE SDI ERROR BYTE	HIGH BYTE LAST SDI COMMAND	LOW BYTE RETRY COUNT

WORD 27		WORD 26	
HIGH BYTE FRONT PANEL FAULT CODE	LOW BYTE DRIVE ERROR CODE	HIGH BYTE CURRENT GROUP	LOW BYTE CURRENT CYL HIGH WORD

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16.2.1 RA80 Request Byte

Request byte is the low byte of word 22. The request byte contains general drive status information. See Figure 16-2 and Table 16-1.

Figure 16-2 RA80 Request Byte

7							0
OA	RR	DR	SR	EL	PB	PS	RU

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Table 16-1 RA80 Request Byte

Bit	Bit Name	
0	DRIVE RUNNING (RU)	
	State	**Description**
	1	The RUN/STOP switch is pushed in (RUN).
	0	The switch is out (STOP). The HDA may not actually be spinning when the switch is pushed in. See the SR bit described below.
1	PORT SELECTED (PS)	
	State	**Description**
	1	The Drive Port Select switch is pushed in (selected).
	0	The Port switch is out (not selected).
2	PORT B SELECTED (PB)	
	State	**Description**
	1	The controller is accessing the drive through Port B.
	0	The controller is accessing the drive through Port A.

Table 16-1 (Cont.) RA80 Request Byte

3	**ERROR LOG REQUEST (EL)**	
	State	**Description**
	1	Drive specific information is available in the extended status area of drive memory.
	0	No information is available in the extended status area.
4	**SPINDLE READY (SR)**	
	State	**Description**
	1	The drive spindle is up to speed.
	0	The drive spindle is not up to speed.
5	**DIAGNOSTIC REQUEST (DR)**	
	State	**Description**
	1	There is a request to load a diagnostic in the drive microprocessor memory.
	0	No diagnostic is being requested of the host system. Drive diagnostics can be down-line loaded into the drive by the controller.
6	**RECALIBRATE/READJUST REQUEST (RR)**	
	State	**Description**
	1	The drive requires an internal readjustment (servo head positioning system needs to be recalibrated). Some drives do not use this bit. For the RA80, the servo may need to be adjusted.
	0	The drive does not require an internal readjustment
7	**ONLINE TO ANOTHER CONTROLLER (OA)**	
	State	**Description**
	1	The drive is online to another controller and therefore unavailable to the controller making the GET STATUS REQUEST.
	0	The drive is available and not online to the controller.

16.2.2 RA80 Mode Byte

Mode byte is the high byte of word 22. The mode byte contains write-protect and media-related status information. See Figure 16-3 and Table 16-2.

Figure 16-3 RA80 Mode Byte

7			4				0
W4	W3	W2	W1	DD	FO	DB	S7

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Table 16-2 RA80 Mode Byte

Bit	Bit Name
0	SECTOR FORMAT (S7)

State	Description
1	A 576-byte sector format (18 bit word) HDA is installed in the drive.
0	The 512-byte sector format (16-bit word) HDA is installed. For example, RSTS/E and VMS have 512 bytes per sector format and must have a 16-bit format HDA installed in the drive.

1 DIAGNOSTIC BLOCK ACCESS (DB)

State	Description
1	The diagnostic blocks on the drive can be accessed (DBN access enabled).
0	The DBNs cannot be accessed.

2 FORMAT OPERATION (FO)

State	Description
1	The drive can be formatted.
0	Formatting operations are disabled in this drive.

3 DISABLE DRIVE (DD)

State	Description
1	The drive has been disabled by a controller error routine or diagnostic. The FAULT light is on when this bit is set.

Table 16-2 (Cont.) RA80 Mode Byte

Bit	State	Description
	0	The drive is enabled by a controller error routine or diagnostic (normal operation).
4		**WRITE PROTECT STATUS (W1)**
	State	**Description**
	1	The drive is write protected.
	0	The drive is not write protected.
5-7		**WRITE PROTECT STATUS (W2-W4)**
	State	**Description**
	1	Not used.
	0	Not used.

16.2.3 RA80 Error Byte

Error byte is the low byte of word 23. The error byte contains general error status information. See Figure 16-4 and Table 16-3.

Figure 16-4 RA80 Error Byte

7							0
DE	RE	PE	DF	WE	0	0	0

CX–1299A

Table 16-3 RA80 Error Byte

Bit	Description
0	Not used.
1	Not used.
2	Not used.
3	WRITE LOCK ERROR (WE)—A write-lock error has occurred.
4	DIAGNOSTIC FAILURE (DF)—A failure in the initialization routine of the drive. A drive error code should be present in the low byte of word 27 of the RA80 Status Bytes.

Table 16-3 (Cont.) RA80 Error Byte

Bit	Description
5	PROTOCOL ERROR (PE)—Improper command codes or parameters were issued to the drive.
6	TRANSMISSION ERROR (RE)—An error occurred in the transmission of a command from the controller to the drive. The error can be a checksum error or an incorrectly formatted command string. It is most likely an SDI cabling problem.
7	DRIVE ERROR (DE)—A drive error has occurred, and the drive FAULT light may be on.

16.2.4 RA80 Controller Byte

Controller byte is the high byte of word 23. The controller byte contains general status information. See Figure 16-5 and Table 16-4.

Figure 16-5 RA80 Controller Byte

7							0
S4	S3	S2	S1	C1	C2	C3	C4

CX–1300A

Table 16-4 RA80 Controller Byte

Bit	Description
0-3	**C4—C1**

This is a 4-bit drive status code indicating various states of a drive operation. At the present time, only three codes are valid.

State	Code Description
0000	Normal operation.
1000	The drive is offline due to being under control of a diagnostic.
1001	The drive is offline because another drive has the same unit identifier.

Bit	Description
4-7	**SUPPRESS (S1—S4)**

The drive suppression of the attention-available messages. These messages may be suppressed and are sent to the controller when the drive is in the Available state.

16.2.5 RA80 Retry Count

Retry count is the low byte of word 24. Some errors are retried several times before a failure is declared. The retry count is the number of retries attempted from the previous operation.

16.2.6 RA80 Last SDI Command

Last SDI command is the high byte of word 24. This byte contains the last SDI command received by the drive. SDI commands are different than MSCP commands from the host to the controller. For the SDI commands see Table 16-5.

Table 16-5 SDI Commands

Opcode	Command
03	DIAGNOSE
05	DRIVE CLEAR
06	ERROR RECOVERY
09	GET STATUS
0A	INITIATE SEEK
0C	RUN
0F	WRITE MEMORY
81	CHANGE MODE
82	CHANGE CONTROLLER FLAGS
84	DISCONNECT
87	GET COMMON CHARACTERISTICS
88	GET SUBUNIT CHARACTERISTICS
8B	ONLINE
8D	READ MEMORY
8E	RECALIBRATE
90	TOPOLOGY

16.2.7 RA80 SDI Error Status

SDI error status is the low byte of word 25. This byte contains SDI error status bits 3, 4, 5, and 7. This error code provides information on SDI errors as seen by the drive.

- Bit 3, OVERRUN ERROR—Either a read or a write command extended past the sector or index pulse where the operation began.
- Bit 4, PARITY ERROR FOUND—A parity error is discovered during a transmission on the SDI Real-time Controller State line. The Real-time Controller State line of the SDI bus carries the following four control signals to the selected drive:
  - INIT

  - READ GATE
  - WRITE GATE
  - RECEIVER READY

- Bit 5, CONTROL PULSE ERROR— Two or more pulses of the same polarity are detected on the SDI Real-time Controller State line during the transmission of a real-time command. Normally, SDI signal polarities alternate between positive and negative.
- Bit 7, DATA PULSE ERROR—two or more pulses of the same polarity are detected in the drive on the SDI Write Command data line.

16.2.8 RA80 Current Cylinder Low Byte

Current cylinder low byte is the high byte of word 25. Current cylinder low byte is the low order address bits of the last seek operation.

16.2.9 RA80 Current Cylinder High Byte

Current cylinder high byte is the low byte of word 26. Current cylinder high byte is the high order address bits of the last seek operation.

16.2.10 RA80 Current Group

Current group is the high byte of word 26. This byte contains the present drive group address.

16.2.11 RA80 Drive Error Code

Drive error code is the low byte of word 27. This byte contains the microprocessor error code displayed by the diagnostic terminal or LEDs after the error was detected as shown in the following list:

Spindle motor timeout

Drive/LED Error Code: 01

Spinup too slow

Drive/LED Error Code: 02

Spindle not accelerating

Drive/LED Error Code: 03

Spinup too long

Drive/LED Error Code: 04

Cannot spin up because SIP SET GRANT is not set

Drive/LED Error Code: 05

Level 2 message frame sequence

Drive/LED Error Code: 07

Level 2 message checksum

Drive/LED Error Code: 08

SI message framing

Drive/LED Error Code: 09

Wrong Level 2 opcode parity

Drive/LED Error Code: 0A

Invalid Level 2 opcode

Drive/LED Error Code: 0B

Invalid Level 2 command length

Drive/LED Error Code: 0C

Attempt to execute command with status byte nonzero

Drive/LED Error Code: 0D

Incorrect group select code

Drive/LED Error Code: 0E

Attempt to WRITE ENABLE drive with switch in PROT position

Drive/LED Error Code: 0F

Wrong peak entering detente mode

Drive/LED Error Code: 11

Servo active PLO

Drive/LED Error Code: 12

No Fine Track

Drive/LED Error Code: 13

Servo speed or direction

Drive/LED Error Code: 14

SEEK/RECAL timeout

Drive/LED Error Code: 15

Guard band

Drive/LED Error Code: 16

Track counter underflow

Drive/LED Error Code: 17

Invalid cylinder address

Drive/LED Error Code: 1A

Sector overrun

Drive/LED Error Code: 1F

Controller Real-time state parity

Drive/LED Error Code: 20

Control pulse

Drive/LED Error Code: 21

Data pulse

Drive/LED Error Code: 22

Spindle motor interlock

Drive/LED Error Code: 23

Servo inactive PLO

Drive/LED Error Code: 24

Servo error set

Drive/LED Error Code: 25

Spindle speed

Drive/LED Error Code: 26

HDA over temperature

Drive/LED Error Code: 27

Servo module over temperature

Drive/LED Error Code: 28

Invalid error recovery level specified

Drive/LED Error Code: 29

Invalid subunit specified

Drive/LED Error Code: 2A

Invalid region (test number) in DIAGNOSE command

Drive/LED Error Code: 2B

Seek/Recal command given when spindle not spinning

Drive/LED Error Code: 2C

Invalid command timeout value given

Drive/LED Error Code: 2D

Controller flags prohibit spinup

Drive/LED Error Code: 2E

RUN command issued with RUN/STOP switch in RUN position

Drive/LED Error Code: 2F

WRITE CURRENT and no WRITE-GATE

Drive/LED Error Code: 30

READ and WRITE

Drive/LED Error Code: 31

READ/WRITE while faulted

Drive/LED Error Code: 32

Data separator/encoder

Drive/LED Error Code: 33

Write compensation

Drive/LED Error Code: 34

WRITE and WRITE UNSAFE

Drive/LED Error Code: 35

READ/WRITE head shorted

Drive/LED Error Code: 36

WRITE GATE and NO WRITE CURRENT

Drive/LED Error Code: 37

READ and MULTICHIP SELECT

Drive/LED Error Code: 38

WRITE and OFF TRACK

Drive/LED Error Code: 39

WRITE and WRITE PROTECTED

Drive/LED Error Code: 3A

Invalid Read/Write region

Drive/LED Error Code: 40

Response times out

Drive/LED Error Code: 41

SEEK command issued when drive not online

Drive/LED Error Code: 42

REAL-TIME command when READ/WRITE READY not set

Drive/LED Error Code: 43

FORMAT command when FORMAT ENABLE not set

Drive/LED Error Code: 44

Invalid head (track) address in REAL-TIME command

Drive/LED Error Code: 45

Read/Write Safety interrupt with no cause bit set

Drive/LED Error Code: 46

TT bit incorrect in DISCONNECT command

Drive/LED Error Code: 47

Invalid Write Memory offset or byte count

Drive/LED Error Code: 48

Invalid command during Topology mode

Drive/LED Error Code: 49

Drive disabled by DD bit

Drive/LED Error Code: 4A

Sector/byte counter

Drive/LED Error Code: 51

Personality module microsequencer

Drive/LED Error Code: 53

Multiplexer head-select

Drive/LED Error Code: 54

RAM 1 general purpose counter

Drive/LED Error Code: 57

RAM 0 general purpose counter

Drive/LED Error Code: 58

Read/Write head select

Drive/LED Error Code: 60

Data port preset

Drive/LED Error Code: 61

Read-only test overall read

Drive/LED Error Code: 62

Read-only test partial read

Drive/LED Error Code: 63

Sector timeout

Drive/LED Error Code: 64

Sector timeout

Drive/LED Error Code: 65

Read-only test read and no enable

Drive/LED Error Code: 66

Write test not executable

Drive/LED Error Code: 67

Read/Write test overall read

Drive/LED Error Code: 6A

Read/Write test partial read

Drive/LED Error Code: 6B

Read/Write control-select

Drive/LED Error Code: 70

Utility head-select

Drive/LED Error Code: 71

Microprocessor and personality board communication error 1

Drive/LED Error Code: 72

Microprocessor and personality board communication error 2

Drive/LED Error Code: 73

Initial board status

Drive/LED Error Code: 74

Control clock error detect circuit

Drive/LED Error Code: 75

Data clock error detect circuit

Drive/LED Error Code: 76

Port A select flop

Drive/LED Error Code: 77

Port A data xmit/rcvrs

Drive/LED Error Code: 78

Port A control xmit/rcvrs

Drive/LED Error Code: 79

Port B select flop

Drive/LED Error Code: 7A

PCB test cannot be done while motor is spinning

Drive/LED Error Code: 7B

Too slow seek

Drive/LED Error Code: 7C

Bad seek count overflow

Drive/LED Error Code: 7D

Too fast seek

Drive/LED Error Code: 7E

Spindle not spinning

Drive/LED Error Code: 7F

ROM set

Drive/LED Error Code: 80

Command available reset

Drive/LED Error Code: 81

Frame code reset and response

Drive/LED Error Code: 82

Init receivability from port B

Drive/LED Error Code: 83

CLRINI not clearing pending init

Drive/LED Error Code: 84

RAM 0

Drive/LED Error Code: 85

RAM 1

Drive/LED Error Code: 86

ROM 0 checksum

Drive/LED Error Code: 87

Module interlock

Drive/LED Error Code: 8A

Discrete port enable

Drive/LED Error Code: 8B

ROM 1 checksum

Drive/LED Error Code: 8F

Port B data xmit/rcvr

Drive/LED Error Code: 90

Port B control xmit/rcvr

Drive/LED Error Code: 91

Port A wrap-around reselect

Drive/LED Error Code: 92

Response serializer

Drive/LED Error Code: 93

Frame around receive

Drive/LED Error Code: 94

Loop around decode

Drive/LED Error Code: 95

Data byte receive

Drive/LED Error Code: 96

ROM 2 checksum

Drive/LED Error Code: 97

ROM 3 checksum

Drive/LED Error Code: 9F

READ and WRITE safety

Drive/LED Error Code: A0

Forced READ and WRITE

Drive/LED Error Code: A3

Forced WRITE CURRENT and NO WRITE GATE

Drive/LED Error Code: A4

Forced WRITE GATE and NO WRITE CURRENT

Drive/LED Error Code: A5

Forced separator/encoder

Drive/LED Error Code: A6

ROM 4 checksum

Drive/LED Error Code: A7

Servo caused Read/Write forced fault

Drive/LED Error Code: A9

Outer guard band seek

Drive/LED Error Code: AB

ROM 5 checksum

Drive/LED Error Code: AF

Three-module microprocessor bus

Drive/LED Error Code: B0

Three-module personality bus

Drive/LED Error Code: B1

Three-module servo bus

Drive/LED Error Code: B2

Microprocessor module bus

Drive/LED Error Code: B3

Personality module bus

Drive/LED Error Code: B4

Servo module bus

Drive/LED Error Code: B5

Fine track status

Drive/LED Error Code: C2

Fine track over range

Drive/LED Error Code: C3

Fine track under range

Drive/LED Error Code: C4

Off-track status

Drive/LED Error Code: C5

Off-track over range

Drive/LED Error Code: C6

Off-track under range

Drive/LED Error Code: C7

Acceleration status

Drive/LED Error Code: CB

Track counter

Drive/LED Error Code: CD

Funct check PLO-OK not false after disable

Drive/LED Error Code: CE

Funct check PLO-OK not true after enable

Drive/LED Error Code: CF

Recalibration

Drive/LED Error Code: D0

Outer guard band status

Drive/LED Error Code: D1

Inner guard band status

Drive/LED Error Code: D2

Seek into outer guard band

Drive/LED Error Code: D3

Outer guard band status not true

Drive/LED Error Code: D4

Recal from outer guard band

Drive/LED Error Code: D5

Two-track seek to Track 560

Drive/LED Error Code: D6

Seek into inner guard band

Drive/LED Error Code: D7

Inner guard band status not true

Drive/LED Error Code: D8

Recal from inner guard band

Drive/LED Error Code: D9

Random seek

Drive/LED Error Code: E0

Seek check

Drive/LED Error Code: E1

Cannot run test, drive faulted

Drive/LED Error Code: EA

Entry

Drive/LED Error Code: EE

Field engineer entered invalid cylinder address

Drive/LED Error Code: EF

Rotary switch

Drive/LED Error Code: FE

16.2.12 RA80 Front Panel Fault Code

Front panel fault code is the high byte of word 27. This byte contains the codes representing the front panel fault indicators. The code reported in this byte is not the same as would be seen on the operator control panel lights. See Table 16-6.

Table 16-6 RA80 Front Panel Fault Code

Code	Fault Condition
14	R/W diagnostic
16	Spindle motor interlock
18	Spinup
19	R/W unsafe
1E	Spindle motor speed
34	HDA or servo board over-temperature
36	Initial recal
38	Drive disabled by DD bit
3A	Servo diagnostic
3C	Microcode
3F	Microprocessor Hard-core test

CHAPTER 17
RA81 DRIVE STATUS

17.1 INTRODUCTION

Chapter 17 explains the RA81 disk status portion of the Standard Disk Interconnect Error Log Message. Standard Disk Interconnect is hereafter referred to as SDI.

The SDI error log message contains 12 bytes of drive status information. The SDI error log message reports SDI errors detected by the drive and any errors that occured within the drive. The SDI error information comes directly from the drive as drive status information. The drive status information provides the details of the problem reported by the drive.

17.2 RA81 STATUS BYTES

The following is drive status information for the RA81. Byte references refer to drive status bytes in the SDI packet. See Figure 17-1.

Figure 17-1 RA81 Status Bytes

WORD 23		WORD 22	
HIGH BYTE CONTROLLER BYTE	LOW BYTE ERROR BYTE	HIGH BYTE MODE BYTE	LOW BYTE REQUEST BYTE

WORD 25		WORD 24	
HIGH BYTE CURRENT CYL LOW WORD	LOW BYTE SDI ERROR BYTE	HIGH BYTE LAST SDI COMMAND	LOW BYTE RETRY COUNT

WORD 27		WORD 26	
HIGH BYTE FRONT PANEL FAULT CODE	LOW BYTE DRIVE ERROR CODE	HIGH BYTE CURRENT GROUP	LOW BYTE CURRENT CYL HIGH WORD

CX–1296A

17.2.1 RA81 Request Byte

Request byte is the low byte of word 22. The request byte contains general drive status information. See Figure 17-2 and Table 17-1.

Figure 17-2 RA81 Request Byte

7							0
OA	RR	DR	SR	EL	PB	PS	RU

CX–1297A

Table 17-1 RA81 Request Byte

Bit	Bit Name	
0	DRIVE RUNNING (RU)	
	State	**Description**
	1	The RUN/STOP switch is pushed in (RUN).
	0	The switch is out (STOP). The HDA may not actually be spinning when the switch is pushed in. See the SR bit described below.
1	PORT SELECTED (PS)	
	State	**Description**
	1	The Drive Port Select switch is pushed in (selected).
	0	The Port Switch is out (not selected).
2	PORT B SELECTED (PB)	
	State	**Description**
	1	The controller is accessing the drive through Port B.
	0	The controller is accessing the drive through Port A.

Table 17-1 (Cont.) RA81 Request Byte

3 ERROR LOG REQUEST (EL)

State	Description
1	Drive specific information is available in the extended status area of drive memory.
0	No information is available in the extended status area.

4 SPINDLE READY (SR)

State	Description
1	The drive spindle is up to speed.
0	The drive spindle is not up to speed.

5 DIAGNOSTIC REQUEST (DR)

State	Description
1	There is a request for a diagnostic to be loaded in the drive microprocessor memory.
0	No diagnostic is being requested of the host system. Drive diagnostics can be down-line loaded into the drive by the controller.

6 RECALIBRATE/READJUST REQUEST (RR)

State	Description
1	The drive requires an internal readjustment (servo head positioning system needs to be recalibrated). The microprocessor in an RA81 does this internal readjustment automatically each time the HDA is spun up. Some drives do not use this bit.
0	The drive does not require an internal readjustment

7 ONLINE TO ANOTHER CONTROLLER (OA)

State	Description
1	The drive is unavailable to the controller making the GET STATUS REQUEST (online to another controller).
0	The drive is available and not online to the controller.

17.2.2 RA81 Mode Byte

Mode byte is the high byte of word 22. The mode byte contains write-protect and media-related status information. See Figure 17-3 and Table 17-2.

Figure 17-3 RA81 Mode Byte

7			4				0
W4	W3	W2	W1	DD	FO	DB	S7

CX–1298A

Table 17-2 RA81 Mode Byte

Bit	Bit Name	
0	SECTOR FORMAT (S7)	
	State	**Description**
	1	A 576-byte sector format (18-bit word) HDA is installed in the drive.
	0	The 512-byte sector format (16-bit word) HDA is installed. For example, RSTS/E and VMS have 512 bytes per sector format and must have a 16-bit format HDA installed in the drive.
1	DIAGNOSTIC BLOCK ACCESS (DB)	
	State	**Description**
	1	The diagnostic blocks on the drive can be accessed (DBN access enabled).
	0	The DBNs cannot be accessed.
2	FORMAT OPERATION (FO)	
	State	**Description**
	1	The drive can be formatted.
	0	Formatting operations are disabled in this drive.
3	DISABLE DRIVE (DD)	
	State	**Description**
	1	The drive has been disabled by a controller error routine or diagnostic. The FAULT light is on when this bit is set.

Table 17-2 (Cont.) RA81 Mode Byte

	State	Description
	0	The drive is enabled by a controller error routine or diagnostic (normal operation).
4	**WRITE PROTECT STATUS (W1)**	
	State	**Description**
	1	The drive is write protected.
	0	The drive is not write protected.
5-7	**WRITE PROTECT STATUS (W2-W4)**	
	State	**Description**
	1	Not used.
	0	Not used.

17.2.3 RA81 Error Byte

Error byte is the low byte of word 23 and contains general error status information. See Figure 17-4 and Table 17-3.

Figure 17-4 RA81 Error Byte

7							0
DE	RE	PE	DF	WE	0	0	0

CX–1299A

Table 17-3 RA81 Error Byte

Bit	Description
0	Not used.
1	Not used.
2	Not used.
3	WRITE-LOCK ERROR (WE)—A write-lock error has occurred.
4	DIAGNOSTIC FAILURE (DF)—A failure occurred in the initialization routine of the drive. A drive error code should be present in the low byte of word 27 of the RA81 Status Bytes.

Table 17-3 (Cont.) RA81 Error Byte

Bit	Description
5	PROTOCOL ERROR (PE)—Improper command codes or parameters were issued to the drive.
6	TRANSMISSION ERROR (RE)—An error occurred in the transmission of a command from the controller to the drive. The error can be a checksum error, an incorrectly formatted command string, but is most likely an SDI cabling problem.
7	DRIVE ERROR (DE)—A drive error has occurred and the drive FAULT light may be on.

17.2.4 RA81 Controller Byte

Controller byte is the high byte of word 23. The controller byte contains general status information. See Figure 17-5 and Table 17-4.

Figure 17-5 RA81 Controller Byte

7							0
S4	S3	S2	S1	C1	C2	C3	C4

CX–1300A

Table 17-4 RA81 Controller Byte

Bit	Description
0-3	**C4—C1**
	A 4-bit drive status code indicating various states of a drive operation. At the present time, only the three codes listed are valid.
	State — **Code Description**
	0000 — Normal operation
	1000 — The drive is offline due to being under control of a diagnostic.
	1001 — The drive is offline because another drive has the same unit identifier.
4-7	**SUPPRESS (S1—S4)**
	The drive suppressed the attention-available messages. These messages may be suppressed and are sent to the controller when the drive the Available State.

17.2.5 RA81 Retry Count

Retry count is the low byte of word 24. Some errors are retried several times before a failure is declared. The retry count is the number of retries attempted from the previous operation.

17.2.6 RA81 Last SDI Command

Last SDI command is the high byte of word 24. This byte contains the last SDI command received by the drive. SDI Commands are different than MSCP commands from the host to the controller. For the SDI commands see Table 17-5.

Table 17-5 SDI Commands

Opcode	Command
03	DIAGNOSE
05	DRIVE CLEAR
06	ERROR RECOVERY
09	GET STATUS
0A	INITIATE SEEK
0C	RUN
0F	WRITE MEMORY
81	CHANGE MODE
82	CHANGE CONTROLLER FLAGS
84	DISCONNECT
87	GET COMMON CHARACTERISTICS
88	GET SUBUNIT CHARACTERISTICS
8B	ONLINE
8D	READ MEMORY
8E	RECALIBRATE
90	TOPOLOGY

17.2.7 RA81 SDI Error Status

SDI error status is the low byte of word 25. This byte contains SDI error status bits 3, 4, 5, and 7. This error code provides information on SDI errors as seen by the drive.

- Bit 3, OVERRUN ERROR—Either a read or a write command extends past the sector or index pulse where the operation began.
- Bit 4, PARITY ERROR FOUND—A parity error is discovered during a transmission on the SDI Real-time Controller State line. The Real-time Controller State line of the SDI bus carries the following four control signals to the selected drive:

- INIT
- READ GATE
- WRITE GATE
- RECEIVER READY

- Bit 5, CONTROL PULSE ERROR—During the transmission of a real-time command if two or more pulses of the same polarity are detected on the SDI Real-time Controller State line. Normally, SDI signal polarities alternate between positive and negative.
- Bit 7, DATA PULSE ERROR—Two or more pulses of the same polarity are detected in the drive on the SDI write command data line.

17.2.8 RA81 Current Cylinder Low Byte

Current cylinder low byte is the high byte of word 25. Current cylinder low byte is the low order address bits of the last seek operation.

17.2.9 RA81 Current Cylinder High Byte

Current cylinder high byte is the low byte of word 26. Current cylinder high byte is the high order address bits of the last seek operation.

17.2.10 RA81 Current Group

Current group is the high byte of word 26. This byte contains the present drive group address.

17.2.11 RA81 Drive Error Code

Drive error code is the low byte of word 27. This byte contains the microprocessor error code displayed by the diagnostic terminal or LEDs after the error was detected:

Spindle motor speed transducer timeout

Drive/LED Error Code: 01

Spindle speed of 1000 rpm not reached in 6 seconds during spinup

Drive/LED Error Code: 02

Spindle not accelerating during spinup

Drive/LED Error Code: 03

Spindle speed of 3420 rpm not reached in 40 seconds during spinup

Drive/LED Error Code: 04

Startup inhibited by absence of drive spinup sequencing grant or presence of start in progress (SIP). (This could be legitimate status.)

Drive/LED Error Code: 05

Microcode fault

Drive/LED Error Code: 06

Level 2 Message Frame Sequencing error

Drive/LED Error Code: 07

Level 2 Message Checksum error

Drive/LED Error Code: 08

SDI Message Framing error

Drive/LED Error Code: 09

Invalid operation code parity for a Level 1 or 2 message

Drive/LED Error Code: 0A

Invalid operation code for a Level 1 or 2 message

Drive/LED Error Code: 0B

Invalid command length for a Level 2 message

Drive/LED Error Code: 0C

Status error byte nonzero while attempting to execute a command

Drive/LED Error Code: 0D

Group select code nonzero while attempting to execute a command

Drive/LED Error Code: 0E

Write-protect switch in the PROTECT position while attempting to write enable the drive

Drive/LED Error Code: 0F

Invalid error code sent by slave

Drive/LED Error Code: 10

SDI transfer command when R/W error pending

Drive/LED Error Code: 11

SDI transfer command when drive error pending

Drive/LED Error Code: 12

Fine track not reached during detente mode

Drive/LED Error Code: 13

Attempt to format when format disabled

Drive/LED Error Code: 14

Too much time to execute a SEEK or Recal command

Drive/LED Error Code: 15

Guard band detected while performing a SEEK command

Drive/LED Error Code: 16

Seek logic difference counter decremented past zero before expected cylinder reached

Drive/LED Error Code: 17

Seek command contains an invalid cylinder address

Drive/LED Error Code: 1A

Velocity calibration detects too many bad seeks

Drive/LED Error Code: 1B

Unsuccessful RECALIBRATE command detected during a velocity calibration

Drive/LED Error Code: 1C

Drive seeks more than 10% too fast

Drive/LED Error Code: 1D

Drive seeks more than 15% too slow

Drive/LED Error Code: 1E

Sector pulse detected during execution of sector read or write

Drive/LED Error Code: 1F

Parity error detected on Controller Real-time State line

Drive/LED Error Code: 20

Two or more pulses of same polarity detected on Controller Real-time State line (control pulse error)

Drive/LED Error Code: 21

Two or more pulses of same polarity detected on Controller Write Command Data line (data pulse error)

Drive/LED Error Code: 22

Spindle motor interlock broken; belt tension lever released

Drive/LED Error Code: 23

Servo error (SVOCHK) detected; off track during detente mode

Drive/LED Error Code: 25

Spindle speed detected as being less than 3420 rpm (3600-5%)

Drive/LED Error Code: 26

HDA temperature too high

Drive/LED Error Code: 27

Servo module temperature too high

Drive/LED Error Code: 28

Invalid error recovery level specified

Drive/LED Error Code: 29

Invalid subunit specified

Drive/LED Error Code: 2A

Invalid region specified in a diagnostic command

Drive/LED Error Code: 2B

SEEK or RECAL command attempted while spindle not spinning

Drive/LED Error Code: 2C

Invalid command timeout value given

Drive/LED Error Code: 2D

Controller flags detected prohibiting drive spin-up

Drive/LED Error Code: 2E

RUN/STOP switch in stop position while attempting run command

Drive/LED Error Code: 2F

WRITE CURRENT turned on without WRITE GATE being asserted

Drive/LED Error Code: 30

READ command attempted with WRITE GATE asserted

Drive/LED Error Code: 31

READ or WRITE command attempted while drive faulted

Drive/LED Error Code: 32

Burst error detected while writing

Drive/LED Error Code: 33

Read Data Separator/Encoder error

Drive/LED Error Code: 34

Write Unsafe error detected while attempting a WRITE command

Drive/LED Error Code: 35

Short circuit detected in head winding

Drive/LED Error Code: 36

No WRITE CURRENT detected with WRITE GATE asserted

Drive/LED Error Code: 37

READ command attempted with multiple heads selected

Drive/LED Error Code: 38

WRITE command attempted while positioner is off track (not detented)

Drive/LED Error Code: 39

WRITE command attempted while drive is write protected

Drive/LED Error Code: 3A

Servo/HDA interlock broken

Drive/LED Error Code: 3B

Servo interlock broken

Drive/LED Error Code: 3C

R/W interlock broken

Drive/LED Error Code: 3D

Control panel interlock broken

Drive/LED Error Code: 3E

Personality module interlock broken

Drive/LED Error Code: 3F

Invalid R/W region specified

Drive/LED Error Code: 40

SDI controller response timed out

Drive/LED Error Code: 41

Drive not in an ONLINE state while attempting SEEK command

Drive/LED Error Code: 42

R/W READY not set while attempting REAL-TIME command

Drive/LED Error Code: 43

Format Enable not set while attempting format command

Drive/LED Error Code: 44

REAL-TIME command contains invalid head (track) address

Drive/LED Error Code: 45

R/W Safety Interrupt occurs with no cause bits set

Drive/LED Error Code: 46

DISCONNECT command contains incorrect TT bit

Drive/LED Error Code: 47

WRITE MEMORY offset or byte count invalid

Drive/LED Error Code: 48

INVALID command while in Topology mode

Drive/LED Error Code: 49

Drive disabled by DD bit

Drive/LED Error Code: 4A

Index Pulse error

Drive/LED Error Code: 4B

Bad embedded servo data during WRITE command

Drive/LED Error Code: 4D

Can write or format when drive is write protected

Drive/LED Error Code: 4E

SDI Transfer error

Drive/LED Error Code: 4F

Slave diagnostic timeout (error could be result of positioner lock lever in lock position.)

Drive/LED Error Code: 50

Sector/byte fails to count properly

Drive/LED Error Code: 51

Group zero cannot be selected

Drive/LED Error Code: 52

Group one cannot be selected

Drive/LED Error Code: 53

R/W Head Select error detected while executing Head Select Multiplexer test

Drive/LED Error Code: 54

Master timer faulty

Drive/LED Error Code: 57

R/W Head Select error detected while executing R/W test

Drive/LED Error Code: 60

R/W Data Set-up error (Diagnostic Write Data register not equal to Diagnostic Read Data register)

Drive/LED Error Code: 61

Bad data from three or more heads while executing Read-only test

Drive/LED Error Code: 62

Bad data from one or two heads while executing Read-only test

Drive/LED Error Code: 63

R/W test sector not found within two revolutions of the disk

Drive/LED Error Code: 65

Read failure caused by servo being off track

Drive/LED Error Code: 66

Write test not executed because Test F has not run or failed

Drive/LED Error Code: 67

Read-only cylinder cannot be reformatted without jumper

Drive/LED Error Code: 68

R/W diagnostic comparison circuitry never detects error

Drive/LED Error Code: 69

DIAGNOSTIC WRITE attempted while write protected

Drive/LED Error Code: 6F

Command Available Timeout error during execution of PCB Wrap test

Drive/LED Error Code: 70

SDI INIT always asserted

Drive/LED Error Code: 71

No control clock or framing error during execution of PCB Wrap test

Drive/LED Error Code: 72

Microprocessor and PCB board data bus communication error

Drive/LED Error Code: 73

Initial personality board status incorrect for offline condition

Drive/LED Error Code: 74

Failure in control clock error detect circuit

Drive/LED Error Code: 75

Failure in data clock error detect circuit

Drive/LED Error Code: 76

Failure of Port A select latch

Drive/LED Error Code: 77

Port A Data Transmitter/Receiver error

Drive/LED Error Code: 78

Port A Control Line Transmitter/Receiver error

Drive/LED Error Code: 79

Failure of Port B select latch

Drive/LED Error Code: 7A

Spindle motor spinning while attempting PCB test

Drive/LED Error Code: 7B

Receive error in frame code during PCB Wrap test

Drive/LED Error Code: 7C

Receive error in data byte during PCB Wrap test

Drive/LED Error Code: 7D

Consistency fault detected in master ROM

Drive/LED Error Code: 80

Command available not reset after reading data

Drive/LED Error Code: 81

Frame code not reset after reading data

Drive/LED Error Code: 82

SDI INIT not received from Port B

Drive/LED Error Code: 83

INIT bit not reset following INIT

Drive/LED Error Code: 84

Master RAM 0 fails RAM test

Drive/LED Error Code: 85

Master RAM 1 fails RAM test

Drive/LED Error Code: 86

Checksum error in master ROM 0

Drive/LED Error Code: 87

Unable to reset SDI Error register

Drive/LED Error Code: 8A

Drive SDI interface not ready to start

Drive/LED Error Code: 8B

Error during frame transmission

Drive/LED Error Code: 8C

Checksum error in master ROM 1

Drive/LED Error Code: 8F

Port B data Transmitter/Receiver error

Drive/LED Error Code: 90

Port B control line Transmitter/Receiver error

Drive/LED Error Code: 91

Port A wraparound error

Drive/LED Error Code: 92

Response serializer error

Drive/LED Error Code: 93

Loop-around frame not received properly

Drive/LED Error Code: 94

Loop-around frame not decoded properly

Drive/LED Error Code: 95

Loop-around frame data byte not received properly

Drive/LED Error Code: 96

Checksum error in master ROM 2

Drive/LED Error Code: 97

Checksum error in master ROM 3

Drive/LED Error Code: 9F

Unable to clear faults at R/W safety register

Drive/LED Error Code: A0

Unable to force Head Short error while writing

Drive/LED Error Code: A1

Unable to force Multiple Head Select error while reading

Drive/LED Error Code: A2

Unable to force READ GATE and WRITE GATE active at the same time

Drive/LED Error Code: A3

Unable to force WRITE CURRENT without WRITE GATE

Drive/LED Error Code: A4

Unable to force WRITE GATE without WRITE CURRENT

Drive/LED Error Code: A5

Unable to force a miscompare of the data from the write compensation logic and the read encoder logic

Drive/LED Error Code: A6

Checksum error in master ROM 4

Drive/LED Error Code: A7

Servo fault causes a R/W forced fault

Drive/LED Error Code: A9

Diagnostic firmware has good prompt code

Drive/LED Error Code: AA

Checksum error in master ROM 5

Drive/LED Error Code: AF

Test not running due to drive fault

Drive/LED Error Code: B0

Bus Test error in microprocessor module

Drive/LED Error Code: B3

Bus Test error in personality module

Drive/LED Error Code: B4

UART Transmitter/Receiver error

Drive/LED Error Code: B6

Stream test write clock not active

Drive/LED Error Code: B8

Stream read clock not active

Drive/LED Error Code: B9

Stream buffered servo clock not active

Drive/LED Error Code: BA

Stream ECL write data not present

Drive/LED Error Code: BB

Stream encoded write data not present

Drive/LED Error Code: BC

Stream decoded read data not present

Drive/LED Error Code: BD

Stream ECL read data not present

Drive/LED Error Code: BE

Unable to reset stream bit

Drive/LED Error Code: BF

Fine Track Timer error

Drive/LED Error Code: C0

Fine Track status not asserted

Drive/LED Error Code: C1

Fine Track status not deasserted

Drive/LED Error Code: C2

Fine Track over range error

Drive/LED Error Code: C3

Fine Track under range error

Drive/LED Error Code: C4

Wrong Fine Track channel

Drive/LED Error Code: C5

PLO error

Drive/LED Error Code: C6

ADC/DAC reference voltage not within range

Drive/LED Error Code: C8

ADC/DAC Bit error

Drive/LED Error Code: C9

ADC/DAC Bit error

Drive/LED Error Code: CA

Servo Velocity Test Acceleration Status error

Drive/LED Error Code: CB

Seek Difference counter not loading correctly

Drive/LED Error Code: CC

Seek Difference Counter error or wrong old gray code bits

Drive/LED Error Code: CD

Servo Sanity Tests Timer error

Drive/LED Error Code: CE

Load attempt failed

Drive/LED Error Code: D0

Outer guard band detected following Head-load operation

Drive/LED Error Code: D1

Inner guard band detected following Head-load operation

Drive/LED Error Code: D2

Seek into outer guard band failed

Drive/LED Error Code: D3

Outer guard band not detected following seek into outer guard band

Drive/LED Error Code: D4

Load from outer guard band failed

Drive/LED Error Code: D5

Spindle not up to speed

Drive/LED Error Code: D6

Seek into inner guard band failed

Drive/LED Error Code: D7

Inner guard band not detected following seek into inner guard band

Drive/LED Error Code: D8

Load from inner guard band failed

Drive/LED Error Code: D9

Spindle not spinning

Drive/LED Error Code: DA

Diagnostic seek failed

Drive/LED Error Code: DB

Incorrect parameters entered during execution of drive-resident diagnostics

Drive/LED Error Code: DC

Recalibrate error

Drive/LED Error Code: DD

Low Velocity Seek error

Drive/LED Error Code: DE

Spinup failed

Drive/LED Error Code: DF

Random Seek error

Drive/LED Error Code: E0

Integrator error

Drive/LED Error Code: E1

Slave ROM Consistency error

Drive/LED Error Code: E2

Checksum error on slave ROM 0

Drive/LED Error Code: E3

Checksum error on slave ROM 1

Drive/LED Error Code: E4

Checksum error on slave ROM 2

Drive/LED Error Code: E5

Checksum error on slave ROM 3

Drive/LED Error Code: E6

Test execution code

Drive/LED Error Code: E7

Error in slave RAM 0

Drive/LED Error Code: E8

Error in slave RAM 1

Drive/LED Error Code: E9

Incorrect test parameter entered

Drive/LED Error Code: EE

Slave uncommanded spindown

Drive/LED Error Code: F0

Slave load timeout

Drive/LED Error Code: F1

Slave sent unexpected message

Drive/LED Error Code: F2

Slave received bad command packet

Drive/LED Error Code: F3

Slave Operation Code Parity error

Drive/LED Error Code: F4

Slave received invalid operation code

Drive/LED Error Code: F5

Master received bad status packet from slave

Drive/LED Error Code: F6

Slave Recalibrate timeout (error could be result of positioner lock lever in lock position)

Drive/LED Error Code: F7

Slave Seek timeout

Drive/LED Error Code: F8

Slave Offset timeout

Drive/LED Error Code: F9

Slave Spin-up timeout

Drive/LED Error Code: FA

Slave Spin-down timeout

Drive/LED Error Code: FB

Slave Send-status timeout

Drive/LED Error Code: FC

Slave Initialization timeout

Drive/LED Error Code: FD

Slave Speed-check timeout

Drive/LED Error Code: FE

17.2.12 RA81 Front Panel Fault Code

Front panel fault code is the high byte of word 27. This byte contains the codes representing the front panel fault indicators. The code reported in this byte is not the same as would be seen on the operator control panel lights. See Table 17-6.

Table 17-6 RA81 Front Panel Fault Code

Code	Fault Condition
11	Index error
12	Master/slave error
13	Servo Diagnostic Test error
14	Microprocessor fault
15	Drive disabled by DD bit
16	Servo Course Positioning error
17	Diagnostic Idle Loop Test error
18	Spin error
19	Write and bad embedded data
1A	Servo Fine Positioning error
1B	R/W diagnostic test error
1C	SDI error
1D	Write-enabled and Write-protect Asserted error
1E	Spindle Motor Interlock error
30	Servo or HDA Over-temperature error

Table 17-6 (Cont.) RA81 Front Panel Fault Code

Code	Fault Condition
32	Servo/Microprocessor Interlock error
34	R/W Command error
36	Control Panel/microprocessor Interlock error
38	R/W Unsafe error
3A	R/W Microprocessor Interlock error
3C	Servo/HDA Interlock error
3E	Personality/Micoprocessor Interlock error
3F	Microprocessor Hardcore Test error
*	DC low

CHAPTER 18
RA82 DRIVE STATUS

18.1 INTRODUCTION

Chapter 18 explains the RA82 disk status portion of the Standard Disk Interconnect Error Log Message. Standard Disk Interconnect is hereafter referred to as SDI.

The SDI error log message contains 12 bytes of drive status information. The SDI error log message reports SDI errors detected by the drive and any errors that occur within the drive. The SDI error information comes directly from the drive as drive status information. The drive status information provides the details of the problem reported by the drive.

18.2 RA82 STATUS BYTES

The following is drive status information for the RA82. Byte references refer to drive status bytes in the SDI packet. See Figure 18-1.

Figure 18-1 RA82 Status Bytes

WORD 23		WORD 22	
HIGH BYTE CONTROLLER BYTE	LOW BYTE ERROR BYTE	HIGH BYTE MODE BYTE	LOW BYTE REQUEST BYTE

WORD 25		WORD 24	
HIGH BYTE CURRENT CYL LOW WORD	LOW BYTE REAL-TIME PORT IMAGE	HIGH BYTE LAST OP CODE	LOW BYTE RETRY COUNT

WORD 27		WORD 26	
HIGH BYTE FRONT PANEL FAULT CODE	LOW BYTE DRIVE ERROR CODE	HIGH BYTE CURRENT GROUP RECOVERY LEVEL	LOW BYTE CURRENT CYL HIGH WORD

CX-1301A

18.2.1 RA82 Request Byte

Request byte is the low byte of word 22. The request byte contains general drive status information. See Figure 18-2 and Table 18-1.

Figure 18-2 RA82 Request Byte

7							0
OA	RR	DR	SR	EL	PB	PS	RU

CX–1297A

Table 18-1 RA82 Request Byte

Bit	Bit Name	
0	**DRIVE RUNNING (RU)**	
	State	**Description**
	1	The RUN/STOP switch is pushed in (RUN).
	0	The switch is out (STOP). The HDA may not actually be spinning when the switch is pushed in. See the SR bit described below.
1	**PORT SELECTED (PS)**	
	State	**Description**
	1	The Drive Port Select switch is pushed in (selected).
	0	The Port switch is out (not selected).
2	**PORT B SELECTED (PB)**	
	State	**Description**
	1	The controller is accessing the drive through Port B.
	0	The controller is accessing the drive through Port A.

Table 18-1 (Cont.) RA82 Request Byte

3	**ERROR LOG REQUEST (EL)**	
	State	**Description**
	1	Drive specific information is available in the extended status area of drive memory.
	0	No information is available in the extended status area.
4	**SPINDLE READY (SR)**	
	State	**Description**
	1	The drive spindle is up to speed.
	0	The drive spindle is not up to speed.
5	**DIAGNOSTIC REQUEST (DR)**	
	State	**Description**
	1	There is a request for a diagnostic to be loaded in the drive microprocessor memory.
	0	No diagnostic is being requested of the host system. Drive diagnostics can be down-line loaded into the drive by the controller.
6	**RECALIBRATE/READJUST REQUEST (RR)**	
	State	**Description**
	1	The drive requires an internal readjustment (servo head positioning system needs to be recalibrated).
	0	The drive does not require an internal readjustment.
7	**ONLINE TO ANOTHER CONTROLLER (OA)**	
	State	**Description**
	1	The drive is unavailable to the controller making the GET STATUS REQUEST (online to another controller).
	0	The drive is available and not online to the controller.

18.2.2 RA82 Mode Byte

Mode byte is the high byte of word 22. The mode byte contains write-protect and media-related status information. See Figure 18-3 and Table 18-2.

Figure 18-3 RA82 Mode Byte

7			4				0
W4	W3	W2	W1	DD	FO	DB	S7

CX–1298A

Table 18-2 RA82 Mode Byte

Bit	Bit Name
0	SECTOR FORMAT (S7)

State	Description
1	A 576-byte sector format (18-bit word) HDA is installed in the drive.
0	The 512-byte sector format (16-bit word) HDA is installed. For example, RSTS/E and VMS have 512 bytes per sector format and must have a 16-bit format HDA installed in the drive.

Bit	Bit Name
1	DIAGNOSTIC BLOCK ACCESS (DB)

State	Description
1	The diagnostic blocks on the drive can be accessed (DBN access enabled).
0	The DBNs cannot be accessed.

Bit	Bit Name
2	FORMAT OPERATION (FO)

State	Description
1	The drive can be formatted.
0	Formatting operations are disabled in this drive.

Bit	Bit Name
3	DISABLE DRIVE (DD)

State	Description
1	The drive has been disabled by a controller error routine or diagnostic. The FAULT light is on when this bit is set.

Table 18-2 (Cont.) RA82 Mode Byte

	0	The drive is enabled by a controller error routine or diagnostic (normal operation).
4	**WRITE PROTECT STATUS (W1)**	
	State	**Description**
	1	The drive is write protected.
	0	The drive is not write protected.
5-7	**WRITE PROTECT STATUS (W2-W4)**	
	State	**Description**
	1	Not used.
	0	Not used.

18.2.3 RA82 Error Byte

Error byte is the low byte of word 23. The error byte contains general error status information. See Figure 18-4 and Table 18-3.

Figure 18-4 RA82 Error Byte

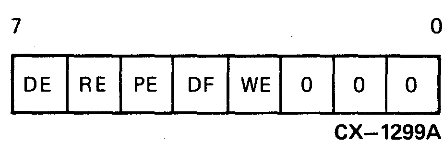


Table 18-3 RA82 Error Byte

Bit	Description
0	Not used.
1	Not used.
2	Not used.
3	WRITE-LOCK ERROR (WE)—A write-lock error has occurred.
4	DIAGNOSTIC FAILURE (DF)—Not used.

Table 18-3 (Cont.) RA82 Error Byte

Bit	Description
5	PROTOCOL ERROR (PE)—Improper command codes or parameters were issued to the drive.
6	TRANSMISSION ERROR (RE)—An error occurred in the transmission of a command from the controller to the drive. The error can be a checksum error or an incorrectly formatted command string, but is most likely an SDI cabling problem.
7	DRIVE ERROR (DE)—A drive error has occurred, and the drive FAULT light may be on.

18.2.4 RA82 Controller Byte

Controller byte is the high byte of word 23. The controller byte contains general status information. See Figure 18-5 and Table 18-4.

Figure 18-5 RA82 Controller Byte

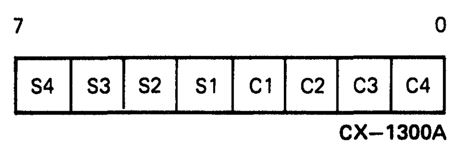


Table 18-4 RA82 Controller Byte

Bit	Description
0-3	**C4—C1**
	This is a 4-bit drive status code indicating various states of a drive operation. At the present time only three codes are valid.
	State — **Code Description**
	0000 — Normal operation.
	1000 — The drive is offline due to being under control of a diagnostic.
	1001 — The drive is offline because another drive has the same unit identifier.
4-7	**SUPPRESS (S1—S4)**
	Not used.

18.2.5 RA82 Retry Count

Retry count is the low byte of word 24. Some errors are retried several times before a failure is declared. The retry count is the number of retries attempted from the previous operation.

18.2.6 RA82 Last Opcode

Last opcode is the high byte of word 24. This byte contains the last opcode received by the drive. Remember that opcodes are different than MSCP commands from the host to the controller. For the opcodes see Table 18-5.

Table 18-5 Op Codes

Opcode	Command
03	DIAGNOSE
05	DRIVE CLEAR
06	ERROR RECOVERY
09	GET STATUS
0A	INITIATE SEEK
0C	RUN
0F	WRITE MEMORY
81	CHANGE MODE
82	ChANGE CONTROLLER FLAGS
84	DISCONNECT
87	GET COMMON CHARACTERISTICS
88	GET SUBUNIT CHARACTERISTICS
8B	ONLINE
8D	READ MEMORY
8E	RECALIBRATE
90	TOPOLOGY

18.2.7 RA82 Real-Time Drive Port Image

Real-time drive port image is the low byte of word 25. The Real-time drive port image provides information on the condition of the internal hardware port selection and the drive state bits currently activated to that port. The following list is the bit representation:

- Bit 0 = Port B RTDS (output) enabled
- Bit 1 = Port A RTDS (output) enabled
- Bit 2 = Port B (RTCS + WTR/CMD input) enabled
- Bit 3 = Port A (RTCS + WTR/CMD input) enabled

- Bit 4 = AVAILABLE asserted
- Bit 5 = ATTENTION asserted
- Bit 6 = R/W READY asserted
- Bit 7 = RECEIVER READY asserted

18.2.8 RA82 Current Cylinder Low Byte

Current cylinder low byte is the high byte of word 25. Current cylinder low byte is the low order address bits of the last seek operation.

18.2.9 RA82 Current Cylinder High Byte

Current cylinder high byte is the low byte of word 26. Current cylinder high byte is the high order address bits of the last seek operation.

18.2.10 RA82 Current Group

Current group is the low nibble of the high byte of word 26. This byte contains the present drive group address.

18.2.11 RA82 Recovery Level

Recovery level is the high nibble of the high byte of word 26. This byte contains the recovery level the RA82 is currently using. See Table 18-6. A brief discussion of the error recovery levels follows the table.

Table 18-6 RA82 Error Recovery Levels

Recovery Level	Description
7 (1st level tried)	Decrease read threshold
6	Holdover one shot
5	Skew read gate
4	Decrease read threshold + holdover one shot
3	Decrease read threshold + skew read gate
2	Holdover one shot + skew read gate
1	Decrease read threshold + holdover one shot + skew read gate
0	No operation—default mode of drive

- DECREASE READ THRESHOLD—This circuit decreases the threshold at which the R/W circuitry detects read pulses from the disk.
- HOLDOVER ONE SHOT—This circuitry holds the VCO control voltage stable to prevent large phase errors from occurring due to momentary loss of pulses being read from the disk.

- **SKEW READ GATE**—This circuitry introduces a delay of one or two bytes in READ GATE between the time the hybrid module receives READ GATE from the controller and the time the R/W module receives it. The amount of skew changes at index time and is one byte for the first revolution of the disk, two bytes on the second revolution, one byte for the third, etc.

18.2.12 RA82 Drive Error Code

Drive error code is the low byte of word 27. This byte contains the microprocessor error code displayed by the diagnostic terminal or LEDs after the error was detected. The following is a list of drive error codes:

Spin-up Error, Spindle Motor Transducer timeout

Drive/LED Error Code: 01

Error Description: When the motor fails to spin, this fault is generated because no TACH PULSE signal transitions are detected.

Spin-up Error, 0-1000 RPM too slow

Drive/LED Error Code: 02

Error Description: The spindle motor began to spin on command but failed to accelerate to 1000 rpm within 6 seconds.

Spin-up Error, spindle not accelerating

Drive/LED Error Code: 03

Error Description: The motor achieved 1000 rpm in 6 seconds, but while monitoring speed for either 1480 or 3420 rpm, TACH PULSE transitions failed, indicating the inability to accelerate beyond a particular speed.

Spin-up error, too long to get up to speed

Drive/LED Error Code: 04

Error Description: TACH PULSE H transitions are occurring, the motor is accelerating, but the spindle motor failed to achieve the minimum steady state speed of 3420 rpm within 50 seconds.

Spinup inhibited—grant not present OR sip present

Drive/LED Error Code: 05

Error Description: This is usually not an error. It is normally caused when the preceding drive performs a spin-up sequence. Check to see if the drive can spin up with the power sequence terminator moved to the SEQ IN connector for this drive. If the drive now spins up, then problem is with the preceding drive. Check the sequence cables, or if previous drive is an RA82, check/replace the hybrid module in that RA82.)

NOTE

A drive sequence terminator can be locally simulated by removing the cable connected to J303 on the hybrid module and connecting a jumper between pins 3 and 4 of J303.

Microcode fault

Drive/LED Error Code: 06

Error Description: Any one or more of the following error conditions occurred:

- Hybrid microcode attempted to jump to a nonused area of EPROM.
- Invalid interrupt occurred on the hybrid module.
- One or more EPROMs (E48, E49, E50) are not installed in the correct sockets on the hybrid module.
- Servo microcode fault.

Level 2 SDI Command Frame Sequence error

Drive/LED Error Code: 07

Error Description: This error is generated when any one of the following occurs:

- A CONTINUE frame was detected, but a START frame was not previously detected to put the drive into Level 2 SDI command mode.
- A END frame was detected, but a START frame was not previously detected to put the drive into Level 2 SDI command mode.
- An unexpected START frame was detected while the drive was expecting a CONTINUE or END frame during Level 2 SDI command mode.
- A Level 1 SELECT GROUP command was detected while the drive was expecting a CONTINUE or END frame during Level 2 SDI command mode.

A Level 2 SDI command occurs in the following sequence as defined by SDI specifications:

1. The drive detects a START frame code (Hex 71) from an SDI controller. This detection puts the drive into Level 2 mode of SDI command decoding. The message data included with the START frame is the opcode of the desired command the drive is to execute.
2. The drive detects 1 to 62 CONTINUE frame codes (the number detected depends entirely on the type of command the controller is sending) from an SDI controller. Some Level 2 commands DO NOT require any continue frames. The message data included with each continue frame contains any additional information required by the drive to complete the Level 2 command.
3. The drive detects an END frame code (Hex B2) from an SDI controller. This detection indicates the END of the entire specified Level 2 command. The message data included with the END frame contains a checksum value. The drive uses the checksum word to validate all message data received during reception of the current Level 2 command.

Level 2 SDI Command Checksum error

Drive/LED Error Code: 08

Error Description: The checksum data received in an END frame during a Level 2 command from an SDI controller did not match the checksum generated by the drive firmware. During reception of a START frame (Hex 71) and any CONTINUE frames (Hex D4), the drive calculates an on-going checksum for the frame data bytes. An END frame (Hex B2) indicates the end of the current Level 2 command. The frame data in the END frame contains the checksum byte the controller generates while sending the Level 2 command and must match the checksum the drive firmware generated during command reception.

SDI Command Framing error

Drive/LED Error Code: 09

Error Description: The drive received an SDI command, but the FRAME CODE was not one of the nine codes permitted by SDI protocol.

SDI Opcode Command Parity error

Drive/LED Error Code: 0A

Error Description: The opcode in a Level 2 SDI command was received with incorrect parity. A Level 2 opcode is contained within the frame data byte of a START frame and explicitly defines the required Level 2 command the controller expects the drive to perform. The opcode byte must be even parity.

Invalid Level 2 SDI Command opcode

Drive/LED Error Code: 0B

Error Description: The opcode in a Level 2 SDI command received from a controller had correct parity but did not match any of the 16 permitted Level 2 commands.

Invalid Level 2 SDI Command Length

Drive/LED Error Code: 0C

Error Description: A Level 2 command was received from an SDI controller with an invalid number of bytes for the operation requested or was longer than 64 bytes in length.

Attempt command while drive status error byte is nonzero

Drive/LED Error Code: 0D

Error Description: A Level 2 SEEK command, RECALIBRATE command, or ERROR RECOVERY command was received while the drive was currently exhibiting an error condition.

Invalid Group Select error

Drive/LED Error Code: 0E

Error Description: The controller attempted to issue a GROUP SELECT command to the drive with a group select number greater than the drive capability. A logical group number in the RA82 is the same as a R/W head number selection. Since the RA82 incorporates 15 physical heads numbered 0 through 14 (Decimal), the maximum group number is 0E (Hex).

SDI WRITE-ENABLE command while drive is hardware write protected

Drive/LED Error Code: 0F

Error Description: The SDI controller attempted to issue a command to write enable the drive while the drive OCP Write-protect switch was in the WRITE-PROTECT position.

Slave sent invalid error code

Drive/LED Error Code: 10

Error Description: The hybrid microprocessor received an error code from the slave microprocessor (located on the servo module) that was either unknown to the hybrid firmware or invalid for the operation being performed.

TRANSFER command while NO R/W READY

Drive/LED Error Code: 11

Error Description: The signal R/W Ready was not asserted by the drive after it detected a Level 1 FORMAT, READ, or WRITE transfer command from an SDI controller. When asserted by the RA82, R/W Ready indicates the drive is capable of performing a data transfer to or from the disk surface.

TRANSFER command while Drive error

Drive/LED Error Code: 12

Error Description: The drive was already in a fault/error condition (DE/Drive Error bit was set) when it received a FORMAT, READ, or WRITE transfer command from the controller. The DE bit is asserted during most fault conditions which can occur with the RA82.

Failed to achieve Fine Track after seek

Drive/LED Error Code: 13

Error Description: After a seek operation, the drive enters detent mode in an attempt to accurately position the selected R/W head on track center line and assert FINE TRACK. This error occurs if FINE TRACK does not get asserted or remains asserted during a specific amount of time determined by slave firmware.

Format attempted while format disabled

Drive/LED Error Code: 14

Error Description: The RA82 detected an SDI Level 1 FORMAT command from the controller when Format Operations (FO) were not enabled in the drive. Format Operations must first be enabled by the SDI controller via a SDI Level 2 CHANGE MODE command (provided the FO bit is asserted within the CHANGE MODE command).

Illegal attempt to change 512/576 Byte mode

Drive/LED Error Code: 15

Error Description: The SDI controller attempted to illegally instruct the RA82 to change from 512-byte mode to 576-byte mode.

Unable to find first track after guard band

Drive/LED Error Code: 17

Error Description: During a recalibrate operation, the drive detected the outer guard band but could not detect Track 0 when moving forward beyond the guard band.

AGC Calibration Timeout error

Drive/LED Error Code: 18

Error Description: The servo firmware has determined an AGC calibration operation took too long to complete. The AGC calibration operation is also invoked and performed by the slave firmware on the servo module.

Seek or Recalibration error during adaptive bias compensation

Drive/LED Error Code: 19

Error Description: While performing an adaptive bias compensation calibration operation, the servo firmware determined that a seek error occurred or a Return to Cylinder Zero (RTZ) operation failed. The bias compensation routine is one of several automatic servo calibration operations the servo firmware performs to compensate for slight mechanical variations that exist between different HDA positioners used in the RA82 drives.

SEEK command contained an invalid cylinder address

Drive/LED Error Code: 1A

Error Description: The drive received a Level 2 SEEK command from the controller, but the cylinder address was invalid for one of the following reasons:

1. Cylinder address range beyond the RA82 capability. The maximum RA82 cylinder address is Decimal 1434.
2. The SDI controller attempted to access diagnostics cylinders (Decimal 1431-1434) in the logical DBN area. However, the Mode byte indicates the controller had not previously enabled access to the DBN area.

AGC Calibration out of range

Drive/LED Error Code: 1B

Error Description: The AGC calibration process is automatically performed by slave firmware on the servo module during a spin-up operation or during a recalibrate operation. This error occurs when a value read from the ADC is outside the acceptable limits of 2.75 and 7.75 volts.

Unit Select number changed while online

Drive/LED Error Code: 1C

Error Description: The unit number has changed while in the online state. This condition does not generate a drive fault and does not get passed to the controller. This error code is pushed on the error silo only.

Controller timeout

Drive/LED Error Code: 1D

Error Description: The controller did not respond after the timer expired for the second time with the ATTENTION bit set. The drive then becomes available to both of its ports. This condition does not generate a drive fault and does not get passed to the controller. The error code is pushed on the error silo only.

R/W Sector Overrun error

Drive/LED Error Code: 1F

Error Description: The drive detected READ or WRITE GATE asserted while simultaneously detecting the presence of a sector pulse or an index pulse.

Spindle Motor Interlock error

Drive/LED Error Code: 23

Error Description: This error indicates the Motor/Belt Tension Cable assembly is not properly engaged, or the belt tension microswitch is tripped or defective.

Detent on wrong track after seek

Drive/LED Error Code: 24

Error Description: Following a seek operation and a detent onto fine track, the servo firmware determined the selected head is centered on the wrong track. This is determined by comparing the servo data information read from the current track and to internal ROM tables (on the servo module) established for the desired track.

Servo fault

Drive/LED Error Code: 25

Error Description: Servo loop detection circuits detected an error in the servo loop system causing servo CHECK ERROR to assert on the Servo module.

Spindle speed less than 3420 rpm (3600 -5%)

Drive/LED Error Code: 26

Error Description: During frequent checking of various drive conditions, the servo firmware determined the speed of the spindle dropped below 3420 rpm. The speed is determined by measuring the time duration of the tach pulses from the HDA and must remain within 5% (3420) of the nominal 3600 rpm.

HDA temperature is too high

Drive/LED Error Code: 27

Error Description: The RA82 hybrid microprocessor determined the temperature within the HDA exceeded approximately 53° Centigrade (128° Fahrenheit).

Servo temperature is too high

Drive/LED Error Code: 28

Error Description: The temperature of the servo module heat sink assembly has exceeded approximately 74° Centigrade (165° Fahrenheit).

Invalid error recovery level specified

Drive/LED Error Code: 29

Error Description: This error occurs when an SDI controller issues a Level 2 ERROR RECOVERY command and specifies an error recovery level number greater than the RA82 is capable of supporting. The maximum error recovery level for the RA82 is 7.

Invalid Subunit number specified

Drive/LED Error Code: 2A

Error Description: The SDI controller attempted to issue a Level 2 command (GET SUBUNIT CHARACTERISTICS) with the specified subunit number greater than the number of allowable subunits within a RA82. The maximum RA82 subunit number is zero since the RA82 only supports a single addressable media subunit.

Invalid Test number specified in DIAGNOSE command

Drive/LED Error Code: 2B

Error Description: The SDI controller (or operator) attempted to issue a Level 2 DIAGNOSE command and specified a resident disk diagnostic test number that cannot be executed from a SDI controller via the the DIAGNOSE command.

SEEK or RECALIBRATE command received while spindle not ready

Drive/LED Error Code: 2C

Error Description: The SDI controller attempted to issue a SEEK or RECALIBRATE command to the RA82 while the drive internal status byte indicates SPINDLE NOT READY.

Controller flags prohibit manual spinup

Drive/LED Error Code: 2E

Error Description: This error occurs when an operator attempts to manually spin up the drive using the drive's RUN switch, but the C1 flag is set within the drive. The SDI controller may set the C1 flag if it detects duplicate unit numbers, a serious drive problem, or if diagnostics are in progress and spinup must be inhibited.

RUN command received while Run/Stop switch in stop position

Drive/LED Error Code: 2F

Error Description: The SDI controller issued a Level 2 RUN command to the drive while the drive front panel RUN/STOP switch was in the STOP position.

WRITE CURRENT and NO WRITE GATE

Drive/LED Error Code: 30

Error Description: The drive detected the presence of WRITE CURRENT on the R/W module, but WRITE GATE was not asserted.

READ GATE and WRITE GATE

Drive/LED Error Code: 31

Error Description: The drive detected simultaneous assertion of READ GATE and WRITE GATE. READ or WRITE GATE is assertable by either the drive and/or the SDI controller.

READ or WRITE while drive faulted

Drive/LED Error Code: 32

Error Description: The drive detected assertion of READ or WRITE GATE while the drive was already in the fault condition (fault light ON.)

Write and Burst error

Drive/LED Error Code: 33

Error Description: An attempt was made to write over or through the imbedded servo burst area of a sector.

WRITE and WRITE UNSAFE

Drive/LED Error Code: 35

Error Description: The drive detected a Write Unsafe condition from the HDA preamp module while WRITE GATE was asserted (Write operation was in progress).

R/W HEAD SHORT

Drive/LED Error Code: 36

Error Description: The drive detected one of the two following conditions from the HDA preamp assembly:

1. Shorted windings in a R/W head within the HDA.
2. Two or more heads simultaneously selected within the HDA.

WRITE GATE and NO WRITE CURRENT

Drive/LED Error Code: 37

Error Description: The drive detected NO WRITE CURRENT generated on the R/W module when WRITE GATE was asserted during a write operation.

Read and Multichip Select error

Drive/LED Error Code: 38

Error Description: The drive detected that more than one R/W head select chip was selected on the HDA preamp assembly during a read operation with READ GATE asserted.

WRITE and OFF TRACK

Drive/LED Error Code: 39

Error Description: The drive detected the R/W heads were off track during a write operation with WRITE GATE asserted.

WRITE and WRITE PROTECT

Drive/LED Error Code: 3A

Error Description: WRITE GATE assertion was detected while the drive was in a Write-protect condition. This condition is the result of the Write-protect switch enabled or the SDI controller previously commanded the drive into an internal write-protect condition.

R/W-HDA-Servo-hybrid Interlock error

Drive/LED Error Code: 3B

Error Description: An Interlock Open condition exists in a connection path starting from the R/W module (J503) to the HDA (J601 and J602) to the servo module (J401 and J402) and to the hybrid module (J305). This path is different than the physical path detected by error code 3C.

Hybrid-servo Interlock error

Drive/LED Error Code: 3C

Error Description: An interlock open condition exists in a connection between the servo module (J402) and the hybrid module (J305). This path is different than the physical path detected by error code 3B.

Hybrid-R/W Interlock error

Drive/LED Error Code: 3D

Error Description: An Interlock Open condition exists in a connection between the R/W module (J502) and hybrid module (J304).

Hybrid-OCP Interlock error

Drive/LED Error Code: 3E

Error Description: An Interlock Open condition exists in a connection path between the operator control panel module (J101) and the hybrid module (J301).

Invalid R/W Memory Region specified

Drive/LED Error Code: 40

Error Description: The SDI controller issued a READ MEMORY REGION or WRITE MEMORY REGION command to the drive and specified an illegal or non-R/W Memory Region number. The RA82 supports the valid regions listed in Table 18-7 for a READ MEMORY command.

Table 18-7 Read Memory Valid Regions

Region	Description	No. Bytes
1	Diagnostic results table	40
2	Previous error silo	16
3	Seek/Retry/Read no enable counters	10
4	Extended diagnostic status	98
5	ROM 0 revision/checksum field	8
6	ROM 1 revision/checksum field	8
7	ROM 2 revision/checksum field	8
8	RAM, SDI buffers and status words	103
FFFE	Extended drive status region	16
FFFC	Diagnostic parameters	6

The RA82 supports the valid region listed in Table 18-8 for the WRITE MEMORY command.

Table 18-8 Write Memory Valid Regions

Region	Description	No. Bytes
FFFC	Diagnostic parameters	6

Response Timeout error

Drive/LED Error Code: 41

Error Description: The drive determined a pending response from the drive to the controller failed to complete transmission to the controller within a specified time period. Either the SDI response generator circuits in the hybrid failed to complete the sequence of transmission events, or drive response transmission became inhibited due to loss of RECEIVER READY from the SDI controller.

SEEK command received while drive not online

Drive/LED Error Code: 42

Error Description: The controller attempted to issue a SEEK command to a drive not online. The controller must first put the drive into the online state before issuing a SEEK to the drive.

LEVEL 1 SDI command while NO R/W READY

Drive/LED Error Code: 43

Error Description: The controller attempted to issue a Level 1 command while the drive did not have R/W READY asserted. Level 1 READ, WRITE, or FORMAT commands are permitted to execute only if the drive is ready to read or write.

R/W Safety interrupt with no cause bits set

Drive/LED Error Code: 46

Error Description: This error occurs when a R/W Safety/Error interrupt occurs but none of the error bits that generate this interrupt were asserted. See Tables 18-9 and 18-10.

Table 18-9 R/W Safety Register #1

Bit	Indication	Error Code
0	WRITE and OFF TRACK	39
1	WRITE and WRITE PROTECT	3A
2	READ and WRITE SET simultaneously	31
3	WRITE and WRITE UNSAFE	35
4	WRITE CURRENT and NO WRITE GATE	30
5	WRITE GATE and NO WRITE CURRENT	37
6	READ and MULTICHIP SELECT	38
7	HEAD SHORT	36

Table 18-10 R/W Safety Register #2

Bit	Indication	Error Code
1	WRITE and BURST FAULT	33
2	SERVO FAULT	VARIOUS
3	R/W while faulted	32
4	INDEX ERROR	4B
5	WRITE and BAD IMBEDDED	4D
6	-	-
7	READ and OFF TRACK	66

Incorrect TT bit during DISCONNECT command

Drive/LED Error Code: 47

Error Description: The controller issued a DISCONNECT command to the drive with the Terminate Topology (TT) bit incorrectly asserted or negated for the particular operation being performed.

Invalid WRITE MEMORY offset or BYTE count

Drive/LED Error Code: 48

Error Description: The controller attempted to issue a WRITE MEMORY command to the drive and one of following error conditions occurred:

1. Byte count specified exceeds drive memory region.
2. Byte count specified is not equal to actual number of bytes sent.
3. Offset specified caused an overflow beyond the region boundaries specified in drive memory.

Invalid command during Topology mode

Drive/LED Error Code: 49

Error Description: A controller (not ONLINE to the drive) attempted to issue an illegal command to the drive while the drive was in TOPOLOGY mode.

Drive disabled by DD bit

Drive/LED Error Code: 4A

Error Description: This error is produced by the changing of the Drive Disable (DD) bit via a Level 2 command from the controller. Although it does not necessarily correspond to a drive fault, this bit can be set at the controller's discretion if the controller requires the drive to be disabled due to a subsystem fault or for diagnostic purposes.

Index Pulse error

Drive/LED Error Code: 4B

Error Description: While the disk was spinning, an index pulse was detected when it should not have been present, it was not detected when it should have been present, or it was missing altogether.

WRITE and BAD EMBEDDED

Drive/LED Error Code: 4D

Error Description: The drive detected invalid embedded servo data while WRITE GATE was asserted during a Write operation. In this situation, the detection of bad embedded servo could imply the writing off track.

WRITE or FORMAT command received while drive write protected

Drive/LED Error Code: 4E

Error Description: The controller attempted to execute a Level 1 WRITE or FORMAT command while the drive was in a Write-protect condition. In this case, the Write-Protect switch may have been pressed or the controller may have commanded the drive into an internal Write-protect condition.

SDI Transmission/Transfer error

Drive/LED Error Code: 4F

Error Description: The drive has detected a transmission error from the controller on the RTCS or WRT/CMD lines. One of three possibilities exist:

1. Parity error detected on RTCS line.
2. Control pulse error on the RTCS line.
3. Data Pulse error on the WRT/CMD line.

Slave Diagnostic timeout

Drive/LED Error Code: 50

Error Description: The hybrid microprocessor (master) issued a diagnostic command request to the servo microprocessor (slave), but the slave failed to provide a response within a specified amount of time (depending up the specific diagnostic requested).

Sector/Byte Counter Count error

Drive/LED Error Code: 51

Error Description: Either the sector counter or the byte counter on the hybrid module is not functioning properly.

Head Select Register Test error

Drive/LED Error Code: 54

Error Description: The Head Select register cannot be set to a particular head address during the internal head select multiplexer Test 07. This register is internally resident in the IFL gate array (G1) on the hybrid module.

Faulty Hybrid timer

Drive/LED Error Code: 57

Error Description: Internal testing determined the programmable timer on the hybrid module is defective.

Missing Index or Sector Pulse fault

Drive/LED Error Code: 58

Error Description: While executing Internal Diagnostic Test 05, Index pulse or at least one Sector pulse was not detected by the hybrid module timer during one revolution of the disk.

R/W Test, Head Select error

Drive/LED Error Code: 60

Error Description: The Head Select register cannot be set to a particular head address during Test 0F (Read Only test) or Test 10 (R/W test). This register is internal to the IFL gate array (G1) on the hybrid module.

R/W Test, data setup error

Drive/LED Error Code: 61

Error Description: The data sent to the Diagnostic Data output buffer was incorrectly read back from the Diagnostic Data input buffer during a wrap around test on the hybrid module.

Read Test, overall failure

Drive/LED Error Code: 62

Error Description: During internal R/W testing of the dedicated internal field engineer cylinders, incorrect data was detected from four or more selected R/W heads. Four heads are not likely bad; instead, a R/W data path error exists or head selection logic is bad. When this error occurs, the RA82 diagnostic monitor also prints out the decimal number of the R/W heads that failed the test.

Read Test, partial failure

Drive/LED Error Code: 63

Error Description: During internal R/W testing of the dedicated internal FE cylinders, incorrect data was detected from three or less R/W heads. When this error occurs, the RA82 diagnostic monitor also prints out the decimal number of the R/W heads that failed the test.

R/W Test, Sector Sync Timeout error

Drive/LED Error Code: 65

Error Description: During internal R/W testing, the drive could not synchronize to a sector after two revolutions of the spindle.

READ and OFF TRACK

Drive/LED Error Code: 66

Error Description: A Read Data operation was attempted (READ GATE asserted) while the selected head was off track and not detented within track centerline specifications.

Write Test not executable

Drive/LED Error Code: 67

Error Description: Test 10 (Write and Read) was attempted before a successful completion of Test 0F (Read only).

R/W Test, Faulty Data Detect error

Drive/LED Error Code: 69

Error Description: During test 0F (Read Only), a data error was intentionally invoked, but the error was not detected.

Diagnostic Write attempt while write protected

Drive/LED Error Code: 6F

Error Description: Execution of an internal drive diagnostic was attempted that required the drive to be write enabled, but the Hybrid firmware determined the drive was currently write protected.

Internal test cannot run while spindle is spinning

Drive/LED Error Code: 7B

Error Description: Test 0C (SDI Loopback) was attempted while the drive was spinning. This test requires the spindle be stationary.

Hybrid ROM Consistency fault

Drive/LED Error Code: 80

Error Description: The ROMs containing the firmware on the hybrid module were not of the same set. All of the firmware ROMs must contain compatible consistency words to assure all the ROMs and subsequent sets of firmware are compatible within the same module.

SDI Wrap test, Command AVAILABLE did not reset

Drive/LED Error Code: 81

Error Description: During Test 0C (SDI Loopback), the signal COMMAND AVAILABLE failed to properly reset after reading SDI command data sent and properly received through the Hybrid SDI logic and loopback connectors.

SDI Wrap test, Init Not Received error

Drive/LED Error Code: 83

Error Description: During Test 0C (SDI Loopback), an SDI INIT signal was simulated but failed to be properly received and processed.

SDI Wrap test, init failed to clear

Drive/LED Error Code: 84

Error Description: During Test 0C, (SDI Loopback), the signal SDI INIT H failed to clear after it was wrapped, detected, and processed.

Hybrid RAM Test failure on RAM 0

Drive/LED Error Code: 85

Error Description: Internal drive testing determined that RAM 0 on the hybrid module is faulty.

Hybrid ROM 0 Checksum error

Drive/LED Error Code: 87

Error Description: During internal drive testing, a checksum value is computed while reading the contents of ROM 0, but the resulting value did not match the checksum stored in ROM 0.

SDI Wrap test, bit stuck in SDI Error register

Drive/LED Error Code: 8A

Error Description: When executing Test 0C, (SDI Loopback), the SDI error register was cleared, then examined and found to have an error bit still asserted.

SDI Wrap test, SDI Transfer error

Drive/LED Error Code: 8C

Error Description: This error is caused by the assertion of TRANSMISSION ERROR H during Test 0C (SDI Loopback) as the result of detecting a data pulse error, a control pulse error, or a state parity error.

Hybrid ROM 1 Checksum error

Drive/LED Error Code: 8F

Error Description: During internal drive testing, a checksum value is computed while reading the contents of ROM 1, but the value did not match the checksum stored in ROM 1.

SDI Wrap test, Command AVAILABLE timeout

Drive/LED Error Code: 94

Error Description: COMMAND AVAILABLE failed to assert following the transmission of data during Test 0C (SDI Loopback).

SDI Wrap test, Frame Code Receive error

Drive/LED Error Code: 95

Error Description: During Test 0C (SDI Loopback), an incorrect frame byte was received.

SDI Wrap test, Data Byte Receive error

Drive/LED Error Code: 96

Error Description: During Test 0C (SDI Loopback), the data byte was received did not match the data byte transmitted.

Hybrid ROM 2 Checksum Error

Drive/LED Error Code: 97

Error Description: During internal testing, a checksum value is computed while reading the contents of ROM 2, but the resulting value did not match the checksum stored in ROM 2.

Hybrid ROMs in wrong sockets

Drive/LED Error Code: 9E

Error Description: The hybrid firmware ROMs are not installed in the correct sockets on the hybrid module, or a problem exists within the hybrid ROM firmware.

R/W Safety Port Stuck Bit fault

Drive/LED Error Code: A0

Error Description: During internal drive diagnostics, one of the two R/W Safety Status registers could not be cleared. These registers are internal to the IFL gate array (G1) on the hybrid module.

Failed to fault during forced MULTICHIP SELECT WHILE READING

Drive/LED Error Code: A2

Error Description: During internal drive testing, the hybrid firmware and logic simulated a multichip select error with READ GATE asserted, but the fault detection logic failed to detect this error.

Failed to fault during forced simultaneous READ GATE and WRITE GATE

Drive/LED Error Code: A3

Error Description: During internal drive testing, the hybrid firmware and logic simulated a simultaneous READ GATE AND WRITE GATE error, but the fault detection failed to detect this error.

Failed to fault during forced WRITE CURRENT and NO WRITE GATE

Drive/LED Error Code: A4

Error Description: During internal drive testing, the hybrid firmware and logic simulated a WRITE CURRENT AND NO WRITE GATE error, but the fault detection logic failed to detect this error.

Failed to fault during forced WRITE GATE and NO WRITE CURRENT

Drive/LED Error Code: A5

Error Description: During internal drive testing, the hybrid firmware and logic simulated a WRITE GATE AND NO WRITE CURRENT error, but the fault detection logic failed to detect this error.

Servo fault during R/W Forced Fault test

Drive/LED Error Code: A9

Error Description: During R/W forced fault testing (Test 0E), a servo fault was detected.

Test completed OK

Drive/LED Error Code: AA

Error Description: This code is NOT an error code but an indicates an internal firmware test has successfully completed.

Test will not run due to a drive fault

Drive/LED Error Code: B0

Error Description: A fault condition within the drive prevents executing this particular internal diagnostic. It results when the firmware tests a RAM memory location for the presence of a fault bit still set from a previous operation or fault condition.

Hybrid Microprocessor Bus Test error

Drive/LED Error Code: B3

Error Description: A data byte was written onto the hybrid processor data bus, read back, and the value read did not match the value written.

USART Transmit/Receiver error

Drive/LED Error Code: B6

Error Description: Internal testing has determined the USART and/or transmit/receive circuits are defective. The USART is the primary circuit for drive communications to and from the field service terminal connected to the ASCII port on the front of the RA82.

No Stream Test Write Clock

Drive/LED Error Code: B8

Error Description: Test 0A (R/W Stream) failed because it did not detect the TEST WT CLK H signal at the stream MUX on the hybrid module.

No Stream ECL Read Clock

Drive/LED Error Code: B9

Error Description: Test 0A (R/W Stream) failed because it did not detect the ECL RD CLK L signal at the Stream MUX on the hybrid module.

No Stream Buffered Servo Clock

Drive/LED Error Code: BA

Error Description: Test 0A (R/W Stream) failed because it did not detect the ECL BUF SVO CLK H signal at the Stream MUX on the hybrid module.

No Stream ECL Write Data

Drive/LED Error Code: BB

Error Description: Test 0A (R/W Stream) failed because it did not detect the ECL WRT DATA H signal at the Stream MUX on the hybrid module.

No Stream Encoded Write Data

Drive/LED Error Code: BC

Error Description: Test 0A (R/W Stream) failed, because it did not detect the ENCODED WRT DATA L signal at the Stream MUX on the hybrid module.

No Stream Decoded Read Data

Drive/LED Error Code: BD

Error Description: Test 0A (R/W Stream) failed because, it did not detect the DECODED DATA L signal at the Stream MUX on the hybrid module.

No Stream ECL Read Data

Drive/LED Error Code: BE

Error Description: Test 0A (R/W Stream) failed because it did not detect the READ DATA L signal at the Stream MUX on the hybrid module.

Stream Flip-flop Reset error

Drive/LED Error Code: BF

Error Description: During Test 0A (R/W Stream), the stream flip-flop could not be cleared.

Fine Track Timer error

Drive/LED Error Code: C0

Error Description: The Fine Track timer is causing the signal FINE TRACK to be asserted too early or too late.

Fine Track Status Not True error

Drive/LED Error Code: C1

Error Description: The signal FINE TRACK could not be asserted during Fine Track tests.

Fine Track Status Not False error

Drive/LED Error Code: C2

Error Description: The signal FINE TRACK could not be negated during Fine Track tests.

Fine Track Over Range error

Drive/LED Error Code: C3

Error Description: During the Diagnostic Range test for positioning voltage, an excessive amount of voltage was required to move the R/W heads to track centerline.

Fine Track Under Range error

Drive/LED Error Code: C4

Error Description: During the Diagnostic Range test for positioning voltage, an excessively low amount of voltage was required to move the R/W heads to centerline.

Wrong Fine Track Channel detected

Drive/LED Error Code: C5

Error Description: A servo channel was selected, the Servo Status register was checked, and the appropriate gray code bits were not properly set.

PLO error

Drive/LED Error Code: C6

Error Description: The servo PLO OK signal was found to be in the wrong state indicating a failure in the servo Phase-Locked Oscillator (PLO) circuits.

ADC/DAC Reference Voltage out of range

Drive/LED Error Code: C8

Error Description: While attempting to find the ADC/DAC loop zero reference voltage, a 0 into the DAC (digital to analog converter) produced an ADC (analog to digital converter) value outside of the allowable 400mV window.

ADC/DAC Bit error

Drive/LED Error Code: C9

Error Description: A value was written to the DAC, wrapped to the ADC, and the deviation in values read was outside the range of allowable bit errors.

ADC/ODAC Bit error

Drive/LED Error Code: CA

Error Description: A value was written to the Offset DAC and wrapped to the ADC. The deviation in values read was outside the range of allowable bit errors.

Difference Counter Load error

Drive/LED Error Code: CC

Error Description: A value was written to the Track Difference counter and the value read back did not match the value written.

Difference Counter Count error or incorrect Gray Code Bits

Drive/LED Error Code: CD

Error Description: The Track Difference counter did not count tracks correctly, or the gray code bits did not indicate the correct track.

Servo Sanity error

Drive/LED Error Code: CE

Error Description: The Programmable Interval timer on the servo module failed to produce a TRAP interrupt to the slave microprocessor.

Head load attempt failed

Drive/LED Error Code: D0

Error Description: During guard band diagnostic tests, a head load failed prior to a guard band seek.

Outer Guard Band Status error after load

Drive/LED Error Code: D1

Error Description: During diagnostic guard band tests, the outer guard band status bit was checked prior to guard band seeks and found to be true when expected to be false.

Inner Guard Band Status error after load

Drive/LED Error Code: D2

Error Description: During diagnostic guard band tests, the inner guard band status bit was checked prior to guard band seeks and found to be true when expected to be false.

Seek into outer guard band failed

Drive/LED Error Code: D3

Error Description: During diagnostic guard band tests, a seek to the outer guard band failed.

Outer guard band false after outer band seek

Drive/LED Error Code: D4

Error Description: During diagnostic guard band tests, a seek to the outer guard band was performed followed by a read of the outer guard band bit. This bit should have been set following the seek but was not.

Load from outer guard band failed

Drive/LED Error Code: D5

Error Description: During diagnostic guard band tests, a head load failed from the outer guard band.

Spindle not up to speed

Drive/LED Error Code: D6

Error Description: During diagnostic guard band tests, the spindle motor was checked and found to be spinning at an incorrect speed.

Seek into inner guard band failed

Drive/LED Error Code: D7

Error Description: During diagnostic guard band tests, a seek to the inner guard band failed.

Inner guard band false after inner guard band seek

Drive/LED Error Code: D8

Error Description: During diagnostic guard band tests, a seek to the inner guard band was performed followed by a read of the inner guard band bit. This bit should have been set following the seek but was not.

Load from inner guard band failed

Drive/LED Error Code: D9

Error Description: During diagnostic guard band tests, a head load from the inner guard band failed.

Spindle not spinning

Drive/LED Error Code: DA

Error Description: During certain diagnostic tests, the spindle motor was checked and found to be stopped. The spindle must be spinning prior to the start of these tests. This may be an operator error.

DIAGNOSTIC SEEK failed

Drive/LED Error Code: DB

Error Description: A seek error was encountered in the process of performing a diagnostic test.

F.E. Diagnostic Set-up error

Drive/LED Error Code: DC

Error Description: The field service engineer entered an incorrect cylinder address value for a diagnostic. The start cylinder address value must not equal the end cylinder address value. A cylinder address value must not be greater than 1434 (Decimal).

Recalibration error

Drive/LED Error Code: DD

Error Description: A recalibration operation was unsuccessful during internal diagnostics.

Low Velocity Seek error

Drive/LED Error Code: DE

Error Description: A seek error was encountered in the process of a low velocity seek to the last data track during Diagnostic Test 21.

Random Seek error

Drive/LED Error Code: E0

Error Description: After performing random seeks in Diagnostic Test 25, one last seek was performed to the inner guard band to check guard band status, and the guard band status bits were incorrect.

Slave ROM Consistency error

Drive/LED Error Code: E2

Error Description: The ROMs containing the firmware on the servo module are not of the same set. All of the firmware ROMs must contain compatible consistency words to assure all the ROMs and subsequent sets of firmware are compatible within the same module.

Slave ROM 0 Checksum error

Drive/LED Error Code: E3

Error Description: During internal drive testing, a checksum value was computed while reading the contents of ROM 0, but the resulting value did not match the checksum stored in ROM 0.

Slave ROM 1 Checksum error

Drive/LED Error Code: E4

Error Description: During internal drive testing, a checksum value was computed while reading the contents of ROM 1 but the resulting value did not match the checksum stored in ROM 1.

Slave ROM 2 Checksum error

Drive/LED Error Code: E5

Error Description: During internal drive testing, a checksum value was computed while reading the contents of ROM 2, but the resulting value did not match the checksum stored in ROM 2.

Slave ROM 3 Checksum error

Drive/LED Error Code: E6

Error Description: During internal drive testing, a checksum value was computed while reading the contents of ROM 3, but the resulting value did not match the checksum stored in ROM 3.

A diagnostic test is executing

Drive/LED Error Code: E7

Error Description: This occurs in the hybrid LEDs while an internal drive diagnostic is executing. It is a status indication for the service engineer and is not an error indication.

RAM Test error on Servo RAM 0

Drive/LED Error Code: E8

Error Description: Internal drive testing determined RAM 0 on the servo module is faulty.

RAM Test error on Servo RAM 1

Drive/LED Error Code: E9

Error Description: Internal drive testing determined RAM 0 on the servo module is faulty.

Operator Input Entry error

Drive/LED Error Code: EE

Error Description: The operator specified an invalid diagnostic test number.

Slave Load timeout

Drive/LED Error Code: F1

Error Description: Response timeout occurred during a slave head load operation from the hybrid to the servo.

Slave sent unexpected message

Drive/LED Error Code: F2

Error Description: The master (hybrid) detected a byte of data ready to be transferred from the slave (servo), but the Hybrid firmware was not expecting any message from the slave.

Slave received command packet with checksum error

Drive/LED Error Code: F3

Error Description: The servo firmware (slave) detected a checksum error after receiving a command packet from the hybrid module firmware (master). During master/slave communications, the last byte of the command packet transferred contains a checksum generated while sending the packet.

Slave Opcode Parity error

Drive/LED Error Code: F4

Error Description: The servo firmware (slave) received a command packet from the hybrid firmware (master) containing an opcode having odd parity instead of even parity.

Slave received invalid opcode

Drive/LED Error Code: F5

Error Description: The servo firmware (slave) received a command packet from the hybrid firmware (master) containing an invalid opcode.

Master detected checksum error from slave

Drive/LED Error Code: F6

Error Description: The hybrid firmware detected a checksum error when receiving a command response packet from the Servo module firmware. During master/slave communications, the last byte of the command response packet transferred contains a checksum generated while sending the packet.

Slave Recalibration timeout

Drive/LED Error Code: F7

Error Description: A Recalibration operation took too long and timed out the servo sanity timer.

Slave Seek timeout

Drive/LED Error Code: F8

Error Description: A Seek operation took too long and timed out the servo sanity timer.

Slave Offset timeout

Drive/LED Error Code: F9

Error Description: A Servo Offset operation was issued from the hybrid firmware (master) to the servo firmware (slave), and the operation response timed out.

Slave Spinup timeout

Drive/LED Error Code: FA

Error Description: A Spin-up operation was issued from the hybrid firmware (master) to the servo firmware (slave), and the operation response timed out.

Slave Spin-down timeout

Drive/LED Error Code: FB

Error Description: A spin-down operation was issued from the hybrid firmware (master) to the servo firmware (slave), and the operation response timed out.

Slave Send Status timeout

Drive/LED Error Code: FC

Error Description: A Get-Servo-Status operation was issued from the hybrid firmware (master) to the servo firmware (slave), and the operation timed out.

Slave Speed Check timeout

Drive/LED Error Code: FE

Error Description: A SPEED CHECK REQUEST command was issued from the hybrid firmware (master) to the servo firmware (slave), and the operation timed out.

Slave Disabled Embedded Servo timeout

Drive/LED Error Code: FF

Error Description: A DISABLE EMBEDDED servo command was issued from the hybrid firmware (master) to the servo firmware (slave), and the operation timed out.

18.2.13 RA82 Front Panel Fault Code

Front panel fault code is the high byte of word 27. This byte contains the codes representing the front panel fault indicators. The code reported in this byte is not the same as would be seen on the operator control panel lights. See Table 18-11.

Table 18-11 RA82 Front Panel Code

Code	Description
01	Servo or HDA Overtemp error
04	Hybrid fault
05	R/W Command error
08	Spindle error
09	R/W Unsafe error
0C	SDI error
0D	Servo-HDA-R/W Interlock error
10	Master/Slave error
11	Hybrid Servo Interlock error
14	Servo Coarse-positioning error
15	Hybrid-OCP Interlock error
18	Servo Fine-positioning error
19	Hybrid-R/W Interlock error
1C	Spindle Motor Interlock error
20	Index error
24	Drive Disabled by DD bit
28	Write and Bad Embedded servo
2C	Write and Write protect
30	Servo Diagnostics failed
34	Idle Diagnostics failed
38	R/W Diagnostics failed

Table 18-11 (Cont.) RA82 Front Panel Code

Code	Description
3D	Power-up Diagnostics failed
**	DC LOW

* This Hex code represents the code that appears in error log information for Drive Status Byte 15. It is not what is displayed by the front panel indicator lights.

** The DC LOW condition prevents code transmission to the controller and, therefore, does not have a hex code for host diagnostic or error logging output.

CHAPTER 19
TA81 STI STATUS

19.1 INTRODUCTION

Chapter 19 contains TA81 unsuccessful response, extended drive status, and extended formatter status to provide continuity in decoding the error log reports. Operating systems print status bytes in decimal, hexadecimal, or octal. The following status information is provided to decode the error log message of the TA81:

- Unsuccessful Response (Section 19.2)
- Extended Formatter Status (See Section 19.3)
- Extended Drive Status (Section 19.4)

19.2 TA81 UNSUCCESSFUL RESPONSE

Twelve bytes of information are received from the formatter as an unsuccessful response or as a response to a GET SUMMARY STATUS command. These 12 bytes are used by the STI tape controller to report STI communication or command failures. They are explained in the following section.

19.2.1 TA81 Summary Mode Byte 1

Summary Mode Byte 1 is the low byte of word 22. Figure 19-1 shows the format of the byte, and Table 19-1 describes the bits.

Figure 19-1 TA81 Summary Mode Byte 1

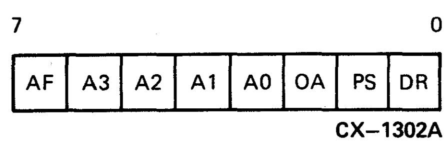


Table 19-1 TA81 Summary Mode Byte 1

Bit	Description
AF	Formatter Attention
A3	Drive 3 Attention
A2	Drive 2 Attention
A1	Drive 1 Attention
A0	Drive 0 Attention
OA	Formatter unavailable
PS	Port switch enabled
DR	Diagnostic requested (formatter requested the controller execute a diagnostic)

19.2.2 TA81 Summary Mode Byte 2

Summary Mode Byte 2 is the high byte of word 22. Figure 19-2 shows the format of the byte, and Table 19-2 describes the bits.

Figure 19-2 TA81 Summary Mode Byte 2

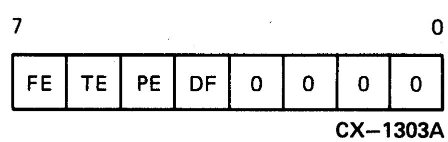


Table 19-2 TA81 Summary Mode Byte 2

Bit	Description
FE	Formatter error
TE	Transmission error
PE	Protocol error
DF	Diagnostic error

19.2.3 TA81 Summary Mode Byte 3

Summary Mode Byte 3 is the low byte of word 23. Figure 19-3 shows the format of the byte, and Table 19-3 describes the bits.

Figure 19-3 TA81 Summary Mode Byte 3

7							0
0	0	0	PB	EL	RP	RT	FD

CX–1304A

Table 19-3 TA81 Summary Mode Byte 3

Bit	Description
PB	0 = Formatter is connected to the controller through Port A.
	1 = Formatter is connected to the controller through Port B.
EL	Error logging information is available.
RP, RT	Indicates the formatter state during error recovery and tells the controller how to proceed in the error recovery sequence. The states are as follows:

RP	RT	State
0	0	No error
0	1	Transfer
1	0	Done
1	1	Retryable

Bit	Description
FD	Used only during error recovery in conjunction with RP and RT bits listed above. When the formatter is in the Transfer state, the FD bit indicates the direction of the transfer as follows:
	0 = Transfer in the same direction as the transfer that failed.
	1 = Transfer in the opposite direction of the original transfer.

Table 19-3 (Cont.) TA81 Summary Mode Byte 3

Bit	Description
	When the formatter is in the Done state, the FD bit indicates the status of the retry attempt: 0 = Retry sequence successful. 1 = Retry sequence failed.

19.2.4 TA81 Controller Byte

The Controller Byte is the high byte of word 23. Figure 19-4 shows the format of the byte, and Table 19-4 describes the bits.

Figure 19-4 TA81 Controller Byte

7							0
C1	C2	C3	C4	C5	C6	C7	C8

CX–1305A

Table 19-4 TA81 Controller Byte

Bit	Combination	Description
C1	C2-C8	
0	All 0s	Normal operation.
1	All 0s	Formatter is offline because diagnostic is currently running.

All other combinations of the Controller Flag bits are reserved. The Controller Flag bits are cleared by the controller whenever it receives a CHANGE CONTROLLER Flags command. The Controller Flag bits are also cleared by the formatter whenever the following occurs:

- The formatter powers up.
- The fault indicator is enabled.
- The port switches are disabled.

19.2.5 TA81 Drive 0 Mode Byte

Drive 0 Mode Byte is the low byte of word 24. Figure 19-5 shows the format of the byte, and Table 19-5 describes the bits.

Figure 19-5 TA81 Drive 0 Mode Byte

7							0
TM	EOT	BOT	WL	OL	AV	MR	EL

CX-1306A

Table 19-5 TA81 Drive 0 Mode Byte

Bit	Description
TM	Tape mark detected.
EOT	Tape is at or beyond end of tape.
BOT	Tape is at beginning of tape.
WL	Tape is without write ring.
OL	Drive is online.
AV	Drive is available.
MR	Maintenance request is sent from formatter.
EL	Error logging information is available

19.2.6 TA81 Drive 0 Error Byte

Drive 0 Error Byte is the high byte of word 24. Figure 19-6 shows the format of the byte, and Table 19-6 describes the bit.

Figure 19-6 TA81 Drive 0 Error Byte

7							0
DE	LP	PL	EX	DTE	SME	DI	ZT

CX–1307A

Table 19-6 TA81 Drive 0 Error Byte

Bit	Description
DE	Any drive error detected is not covered by other status bits.
LP	A lengthy operation is in progress. A Rewind operation, including the rewind of a data security erase operation, is in progress whether the rewind was initiated by the controller or the formatter. This bit is not cleared by the CLEAR DRIVE ERROR command. This bit is cleared automatically by the formatter upon completion of the operation or when the drive goes offline.
PL	The formatter is not certain of the position of the tape.
EX	The formatter encounters a tape mark or the rising edge of EOT or BOT during a data transfer.
DTE	An error prevents a data transfer from completing successfully.
SME	The formatter changes the current operating speed of the drive, if that change is transparent to the controller.
DI	The formatter is requested to use special internal algorithms to check nonperfect performance and performance statistics. When set, the formatter takes the following actions: 1. Writes all records on the tape perfectly. Write operations are retried until the Read-after-Write check sees a perfect record. 2. Modifies the Write-Retry algorithm to allow the formatter to distinguish between transient formatter, drive errors, and defective media.
ZT	The formatter is instructed to change all error thresholds from their normal default values to zero.

19.2.7 TA81 Drive 1 Mode Byte

Drive 1 Mode Byte is the low byte of word 25. Figure 19-7 shows the format of the byte, and Table 19-7 describes the bits.

19.2.5 TA81 Drive 0 Mode Byte

Drive 0 Mode Byte is the low byte of word 24. Figure 19-5 shows the format of the byte, and Table 19-5 describes the bits.

Figure 19-5 TA81 Drive 0 Mode Byte

7							0
TM	EOT	BOT	WL	OL	AV	MR	EL

CX–1306A

Table 19-5 TA81 Drive 0 Mode Byte

Bit	Description
TM	Tape mark detected.
EOT	Tape is at or beyond end of tape.
BOT	Tape is at beginning of tape.
WL	Tape is without write ring.
OL	Drive is online.
AV	Drive is available.
MR	Maintenance request is sent from formatter.
EL	Error logging information is available

19.2.6 TA81 Drive 0 Error Byte

Drive 0 Error Byte is the high byte of word 24. Figure 19-6 shows the format of the byte, and Table 19-6 describes the bit.

Figure 19-6 TA81 Drive 0 Error Byte

7							0
DE	LP	PL	EX	DTE	SME	DI	ZT

CX–1307A

Table 19-6 TA81 Drive 0 Error Byte

Bit	Description
DE	Any drive error detected is not covered by other status bits.
LP	A lengthy operation is in progress. A Rewind operation, including the rewind of a data security erase operation, is in progress whether the rewind was initiated by the controller or the formatter. This bit is not cleared by the CLEAR DRIVE ERROR command. This bit is cleared automatically by the formatter upon completion of the operation or when the drive goes offline.
PL	The formatter is not certain of the position of the tape.
EX	The formatter encounters a tape mark or the rising edge of EOT or BOT during a data transfer.
DTE	An error prevents a data transfer from completing successfully.
SME	The formatter changes the current operating speed of the drive, if that change is transparent to the controller.
DI	The formatter is requested to use special internal algorithms to check nonperfect performance and performance statistics. When set, the formatter takes the following actions: 1. Writes all records on the tape perfectly. Write operations are retried until the Read-after-Write check sees a perfect record. 2. Modifies the Write-Retry algorithm to allow the formatter to distinguish between transient formatter, drive errors, and defective media.
ZT	The formatter is instructed to change all error thresholds from their normal default values to zero.

19.2.7 TA81 Drive 1 Mode Byte

Drive 1 Mode Byte is the low byte of word 25. Figure 19-7 shows the format of the byte, and Table 19-7 describes the bits.

Figure 19-7 TA81 Drive 1 Mode Byte

7							0
TM	EOT	BOT	WL	OL	AV	MR	EL

CX–1306A

Table 19-7 TA81 Drive 1 Mode Byte

Bit	Description
TM	Tape mark detected.
EOT	Tape is at or beyond end of tape.
BOT	Tape is at beginning of tape.
WL	Tape is without write Ring.
OL	Drive is online.
AV	Drive is available.
MR	Maintenance request is sent form the formatter.
EL	Error logging information is available.

19.2.8 TA81 Drive 1 Error Byte

Drive 1 Error Byte is the high byte of word 25. Figure 19-8 shows the format of the byte, and Table 19-8 describes the bit.

Figure 19-8 TA81 Drive 1 Error Byte

7							0
DE	LP	PL	EX	DTE	SME	DI	ZT

CX–1307A

Table 19-8 TA81 Drive 1 Error Byte

Bit	Description
DE	Any drive error detected is not covered by other status bits.
LP	A lengthy operation is in progress. A Rewind operation, including the rewind of a data security erase operation, is in progress whether the rewind was initiated by the controller or the formatter. This bit is not cleared by the CLEAR DRIVE ERROR command. This bit is cleared automatically by the formatter upon completion of the operation or when the drive goes offline.
PL	The formatter is not certain of the position of the tape.
EX	The formatter encounters a tape mark or the rising edge of EOT or BOT during a data transfer.
DTE	An error prevents a data transfer from completing successfully.
SME	The formatter changes the current operating speed of the drive, provided the change is transparent to the controller.
DI	The formatter is requested to use special internal algorithms to check nonperfect performance and to gather performance statistics. The formatter takes the following actions: 1. Writes all records on the tape perfectly. Write operations are retried until the Read-after-Write check sees a perfect record. 2. Modifies the Write-Retry algorithm to allow the formatter to distinguish between transient formatter, drive errors, and defective media.
ZT	The formatter is instructed to change all error thresholds from their normal default values to zero.

19.2.9 TA81 Drive 2 Mode Byte

Drive 2 Mode Byte is the low byte of word 26. Figure 19-9 shows the format of the byte, and Table 19-9 describes the bits.

Figure 19-9 TA81 Drive 2 Mode Byte

7							0
TM	EOT	BOT	WL	OL	AV	MR	EL

CX–1306A

Table 19-9 TA81 Drive 2 Mode Byte

Bit	Description
TM	Tape mark detected.
EOT	Tape is at or beyond end of tape.
BOT	Tape is at beginning of tape.
WL	Tape is without write ring.
OL	Drive is online.
AV	Drive is available.
MR	Maintenance request is send from formatter.
EL	Error logging information is available.

19.2.10 TA81 Drive 2 Error Byte

Drive 2 Error Byte is the high byte of word 26. Figure 19-10 shows the format of the byte, and Table 19-10 describes the bit.

Figure 19-10 TA81 Drive 2 Error Byte

7							0
DE	LP	PL	EX	DTE	SME	DI	ZT

CX-1307A

Table 19-10 TA81 Drive 2 Error Byte

Bit	Description
DE	Any drive error detected is not covered by other status bits.
LP	A lengthy operation is in progress. A Rewind operation, including the rewind of a data security erase operation, is in progress whether the rewind was initiated by the controller or the formatter. This bit is not cleared by the CLEAR DRIVE ERROR command. This bit is cleared automatically by the formatter upon completion of the operation or when the drive goes offline.
PL	The formatter is not certain of the position of the tape.

Table 19-10 (Cont.) TA81 Drive 2 Error Byte

Bit	Description
EX	The formatter encounters a tape mark or the rising edge of EOT or BOT during a data transfer.
DTE	An error prevents a data transfer from completing successfully.
SME	The formatter changes the current operating speed of the drive if that change is transparent to the controller.
DI	The formatter is requested to use special internal algorithms to check nonperfect performance and performance statistics. When set, the formatter takes the following actions: 1. Writes all records on the tape perfectly. Write operations are retried until the Read-after-Write check sees a perfect record. 2. Modifies the Write-Retry algorithm to allow the formatter to distinguish between transient formatter, drive errors, and defective media.
ZT	The formatter is instructed to change all error thresholds from their normal default values to zero.

19.2.11 TA81 Drive 3 Mode Byte

Drive 3 Mode Byte is the low byte of word 27. Figure 19-11 shows the format of the byte, and Table 19-11 describes the bits.

Figure 19-11 TA81 Drive 3 Mode Byte

7							0
TM	EOT	BOT	WL	OL	AV	MR	EL

CX–1306A

Table 19-11 TA81 Drive 3 Mode Byte

Bit	Description
TM	Tape mark detected.
EOT	Tape is at or beyond end of tape.
BOT	Tape is at beginning of tape.
WL	Tape is without write ring.

Table 19-11 (Cont.) TA81 Drive 3 Mode Byte

Bit	Description
OL	Drive is online.
AV	Drive is available.
MR	Maintenance request is sent from formatter.
EL	Error logging information is available.

19.2.12 TA81 Drive 3 Error Byte

Drive 3 Error Byte is the high byte of word 27. Figure 19-12 shows the format of the byte, and Table 19-12 describes the bit.

Figure 19-12 TA81 Drive 3 Error Byte

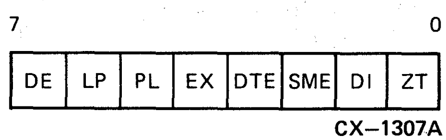


Table 19-12 TA81 Drive 3 Error Byte

Bit	Description
DE	Any drive error detected is not covered by other status bits.
LP	A lengthy operation is in progress. A Rewind operation, including the rewind of a data security erase operation, is in progress whether the rewind was initiated by the controller or the formatter. This bit is not cleared by the CLEAR DRIVE ERROR command. This bit is cleared automatically by the formatter upon completion of the operation or when the drive goes offline.
PL	The formatter is not certain of the position of the tape.
EX	The formatter encounters a tape mark or the rising edge of EOT or BOT during a data transfer.
DTE	An error prevents a data transfer from completing successfully.
SME	The formatter changes the current operating speed of the drive if that change is transparent to the controller.

Table 19-12 (Cont.) TA81 Drive 3 Error Byte

Bit	Description
DI	The formatter is requested to use special internal algorithms to check nonperfect performance and performance statistics. When set, the formatter takes the following actions: 1. Writes all records on the tape perfectly. Write operations are retried until the Read-after-Write check sees a perfect record. 2. Modifies the Write-Retry algorithm to allow the formatter to distinguish between transient formatter, drive errors, and defective media.
ZT	The formatter is instructed to change all error thresholds from their normal default values to zero.

19.3 TA81 EXTENDED FORMATTER STATUS

There are 24 bytes of information received from the formatter in response to a GET EXTENDED FORMATTER STATUS command. The format of this information is formatter and error type dependent and varies in length and content. If the information received from the formatter is less than 24 bytes, the controller zero fills the remaining unused bytes of the error log message. These 24 bytes used by the GET EXTENDED FORMATTER STATUS response are explained in the following sections.

19.3.1 TA81 Summary Error Byte

Summary Error Byte is the low byte of word 22. Table 19-13 describes the Summary Error Byte.

Table 19-13 Summary Error Byte

Bit	Description
FE	Formatter error
TE	Transmission error
PE	Protocol error
DF	Diagnostic error

19.3.2 TA81 Data Transfer Error Symptom Code

Data Transfer Error Symptom Code is the high byte of word 22. Table 19-14 describes the data transfer error symptom codes.

Table 19-14 Data Transfer Error Symptom Code

Code	Description
01	FIFO Parity error.
02	Read Parity error.
04	Sequence error.

Table 19-14 (Cont.) Data Transfer Error Symptom Code

Code	Description
08	RAW CNT zero signal not set after write operation.
10	Write counter not zero on write operation.
20	EDC not zero on write operation.

19.3.3 TA81 Formatter Error Symptom Code

Formatter Error Symptom Code is the low byte of word 23. Table 19-15 describes the Formatter Error Symptom codes.

Table 19-15 Formatter Error Symptom Code

Code	Description
01	Formatter command busy active for 100 milliseconds when I/F ready to issue command.
02	Formatter did not send all data within 50 milliseconds.
03	Formatter did not complete data transfer within 50 milliseconds.
04	Formatter did not take right number of data.
05	Formatter sent more than 25 bytes.
06	Command busy after sending command to send test/response to formatter.
07	Command busy after sending test number/comp code.
08	Command busy after sending test op/sub comp code.
09	Command busy not active after sending command.
10	HER set on nondata transfer type command.
11	RAM parity error.
12	ROM parity error.
13	EDC Hardware error.
14	Formatter equipment check.
15	Command reject bit or intervention required bit set by formatter.
16	Speed/density change command failed after rewind.

Table 19-15 (Cont.) Formatter Error Symptom Code

Code	Description
8X	Sense error—The following is the low order of the 8X and only has meaning if there is an 8 in the high order
81	HER set.
82	Write counter not zero.
84	Formatter sent less than 25 bytes.
88	FIFO empty.

19.3.4 TA81 Transmission Error Symptom Code

Transmission Error Symptom Code is the high byte of word 23. Table 19-16 describes the Transmission Error Symptom codes.

Table 19-16 Transmission Error Symptom Code

Code	Description.
01	Start frame received then invalid framing code or invalid sequence.
02	Invalid first frame.
03	REAL-TIME command with invalid unit number or drive.
04	REAL-TIME READ command when in error recovery state for write.
05	REAL-TIME WRITE command when in error recovery state for read.
06	Checksum error.
10	READ REVERSE command received.
11	First frame not start or diagnostic echo frame during topology.
8X	Pulse/Parity error—The following is the low order of the 8X and only has meaning if there is an 8 in the high order.
81	Data Pulse error during data transfer.
84	State Parity error during data transfer.

19.3.5 Protocol Error Symptom Code

Protocol Error Symptom Code is the low byte of word 24. Table 19-17 describes the Protocol Error Symptom codes.

Table 19-17 Protocol Error Symptom Code

Code	Description.
01	Invalid opcode.
02	Too many or too few parameters.
03	Inconsistent parameter.
04	Opcode inconsistent with the present state of the microcode .

19.3.6 Sense Byte 1

Sense Byte 1 is the high byte of word 24. Table 19-18 describes Sense Byte 1.

Table 19-18 Sense Byte 1

Bit	Description
0	Unit Exception—Marginal acceleration, or correction was performed on a read.
1	Unit Check—A hard error condition and an indicator that at least one of the following bits are also set: • Data Check • Equipment Check • Intervention Required • Command Reject
2	Not Used.
3	Data Check—Uncorrectable data error. Detailed information is available from remaining sense bytes.
4	Equipment Check—Hardware malfunction in the formatter or drive .
5	Not used.
6	Intervention Required—An existing condition that must be corrected by the operator or host system before normal operation can be resumed.
7	Command Reject—An invalid command was received from host adapter.

19.3.7 Sense Byte 2

Sense Byte 2 is the low byte of word 25. Table 19-19 describes Sense Byte 2.

Table 19-19 Sense Byte 2

Bit	Description
0	Device offline—A device command was received, and the drive was offline.
1	Device not ready—A device command was received, and the drive was not ready.
2	Not used.
3	Reset key—The Reset switch on the front panel has been activated.
4	File protected—A write command was issued to the device with no write ring.
5	Not used.
6	Device Command check—A READ REVERSE or BACKSPACE command was issued at BOT or device rejected a formatter command.
7	Illegal Channel command—Illegal opcode from host (implies hardware malfunction.)

19.3.8 Sense Byte 3

Sense Byte 3 is the high byte of word 25. Table 19-20 describes Sense Byte 3

Table 19-20 Sense Byte 3

Bit	Description
0	Device Interrupt—A device interrupt occurred during the operation.
1	Velocity Check—The drive did not come up to speed in the required time.
2	Device Hardware Check—A hardware malfunction occurred in the drive.
3	Device Response Check—The device presented incorrect status to the formatter.
4	Write Hardware Check—A hardware malfunction occurred in the formatter write circuitry.
5	Read Hardware Check—A hardware malfunction occurred in the formatter read circuitry.
6	Channel Response Check—The adapter did not respond to formatter during diagnostic protocol.
7	Channel Parity Error—The formatter detected either a command or data parity error from the adapter.

19.3.9 Sense Byte 4

Sense Byte 4 is the low byte of word 26. Table 19-21 describes Sense Byte 4.

Table 19-21 Sense Byte 4

Bit	Description
0	Tape moved.
1	Error occurred at BOT—Rewind required.
2	Unrecoverable error.
3	Not used.
4	ID Fault—The formatter detected a bad id field on the tape .
5	Read Data Check—The formatter read logic detected an error.
6	PE CRC CHECK.
7	AGC Fault—The gain could not be set properly in GCR during ARA burst.

19.3.10 Sense Byte 5 (Formatter Command Code)

Sense Byte 5 is the high byte of word 26. Sense Byte 5 contains the formatter command code. See Table 19-22.

Table 19-22 Sense Byte 5 (Formatter Command Code)

Code	Command
01	Read reverse (not supported)
02	Read file forward
04	Read forward with high threshold (PE only)
08	Space forward
0B	Backspace file
0C	Controlled space forward
0D	Controlled space reverse
10	Write
16	Controlled erase (PE only)
1A	Write File Mark with long gap
1C	Erase gap with long gap
20	Sense
23	Online
25	Select remote density

Table 19-22 (Cont.) Sense Byte 5 (Formatter Command Code)

Code	Command
3B	Device interface loopback
3D	Diagnostic test
3E	Diagnostic sense
40	Mode change
80	Read forward
83	Read file reverse
89	Space reverse
8A	Space file
92	Write File Mark
94	Erase gap
97	Data security erase
98	Write with long gap
9E	Controlled erase with long gap
A1	Rewind
A2	Unload
A4	Load
B9	Formatter health check
BA	Formatter loopback
BC	Device R/W loopback
BF	Diagnostic response

19.3.11 Sense Byte 6

Sense Byte 6 is the low byte of word 27. Table 19-23 describes Sense Byte 6.

Table 19-23 Sense Byte 6

Bit	Description
0	Variable Short Gap mode—The formatter was in the variable short gap mode during last operation.
1	Variable Long Gap mode—The formatter was in the variable long gap mode during the last operation.
2	Start/Stop mode—The formatter was in start/stop mode during the last operation.
3	Diagnostic mode—Only set while executing a diagnostic test.
4	File Mark Detected—A file was detected during the last operation.
5	Auto Speed mode—The speed was automatically selected by the formatter during the last operation.
6	High Speed mode—The formatter was in high speed mode during the last operation.
7	GCR mode—The formatter was in GCR mode during the last operation.

19.3.12 Sense Byte 7

Sense Byte 7 is the high byte of word 27. Table 19-24 describes Sense Byte 7.

Table 19-24 Sense Byte 7

Bit	Description
0	Not used.
1	Not used.
2	Write AUX CRC Parity error—A malfunction in the write AUX CRC generator.
3	Not used.
4	4 to 5 Parity error—A malfunction in the the GCR write 4 to 5 conversion logic.
5	Write CRC Parity error—A malfunction in the write CRC generator.
6	Residual Byte Count check—A malfunction in the formatter latency buffer resulting in the wrong number of residual bytes at the end of an operation.
7	Write Transfer check—A malfunction in the write strobe generator.

19.3.13 Sense Byte 8

Sense Byte 8 is the low byte of word 28. Table 19-25 describes Sense Byte 8.

Table 19-25 Sense Byte 8

Bit	Description
0	Excessive Pointers—An error was detected in GCR mode, and more than 2 pointers were specified
1	No Track pointer—An error was detected in PE mode, and no track pointer was specified.
2	Uncorrectable data—An uncorrectable error was encountered in the data.
3	ECC3 check—An error was detected on the corrected data.
4	Resync error—An error was detected in the GCR resync group.
5	Read AUX CRC check—The GCR auxiliary character is in error.
6	Read CRC check—The GCR CRC character is in error.
7	Residual Character check—The GCR residual character is in error.

19.3.14 Sense Byte 9

Sense Byte 9 is the high byte of word 28. Table 19-26 describes Sense Byte 9.

Table 19-26 Sense Byte 9

Bit	Description
0	ARA ID check—An error was detected in the ARA ID in GCR mode.
1	ARA Burst check—An error was detected during the ARA burst in GCR mode.
2	ID check—An error was detected in the ID burst in PE or GCR mode.
3	Write Tape Mark check—A Read-after-Write error was detected while writing a tape mark.
4	Read timeout—A Long gap was detected during a read operation or the Read-after-Write data was not detected within a predetermined window.
5	Skew error—Excessive skew was detected.
6	Postamble error—An error was detected in the postamble.
7	Noise check—An incomplete or marginal Erase operation is indicated.

19.3.15 Sense Byte 10.

Sense Byte 10 is the low byte of word 29. Table 19-27 describes Sense Byte 10.

Table 19-27 Sense Byte 10

Bit	Description
0	TIE 4 (P)—The parity track was in error.
1	Single Track correction—Single track correction occurred in PE or GCR mode.
2	Dual Track correction—Dual track correction occurred in GCR mode.
3	End Mark check—Missing end mark in GCR mode.
4	Read Data Parity error—A parity error was detected by the read circuitry while passing data to the read output buffer during diagnostics.
5	Read Transfer check—A malfunction occurred in the read strobe generator.
6	Read Buffer in Parity error—A parity error occurred on read data into the latency buffer.
7	EC Hardware check—A malfunction occurred in error correction hardware.

19.3.16 Sense Byte 11

Sense Byte 11 is the high byte of word 29. Table 19-28 describes Sense Byte 11.

Table 19-28 Sense Byte 11

Bit	Description
0	TIE 2
1	TIE 8
2	TIE 1
3	TIE 9
4	TIE 3
5	TIE 5
6	TIE 6
7	TIE 7

19.3.17 Sense Byte 12

Sense Byte 12 is the low byte of word 30. Table 19-29 describes Sense Byte 12.

Table 19-29 Sense Byte 12

Bit	Description
0	EOT
1	BOT
2	High Speed
3	Gap Control
4	File Protected
5	Rewind
6	Online
7	Ready

19.3.18 Sense Byte 13

Sense Byte 13 is the high byte of word 30. Table 19-30 describes Sense Byte 13.

Table 19-30 Sense Byte 13

Bit	Description
0	Not used.
1	Not used.
2	Start/Stop mode—Streaming mode is indicated when reset.
3	Variable Long gap—Normal gap is indicated when reset.
4	GCR—When reset indicates PE mode.
5	Data Security Erase.
6	Write—When reset indicates a read operation.
7	Reverse—When reset indicates forward tape motion.

19.3.19 Sense Byte 14

Sense Byte 14 is the low byte of word 31. Table 19-31 describes Sense Byte 14.

Table 19-31 Sense Byte 14

Bit	Description
0	Airflow/Temperature Check
1	Reverse in BOT—BOT was encountered while the drive was going in reverse.
2	Reset key—The reset switch on the drive panel was activated.
3	AGC check—The drive could not set up the AGC correctly in GCR mode.
4	Density change
5	Diagnostic request—The drive notified the formatter that a local diagnostic is to be executed.
6	Intervention required—A condition must be corrected by the operator or host system before normal operation can be resumed.
7	Command rejected—An invalid command was received from the adapter.

19.3.20 Sense Byte 15 (Command Code)

Sense Byte 15 is the high byte of word 31. Sense Byte 15 contains the drive's last rejected command code. See Table 19-32.

Table 19-32 Sense Byte 15 (Command Code)

Code	Command
01	Read reverse (not supported)
02	Read file forward
04	Read forward with high threshold (PE only)
08	Space forward
0B	Backspace file
0C	Controlled space forward
0D	Controlled space reverse
10	Write
16	Controlled erase (PE only)
1A	Write file mark with long gap
1C	Erase gap with long gap
20	Sense
23	Online

Table 19-32 (Cont.) Sense Byte 15 (Command Code)

Code	Command
25	Select remote density
3B	Device interface loopback
3D	Diagnostic test
3E	Diagnostic sense
40	Mode change
80	Read forward
83	Read file reverse
89	Space reverse
8A	Space file
92	Write file mark
94	Erase gap
97	Data security erase
98	Write with long gap
9E	Controlled erase with long gap
A1	Rewind
A2	Unload
A4	Load
B9	Formatter health check
BA	Formatter loopback
BC	Device R/W Loopback
BF	Diagnostic response

19.4 TA81 EXTENDED DRIVE STATUS

There are 62 bytes of information received from the drive in response to a GET EXTENDED DRIVE STATUS command. The format of this information is drive and error type dependent and varies in length and content. If the information received from the drive is less then 62 bytes, the controller zero fills the remaining unused bytes of the error log message. These 62 bytes used by the GET EXTENDED DRIVE STATUS response are explained in the following sections.

19.4.1 Speed Byte

Speed byte is the low byte of word 22 and is the currently set speed of the drive. It is an integer value in inches per second (IPS) rounded down to the nearest integer. For a totally variable speed drive, the speed returned is the lower bound of the range of permissible speeds. For (example 7D = 125 IPS.)

19.4.2 Density Byte

Density byte is the high byte of word 22 and is a bit mask with one bit assigned to each possible tape density. There are three currently allowable tape densities: 800 BPI NRZI encoding, 1600 BPI PE encoding, and 6250 BPI GCR encoding. The bit position for the densities are:

- Bit 0 = 800 BPI NRZI
- Bit 1 = 1600 BPI PE
- Bit 2 = 6250 BPI GCR

19.4.3 MSCP Unit Number Low Byte

MSCP Unit Number Low byte is the low byte of word 23 and contains the low byte of the unit number.

19.4.4 MSCP Unit Number High Byte

MSCP Unit Number High byte is the high byte of byte of the unit number.

19.4.5 Gap Count Byte 1

Gap Count byte 1 is the low byte of word 24 and is the least significant byte of the number of gaps the formatter believes the tape drive to be from the beginning of tape.

19.4.6 Gap Count Byte 2

Gap Count byte 2 is the high byte of word 24 and is the second byte of the number of gaps the formatter believes the tape drive to be from the beginning of tape.

19.4.7 Gap Count Byte 3

Gap Count byte 3 is the low byte of word 25 and is the third byte of the number of gaps the formatter believes the tape to be from the beginning of tape.

19.4.8 Gap Count Byte 4

Gap Count byte 4 is the high byte of word 25 and is the forth byte of the number of gaps the formatter believes the tape to be from the beginning of tape.

19.4.9 Transfer Description Code 0

Transfer Description Code 0 byte is the low byte of word 26. Table 19-33 describes the Transfer Description Code 0.

Table 19-33 Transfer Description Code 0

Bit	Description
01	Two track error correction
03	Single track error correction

Table 19-33 (Cont.) Transfer Description Code 0

Bit	Description
05	Read error
07	Write error
08	Media error

19.4.10 Transfer Description Code 1
Transfer Description Code 1 byte is the high byte of word 26 and contains the following code: 07 = Write Error.

19.4.11 Transfer Description Code 3
Transfer Description Code 3 byte is the low byte of word 27 and contains 0s.

19.4.12 Transfer Description Code 4
Transfer Description Code 4 byte is the high byte of word 27 and contains 0s.

19.4.13 Sense Byte 1
Sense Byte 1 is the low byte of word 28. Table 19-34 describes Sense Byte 1.

Table 19-34 Sense Byte 1

Bit	Description
0	Unit exception—Marginal acceleration, or correction was performed on a read.
1	Unit check—A hard error condition exists and at least one of the following bits are also set: • Data check • Equipment check • Intervention required • Command reject
2	Not used.
3	Data check—Uncorrectable data error. Detailed information is available from remaining sense bytes.
4	Equipment check—Hardware malfunction in the formatter or drive.
5	Not used.
6	Intervention required—A condition must be corrected by the operator or host system before normal operation can be resumed.
7	Command reject—An invalid command was received from host adapter.

19.4.14 Sense Byte 2

Sense Byte 2 is the high byte of word 28. Table 19-35 describes Sense Byte 2.

Table 19-35 Sense Byte 2

Bit	Description
0	Device offline—A device command was received, and the drive was offline.
1	Device not ready—A device command was received, and drive was not ready.
2	Not used.
3	Reset key—The reset switch on the front panel has been activated.
4	File protected—A write command was issued to the device with no write ring.
5	Not used.
6	Device command check—A read reverse or backspace command was issued at BOT or device rejected a formatter command.
7	Illegal channel command—Illegal opcode from host (implies hardware malfunction.)

19.4.15 Sense Byte 3

Sense Byte 3 is the low byte of word 29. Table 19-36 describes Sense Byte 3.

Table 19-36 Sense Byte 3

Bit	Description
0	Device interrupt—A device interrupt occurred during the operation.
1	Velocity check—The drive did not come up to speed in the required time.
2	Device hardware check—A hardware malfunction occurred in the drive.
3	Device response check—The device presented incorrect status to the formatter.
4	Write hardware check—A hardware malfunction occurred in the formatter write circuitry.
5	Read hardware check—A hardware malfunction occurred in the formatter read circuitry.
6	Channel response check—The adapter did not respond to the formatter during diagnostic protocol.
7	Channel parity error—The formatter detected either a command or a data parity error from the adapter.

19.4.16 Sense Byte 4

Sense Byte 4 is the high byte of word 29. Table 19-37 describes Sense Byte 4.

Table 19-37 Sense Byte 4

Bit	Description
0	Tape moved.
1	Error occurred at BOT—Rewind required.
2	Unrecoverable error.
3	Not used.
4	ID fault—The formatter detected a bad ID field on the tape.
5	Read Data check—The formatter read logic detected an error.
6	PE CRC check.
7	AGC fault—The gain could not be set properly in GCR during ARA burst.

19.4.17 Sense Byte 5 (Formatter Command Code)

Sense Byte 5 is the low byte of word 30. Sense Byte 5 contains the executed formatter command code. See Table 19-38.

Table 19-38 Sense Byte 5 (Formatter Command Code)

Code	Command
01	Read reverse (not supported)
02	Read file forward
04	Read forward with high threshold (PE only)
08	Space forward
0B	Backspace File
0C	Controlled space forward
0D	Controlled space reverse
10	Write
16	Controlled erase (PE only)
1A	Write file mark with long gap
1C	Erase gap with long gap
20	Sense
23	Online
25	Select remote density

Table 19-38 (Cont.) Sense Byte 5 (Formatter Command Code)

Code	Command
3B	Device interface loopback
3D	Diagnostic test
3E	Diagnostic sense
40	Mode change
80	Read forward
83	Read file reverse
89	Space reverse
8A	Space file
92	Write file mark
94	Erase gap
97	Data security erase
98	Write with long gap
9E	Controlled erase with long gap
A1	Rewind
A2	Unload
A4	Load
B9	Formatter health check
BA	Formatter loopback
BC	Device R/W loopback
BF	Diagnostic response

19.4.18 Sense Byte 6

Sense Byte 6 is the high byte of word 30. Table 19-39 describes Sense Byte 6.

Table 19-39 Sense Byte 6

Bit	Description
0	Variable Short-gap mode—The formatter was in the variable Short-gap mode during the last operation.
1	Variable Long-gap mode—The formatter was in the variable Long-gap mode during the last operation.
2	Start/Stop mode—The formatter was in Start/Stop mode during the last operation.
3	Diagnostic mode—Only set while executing a diagnostic test.
4	File mark detected—A file was detected during the last operation.
5	Auto-speed mode—The speed was automatically selected by the formatter during the last operation.
6	High-speed mode—The formatter was in High-speed mode during the last operation.
7	GCR mode—The formatter was in GCR mode during the last operation.

19.4.19 Sense Byte 7

Sense Byte 7 is the low byte of word 31. Table 19-40 describes Sense Byte 7.

Table 19-40 Sense Byte 7

Bit	Description
0	Not used.
1	Not used.
2	Write AUX CRC Parity error—A malfunction exists in the write AUX CRC generator.
3	Not used.
4	4 to 5 Parity error—A malfunction exists in the the GCR Write 4 to 5 conversion logic.
5	Write CRC Parity error—A malfunction exists in the Write CRC generator.
6	Residual Byte Count check—A malfunction exists in the formatter latency buffer resulting in the wrong number of residual bytes at the end of an operation.
7	Write Transfer check—A malfunction exists in the Write Strobe generator.

19.4.20 Sense Byte 8.

Sense Byte 8 is the high byte of word 31. Table 19-41 describes Sense Byte 8.

Table 19-41 Sense Byte 8

Bit	Description
0	Excessive pointers—An error was detected in GCR mode, and more than two pointers were specified.
1	No track pointer—An error was detected in PE mode, and no track pointer was specified.
2	Uncorrectable data—An uncorrectable error was encountered in the data.
3	ECC3 check—An error was detected on the corrected data.
4	Resync error—An error was detected in the GCR resync group.
5	Read AUX CRC check—The GCR auxiliary character is in error.
6	Read CRC check—The GCR CRC character is in error.
7	Residual character check—The GCR residual character is in error.

19.4.21 Sense Byte 9

Sense Byte 9 is the low byte of word 32. Table 19-42 describes Sense Byte 9.

Table 19-42 Sense Byte 9

Bit	Description
0	ARA ID check—An error was detected in the ARA ID in GCR mode.
1	ARA Burst check—An error was detected during the ARA burst in GCR mode.
2	ID check—An error was detected in the ID burst in PE or GCR mode.
3	Write Tape Mark check—A Read-after-Write error was detected while writing a tape mark.
4	Read Timeout—A long gap was detected during a read operation, or the Read-after-Write data was not detected within a predetermined window.
5	Skew error—Excessive skew was detected.
6	Postamble error—An error was detected in the postamble.
7	Noise check—Indicates an incomplete or marginal erase operation.

19.4.22 Sense Byte 10

Sense Byte 10 is the high byte of word 32. Table 19-43 describes Sense Byte 10.

Table 19-43 Sense Byte 10

Bit	Description
0	TIE 4 (P)—The parity track was in error.
1	Single Track correction—Single track correction occurred in PE or GCR mode.
2	Dual Track correction—Dual track correction occurred in GCR mode.
3	End Mark check—Missing end mark in GCR mode.
4	Read Data Parity error—A parity error was detected by the read circuitry while passing data to the read output buffer during diagnostics.
5	Read Transfer check—A malfunction occurred in the read strobe generator.
6	Read Buffer in Parity error—A parity error occurred on reading data into the latency buffer.
7	EC Hardware check—A malfunction occurred in error correction hardware.

19.4.23 Sense Byte 11

Sense Byte 11 is the low byte of word 33. Table 19-44 describes Sense Byte 11.

Table 19-44 Sense Byte 11

Bit	Description
0	TIE 2
1	TIE 8
2	TIE 1
3	TIE 9
4	TIE 3
5	TIE 5
6	TIE 6
7	TIE 7

19.4.24 Sense Byte 12

Sense Byte 12 is the high byte of word 33. Table 19-45 describes Sense Byte 12.

Table 19-45 Sense Byte 12

Bit	Description
0	EOT
1	BOT
2	High speed
3	Gap control
4	File protected
5	Rewind
6	Online
7	Ready

19.4.25 Sense Byte 13

Sense Byte 13 is the low byte of word 34. Table 19-46 describes Sense Byte 13.

Table 19-46 Sense Byte 13

Bit	Description
0	Not used.
1	Not used.
2	Start/Stop mode—Streaming mode is indicated when reset.
3	Variable Long gap—Normal gap is indicated when reset.
4	GCR—When reset indicates PE mode.
5	Data Security Erase.
6	Write—When reset indicates a read operation.
7	Reverse—When reset indicates forward tape motion.

19.4.26 Sense Byte 14

Sense Byte 14 is the high byte of word 34. Table 19-47 describes Sense Byte 14.

Table 19-47 Sense Byte 14

Bit	Description
0	GCR default density.
1	Local density select.
2	Not used.
3	LWR GCR—A Loop Write-to-read Diagnostic test was being executed in GCR mode through the drive R/W hardware.
4	LWR PE—A Loop Write-to-read Diagnostic test was being executed in PE mode through the drive R/W hardware.
5	LWR I/F—A Loop Write-to-read Diagnostic test was being executed on the drive/formatter interface.
6	Remote diagnostic—A diagnostic test was being executed from the host.
7	Remote diagnostic inhibit.

19.4.27 Sense Byte 15

Sense Byte 15 is the low byte of word 35. Table 19-48 describes Sense Byte 15.

Table 19-48 Sense Byte 15

Bit	Description
0	Airflow/temperature check.
1	Reverse in BOT—BOT was encountered while the drive was in reverse.
2	Reset key—The reset switch on the drive panel was activated.
3	AGC check—The drive could not set up the AGC correctly in GCR mode.
4	Density change.
5	Diagnostic request—The drive notified the formatter that a local diagnostic is to be executed.
6	Intervention required—A condition must be corrected by the operator or host system before normal operation can be resumed.
7	Command rejected—An invalid command was received from the adapter.

19.4.28 Sense Byte 16

Sense Byte 16 is the high byte of word 35. Sense Byte 16 contains a representation of the drive's last rejected command code. See Table 19-51.

Table 19-51 Sense Byte 16

Code	Command
01	Read Reverse (not supported)
02	Read file forward
04	Read forward with high threshold (PE only)
08	SPACE FORWARD
0B	Backspace File
0C	Controlled space forward
0D	Controlled space reverse
10	Write
16	Controlled erase (PE only)
1A	Write file mark with long gap
1C	Erase gap with long gap
20	Sense
23	Online
25	Select remote density
3B	Device interface loopback
3D	Diagnostic test
3E	Diagnostic sense
40	Mode change
80	Read forward
83	Read file reverse
89	Space reverse
8A	Space file
92	Write file mark
94	Erase gap
97	Data security erase
98	Write with long gap

Table 19-51 (Cont.) Sense Byte 16

Code	Command
9E	Controlled erase with long gap
A1	Rewind
A2	Unload
A4	Load
B9	Formatter health check
BA	Formatter loopback
BC	Device R/W loopback
BF	Diagnostic response

19.4.29 Sense Byte 17

Sense Byte 17 is the low byte of word 36. Table 19-50 describes Sense Byte 17.

Table 19-50 Sense Byte 17

Bit	Description
0	HSPD AGC
1	LSPD AGC
2	LSPD speed
3	HSPD speed
4	LSPD down ramp timeout of marginal limits
5	HSPD down ramp timeout of marginal limits
6	LSPD up ramp timeout of marginal limits
7	HSPD up ramp timeout of marginal limits

19.4.30 Sense Byte 18

Sense Byte 18 is the high byte of word 36. Sense Byte 18 contains a representation of the internally detected failure mode when a hard error occurs. This is the code displayed on the operator control panel. Sense Byte 18 in remote diagnostics contains the test completion code. See Table 19-51.

19.4.31 Sense Byte 19

Sense Byte 19 is the low byte of word 37. Sense Byte 19 contains a representation of the internally detected subfault code when a hard error occurs. Sense Byte 19 in remote diagnostics contains the test subcompletion code. See Table 19-51. Subfault codes are listed after the associated fault code. To interpret the subfault codes see Example 19-1.

Example 19-1 Subfault Code Interpretation

```
Fault Code 25, Subfault Code 64

        a 40 Take-up sensor saw the fault first
        b 20 Fault occurred on up ramp
        c 04 Fault occurred in reverse direction
        d 00 Fault occurred with low speed demanded
        e 00 Fault occurred while drive was moving at constant velocity
        f 00 Fault occurred with pneumatic pump enabled
          --
          64

        25     LOW TENSION FAULT
                 SUBFAULT CODE GROUP 1
        00 Supply sensor saw the fault first
a  --  -- > 40 Take-up sensor saw the fault first
                 SUBFAULT CODE GROUP 2
        00 Fault occurred during constant motion .
        10 Fault occurred on down ramp
b  --  -- > 20 Fault occurred on up ramp
        30 Fault occurred in stoplock
                 SUBFAULT CODE GROUP 3
        00 Fault occurred in forward direction
c  --  -- > 04 Fault occurred in reverse direction
                 SUBFAULT CODE GROUP 4
d  --  -- > 00 Fault occurred with low speed demanded
        01 Fault occurred with high speed demanded
        02 Fault occurred with rewind speed demanded
        03 Fault occurred with slow speed mode demanded
                 SUBFAULT CODE GROUP 5
e  --  -- > 00 Fault occurred while drive was moving at constant velocity, on
           ramp, or in stoplock for less then 1 second
        01 Fault occurred with drive in stoplock for more then 1 second
                 SUBFAULT CODE GROUP 6
f  --  -- > 00 Fault occurred with pneumatic pump enabled
        08 Fault occurred with pneumatic pump shut down
```

Table 19-51 Fault/SUBFAULT Code

Fault Code	Sub Fault Code	Description
01	READ ENVELOPE	
	00	Envelope not detected during read amplitude check (EGC test.)
02	READ AMPLITUDE TOLERANCE	
	00	Read amplitude outside range 1.5 volts $\pm$ 0.8 volts.
03	IDENTIFICATION BURST	
	00	Unable to read or write PE Identification Burst.
	01	Unable to read or write GCR ID, ARA Burst, or ARA ID.
	02	AGC fault occurred while reading or writing from BOT in GCR.
04	LOW SPEED WRITE ERRORS	
	00	Unable to write a block in PE within 5 attempts.
	01	Unable to write a block in GCR within 5 attempts.
	37	File mark detection error.
	38	More than 32 write error recoveries performed while writing to EOT.
05	LOW SPEED READ ERROR	
	00	Data error detected while reading in PE (No error recovery performed.)
	01	Data error detected while reading in GCR (No error recovery performed.)
	37	File mark detection error.
06	HIGH SPEED WRITE ERROR	
	00	Unable to write a block in PE within 5 attempts.
	01	Unable to write a block in GCR within 5 attempts.
	37	File mark detection error.
	38	More then 32 write error recoveries performed while writing to EOT.
07	HIGH SPEED READ ERROR	
	00	Data error detected while reading in PE (No error recovery performed.)

Table 19-51 (Cont.) Fault/SUBFAULT Code

	01	Data error detected while reading in GCR (No error recovery performed.)
	37	File mark detection error.
08	NOISE IN IBG	
	00	Noise detected while erasing.
09	HARDWARE FAILURE	
	00	A hardware failure occurred while executing R/W diagnostic.
	01	Formatter Write Module hardware failure.
	02	Formatter Read Module hardware failure.
	03	Servo—Control Module hardware failure.
10	OPERATOR DOOR OPEN	
	01	Door open on load.
	02	Door open after tensioning.
	03	Door opened during unload.
	04	Door open on untensioned unload.
	05	Door opened during untensioned unload.
	06	Door opened during retensioned load unload.
	07	Door open on diagnostic test.
11	ABSENCE OF TAPE	
	01	Absence of tape on load.
	02	Absence of tape on Operator Test 2.
12	LOAD FAULT	
	01	Tension fault on load.
13	TAPE THREADED INCORRECTLY	
	01	Tension not detected on both sensors within 10 seconds.
	02	Two course tachs not detected within 10 seconds.
	03	Tension not detected within 2 seconds after seeing 2 course tachs.

Table 19-51 (Cont.) Fault/SUBFAULT Code

14	**BOT LOCATION FAULT**	
	01	Tension fault—Loading—BOT not seen.
	02	Absence of Tape—Loading—BOT not seen.
	03	Did not get below lower tension limit within prescribed period during unload.
15	**LOAD/UNLOAD ABORTED BY OPERATOR**	
	01	RESET/FAULT pressed during load.
	02	RESET/FAULT pressed during unload.
16	**DIAGNOSTIC TAPE IS WRITE PROTECTED**	
	00	Attempted to execute a R/W diagnostic with write protected tape.
17	**RAN OFF END OF TAPE**	
	01	AOT—trailer—forward.
	02	BLTL—trailer—forward.
18	**TAPE ALREADY LOADED**	
	00	Attempted to execute Diagnostic Test 1 with tape already loaded.
20	**SUPPLY TENSION SENSOR FAULT**	
	00	Offset comparator is low with minimum offset.
	01	Offset comparator is high with maximum offset.
	02	2 ounces detected with no tension.
	04	Upper tension detected with no tension.
	05	Did not reach 2 ounces within 100 milliseconds of take-up sensor detecting 2 ounces during load.
21	**TAKE—UP TENSION SENSOR FAULT**	
	00	Offset comparator is low with minimum offset.
	01	Offset comparator is high with maximum offset.
	02	2 ounces detected with no tension.
	03	9 ounces detected with no tension.
	04	Upper tension detected with no tension.

Table 19-51 (Cont.) Fault/SUBFAULT Code

	05	Did not reach 2 ounces within 100 milliseconds of file sensor detecting 2 oz. during load.
22	UNABLE TO TENSION TAPE	
	01	Unable to successfully maintain tension during load. Fault is reported after tape is unloaded off EOT.
	02	Unable to successfully maintain tension during load. Fault is reported with tape still in the tape path after failing to find AOT within 30 seconds.
	03	Tape slipping on file reel while accelerating during tension recovery.
	04	Tape slipping on file reel while decelerating during tension recovery.
	05	Tape slipping on file reel while decelerating during tension recovery/test load.
23	UNABLE TO REESTABLISH TENSION	
	01	Unable to establish tension during test load.
	02	Unable to maintain tension after stopping tape following a test load.
	03	Unable to reestablish tension after hub-latched test.
24	HIGH TENSION FAULT	
		SUBFAULT CODE GROUP 1
	00	Fault occurred during constant velocity motion.
	10	Fault occurred on down ramp.
	20	Fault occurred on up ramp.
	30	Fault occurred in stoplock.
		SUBFAULT CODE GROUP 2
	00	Fault occurred in forward direction.
	04	Fault occurred in reverse direction.
		SUBFAULT CODE GROUP 3
	00	Fault occurred with low speed demanded.
	01	Fault occurred with high speed demanded.
	02	Fault occurred with rewind speed demanded.

Table 19-51 (Cont.) Fault/SUBFAULT Code

		SUBFAULT CODE GROUP 4
	00	Fault occurred while drive was moving at constant velocity, on ramp, or in stoplock for less than 1 second.
	01	Fault occurred with drive in stoplock for than 1 second.
		SUBFAULT CODE GROUP 5
	00	Fault occurred with pneumatic pump enabled.
	08	Fault occurred with pneumatic pump shut down.
25	LOW TENSION FAULT	
		SUBFAULT CODE GROUP 1
	00	Supply sensor saw the fault first.
	40	Take-up sensor saw the fault first.
		SUBFAULT CODE GROUP 2
	00	Fault occurred during constant motion.
	10	Fault occurred on down ramp.
	20	Fault occurred on up ramp.
	30	Fault occurred in stoplock.
		SUBFAULT CODE GROUP 3
	00	Fault occurred in forward direction.
	04	Fault occurred in reverse direction.
		SUBFAULT CODE GROUP 4
	00	Fault occurred with low speed demanded.
	01	Fault occurred with high speed demanded.
	02	Fault occurred with rewind speed demanded.
	03	Fault occurred with slow speed mode demanded.
		SUBFAULT CODE GROUP 5
	00	Fault occurred while drive was moving at constant velocity, on ramp, or in stoplock for less then 1 second.
	01	Fault occurred with drive in stoplock for more then 1 second.

Table 19-51 (Cont.) Fault/SUBFAULT Code

		SUBFAULT CODE GROUP 6
	00	Fault occurred with pneumatic pump enabled.
	08	Fault occurred with pneumatic pump shut down.
26	SERVO FAULT	
	01	Take-up reel moving in wrong direction during untensioned unload.
	02	Take-up reel not moving during untensioned unload.
	03	Take-up reel too fast during untensioned unload.
	04	Take-up reel too slow during untensioned unload.
	05	Voltage sensed in wrong half of file reel amplifier bridge while pulsing supply reel.
	06	Time-out to get unwind speed during untensioned unload.
	07	Voltage sense fault in supply reel amplifier bridge during load.
	08	Voltage sense fault in take-up reel amplifier bridge during load.
	09	Fine line tach fault on load.
27	NO COURSE TACHS	
	01	No Course Tachs during load.
	02	No Course Tachs during tension recovery section of load.
	03	Two No Course Tachs not detected within 4 seconds during file reel radius calculation.
	04	File reel radius calculation out of range during load.
29	ABSENCE OF TAPE	
	01	Absence of tape.
30	UP RAMP FAULT	
		SUBFAULT CODE GROUP 1
	03	Failed to move 0.12 inch in forward direction within deadman time (detected by stiction test.).
	04	Failed to move 0.18 inch in forward direction within deadman time (detected by stiction test.)
	05	Failed to reach end of up ramp within deadman time.

Table 19-51 (Cont.) Fault/SUBFAULT Code

	06	Ramp time less than nominal —50% (too fast)
	07	Ramp time greater than nominal +50% (too slow.)
		SUBFAULT CODE GROUP 2
	00	Fault occurred on forward ramp.
	20	Fault occurred on reverse ramp.
		SUBFAULT CODE GROUP 3
	00	Fault occurred on 25 IPS start/stop ramp.
	10	Fault occurred on 12.5 IPS start/stop ramp.
	40	Fault occurred on 75 IPS start/stop ramp.
31	DOWN RAMP FAULT	
		SUBFAULT CODE GROUP 1
	03	Failed to detect change of direction (forward to reverse) on forward high speed down ramp.
	04	Failed to detect change of direction (reverse to forward) on reverse high speed down ramp.
	05	Failed to reach end of down ramp within deadman time.
	06	Ramp time less than nominal —50% (too fast.)
	07	Ramp time less than nominal +50% (too slow.)
		SUBFAULT CODE GROUP 2
	00	Fault occurred on forward ramp.
	20	Fault occurred on reverse ramp.
		SUBFAULT CODE GROUP 3
	00	Fault occurred on 25 IPS start/stop ramp.
	10	Fault occurred on 12.5 IPS start/stop ramp.
	40	Fault occurred on 75 IPS start/stop ramp.
32	STOPLOCK OVERRUN	
	01	Position 32 quarter tachs reverse of correct Stoplock position.
	02	Position 32 quarter tachs forward of corrected Stoplock position.

Table 19-51 (Cont.) Fault/SUBFAULT Code

	04	Fault occurred while in Gentle Dither mode.
	10	Fault occurred while in Pump shutdown mode.
33	TAPE POSITION FAULT	
	01	Passed erase head turn-on point when about to write at low speed.
	02	Passed erase head turn-on point when about to write at high speed.
34	BOT POSITIONING FAULT	
	01	Timeout waiting for BOT in forward direction during a Load-point reposition.
	02	Timeout waiting for BOT in reverse direction during a Load-point reposition.
35	POSITIONING FAULT	
		SUBFAULT CODE GROUP 1
	00	Failed to reach target at low speed.
	02	Failed to reach target at high speed.
		SUBFAULT CODE GROUP 2
	00	Failed to reach target in forward direction.
	01	Failed to reach target in reverse direction.
36	SPEED FAULT	
	00	Excessive speed when running at low speed.
	04	Speed too slow when running at high speed.
37	PUMP POWER-UP FAULT	
	01	Unable to reestablish tension within 5 seconds.
41	DEVICE PROCESSOR ILLOGICAL FAULT	
	01	Hardware stack underflow.
	02	Hardware stack overflow.
	03	User stack underflow.
	04	User stack overflow.
42	HIGH TEMPERATURE LIMIT EXCEEDED FAULT	

Table 19-51 (Cont.) Fault/SUBFAULT Code

		N/A
43	HIGH TEMPERATURE LIMIT EXCEEDED FAULT	
	01	Upper temperature has been exceeded.
44	UNIT IDENTIFIER FAULT	
	01	2201A back-up memory checksum fault.
	02	Test 49 must be executed prior to entering the unit identifier.
47	VELOCITY CORRECTION FAULT	
	01	Speed correction multiplier in the back-up memory is out of range.
48	UNLOAD FAULT	
	01	Did not find AOT within 6 seconds of losing tension on unload.
50	IRRECOVERABLE DEVICE HEALTH CHECK FAULT	
	01	Servo—Control diagnostic PROM checksum fault.
	02	Servo—Control flag memory fault.
	03	Servo—Control PTM II fault.
	04	Servo—Control PTM I fault.
	05	Servo—Control RAM fault.
	08	Servo—Control functional PROM checksum fault.
51	RECOVERABLE DEVICE HEALTH CHECK FAULT	
	01	2201 EEPROM checksum fault.
	02	2210 EEPROM checksum fault.
	14	DAC fault.
52	SPEED CALCULATION CHECK FAULT	
		SUBFAULT CODE GROUP 1
	10	A previous fault caused by modulus being too large.
	20	A previous fault caused by modulus change inconsistent with direction of tape.
	40	A previous fault caused by modulus being outside expected range.

Table 19-51 (Cont.) Fault/SUBFAULT Code

	80	Unable to obtain consistent harvest counts in determining the file reel radius.
		SUBFAULT CODE GROUP 2
	01	Fault caused by modulus being too large.
	02	Fault caused by modulus change inconsistent with direction of tape.
	04	Fault caused by modulus being outside expected range.
	08	Fault caused by harvest count greater than 8000.
53	ARITHMETIC ERROR	
	01	Attempt to divide by 0.
	02	Integer overflow on floating point integer conversation.
	03	Negative result on floating point subtraction.
	04	Radius calculation during load out of range.
54	ERASE/WRITE CURRENT FAULT	
	01	Erase Current present after write.
	02	Write Current present when degauss.
	04	Write Current not present when writing.
	08	Write Current present when reading.
	10	Erase Current not present when writing.
	20	Erase Current present when reading.
55	ILLOGICAL FAULT	
	01	Failed to reach BOT within specified time during load.
	02	Failed to reach BOT within specified time during rewind.
56	PROCESSOR COMMUNICATION FAULT	
	01	Move Tag, Command Tag or Status/Data did not reset.
	02	Interrupt or Move Tag did not set.
	03	Acknowledge or Command Tag did not set.
	04	Busy or Status/Data did not set.
	05	Busy or Status/Data did not reset.

Table 19-51 (Cont.) Fault/SUBFAULT Code

	06	Interrupt or Move Tag did not reset.
	07	Acknowledge or Command Tag did not reset.
	08	Acknowledge or Command Tag did not set.
	09	Data Strobe did not reset.
	10	Data Strobe did not set.
	11	Bus Integrity test fault.
	12	Primary Status test fault.
	13	PIA/1 Port A test fault.
	19	Formatter health check did not complete within 20 milliseconds.
	20	Formatter did not respond to interrupt within 1 second.
	22	Number of bytes transferred exceeded 32 during test 95 or 99.
60	IRRECOVERABLE OPERATOR PANEL FAULT	
	00	Load/Rewind, Unload, Online or Reset/Fault switch permanently pressed.
61	RECOVERABLE OPERATOR PANEL FAULT	
	00	Test, Step, CE, or Exec switch permanently pressed.
62	FORMATTER WRITE MODULE HEALTH CHECK	
	00	Power-up flip/flop could not be reset.
	01	Write Data transfer did not complete within specified time.
	02	Residual Byte Count check.
	03	CRC Generator Parity error.
	04	AUX CRC Generator Parity error.
	11	ALUZ signal not functional.
	12	ALUZ 2 signal not functional.
	13	ALUN signal not functional.
	14	Arithmetic operation failed.
	15	Logical operation failed.
	20	Microprocessor internal RAM fault.

Table 19-51 (Cont.) Fault/SUBFAULT Code

31	Write checksum fault (IC E17).
32	Write checksum fault (IC E18).
33	Write checksum fault (IC E19).
34	Write checksum fault (IC G17).
35	Write checksum fault (IC G18).
36	Write checksum fault (IC G19).
40	Last Word signal stuck high.
41	Move Tag signal not functional.
42	Command Tag signal not functional.
43	Status/Data Tag signal not functional.
44	GCR status signal not functional.
45	High Speed (HSPD) status signal not functional.
46	Flag bit not functional.
47	One of the formatter status bits to the interface board not functional.
48	One of the device status bits to the interface board not functional.
49	Microprocessor parity generator not functional.
51	Data Strobe signal from timer not functional.
52	Variable timer not functional.
53	Fixed timer (one shot) not functional.
61	4 to 5 converter failed.
62	ECC generator failed.
63	CRC generator failed.
64	AUX CRC generator failed.
71	Write FIFO Available signal not functional.
72	Write Data Transfer Complete signal not functional.
73	Write Transfer Check signal not functional.
81	Sense data path failed.

Table 19-51 (Cont.) Fault/SUBFAULT Code

	82	Device data path failed.
	83	Read Invert signal failed.
63	FORMATTER R/W INTERFACE HEALTH CHECK	
	01	Read failed to go busy.
	02	Read stuck busy.
	03	Read detected an error.
	04	Read detected an error.
	05	Error occurred during a data loopback.
	06	Write FIFO Available signal not functional.
	07	Data compare error.
	08	Write data transfer did not complete within specified time.
	09	Write transfer check.
	11	Read failed to go busy.
	12	Read stuck busy.
	13	Read detected an error.
	14	Read detected an error.
	21	Read Gate signal not functional.
	22	GCR ID signal not functional.
	23	FMK DET signal not functional.
	24	Read Intr signal not functional.
	25	Read Cer signal not functional.
	26	Block Det signal not functional.
	27	Daten signal not functional.
	28	Read Gate signal not functional.
	29	Read buffer was empty with interrupt set.
	30	Read Tag signal not functional.
	31	BYP VFO signal not functional.

Table 19-51 (Cont.) Fault/SUBFAULT Code

	32	REV signal not functional.
	33	GCR signal not functional.
	34	RAW signal not functional.
	35	HSPD signal not functional.
	36	Sense signal not functional.
	37	Diag signal not functional.
	38	Space signal not functional.
	39	WFM signal not functional.
	40	Erase signal not functional.
	41	ID signal not functional.
	42	Read signal not functional.
	43	DSRT signal not functional.
64	**FORMATTER READ MODULE HEALTH CHECK FAULT IN DATA LOOPBACK**	
	11	Read checksum fault (IC D3).
	12	Read checksum fault (IC D2).
	13	Read checksum fault (IC D1).
	21	Read failed to go busy during Sense operation.
	22	Read stuck busy during Sense operation.
	23	Read detected an error during Sense operation.
	24	Read detected an error during Sense operation.
	25	No sense read data.
	26	Excess sense read data.
	31	Read failed to go busy during self-diagnostics.
	32	Read stuck busy during self-diagnostics.
	41	Read failed to go busy during ID operation.
	42	Read stuck busy during ID operation.
	43	Read detected an error during PE ID operation.

Table 19-51 (Cont.) Fault/SUBFAULT Code

44	Read detected an error during GCR ID operation.
45	Read Gate signal failed during ID operation.
46	GCR ID signal failed during ID operation.
51	Read failed to go busy during a Write File Mark operation.
52	Read stuck busy during a Write File Mark operation.
53	Read detected an error during a Write File Mark operation.
54	Read detected an error during a Write File Mark operation.
55	FMK DET signal stuck high.
56	FMK DET signal not set during a PE Write File Mark operation.
57	FMK DET signal not set during a GCR Write File Mark operation.
61	Read failed to go busy during a Space operation.
62	Read stuck busy during a Space operation.
63	Read detected an error in PE during a Space operation.
64	Read detected an error in GCR during a Space operation.
65	Block DET signal was not detected during a Space operation.
66	Read Gate signal was not detected during a Space operation.
71	Read failed to go busy during a Read-after-Write operation at high speed.
72	Read stuck busy during a Read-after-Write operation at high speed.
73	Read detected an error in PE during a Read-after-Write operation at high speed.
74	Read detected an error in GCR during a Read-after-Write operation at high speed.
81	Read failed to go busy during a Read-with-Data Compare operation.
82	Read stuck busy during a Read-With-Data Compare operation.
83	Read detected an error in PE during a Read-With-Data Compare operation.
84	Read detected an error in GCR during a Read-With-Data Compare operation.

Table 19-51 (Cont.) Fault/SUBFAULT Code

	85	Read buffer was empty during a Read-With-Data Compare operation.
	86	Data Compare error in PE detected by Write.
	87	Data Compare error in GCR detected by Write.
	91	Read failed to go busy during a Read-after-Write operation using VFO.
	92	Read stuck busy during a Read-after-Write operation using VFO.
	93	Read detected an error in PE during a Read-after-Write operation using VFO.
	94	Read detected an error in GCR during a Read-after-Write operation using VFO.
65	**FORMATTER READ BOARD HEALTH CHECK FAULT**	
	11	ALUZ signal not functional.
	12	ALUZ 2 signal not functional.
	13	ALUN signal not functional.
	14	Arithmetic operation failed.
	15	Logical operation failed.
	20-22	Microprocessor internal RAM fault.
	30	Data Strobe signal stuck high.
	31	Data Strobe signal stuck low.
	32	Variable timer fault.
	33	Variable timer overflow fault.
	40	One of the flag bits cannot be set.
	41	One of the flag bits cannot be reset.
	42	Microprocessor Parity Generator fault.
	43	Microprocessor Parity Generator fault.
	51	Illegal Count fault (contained within deskew buffer.)
	52	Read Transfer check not functional.
	53	Read Data Buffer Input Parity error not functional.
	54	Illegal count could not be reset by Illegal Count Enable signal.

Table 19-51 (Cont.) Fault/SUBFAULT Code

	60	Error correction logic did not correct data properly.
	61	30RGT signal not functional.
	62	SGL PNTR, SGL CORR or MLT PTR signal not functional.
	63	Dual signal not functional.
	64	Error correction pointer from error correction logic was incorrect.
	65	Dual Corr signal not functional.
	66	ECCZ signal not functional.
	67	VRCZ signal not functional.
	68	Error correction did not complete (ECDONE = 1) in nine clock cycles.
	69	UNCORR signal not functional.
	70	ECC generator failed.
	71	CRC generator failed.
	72	AUX CRC generator failed.
	73	ECC generator failed in reverse mode.
	74	CRC generator failed in reverse mode.
	75	AUX CRC generator failed in reverse mode.
	80	Data Block signal not functional.
	81	70RGT signal not functional.
	82	GCR TM signal not functional.
	83	PROM address for block PROM (IC C13) not functional.
	84	Any Block signal not functional.
	91	Deskew buffer Ready signal not functional.
	92	Dead Track signal from a deskew buffer not functional.
	93	Buffer Ready signal did not set for all dead track conditions.
66	**FORMATTER/TMSCP HEALTH CHECK FAULT**	
	00	Adapter interface did not respond to a diagnostic request.
	01	Command from adapter contained a parity error.

Table 19-51 (Cont.) Fault/SUBFAULT Code

	02	Command from adapter was incorrect.
	03	Adapter health check timeout.
	04	TMSCP online to the system.
	11	Command register bit in error.
	12	Data Busy signal not functional.
	13	Write Data Bus check failed.
	14	No data was received during Write Data Bus check.
	15	Last Word signal not functional.
	16	Excessive data was received during Write Data Bus check.
	17	Adapter detected an error during Write Data Bus check.
	18	During Read Data Bus check, the Transfer Complete signal stuck high.
	19	Adapter detected an error during Read Data Bus check.
	20	Status Select signal not functional
67	TMSCP INTERFACE MODULE HEALTH CHECK	
	01	Stack Ram Parity error.
	02	FIFO Parity error.
	03	FIFO Controller not initialized.
	04	FIFO Full signal not functional.
	05	FIFO Full and Overflow bits are set.
	06	FIFO Overflow bit not set.
	07	Send Data signal not initializes.
	08	RAM Parity error.
	09	FIFO Data Miscompare.
	10	FIFO Parity error.
	11	FIFO Data Miscompare.
	12	FIFO Parity error.
	13	Formatter Enable bit not set.

Table 19-51 (Cont.) Fault/SUBFAULT Code

16	Host Byte counter not preset to all zeros.
17	Tape Byte counter not preset to all zeros.
18	Host Byte counter not preset to all ones.
19	Tape Byte counter not preset to all ones.
20	Host/tape byte counters not preset to shifting ones.
27	Formatter HER/CER.
28	Host Byte count not 0.
29	Parity errors/overflow/overrun.
30	Tape Byte count not correct.
31	Data Miscompare on formatter Rx/Tx.
35	Compare error.
36	Incorrect Compare Error Byte count.
Data Transfer from Host to FIFO	
41	Data pattern AA55—Help code not 13.
42	Data pattern AA55—Help bit not reset.
43	Data pattern AA55—Byte count not 0.
44	Data pattern AA55—Data miscompare.
45	Data pattern AA55—FIFO parity.
46	Data pattern 55AA—Help code not 13.
47	Data pattern 55AA—Help bit not reset.
48	Data pattern 55AA—Byte count not 0.
49	Data pattern 55AA—Data miscompare.
50	Data pattern 55AA—FIFO parity.
Data Transfer from Host to FIFO—Byte Swap	
51	Data pattern AA55—Help code not 13.
52	Data pattern AA55—Help bit not reset.
53	Data pattern AA55—Byte count not 0.

Table 19-51 (Cont.) Fault/SUBFAULT Code

54	Data pattern AA55—Data miscompare.
55	Data pattern AA55—FIFO parity.
56	T1 signal is not functional.
57	LESI status has error bit set.
58	LESI parity error.
Data Transfer from FIFO to Host	
60	Data pattern 55AA—Help code not 09.
61	Data pattern 55AA—Data miscompare.
62	Data pattern 55AA—LESI parity error.
63	Data pattern 55AA—FIFO parity empty.
64	Data pattern AA55—Help code not 09.
65	Data pattern AA55—Data miscompare.
66	Data pattern AA55—LESI parity error.
67	Data pattern 55AA—Help code not 09.
68	Data pattern 55AA—Data miscompare.
69	Data pattern 55AA—LESI parity error.
70	Odd Byte—Help code not 09.
71	Odd Byte—Data miscompare.
72	Odd Byte—No LESI parity error.
80	UART status or Data miscompare on ASCII port.
Data Transfer from RAM to LESI	
83	Data pattern AA55—Help code not 09.
84	Data pattern AA55—Data miscompare.
85	Data pattern AA55—Byte count not 0.
86	Data pattern AA55—Errors.
Data Transfer from LESI to RAM	
88	Data pattern 55AA—Help code not 13.

Table 19-51 (Cont.) Fault/SUBFAULT Code

	89	Data pattern 55AA—Help active.
	90	Data pattern 55AA—Byte count not 0.
	91	Data pattern 55AA—Data miscompare.
	92	Data pattern 55AA—Errors.
	93	Timer failed.
	94	Timer interrupt did not occur on timeout.
	95	Timer interrupt occurred before timeout.
68	TMSCP INTERFACE MODULE PROM CHECKSUM	
	01	MSCP01 checksum fault (IC G07).
	02	MSCP03 checksum fault (IC G03).
69	REMOTE DIAGNOSTICS	
	00	Test cannot be run remotely.
	01	Reset button was pushed while executing a remote diagnostic.
	02	Drive was busy and test could not be executed.
	03	Present drive mode must be terminated prior to test execution.
	04	Formatter was busy and test could not be executed.
70/71	INVALID OPERATOR SEQUENCE	
		Test run in improper sequence or other invalid operator action.

CHAPTER 20
TA78 STI STATUS

20.1 INTRODUCTION

Chapter 20 contains TA78 Unsuccessful response, Extended Drive status, and Extended Formatter status. This is to provide continuity for decoding the error log reports. The different operating systems print status bytes in decimal, hexadecimal, or octal. The following status information is provided to decode the error log messages of the TA78.

- Unsuccessful Response (Section 20.2)
- Get Extended Formatter Status (Section 20.3)
- Get Extended Drive Status (Section 20.4)

20.2 TA78 UNSUCCESSFUL RESPONSE

There are 12 bytes of information received from the formatter as an Unsuccessful response or as a response to a GET SUMMARY STATUS command. These 12 bytes used by the STI tape controller to report STI communication or command failures are explained in the following sections.

20.2.1 TA78 Summary Mode Byte 1

Summary Mode Byte 1 is the low byte of word 22. Figure 20-1 shows the format of the byte, and Table 20-1 describes the bits.

Figure 20-1 TA78 Summary Mode Byte 1

7							0
AF	A3	A2	A1	A0	OA	PS	DR

CX–1302A

Table 20-1 TA78 Summary Mode Byte 1

Bit	Description
AF	Formatter Attention
A3	Drive 3 Attention

Table 20-1 (Cont.) TA78 Summary Mode Byte 1

Bit	Description
A2	Drive 2 Attention
A1	Drive 1 Attention
A0	Drive 0 Attention
OA	Formatter unavailable
PS	Port switch enabled
DR	Diagnostic requested (formatter requested the controller to execute a diagnostic)

20.2.2 TA78 Summary Mode Byte 2

Summary Mode Byte 2 is the high byte of word 22. Figure 20-2 shows the format of the byte, and Table 20-2 describes the bits.

Figure 20-2 TA78 Summary Mode Byte 2

7							0
FE	TE	PE	DF	0	0	0	0

CX–1303A

Table 20-2 TA78 Summary Mode Byte 2

Bit	Description
FE	Formatter error
TE	Transmission error
PE	Protocol error
DF	Diagnostic error

20.2.3 TA78 Summary Mode Byte 3

Summary Mode Byte 3 is the low byte of word 23. Figure 20-3 shows the format of the byte, and Table 20-3 describes the bits.

Figure 20-3 TA78 Summary Mode Byte 3

7							0
0	0	0	PB	EL	RP	RT	FD

CX-1304A

Table 20-3 TA78 Summary Mode Byte 3

Bit	Description
PB	0 = Formatter is connected to the controller through Port A. 1 = Formatter is connected to the controller through Port B.
EL	Error logging Information is available.
RP,RT	The Formatter state during error recovery tells the controller how to proceed in the error recovery sequence. The states are as follows: **RP RT State** 0 0 No Error 0 1 Transfer 1 0 Done 1 1 Retryable
FD	Used only during error recovery in conjunction with RP and RT bits listed above. When the formatter is in the Transfer state, the FD bit indicates the direction of the transfer as follows: 0 = Transfer in the same direction as the transfer that failed. 1 = Transfer in the opposite direction of the original transfer. When the formatter is in the Done state, the FD bit indicates the status of the retry attempt: 0 = Retry sequence successful. 1 = Retry sequence failed.

20.2.4 TA78 Controller Byte

The controller Byte is the high byte of word 23. Figure 20-4 shows the format of the byte, and Table 20-4 describes the bits.

Figure 20-4 TA78 Controller Byte

7							0
C1	C2	C3	C4	C5	C6	C7	C8

CX–1305A

Table 20-4 TA78 Controller Byte

Bit	Combination	Description
C1	C2 - C8	
0	All 0s	Normal operation.
1	All 0s	Formatter offline because a diagnostic is currently running.

All other combinations of the Controller Flag bits are reserved. The Controller Flag bits are cleared by the controller whenever it receives a Change Controller Flags command. The Controller Flag bits are also cleared by the formatter whenever the following occurs:

- The formatter powers up
- The fault indicator is enabled
- The port switches are disabled

20.2.5 TA78 Drive 0 Mode Byte

Drive 0 Mode Byte is the low byte of word 24. Figure 20-5 shows the format of the byte, and Table 20-5 describes the bits.

Figure 20-5 TA78 Drive 0 Mode Byte

7							0
TM	EOT	BOT	WL	OL	AV	MR	EL

CX–1306A

Table 20-5 TA78 Drive 0 Mode Byte

Bit	Description
TM	Tape mark detected.
EOT	Tape is at or beyond end of tape.
BOT	Tape is at beginning of tape.
WL	Tape without write ring.
OL	Drive is online.
AV	Drive is available.
MR	Maintenance request (from formatter).
EL	Error logging information is available.

20.2.6 TA78 Drive 0 Error Byte

Drive 0 Error Byte is the high byte of word 24. Figure 20-6 shows the format of the byte, and Table 20-6 describes the bits.

Figure 20-6 TA78 Drive 0 Error Byte

7							0
DE	LP	PL	EX	DTE	SME	DI	ZT

CX–1307A

Table 20-6 TA78 Drive 0 Error Byte

Bit	Description
DE	A drive error detected is not covered by other status bits.
LP	A lengthy operation is in progress. A Rewind operation, including the rewind of a Data Security Erase operation is in progress whether the rewind was initiated by the controller or the formatter. This bit is not cleared by the CLEAR DRIVE ERROR command. It is cleared automatically by the formatter upon completion of the operation or when the drive goes offline.
PL	The formatter is not certain of the position of the tape.
EX	The formatter encounters a tape mark or the rising edge of EOT or BOT during a data transfer.
DTE	An error prevents a data transfer from completing successfully.
SME	The formatter changes the current operating speed of the drive, if changing the drive operating speed is transparent to the controller.
DI	The formatter gathers performance statistics and uses special internal algorithms to check nonperfect performance. When set, the formatter takes the following action: 1. Writes all records on the tape perfectly. Write operations are retried until the Read-after-write check sees a perfect record. 2. Modifies the write retry algorithm in order to distinguish between transient formatter, drive errors, and defective media.
ZT	Special diagnostic requirements are required. This bit instructs the formatter to change all error thresholds from their normal default values to zero.

20.2.7 TA78 Drive 1 Mode Byte

Drive 1 Mode Byte is the low byte of word 25. Figure 20-7 shows the format of the byte, and Table 20-7 describes the bits.

Figure 20-7 TA78 Drive 1 Mode Byte

7							0
TM	EOT	BOT	WL	OL	AV	MR	EL

CX-1306A

Table 20-7 TA78 Drive 1 Mode Byte

Bit	Description
TM	Tape mark detected.
EOT	Tape is at or beyond end of tape.
BOT	Tape is at beginning of tape.
WL	Tape without write ring.
OL	Drive is online.
AV	Drive is available.
MR	Maintenance Request (from formatter).
EL	Error Logging information is available.

20.2.8 TA78 Drive 1 Error Byte

Drive 1 Error Byte is the high byte of word 25. Figure 20-8 shows the format of the byte, and Table 20-8 describes the bits.

Figure 20-8 TA78 Drive 1 Error Byte

7							0
DE	LP	PL	EX	DTE	SME	DI	ZT

CX-1307A

Table 20-8 TA78 Drive 1 Error Byte

Bit	Description
DE	A drive error detected is not covered by other status bits.
LP	A lengthy operation is in progress. A Rewind operation, including the rewind of a Data Security Erase operation is in progress whether the rewind was initiated by the controller or the formatter. This bit is not cleared by the CLEAR DRIVE ERROR command. It is cleared automatically by the formatter upon completion of the operation or when the drive goes offline.
PL	The formatter is not certain of the position of the tape.
EX	The formatter encounters a tape mark or the rising edge of EOT or BOT during a data transfer.
DTE	An error prevents a data transfer from completing successfully.
SME	The formatter changes the current operating speed of the drive, if changing the drive operating speed is transparent to the controller.
DI	The formatter gathers performance statistics and uses special internal algorithms to check nonperfect performance. When set, the formatter takes the following action: 1. Writes all records on the tape perfectly. Write operations are retried until the Read-after-write check sees a perfect record. 2. Modifies the write retry algorithm in order to distinguish between transient formatter, drive errors, and defective media.
ZT	Special diagnostic requirements are required. This bit instructs the formatter to change all error thresholds from their normal default values to zero.

20.2.9 TA78 Drive 2 Mode Byte

Drive 2 Mode Byte is the low byte of word 26. Figure 20-9 shows the format of the byte and Table 20-9 describes the bits.

Figure 20-9 TA78 Drive 2 Mode Byte

7							0
TM	EOT	BOT	WL	OL	AV	MR	EL

CX-1306A

Table 20-9 TA78 Drive 2 Mode Byte

Bit	Description
TM	Tape mark detected.
EOT	Tape is at or beyond end of tape.
BOT	Tape is at beginning of tape.
WL	Tape without write ring.
OL	Drive is online.
AV	Drive is available.
MR	Maintenance request (from formatter).
EL	Error Logging information is available.

20.2.10 TA78 Drive 2 Error Byte

Drive 2 Error Byte is the high byte of word 26. Figure 20-10 shows the format of the byte and Table 20-10 describes the bits.

Figure 20-10 TA78 Drive 2 Error Byte

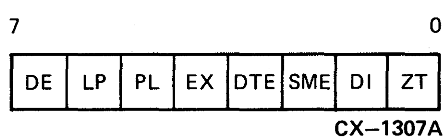


Table 20-10 TA78 Drive 2 Error Byte

Bit	Description
DE	A drive error detected is not covered by other status bits.
LP	A lengthy operation is in progress. A Rewind operation, including the rewind of a Data Security Erase operation is in progress whether the rewind was initiated by the controller or the formatter. This bit is not cleared by the CLEAR DRIVE ERROR command. It is cleared automatically by the formatter upon completion of the operation or when the drive goes offline.
PL	The formatter is not certain of the position of the tape.
EX	The formatter encounters a tape mark or the rising edge of EOT or BOT during a data transfer.
DTE	An error prevents a data transfer from completing successfully.
SME	The formatter changes the current operating speed of the drive, if changing the drive operating speed is transparent to the controller.
DI	The formatter gathers performance statistics and uses special internal algorithms to check nonperfect performance. When set, the formatter takes the following action: 1. Writes all records on the tape perfectly. Write operations are retried until the Read-after-write check sees a perfect record. 2. Modifies the write retry algorithm in order to distinguish between transient formatter, drive errors, and defective media.
ZT	Special diagnostic requirements are required. This bit instructs the formatter to change all error thresholds from their normal default values to zero.

20.2.11 TA78 Drive 3 Mode Byte

Drive 3 Mode Byte is the low byte of word 27. Figure 20-11 shows the format of the byte and Table 20-11 describes the bits.

Figure 20-11 TA78 Drive 3 Mode Byte

7							0
TM	EOT	BOT	WL	OL	AV	MR	EL

CX-1306A

Table 20-11 TA78 Drive 3 Mode Byte

Bit	Description
TM	Tape mark detected.
EOT	Tape is at or beyond end of tape.
BOT	Tape is at beginning of tape.
WL	Tape without write ring.
OL	Drive is online.
AV	Drive is available.
MR	Maintenance request (from formatter).
EL	Error Logging information is available.

20.2.12 TA78 Drive 3 Error Byte

Drive 3 Error Byte is the high byte of word 27. Figure 20-12 shows the format of the byte and Table 20-12 describes the bits.

Figure 20-12 TA78 Drive 3 Error Byte

7							0
DE	LP	PL	EX	DTE	SME	DI	ZT

CX–1307A

Table 20-12 TA78 Drive 3 Error Byte

Bit	Description
DE	A drive error detected is not covered by other status bits.
LP	A lengthy operation is in progress. A Rewind operation, including the rewind of a Data Security Erase operation is in progress whether the rewind was initiated by the controller or the formatter. This bit is not cleared by the CLEAR DRIVE ERROR command. It is cleared automatically by the formatter upon completion of the operation or when the drive goes offline.
PL	The formatter is not certain of the position of the tape.
EX	The formatter encounters a tape mark or the rising edge of EOT or BOT during a data transfer.
DTE	An error prevents a data transfer from completing successfully.
SME	The formatter changes the current operating speed of the drive, if changing the drive operating speed is transparent to the controller.
DI	The formatter gathers performance statistics and uses special internal algorithms to check nonperfect performance. When set, the formatter takes the following action: 1. Writes all records on the tape perfectly. Write operations are retried until the Read-after-write check sees a perfect record. 2. Modifies the write retry algorithm in order to distinguish between transient formatter, drive errors, and defective media.
ZT	Special diagnostic requirements are required. This bit instructs the formatter to change all error thresholds from their normal default values to zero.

20.3 TA78 EXTENDED FORMATTER STATUS

There are 24 bytes of information received from the formatter in response to a GET EXTENDED FORMATTER STATUS command. The format of this information is formatter and error type dependent and varies in length and content. If the information received from the formatter is less than 24 bytes, the controller zero fills the remaining unused bytes of the error log message. These 24 bytes used by the Get Extended Formatter Status Response are explained in the following sections.

Notice, the first three bytes (Mode, Error, Controller) are the same as in the Get Summary Status response.

20.3.1 TA78 Summary Mode Byte

The following is the description of the Summary Mode Byte. See Table 20-13.

Table 20-13 TA78 Summary Mode Byte 1

Bit	Description
AF	Formatter Attention
A3	Drive 3 Attention
A2	Drive 2 Attention
A1	Drive 1 Attention
A0	Drive 0 Attention
OA	Formatter unavailable
PS	Port Switch enabled
DR	Diagnostic Requested (formatter requested the controller execute a diagnostic).

20.3.2 TA78 Summary Error Byte

The following is a description of Summary Error Byte. See Table 20-14.

Table 20-14 TA78 Summary Mode Byte 2

Bit	Description
FE	Formatter error
TE	Transmission error
PE	Protocol error
DF	Diagnostic error

20.3.3 TA78 Controller Byte

This is a description of the Controller Byte. See Table 20-15

Table 20-15 TA78 Controller Byte

Bit	Combination	Description
C1	C2 - C8	
0	all 0s	Normal operation.
1	all 0s	Formatter offline because a diagnostic is currently running.

The following bytes are the Get Summary Status Response and are explained in byte location and tables.

20.3.4 Error Number Low Byte (ERRNUM)

Error Number Low Byte is the high byte of word 23. This byte is the first byte of the Get Summary Status response and contains the eight least significant bits of a 10-bit error identification number. Error Number Low Byte and Error Number High Byte work together. See Section 20.3.5

20.3.5 Error Number High Byte (ERRN1)

Error Number High Byte is the low byte of word 24. Error Number Low Byte and Error Number High Byte work together. See Figure 20-13. Table 20-16 describes the bits in Error Number High Byte. The operational error codes (Table 20-17) show the error identification number and fault number. Operational error code consist of:

- Error Number Low Byte
- Two least significant bit of Error Number High Byte
- Bits 3, 4, and 5 of Error Number High Byte

Figure 20-13 Error Number High Byte and Error Number Low Byte

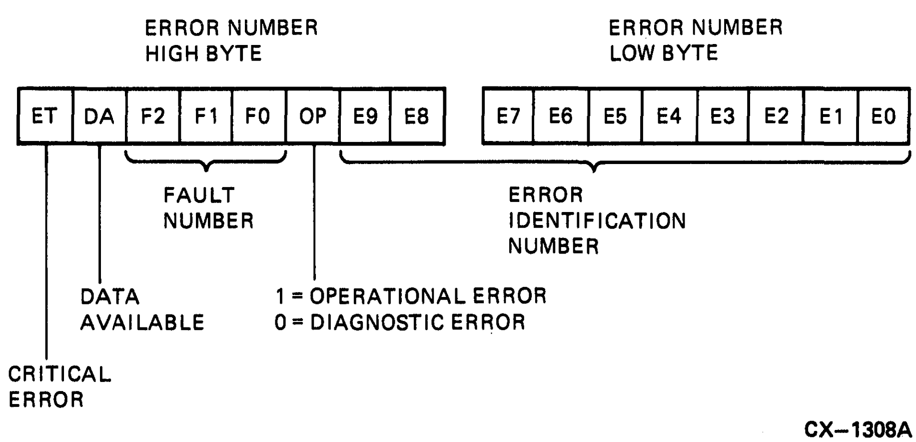


Table 20-16 Error Number High Byte

Bit	Description
1:0	Two most significant bits of 10-bit error identification number.
2	1 = Operational error.
	0 = Diagnostic error.
5:3	Fault number—One of six areas in the formatter that may have caused a fatal error.
6	Data available.
	1 = Data generated by diagnostic code is available.
	0 = Error occured while running operational code.
7	Critical error.
	1 = Error is critical; formatter should be removed from service.
	0 = Error occured while running operational code.

Table 20-17 TA78 Operational Error Codes

Error Number			
High Byte	Low Byte	Fault Number	Error Description
00	00	-	Operation completed with no error detected.
04	01	-	TU CMD did not load correctly to start tape motion in Erase Gap routine.
04	02	-	TU velocity did not come up to acceptable speed (within 10% of 125 in/s).
04	03	-	Write operation successfully completed beyond EOT marker (Exception condition).
04	04	-	Read path could not verify gap at end of Erase Gap routine.
04	05	-	TU velocity changed to unacceptable speed during operation.
04	06	-	Write attempted on file protected tape or TU FPT bit set during operation.
04	09	-	TU CMD did not load correctly to start tape motion to write ID burst.
04	0A	-	TU CMD did not load correctly to set PE tape density at start of write BOT ID burst.

Table 20-17 (Cont.) TA78 Operational Error Codes

Error Number High Byte	Low Byte	Fault Number	Error Description
14	0B	2	Command read from RMC register. RCMLP did not match command loaded into RCMD register. This code isgenerated when Find Gap command loaded during Erase Gap routine.
14	0C	2	Command read from RMC register RCMLP did not match command loaded into RCMD register. This code is generated when Verify ID Burst command loaded during write of BOT area.
04	0D	-	Failed to write density ID burst correctly.
04	0E	-	TU CMD did not load correctly to set GCR tape density after reading a GCR Density ID burst.
14	0F	2	Command read from RMC register RCMLP did not match command loaded into RCMD register. This code is generated when Verify ARA Burst command loaded during write of BOT area.
04	10	-	Failed to write ARA burst correctly.
14	11	2	Command read from RMC register RCMLP did not match command loaded into RCMD register. This code is generated when Verify ARA ID command loaded during write of BOT area.
04	12	-	Failed to write ARA ID correctly.
04	13	-	ARA error bit set in MIA Status B register.
04	14	-	Could not find gap after ID code was written correctly.
04	15	-	TU CMD did not load correctly to start tape motion to write BOT ID burst.
14	16	2	Command read from RMC register. RCMLP did not match command loaded into RCMD register. This code is generated when Verify Gap command loaded during write of BOT area.
04	17	-	TU CMD did not load correctly to back-up tape to BOT after failing to write BOT ID.
04	18	-	Timeout looking for BOT after failing to write BOT ID.
04	19	-	TU CMD did not load correctly to start tape motion in selected function routine.
14	1A	2	Command read from RMC register RCMLP did not match command loaded into RCMD register. This code is generated in selected function routine.

Table 20-17 (Cont.) TA78 Operational Error Codes

Error Number			
High Byte	Low Byte	Fault Number	Error Description
04	1B	-	Failed to write tape mark correctly.
04	1C	-	Tape did not come up to acceptable speed while trying to reposition for a retry of Write tape mark.
04	1D	-	TU CMD did not load correctly to back up for retry of Writing tape mark.
04	1E	-	TU velocity changed to unacceptable speed while trying to reposition for retry of Write tape mark.
04	1F	-	No record found within 7.6 m (25 ft) of tape.
04	20	-	Timeout looking for BOT after detecting ARA ID burst while moving in reverse direction.
04	22	-	Detected BOT marker after tape motion started.
04	23	-	Reverse command issued while tape at BOT.
2C	24	5	ECC ROM parity error.
14	25	2	Command read from RMC register. RCMLP did not match command loaded into RCMD register. (This code generated when Read ID Burst command loaded during read of BOT area.)
04	26	-	ID burst neither PE or GCR.
04	27	-	No Gap found after ID burst (PE) or ARA ID burst (GCR).
04	28	-	TU CMD did not load correctly to start tape motion to read ID burst.
04	29	-	ARA ID not found
14	2A	2	Command read from RMC register RCMLP did not match command loaded into RCMD register. This code generated when VERIFY GAP command loaded during read of BOT area.
14	2B	2	Command read from RMC register RCMLP did not match command loaded into RCMD register. This code generated when VERIFY GAP command loaded during read of BOT area.
04	2D	-	TU CMD did not load correctly to set PE tape density at start of read from BOT.
04	2E	-	TU CMD did not load correctly to set GCR tape density after reading a GCR Density ID burst.

Table 20-17 (Cont.) TA78 Operational Error Codes

Error Number			
High Byte	Low Byte	Fault Number	Error Description
1C	2F	3	WMC general error during Read operation; check Ecode register (byte 41 Get Extended Drive Status) for reason. May be illegal Format or Skip Count codes.
1C	30	3	RD PE set in WMCERR register with no ECC uncorrectable error in ECCSTA register, or during Read operation; WMC ROM PE in WMCERR is set.
1C	31	3	XMC ROM parity error.
1C	32	3	XMC DONE did not set.
1C	33	3	WMC ROM PE set in WMCERR register during Write operation.
1C	34	3	WMC general error during Write operation; check Ecode register (byte 41 Get Extended Drive Status) for reason. May be illegal Format or Skip Count codes.
04	35	-	Could not find a gap after writing record and read path terminated early.
04	36	-	RSTAT (Byte 10 Get Extended Drive Status) contains error code.
1C	37	3	XMC PE Mode Parity error set in INSTA register.
04	38	-	AMTIE, pointer mismatch, uncorrectable, two-track error or single-track error set in ECCSTA register. This code generated by write PE operations.
04	39	-	At least one write fail bit set in RPFAIL and RPATH registers.
04	3A	-	GCR characters from WMC and RMC do not match. This code is generated by write PE operation.
04	3B	-	CRC error, ACRC error, pointer mismatch, uncorrectable or two-track error set in ECCSTA register. This code is generated by write GCR operation.
04	3C	-	More then one write fail bit set in RPFAIL and RPATH registers. (This code generated by write GCR operation).
04	3D	-	Could not detect a gap after writing record.
04	3E	-	TU velocity changed while writing PE gap before starting to write record.
04	3F	-	Read path terminated before entire record was written.
04	40	-	Calculated EDC did not match received EDC during Write operation.

Table 20-17 (Cont.) TA78 Operational Error Codes

Error Number High Byte	Error Number Low Byte	Fault Number	Error Description
34	41	6	PM DONE did not set at end of port switch routine.
34	42	6	PM CROM parity error occurred during port switch routine.
34	43	6	Port enable status read after port switch routine did not match desired port enable status.
34	44	6	PM CROM parity error occurred while receiving message in available state.
34	45	6	PM FIFO input not ready at start of send Level 2 message routine.
34	46	6	Data late error caused by attempting to retrieve message from empty PM FIFO during Level 1 command validation.
34	47	6	PM FIFO output not ready. Message not available at start of Level 2 command validation.
34	48	6	PM CROM parity error occurred during Level 1 validation.
34	49	6	PM FIFO input not ready during diagnostic echo routine.
34	4A	6	PM CROM parity error occurred during diagnostic routine.
34	4B	6	PM CROM parity error occurred during Level 2 command validation.
34	4C	6	PM CROM parity error occurred during send Level 2 message routine.
0C	4D	1	TS78 control panel cable is not present.
34	4E	6	PM FIFO output ready at start of diagnostic echo response. This indicates too many bytes (over two) were in FIFO.
34	4F	6	PM CROM parity error occurred while receiving message in online state.
3C	50	7	Level 2 message byte-count is too large (over 63 bytes) to transmit with send Level 2 routine.
3C	51	7	Message retrieved from PM FIFO, during Level 2 command validation, is too large (over 64 frames).
04	52	-	Uncorrectable data error detected.
04	53	-	Tape mark detected while reading a record.
04	54	-	Transmission error detected in PERI register.

Table 20-17 (Cont.) TA78 Operational Error Codes

Error Number High Byte	Error Number Low Byte	Fault Number	Error Description
34	55	6	PM clock not enabled at start of write routine.
34	56	6	PM CROM parity error occurred during data operation.
3C	57	7	Bad or missing ROM on M8972.
3C	58	7	Write current not inhibited during erase-only portion of Write Retry operation.
04	59	-	Illegal microdiagnostic number detected while running operational code.
04	5A	-	Correctable error detected.
04	5B	-	Minimum integrity failure.
34	5C	6	PM Done did not set at end of read routine.
34	5D	6	PM FIFO output ready. FIFO not empty at end of read routine.
04	5E	-	Data late error detected in PERI register at end of data operation.
3C	5F	7	Stack underflow error.
3C	60	7	AC LO power interrupt received indicating impending power failure.
3C	61	7	Unexpected RST 1 interrupt. RST 1 interrupt received but RX or TX interrupt line not asserted in INTSTA register.
3C	62	7	Unexpected RST 2 interrupt. RST 2 interrupt received but MCLK or RX interrupt line not asserted in INTSTA register.
3C	63	7	Unexpected RST 3 interrupt. RST 3 interrupt received but RX interrupt line not asserted in INTSTA register.
3C	64	7	Unexpected RST 4 interrupt. RST 4 interrupt received but MCLK or TX interrupt line not asserted in INTSTA register.
3C	65	7	Unexpected RST 5 interrupt. RST 5 interrupt received but TX interrupt line not asserted in INTSTA register.
3C	66	7	Unexpected RST 6 interrupt. RST 6 interrupt received but MCLK interrupt line not asserted in INTSTA register.
3C	67	7	Unexpected RST 7 interrupt. RST 7 interrupt received but RTU STAT parity error not asserted in PSTAT register.

Table 20-17 (Cont.) TA78 Operational Error Codes

Error Number High Byte	Error Number Low Byte	Fault Number	Error Description
3C	68	7	Unexpected trap interrupt. Trap interrupt received but AC LO interrupt line not asserted in INSTA register.
3C	69	7	Unexpected RST 5.5 interrupt. (RST 5.5 interrupt received but KINI interrupt line not asserted in INTSTA register).
3C	6A	7	Unexpected RST 6.5 interrupt (8085 received illegal instruction).
3C	6B	7	Unexpected RST 7.5 interrupt (RST 7.5 interrupt received but TU CMD parity error not asserted in PSTAT register).
04	6C	-	Preamble had AMTIE during Write operation.
3C	6D	7	8085 interrupts not enabled in offline state.
04	6E	-	Follow-up Write command not received within 2.4 ms of finishing last record in keep going mode
04	FE	-	Forced Fatal Drive error during data operation for testing HSC.
0C	FF	1	Forced Fatal Formatter error during data operation for testing HSC.

20.3.6 Opcode Save (OPSAV)

Opcode Save is the high byte of word 24. Table 20-18 describes this byte. Bits 7:0 contains the last received level 2 opcode.

Table 20-18 Level 2 Opcode

Command Code	Description
41	Clear Drive Errors
42	Clear Formatter Errors
44	Disconnect
47	Get Formatter Characteristics
48	Get Summary Status
4B	Initiate Rewind
4D	Position Tape
4E	Set Unit Execution Mode
50	Set Byte Count
53	Write Tape Mark
55	Data Error Recovery
C0	Change Controller Flags
C3	Diagnose
C5	Get Extended Drive Status
C6	Get Formatter Error Log
C9	Get Unit Characteristics
CA	Erase Gap
CC	Online
CF	Read Memory
D1	Set Unit Characteristics
D2	Topology
D4	Write Memory

20.3.7 Connection State (CONNST)

Connection State is the low byte of word 25. Table 20-19 describes the Connection State.

Table 20-19 Extended Formatter Status Byte 4

Bit	Description
0	Online—A formatter port is online with respect to controller (ready to receive any command or data). If either PORT SELECT A and B are in enabled position, the other port is unavailable unless formatter is in topology mode.
1	Available—One or both formatter ports are in the Available state relative to the controller. (PORT SELECT A and/or B is in enabled position, but controller has not placed a port online). Controller can access available port, but access is limited to very few commands such as RETRIEVING STATUS.
2	Topology—Formatter entered Topology mode. With one formatter port online, the second port simulates Available state for up to one second.
3	Offline—Both formatter ports are offline with respect to controller. No STI communication since PORT SELECT A and B are in disabled position.
4	Broken—Minimum integrity failure. Formatter cannot communicate via STI bus because of internal hardware problem.
7:5	Not used.

20.3.8 Summary Mode Byte 1 (SUMMOD)

Summary Mode Byte 1 is the high byte of word 25. Table 20-20 describes Summary Mode Byte 1.

Table 20-20 TA78 Summary Mode Byte 1

Bit	Description
AF	Formatter Attention
A3	Drive 3 Attention
A2	Drive 2 Attention
A1	Drive 1 Attention
A0	Drive 0 Attention
OA	Formatter Unavailable
PS	Port Switch Enabled
DR	Diagnostic Requested (Formatter requested the controller execute a diagnostic)

20.3.9 Summary Error Byte (SUMERR)

Summary Error Byte is the high byte of word 25. Table 20-21 describes Summary Error Byte.

Table 20-21 TA78 Summary Mode Byte 2

Bit	Description
FE	Formatter Error
TE	Transmission Error
PE	Protocol Error
DF	Diagnostic Error

20.3.10 Summary Mode Byte 2 (SUMMD2)

Summary Mode Byte 2 is the low byte of word 26. Table 20-22 describes Summary Mode Byte 2.

Table 20-22 Summary Mode Byte 2

Bit	Description
2:0	Retry bits RP, RT and FD indicate formatter progress in an error recovery sequence instructing the controller what recovery step to do next. Retry codes are listed below.

Bit Position

2	1	0	
RP	**RT**	**FD**	**Meaning**
0	0	X	No error.
0	1	0	Ready for data transfer in same direction.
0	1	1	Ready for data transfer in opposite direction.
1	0	0	Retried transfer succeeded.
1	0	1	Retried transfer failed.
1	1	0	Ready to position for retry in same direction.
1	1	1	Ready to position or retry in opposite direction.

Bit	Description
3	When 1, indicates new error log information available in the extended formatter status area.
7:4	Not used.

20.3.11 Controller Flag (CONBYT)

Controller Flag is the low byte of word 26. Table 20-23 describes Controller Flag Byte.

Table 20-23 TA78 Controller Byte

Bit	Combination	Description
C1	C2 - C8	
0	all 0s	Normal operation.
1	all 0s	Formatter is offline because a diagnostic is currently running.

20.3.12 Port Control (PRTOSV)

Port Control is the low byte of word 27. Table 20-24 describes Port Control.

Table 20-24 Port Control

Bit	Description
0	1 = Formatter reception and transmission enabled on Port B data lines, and formatter reception enabled on Port B Real-time Controller state line.
1	1 = Formatter reception and transmission enabled on port A data lines, and formatter reception enabled on port A Real-time Controller state line.
2	1 = Formatter transmission enabled on Port B Real-time Formatter state line.
3	1 = Formatter transmission enabled on Port A Real-time Formatter state line.
7:4	Not used.

20.3.13 Formatter State (FSTOSV)

Formatter State is the high byte of word 27. Table 20-25 describes Formatter State.

Table 20-25 Formatter State

Bit	Description
0	Parity
	0 = Allows normal operation. Calculates odd parity based on bits 6-1 in FSTOSV to yield bit 0 (parity bit) on enabled Real-time Formatter state line(s)
	1 = Forces parity error. Calculates even parity yielding a parity bit in bit 0 that is inverted with respect to its correct value.
1	Available
	0 = Formatter is online.
	1 = Formatter is available or offline.
2	Not used.
	NOTE
	Definitions for bits 2 through 5 are valid only when formatter is online. With formatter in available state, bits 2 through 5 represent a 4-bit event counter with bit 5 being the most significant bit (MSB). The counter records the number of changes in connection state of the transport(s). (The three transport connection states are online, available and offline).
3	Data Ready
	In Read operation, leading edge (transition to 1) indicates tape drive is starting sequence to transmit sync character and then data. Falling edge (transition to 0) indicates formatter has transmitted all of the data and part of the byte count.
	In Write operation, leading edge (transition to 1) indicates tape drive is starting write sequence in autoshift mode. Falling edge (transition to 0) indicates data received and stored with no error, and EDC received and verified.
	In Position Tape operation, toggling data ready bit indicates progress is being made. Formatter complements data ready for every gap detected (for example, every record or tape mark passed). Acceptable progress is a toggling rate of at least twice for every long time-out period. Data ready is 0 at beginning and end of operation.
4	Acknowledge
	0 = Data transfer error (operation aborted) or exception (tape mark, EOT or BOT detected during data transfer) occurred.
5	Attention
	1 = Potentially significant status change not caused by reception, validation, or execution of controller command. In most cases, a status change is caused by user intervention such as opening a transport door or pressing the LOAD/REW button.
6	Formatter Receiver Ready

Table 20-25 (Cont.) Formatter State

Bit	Description
	1 = Formatter is ready to receive a new message frame or data. Reception of a valid sync character causes the formatter to clear this bit to 0.
7	0 = Forces transmission of 0s on enabled port(s) Real-time Formatter state line.
	1 = Allows transmission of state bits on enabled port(s) Real-time Formatter state line.
	Bit 7 is a 1 when formatter is online or available, and 0 when formatter is offline.

20.3.14 Port Switch (PSWISV)

Port Switch is the low byte of word 28. Table 20-26 describes Port Switch.

Table 20-26 Port Switch

Bit	Description
3:0	Not used.
4	1 = PORT SELECT B is in enabled (in) position.
5	1 = PORT SELECT A is in enabled (in) position.
6	1 = FAULT is being pressed.
7	Not used.

20.3.15 Last Status Code (LASSTA)

Last Status Code is the high byte of word 28. Last Status Code is an 8-bit code that describes the last checkpoint passed in operational code before error detection. Table 20-27 describes Last Status Code.

Table 20-27 Last Status Code

Opcode	Description
00	Not used.
01	Not used.
02	Level 2 Protocol error.
03	Transmission error.
04	DIAGNOSTIC ECHO command executed properly.
05	Asserted KINI state bit recognized and STI—Bus initialization executed properly.
06	CHANGE CONTROLLER FLAGS command executed properly.
07	CLEAR DRIVE ERRORS command executed properly.

Table 20-27 (Cont.) Last Status Code

Opcode	Description
08	CLEAR FORMATTER ERRORS command executed properly.
09	DISCONNECT command executed properly.
0A	GET EXTENDED DRIVE STATUS command executed properly.
0B	GET FORMATTER ERROR LOG command executed properly.
0C	GET FORMATTER CHARACTERISTICS command executed properly.
0D	GET SUMMARY STATUS command executed properly.
0E	GET UNIT CHARACTERISTICS command executed properly.
0F	ERASE GAP command executed properly.
10	INITIATE REWIND command executed properly (rewind, rewind/unload, or DSE/rewind initiated successfully).
11	POSITION TAPE command executed properly (tape motion routine initiated successfully and making progress).
12	READ MEMORY command executed properly.
13	SET BYTE COUNT command executed properly.
14	SET UNIT CHARACTERISTICS command executed properly.
15	Topology mode entered successfully.
16	Successful exit of Topology mode.
17	WRITE TAPE MARK command executed properly.
18	WRITE MEMORY command executed properly.
19	Online state entered successfully.
1A	Suspected Level 1 frame received and validation started.
1B	Suspected Level 1 frame failed validation (Bad Hamming code or Wrong Connection state).
40	Erase Gap subroutine (ERAMOT) entered, and Turn-around Delay completed if last operation was in reverse direction.
41	TU CMD loaded correctly to start tape motion in Erase Gap subroutine (ERAMOT).
42	Tape erasing completed and verification of gap started in Erase Gap subroutine (ERAMOT).

Table 20-27 (Cont.) Last Status Code

Opcode	Description
43	Gap verified and TU CMD loaded to stop tape motion in Erase Gap subroutine (ERAMOT).
44	TU CMD loaded (but not verified) to start tape motion to write ID burst.
45	ID burst written correctly and starting to verify IBG while writing in BOT area.
46	TU CMD loaded (but not verified) to start backup tape motion for retry of ID burst.
47	TU CMD loaded (but not verified) to start tape motion to write Tape Mark.
48	Tape mark written and verified in Write Tape Mark subroutine.
49	Successfully moved a record while positioning tape.
4A	TU CMD loaded (but not verified) to start tape motion forward 1 record.
4B	TU CMD loaded (but not verified) to start tape motion reverse 1 record.
4C	TU CMD loaded (but not verified) to start tape motion during read of BOT.
4D	Sample ID burst 255 times and starting valid determination of density during read of BOT area.
4E	ID burst correctly determined and verification of gap starting during read of BOT area.
4F	TU CMD loaded (but not verified) to start tape motion and start erasing before EOT during DSE operation.
50	At EOT and starting erase of additional 10 feet during DSE operation.
51	Erasure of 5 or 10 foot segment after EOT completed during DSE operation (if only 5 feet done, erasing of second 5 foot segment starting. If 10 feet done, rewind starting).
52	Rewind/Unload motion entered successfully.
53	Not used.
54	Read Reverse subroutine (DORDR) entered successfully.
55	Read or Read Reverse command recognized (received, validated, and starting execution).
56	Read subroutine (DORDF) entered successfully.
57	TU CMD loaded (but not verified) to stop tape motion during read or read reverse operation.
58	WRITE command recognized (received, validated, and starting execution).

Table 20-27 (Cont.) Last Status Code

Opcode	Description
59	WRITE command subroutine (DOWRT) entered successfully.
5A	TU CMD loaded (but not verified) to stop tape motion during write operation.
5B	DATA ERROR RECOVERY command executed properly (does not include error termination).
5C	SET UNIT EXECUTION MODE command executed properly.

20.3.16 Error Retry Flag (ERRFLG)

Error Retry Flag is the low byte of word 29. Table 20-28 describes Error Retry Flag.

Table 20-28 Error Retry Flag

Bit	Description
0	Not used.
1	Least significant bit (LSB) of unit number for transport that executed initial command.
2	Most significant bit (MSB) of unit number for transport that executed initial command.
3	1 = Initial command moved tape in opposite direction.
4	1 = Initial command moved tape in reverse direction.
5	1 = Initial command was a write.
7:6	Not used.

20.3.17 Retry Counter (RETCNT)

Retry Counter is the high byte of word 29. Retry Counter contains the number of retry requests during error recovery sequence.

20.3.18 STI Bus Initialization Counter (KICNT)

STI Bus Initialization Counter is the low byte of word 30. STI Bus Initialization Counter contains the number of initializations since master reset or powerup.

20.3.19 Memory Location (X) (FMSTAK 1)

Memory Location (X) is the high byte of word 30. Memory Location (X) contains the memory location specified in stack pointer (SP) after underflow error.

20.3.20 Memory Location (X + 1) (FMSTAK 2)

Memory Location (X + 1) is the low byte of word 31. Memory Location (X + 1) contains the next location (SP+1) after underflow error.

20.3.21 Memory Location (X + 2) (FMSTAK 3)

Memory Location (X + 2) is the high byte of word 31. Memory Location (X + 2) contains the next location (SP+2) after underflow error.

20.3.22 Memory Location (X + 3) (FMSTAK 4)

Memory Location (X + 3) is the low byte of word 32. Memory Location (X + 3) contains the next location (SP+3) after underflow error.

NOTE

FMSTK 1 through FMSTK 4 are only valid if an underflow error has occurred. Otherwise, these four bytes are cleared to 0.

20.4 TA78 EXTENDED DRIVE STATUS

There are 62 bytes of information received from the drive in response to a GET EXTENDED DRIVE STATUS command. The format of this information is drive and error type dependent and varies in length and content. If the information received from the drive is less then 62 bytes, the controller zero fills the remaining unused bytes of the error log message. These 62 bytes used by the GET EXTENDED DRIVE STATUS RESPONSE are explained in the following sections.

20.4.1 Speed Byte

Speed byte is the low byte of word 22 and is the currently set speed of the drive. It is an integer value in inches per second (IPS) rounded down to the nearest integer. For a totally variable speed drive, the speed returned is the lower bound of the range of permissible speeds. (For example, 7D = 125 IPS).

20.4.2 Density Byte

Density byte is the high byte of word 22 and is a bit mask with one bit assigned to each possible tape density. There are three currently allowable tape densities: 800 BPI NRZI encoding, 1600 BPI PE encoding, and 6250 BPI GCR encoding. The following bit position for the densities are:

- Bit 0 = 800 BPI NRZI
- Bit 1 = 1600 BPI PE
- Bit 2 = 6250 BPI GCR

20.4.3 MSCP Unit Number Low Byte

MSCP Unit Number Low byte is the low byte of word 23 and contains the low byte of the unit number.

20.4.4 MSCP Unit Number High Byte

MSCP Unit Number High byte is the high byte of word 23 and contains the high byte of the unit number.

20.4.5 Gap Count Byte 1

Gap Count Byte 1 is the low byte of word 24 and is the least significant byte of the number of gaps the formatter believes the tape drive to be from the beginning of tape.

20.4.6 Gap Count Byte 2

Gap Count Byte 2 is the high byte of word 24 and is the second byte of the number of gaps the formatter believes the tape drive to be from the beginning of tape.

20.4.7 Gap Count Byte 3

Gap Count Byte 3 is the low byte of word 25 and is the third byte of the number of gaps the formatter believes the tape to be from the beginning of tape.

20.4.8 Gap Count Byte 4

Gap Count Byte 4 is the high byte of word 25 and is the forth byte of the number of gaps the formatter believes the tape to be from the beginning of tape.

20.4.9 Diagnostic Mode Status Byte 1

Diagnostic Mode Status Byte 1 is the low byte of word 26. Table 20-29 describes the diagnostic mode status byte 1. With the TA78 in diagnostic mode, Diagnostic Mode Status Byte 1 is one of two status bytes for classifying soft errors. One of six codes, listed and defined below, may appear in this byte. In normal operation, Diagnostic Mode Status Byte 1 is 0.

Table 20-29 Diagnostic Mode Status Byte 1

Partial Diagnostic Mode Soft Error Status Code	Meaning
00	No soft error (note 2)
07	Other (Write)
0E	Status (Read)
16	Status (Read Reverse)
2D	Transmission (Read)
35	Transmission (Read Reverse)

NOTE

1 **Status (Read and Read Reverse)—successful operation after retries.**

Other (Write—Write Retry) succeeded in same physical location that previous write retry failed.

2 **Bytes 1 and 2 must contain 0s to indicate no soft error.**

20.4.10 Diagnostic Mode Status Byte 2

Diagnostic Mode Status Byte 2 is the high byte of word 26. Table 20-30 describes Diagnostic Mode Status Byte 2. With the TA78 in diagnostic mode, Diagnostic Mode Status Byte 2 is one of two status bytes for classifying soft errors. One of eight codes, listed and defined below, may appear in this byte. In normal operation, Diagnostic Mode Status Byte 2 is 0.

Table 20-30 Diagnostic Mode Status Byte 2

Partial Diagnostic Mode Soft Error Status Code	Meaning
00	No soft error
01	Double track correction (Read)
02	Double track correction (Read Reverse)
03	Single track correction (Read)
04	Single track correction (Read Reverse)
08	Media
0D	Other (Read)
15	Other (Read Reverse)

NOTE

1 **Other (Read and Read Reverse)—successful operation without error correction, but with interesting occurrence (AMTIE or PHTIE flag).**

2 **Bytes 1 and 2 must contain 0s to indicate no soft error.**

20.4.11 Diagnostic Mode Status Byte 3

Diagnostic Mode Status Byte 3 is the low byte of word 27 and is reserved for future use and is always a 0.

20.4.12 Diagnostic Mode Status Byte 4

Diagnostic Mode Status Byte 4 is the high byte of word 27 and is reserved for future use and is always a 0.

NOTE

When a nonzero value appears in byte 1 or 2, the TA78 does not update bytes 5 and above in the extended drive status area. The TA78 then transmits only the first 4 bytes of the requested extended drive status area to the HSC.

20.4.13 Opcode Save (OPSAV)

Opcode Save is the low byte of word 28. Table 20-31 describes this byte. Bits 7 through 0 contain the last received Level 2 opcode.

Table 20-31 Level 2 Opcode

Command Code	Description
41	Clear drive errors
42	Clear formatter errors
44	Disconnect
47	Get formatter characteristics
48	Get summary status
4B	Initiate rewind
4D	Position tape
4E	Set unit execution mode
50	Set byte count
53	Write tape mark
55	Data error recovery
C0	Change controller flags
C3	Diagnose
C5	Get extended drive status
C6	Get formatter error log
C9	Get unit characteristics
CA	Erase gap
CC	Online
CF	Read memory
D1	Set unit characteristics
D2	Topology
D4	Write memory

20.4.14 Error Number Low Byte (ERRNUM)

Error Number Low Byte is the high byte of word 23. This byte is the first byte of the GET SUMMARY STATUS response and contains the eight least significant bits of a 10-bit error identification number. Error Number Low Byte and Error Number High Byte work together. See Section 20.4.15

20.4.15 Error Number High Byte (ERRN1)

Error Number High Byte is the low byte of word 24. Error Number Low Byte and Error Number High Byte work together. See Figure 20-14. Table 20-32 describes the bits in Error Number High Byte. The operational error codes (Table 20-33) show the error identification number and fault number. Operational error code consist of:

- Error Number Low Byte
- Two least significant bit of Error Number High Byte
- Bits 3, 4, and 5 of Error Number High Byte

Figure 20-14 Error Number High Byte and Error Number Low Byte

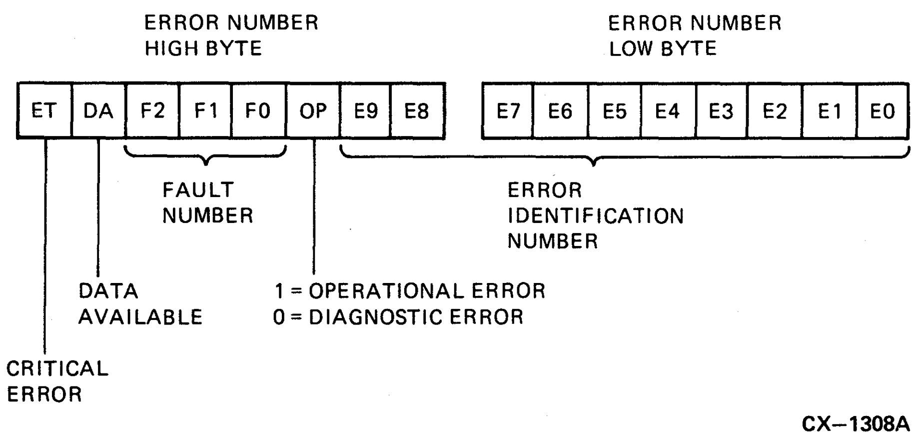


Table 20-32 Error Number High Byte

Bit	Description
1:0	Two most significant bits of 10-bit error identification number
2	1 = Operational error.
	0 = Diagnostic error.
5:3	Fault number—One of six areas in the formatter that may have caused a potentially fatal error.
6	Data available
	1 = Data generated by diagnostic code is available.
	0 = Indicates error occured while running operational code.
7	Critical error
	1 = Error is critical—Formatter should be removed from service.
	0 = Error occured while running operational code.

Table 20-33 TA78 Operational Error Codes

Error Number			
High Byte	Low Byte	Fault Number	Error Description
00	00	-	Operation completed with no error detected.
04	01	-	TU CMD did not load correctly to start tape motion in Erase Gap routine.
04	02	-	TU velocity did not come up to acceptable speed (within 10% of 125 in/s).
04	03	-	Write operation successfully completed beyond EOT marker (exception condition).
04	04	-	Read path could not verify gap at end of Erase Gap routine.
04	05	-	TU velocity changed to unacceptable speed during operation.
04	06	-	Write attempted on file protected tape or TU FPT bit set during operation.
04	09	-	TU CMD did not load correctly to start tape motion to write ID burst.
04	0A	-	TU CMD did not load correctly to set PE tape density at start of write BOT ID burst.

Table 20-33 (Cont.) TA78 Operational Error Codes

Error Number High Byte	Error Number Low Byte	Fault Number	Error Description
14	0B	2	Command read from RMC register. RCMLP did not match command loaded into RCMD register. FIND GAP command was loaded during Erase Gap routine.
14	0C	2	Command read from RMC register RCMLP did not match command loaded into RCMD register. VERIFY ID BURST command was loaded during write of BOT area.
04	0D	-	Failed to write density ID burst correctly.
04	0E	-	TU CMD did not load correctly to set GCR tape density after reading a GCR Density ID burst.
14	0F	2	Command read from RMC register RCMLP did not match command loaded into RCMD register. VERIFY ARA BURST command was loaded during write of BOT area.
04	10	-	Failed to write ARA burst correctly.
14	11	2	Command read from RMC register RCMLP did not match command loaded into RCMD register. (VERIFY ARA ID command loaded during write of BOT area).
04	12	-	Failed to write ARA ID correctly.
04	13	-	ARA error bit set in MIA Status B register.
04	14	-	Could not find gap after ID code was written correctly.
04	15	-	TU CMD did not load correctly to start tape motion to write BOT ID burst.
14	16	2	Command read from RMC register. RCMLP did not match command loaded into RCMD register. (VERIFY GAP command loaded during write of BOT area).
04	17	-	TU CMD did not load correctly to back-up tape to BOT after failing to write BOT ID.
04	18	-	Timeout looking for BOT after failing to write BOT ID.
04	19	-	TU CMD did not load correctly to start tape motion in selected function routine.
14	1A	2	Command read from RMC register RCMLP did not match command loaded into RCMD register (selected function routine).

Table 20-33 (Cont.) TA78 Operational Error Codes

Error Number High Byte	Low Byte	Fault Number	Error Description
04	1B	-	Failed to write tape mark correctly.
04	1C	-	Tape did not come up to acceptable speed while trying to reposition for a retry of Write Tape Mark.
04	1D	-	TU CMD did not load correctly to back up for retry of writing tape mark.
04	1E	-	TU velocity changed to unacceptable speed while trying to reposition for retry of writing tape mark.
04	1F	-	No record found within 7.6 meters (25 ft) of tape.
04	20	-	Timeout looking for BOT after detecting ARA ID burst while moving in reverse direction.
04	22	-	Detected BOT marker after tape motion started.
04	23	-	REVERSE command issued while tape at BOT.
2C	24	5	ECC ROM parity error.
14	25	2	Command read from RMC register. RCMLP did not match command loaded into RCMD register. Read ID Burst command was loaded during read of BOT area.
04	26	-	ID burst neither PE or GCR.
04	27	-	No Gap found after ID burst (PE) or ARA ID burst (GCR).
04	28	-	TU CMD did not load correctly to start tape motion to read ID burst
04	29	-	ARA ID not found.
14	2A	2	Command read from RMC register. RCMLP did not match command loaded into RCMD register. VERIFY GAP command was loaded during read of BOT area.
14	2B	2	Command read from RMC register. RCMLP did not match command loaded into RCMD register. VERIFY GAP command was loaded during read of BOT area
.)			
04	2D	-	TU CMD did not load correctly to set PE tape density at start of read from BOT.

Table 20-33 (Cont.) TA78 Operational Error Codes

Error Number			
High Byte	Low Byte	Fault Number	Error Description
04	2E	-	TU CMD did not load correctly to set GCR tape density after reading a GCR Density ID burst.
1C	2F	3	WMC general error occurred during read operation; check Ecode register (Byte 41 GET EXTENDED DRIVE STATUS) for reason. Illegal Format or Skip Count codes may exist.
1C	30	3	RD PE set in WMCERR register with no ECC uncorrectable error in ECCSTA register, or during read operation; WMC ROM PE in WMCERR is set.
1C	31	3	XMC ROM parity error.
1C	32	3	XMC DONE did not set.
1C	33	3	WMC ROM PE set in WMCERR register during write operation.
1C	34	3	WMC general error occurred during write operation; check Ecode register (byte 41 Get Extended Drive Status) for reason. Illegal Format or Skip Count codes may exist.
04	35	-	Could not find a gap after writing record and read path terminated early.
04	36	-	RSTAT (byte 10 GET EXTENDED DRIVE STATUS) contains error code.
1C	37	3	XMC PE mode parity error set in INSTA register.
04	38	-	AMTIE, pointer mismatch, uncorrectable, two-track error or single-track error set in ECCSTA register (write PE operations).
04	39	-	At least one write fail bit set in RPFAIL and RPATH registers.
04	3A	-	GCR characters from WMC and RMC do not match (Write PE operation).
04	3B	-	CRC error, ACRC error, pointer mismatch, uncorrectable or two-track error set in ECCSTA register (Write GCR operation).
04	3C	-	More then one write fail bit set in RPFAIL and RPATH registers (Write GCR operation).
04	3D	-	A gap could not be detected after writing record.
04	3E	-	TU velocity changed while writing PE gap before starting to write record.
04	3F	-	Read path terminated before entire record was written.
04	40	-	Calculated EDC did not match received EDC during write operation.

Table 20-33 (Cont.) TA78 Operational Error Codes

Error Number High Byte	Error Number Low Byte	Fault Number	Error Description
34	41	6	PM DONE did not set at end of port switch routine.
34	42	6	PM CROM Parity error occurred during port switch routine.
34	43	6	Port Enable status read after Port Switch routine did not match desired Port Enable status.
34	44	6	PM CROM parity error occurred while receiving message in available state.
34	45	6	PM FIFO input not ready at start of send Level 2 message routine.
34	46	6	Data late error caused by attempting to retrieve message from empty PM FIFO during Level 1 command validation.
34	47	6	PM FIFO output not ready. Message not available at start of Level 2 command validation.
34	48	6	PM CROM parity error occurred during Level 1 validation.
34	49	6	PM FIFO input not ready during diagnostic echo routine.
34	4A	6	PM CROM parity error occurred during diagnostic routine.
34	4B	6	PM CROM parity error occurred during Level 2 command validation.
34	4C	6	PM CROM parity error occurred during Send Level 2 message routine.
0C	4D	1	TS78 control panel cable is not present.
34	4E	6	PM FIFO output ready at start of diagnostic echo response. This indicates too many bytes (over two) were in FIFO.
34	4F	6	PM CROM parity error occurred while receiving message in online state.
3C	50	7	Level 2 message byte count is too large (over 63 bytes) to transmit with send Level 2 routine.
3C	51	7	Message retrieved from PM FIFO, during Level 2 command validation, is too large (over 64 frames).
04	52	-	Uncorrectable data error detected.
04	53	-	Tape mark detected while reading a record.
04	54	-	Transmission error detected in PERI register.

Table 20-33 (Cont.) TA78 Operational Error Codes

Error Number			
High Byte	Low Byte	Fault Number	Error Description
34	55	6	PM clock not enabled at start of write routine.
34	56	6	PM CROM parity error occurred during data operation.
3C	57	7	Bad or missing ROM on M8972.
3C	58	7	WRITE CURRENT not inhibited during erase only portion of Write Retry operation.
04	59	-	Illegal microdiagnostic number detected while running operational code.
04	5A	-	Correctable error detected.
04	5B	-	Minimum integrity failure.
34	5C	6	PM done did not set at end of read routine.
34	5D	6	PM FIFO output ready. FIFO not empty at end of read routine.
04	5E	-	Data late error detected in PERI register at end of data operation.
3C	5F	7	Stack underflow error occurred.
3C	60	7	AC LO power interrupt received indicating impending power failure.
3C	61	7	Unexpected RST 1 interrupt. (RST 1 interrupt received but RX or TX interrupt line not asserted in INTSTA register).
3C	62	7	Unexpected RST 2 interrupt. (RST 2 interrupt received but MCLK or RX interrupt line not asserted in INTSTA register).
3C	63	7	Unexpected RST 3 interrupt. (RST 3 interrupt received but RX interrupt line not asserted in INTSTA register).
3C	64	7	Unexpected RST 4 interrupt. (RST 4 interrupt received but MCLK or TX interrupt line not asserted in INTSTA register).
3C	65	7	Unexpected RST 5 interrupt. (RST 5 interrupt received but TX interrupt line not asserted in INTSTA register).
3C	66	7	Unexpected RST 6 interrupt. (RST 6 interrupt received but MCLK interrupt line not asserted in INTSTA register).
3C	67	7	Unexpected RST 7 interrupt. (RST 7 interrupt received but RTU STAT parity error not asserted in PSTAT register).

Table 20-33 (Cont.) TA78 Operational Error Codes

Error Number High Byte	Low Byte	Fault Number	Error Description
3C	68	7	Unexpected trap interrupt. (Trap interrupt received but AC LO interrupt line not asserted in INSTA register).
3C	69	7	Unexpected RST 5.5 interrupt. (RST 5.5 interrupt received but KINI interrupt line not asserted in INTSTA register).
3C	6A	7	Unexpected RST 6.5 interrupt (8085 received illegal instruction).
3C	6B	7	Unexpected RST 7.5 interrupt (RST 7.5 interrupt received but TU CMD parity error not asserted in PSTAT register).
04	6C	-	Preamble had AMTIE during Write operation.
3C	6D	7	8085 interrupts not enabled in Offline state.
04	6E	-	FOLLOW-UP WRITE command not received within 2.4 ms of finishing last record in keep going mode
04	FE	-	Forced Fatal Drive error during data operation, for testing HSC.
0C	FF	1	Forced Fatal Formatter error during data operation for testing HSC.

20.4.16 RMC Write Fail Bits (RPFAIL)

RMC Write Fail bits are the high byte of word 29. RMC Write Fail bits contains the write fail bits from read channels 7:0. Write fail is an OR of certain error conditions. The error conditions are:

- Illegal 5 to 4 translation
- AMTIE
- PHTIE
- Pointer mismatch

20.4.17 Read Path Status (RPATH)

Read Path Status is the low byte of word 30. Table 20-34 describes Read Path Status.

Table 20-34 Read Path Status

Bit	Name	Description
0	Write fail P	Illegal 5 to 4, AMTIE, PHTIE, or pointer mismatch for parity bit.
1	Statistics select	True if TIE bus statistics are being sent to TIE bus.
2	Statistics select	True if Read Path clock is stopped.

Table 20-34 (Cont.) Read Path Status

Bit	Name	Description
3	Beginning of preamble	True when Path senses the preamble has just passed the read head.
4	Data ready	Goes false when M8953 asserts data ready to M8951.
5	Preamble error	True if preamble had AMTIE.
6	Status valid	Indicates M8953 status is valid (set after 0.1 inch gap found).
7	Velocity OK	True if velocity is within 10% of 125 in/sec or jam velocity ok bit is set (RPCTL, 09-W bit 2).

20.4.18 RMC Status (RSTAT)

RMC Status is the high byte of word 30 and contains the Read Path Microcontroller Status codes. Table 20-35 describes RMC Status.

Table 20-35 RMC Status

Status	Meaning
	Status from ECC SELF-TEST command
41	ECC controller passed SELF-TEST.
42	ECC controller failed SELF-TEST.
	Status from an M8953 SELF-TEST command
43	Read path passed SELF-TEST.
44	Read path failed SELF-TEST.
	Status from an M8950 SELF-TEST command
46	Read channel tests all passed.
	Status from a CLEAR ALL TEST command for velocity testing of drive by microcode
1	First tach pulse.
81	Last tach pulse (eleventh; ten spaces.).
	Status from a SAMPLE DENSITY Command
88	NOT CAPABLE found.
89	GCR ID found.
8A	PE ID found.
	Status from a Write Test of IBG, PE ID, GCR ID, ARA ID, or ARA burst

Table 20-35 (Cont.) RMC Status

90	Bad status (write test).
	Status from a Tape Mark test command
92	Good Tape Mark found on Tape status.
	Status resulting from a NON-BOT command (Read or Write FWD or REV, GCR or PE)
98	ARA ID found (not Record or Tape Mark).
99	Tape Mark found.
9C	Preamble End not found.
9D	Read Path Fault 1—Too many M8950s have failed to continue record processing.
9E	Read Path Fault 2— Seven or more M8950 modules found illegal 5 to 4 translations.
A1	Unexpected IBG in data; probably creased tape (seven or more AMTIES active).
B1	Postamble long.
B2	Postamble short.
FF	OK.

20.4.19 RMC Command Loop Back (RCMLP)

RMC Command Loop Back is the low byte of word 31 and contains the last command sent to the M8953 by way of the RCMD (address 0B—W). Table 20-36 identifies each code and it's meaning.

Table 20-36 RMC Command Loop Back

Command Code	Task
00	NOP
01	Interblock read
02	Test PE ID burst
03	Test GCR ID burst
04	Test ARA ID burst
05	Test tape mark
06	Test ARA burst
07	Normal non-BOT read

Table 20-36 (Cont.) RMC Command Loop Back

Command Code	Task
08	Run RMC self-test
09	Test unknown ID burst
0A	Run read channel microtest
0B	DIAGNOSTIC READ command
0C	Run read channel self-test
0D	Run clear all RMC test program
0E	Run ECC self-test program
0F	Find gap

20.4.20 Read Channel AMTIE Status (RAMT)

Read Channel AMTIE Status is the high byte of word 31 and reflects the state of the AMTIE lines for channels 7 through 0.

20.4.21 Read Channel Done Status (RDON)

Read Channel Done Status is the low byte of word 32 and reflects the read channel done status lines. A given bit is false if the associated M8950 has completed its assigned task.

20.4.22 Read Channel Illegal Status (RILL)

Read Channel Illegal Status is the high byte of word 32 and contains read channel illegal status. A given bit is true if the associated M8950 indicates the following:

- GCR—Data contained an illegal 5-bit code which was either an error or tape format control character.
- PE—Data error occurred.

20.4.23 Read Channel Mark 2 Status (RMK2)

Read Channel Mark 2 Status is the low byte of word 33 and indicates the associated M8950 has detected a Mark 2 tape format control character. If the corresponding illegal 5 to 4 bit is set (RILL 7 through 0), a Mark 2 was detected during 5 to 4 conversion.

20.4.24 Read Channel End Status (REND)

Read Channel End Status is the high byte of word 33 and indicates End Mark for Read channels 0 through 7.

20.4.25 Read Channel Parity Status (RPSTA)

Read Channel Parity Status is the low byte of word 34. Table 20-37 describes Read Channel Parity Status

Table 20-37 Read Channel Parity Status

Bit	Name	Description
0	AMTIE P	Weak amplitude on parity bit
1	Not done P	Parity M8950 not done
2	Illegal P	illegal 5-to-4 for parity bit
3	Mark 2 P	Mark 2 for parity bit
4	End P	End Mark for parity bit
5	Post P	PE postamble for parity bit
6	Data P	Contains M8950 data output for parity bit
7	Corrected data P	Contains ECC module corrected output data for parity bit

20.4.26 Read Channel PE Postamble Detect (RPOSTN)

Read Channel PE Postamble Detect is the high byte of word 34. Read Channel PE Postamble Detect in PE contains the inverted data for the byte prior to the one currently on the data lines. Used for PE Postamble. This byte is not used in GCR.

20.4.27 Read Channel Data (RDATA)

Read Channel Data is the low byte of word 35. Read Channel Data contains the data output from read channels 0:7 to the ECC module.

20.4.28 CRC Byte (CRCWRD)

CRC byte is the high byte of word 35. CRC byte contains the CRC checker output bits.

20.4.29 Corrected Data (ECCOR)

Corrected Data is the low byte of word 36. Corrected Data contains the corrected data output from ECC module to the CRC module.

20.4.30 ECC Status (ECCSTA)

ECC Status is the high byte of word 36. Table 20-38 describes ECC Status.

Table 20-38 ECC Status

Bit	Name	Description
0	Single-track error correction	Single-track error correction was performed on data.
1	Two-track error correction	Two-track error correction was performed on data.
2	Uncorrectable	ECC could not correct data error.
3	Pointer mismatch	The track in error did not have a pointer.
4	ACRC error	ACRC did not check.
5	AMTIE occurred	AMTIE occurred during data portion of record.
6	ECC ROM parity error	M8951 program parity error.
7	CRC error	CRC did not check.

20.4.31 Read channels 0 and 1 TIE

Read channels 0 and 1 TIE is the low byte of word 37. Table 20-39 describes Read channels 0 and 1 TIE.

Table 20-39 Read Channels 0 and 1 TIE

Bit	Name	Description
0	CH0 TIE bus 0	0 = Pointer mismatch in GCR and 0 in PE. 1 = Any pointer occurred (GCR and PE).
1	CH0 TIE bus 1	PHTIE
2	CH0 TIE bus 2	AMTIE
3	CH0 TIE bus 3	Illegal 5 to 4 in GCR and dead track in PE. (Bad track register is ORed into this bit).
4	CH1 TIE bus 0	0 = Pointer mismatch in GCR and 0 in PE. 1 = Any pointer occurred (GCR and PE).
5	CH1 TIE bus 1	PHTIE
6	CH1 TIE bus 2	AMTIE
7	CH1 TIE bus 3	Illegal 5 to 4 in GCR and dead track in PE. (Bad track register is ORed into this bit).

20.4.32 Read Channels 2 and 3 TIE

Read Channels 2 and 3 TIE is the high byte of word 37. Table 20-40 describes Read Channels 2 and 3 TIE.

Table 20-40 Read Channels 2 and 3 TIE

Bit	Name	Description
0	CH2 TIE bus 0	0 = Pointer mismatch in GCR and 0 in PE.
		1 = Any pointer occurred (GCR and PE).
1	CH2 TIE bus 1	PHTIE
2	CH2 TIE bus 2	AMTIE
3	CH2 TIE bus 3	Illegal 5 to 4 in GCR and dead track in PE. (Bad Track register is ORed into this bit).
4	CH3 TIE bus 0	0 = Pointer mismatch in GCR and 0 in PE.
		1 = Any pointer occurred (GCR and PE).
5	CH3 TIE bus 1	PHTIE
6	CH3 TIE bus 2	AMTIE
7	CH3 TIE bus 3	Illegal 5 to 4 in GCR and dead track in PE. (Bad Track register is ORed into this bit).

20.4.33 Read Channels 4 and 5 TIE

Read Channels 4 and 5 TIE is the low byte of word 38. Table 20-41 describes Read Channels 4 and 5 TIE.

Table 20-41 Read Channels 4 and 5 TIE

Bit	Name	Description
0	CH4 TIE bus 0	0 = Pointer mismatch in GCR and 0 in PE.
		1 = Any pointer occurred (GCR and PE).
1	CH4 TIE bus 1	PHTIE
2	CH4 TIE bus 2	AMTIE
3	CH4 TIE bus 3	Illegal 5 to 4 in GCR and dead track in PE. (Bad Track register is ORed into this bit).
4	CH5 TIE bus 0	0 = Pointer mismatch in GCR and 0 in PE.
		1 = Any pointer occurred (GCR and PE).

Table 20-41 (Cont.) Read Channels 4 and 5 TIE

Bit	Name	Description
5	CH5 TIE bus 1	PHTIE
6	CH5 TIE bus 2	AMTIE
7	CH5 TIE bus 3	Illegal 5 to 4 in GCR and dead track in PE. (Bad Track register is ORed into this bit).

20.4.34 Read Channels 6 and 7 TIE
Read Channels 6 and 7 TIE is the high byte of word 38. Table 20-42 describes Read Channels 6 and 7 TIE.

Table 20-42 Read Channels 6 and 7 TIE

Bit	Name	Description
0	CH6 TIE bus 0	0 = Pointer mismatch in GCR and 0 in PE.
		1 = Any pointer occurred (GCR and PE).
1	CH6 TIE bus 1	PHTIE
2	CH6 TIE bus 2	AMTIE
3	CH6 TIE bus 3	Illegal 5 to 4 in GCR and dead track in PE. (Bad track register is ORed into this bit).
4	CH7 TIE bus 0	0 = Pointer mismatch in GCR and 0 in PE.
		1 = Any pointer occurred (GCR and PE).
5	CH7 TIE Bus 1	PHTIE
6	CH7 TIE Bus 2	AMTIE
7	CH7 TIE bus 3	Illegal 5 to 4 in GCR and dead track in PE. (Bad Track register is ORed into this bit).

20.4.35 Read Channels P TIE and TIE Bus
Read Channels P TIE and TIE Bus is the low byte of word 39. Table 20-43 describes Read Channels P TIE and TIE Bus.

Table 20-43 Read Channels P TIE and TIE Bus

Bit	Name	Description
0	CHP TIE bus 0	0 = Pointer mismatch in GCR and 0 in PE. 1 = Any pointer occurred (GCR and PE).
1	CHP TIE bus 1	PHTIE
2	CHP TIE bus 2	AMTIE
3	CHP TIE bus 3	Illegal 5 to 4 in GCR and dead track in PE. (Bad track register is ORed into this bit).
4:7	TIE bus	Reads TIE bus without enabling any read channel modules. If jam TIE bus (address 09—W bit 7) is set, then the value written into address 0A—W is read.

20.4.36 AMTIE Byte (TAMT)
AMTIE byte is the high byte of word 39. AMTIE byte reflects the information on TU bus lines AMTIE 7 through 0.

20.4.37 Tape Unit Port Status (PSTAT)
Tape Unit Port Status is the low byte of word 40. Table 20-44 describes Tape Unit Port Status.

Table 20-44 Tape Unit Port Status

Bit	Name	Description
0	AMTIE parity	State of the TU bus line AMTIE P.
1	Read parity	State of the TU bus line RD P.
2	WCS parity	State of the TU bus line WCS P.
3	Tachometer	State of the TU bus line TACH.
4	Tape unit present	A TU78 transport is physically cabled to this TU port.
5	Command parity error	The TU78 has detected a parity error on the WCS lines during a TA78 command or command/status address write.
6	Write data strobe	State of the TU bus line WDS.
7	Status parity error	A parity error has occurred when reading a TU78 register over the WCS lines.

20.4.38 TU Port Read Data (PRDD)
TU Port Read Data is the high byte of word 40 and reflects the information on TU bus lines RD 7 through 0.

20.4.39 STI Bus Errors (PERI)

STI Bus Errors is the low byte of word 41. Table 20-45 describes STI Bus Errors.

Table 20-45 STI Bus Errors

Bit	Name	Description
0	-	Not used.
1	Cable not present	No cable is present connecting the TA78 Logic gate and the TA78 Control panel.
2	Control Pulse error	A pulse is missing on the Real-time Controller state line.
3	Data pulse error	A pulse is missing on Write/Command data line.
4	Control Parity error	A parity error or synchronization error was detected on Real-time Controller state line.
5	Data late	An attempt was made to retrieve data from the PM FIFO and output was not available, an attempt was made to store data in the PM FIFO before the input was ready, or in autoshift mode, new data loaded into the hold register before the PM FIFO could accept the previous data.
6	CROM parity error	M8970 program parity error.
7	Level 1 Protocol error	After the first frame of a Level 2 message, a received Hamming code is not recognized as valid a Continue or End code.

20.4.40 Write Microcontroller Status (WMCSTA)

Write Microcontroller Status is the high byte of word 41. Table 20-46 describes Write Microcontroller Status.

Table 20-46 Write Microcontroller Status

Bit	Name	Description
0	XMC WCLK	True state of Translator Write Clock pulse (110 ns at normal speed)
1	Residual to WMC DR bus	Gates HI or LO nibble of residual character to WMC DR bus
2	ACRC to WMC DR bus	Gates HI or LO nibble of ACRC character to WMC DR bus.
3	CRC to WMC DR bus	Gates HI or LO nibble of CRC character to WMC DR bus.
4	ECC to WMC DR bus	Gates HI or LO nibble of ECC character to WMC DR bus.
5	Transfer	Shifts one nibble on WMC DR bus into translator.

Table 20-46 (Cont.) Write Microcontroller Status

Bit	Name	Description
6	WMC not done 0 = Write microcontroller is done writing PE data or GCR data groups. (Used in diagnostic single-step mode; normally appears for 110 ns). 1 = Write microcontroller busy or idle.	
7	XMC not done. 0 = Translator microcontroller is done writing postamble and waiting to be serviced. 1 = Translator is busy.	

20.4.41 Tape Unit Port 0/1 Select (TUSEL0)

Tape Unit Port 0/1 Select is the low byte of word 42. Table 20-47 describes Tape Unit Port 0/1 Select.

Table 20-47 Tape Unit Port 0/1 Select

Bit	Name	Description
1:0	Tape unit select 1:0	A 2-bit binary field that reflects the tape unit port currently selected by the TUSEL register (E0-W bits 1:0)
2	TU Port 1 write path enable	When true, the write path for tape unit port 1 is enabled.
3	TU Port 0 Write Path Enable	When true, the write path for Tape Unit Port 0 is enabled.
4	TU Port 1 Read Path Enable	When true, that the read path for tape unit port 1 is enabled.
5	TU Port 0 Read Path Enable	When true, that the read path for Tape Unit Port 0 is enabled.
6	Byte count terminal count 0 = Write Microcontroller Count Terminal Count (BCTC) is asserted. 1 = BCTC is not asserted.	
7	Single Tape Unit port. 0 = Both TUP modules are installed in backplane slots 08 and 09. 1 = Only one TUP module is installed in backplane slot 08.	

20.4.42 Tape Unit Port 2/3 Select (TUSEL1)

Tape Unit Port 2/3 Select is the high byte of word 42. Table 20-48 describes Tape Unit Port 2/3 Select.

Table 20-48 Tape Unit Port 2/3 Select

Bit	Name	Description
1:0	Tape Unit Select 1:0	A 2-bit binary field that reflects the tape unit port currently selected by the TUSEL register (E0-W bits 1:0).
2	TU Port 3 Write Path Enable	When true, the write path for tape unit port 3 is enabled.
3	TU Port 2 Write Path Enable	When true, the write path for Tape Unit Port 2 is enabled.
4	TU Port 3 Read Path Enable	When true, the read path for Tape Unit Port 3 is enabled.
5	TU Port 2 Read Path Enable	When true, the read path for Tape Unit Port 2 is enabled.
6:7	-	Not used.

20.4.43 Write Data (WRTDAT)

Write Data is the low byte of word 43 and is the write or read data on the intermediate DRD bus.

20.4.44 Byte Counter Lo

Byte Counter Lo is the high byte of word 43 and contains the low byte of the Write Micro/byte Assembly Byte Counter word.

20.4.45 Byte Counter Hi

Byte Counter Hi is the low byte of word 44. Byte Counter Hi contains the high byte of the Write Micro/byte Assembly Byte Counter word.

20.4.46 Pad Counter Lo

Pad Counter Lo is the high byte of word 44 and contains the low byte of the Write Micro/byte Assembly Pad Character Counter word.

20.4.47 Pad Counter Hi

Pad Counter Hi is the low byte of word 45 and contains the low byte of the Write Micro/byte Assembly Pad Character Counter word.

20.4.48 Error Code Counter Lo

Error Code Counter Lo is the high byte of word 45 and contains the low byte of the Write Micro/byte Assembly Error Code count. See Error Code Counter Hi for Ecode counter values. First read yields this byte.

20.4.49 Error Code Counter Hi

Error Code Counter Hi is the low byte of word 46. Table 20-49 describes Error Code Counter Hi. This is the high byte of write micro/byte assembly error code count. Ecode counter is normally set to zero at the start of an operation. Second read yields this byte.

Table 20-49 Error Code Counter Hi

Bit Value	Error Indication
0	Operation completed successfully.
1	If 0 core dump then, >4 in Read Skip Count.
	If DEC 10 compatible then, >3 in Read Skip Count.
	If DEC 10 high-density then, >8 in Read Skip Count.
2	If PDP-11 normal or PDP-15 normal then, >1 in Read Skip Count.
3	If format code then, >6 in Read Skip Count.
4	WMC self-test diagnostic error.
5	Read overrun or write fault.

20.4.50 Write Microcontroller Errors (WMCERR)

Write Microcontroller Errors is the high byte of word 46. Table 20-50 describes Write Microcontroller Errors.

Table 20-50 Write Microcontroller Errors

Bit	Name	Description
2:0	-	Not used.
3	DR Read Parity error	A parity error was detected on a read data byte sent from the CRC/ACRC to WMC module over the CRC bus.
4	WMC ROM parity error	A write microcontroller ROM parity error detected or the WMC internal microdiagnostic stopped at an error halt.
5	Error	Write microcontroller diagnostic overall error status bit.
6	DR MBD parity error	Bad (even) parity received in data at TA78 input port.
7	-	Not used.

20.4.51 Interrupt Status (INTSTA)

Interrupt Status is the low byte of word 47. Table 20-51 describes Interrupt Status.

Table 20-51 Interrupt Status

Bit	Name	Description
0	Translator ROM parity error	When set, the translator microcontroller ROM has experienced a parity error or has branched to an error halt during its internal diagnostic routines
1	PE write parity error	When set, a vertical parity error was detected at the output of the translator during a phase-encoded write operation.
2	USART transmitter ready (TX)	When clear, the ASCII port USART is ready to accept a new character in the transmitter buffer.
3	KINI	This bit reflects the state of the KINI bit on the Real-time Controller state line. When set, it reflects the controller request for STI bus initialization.
4	Write Data register parity	Reflects the state of the DR BYTE PAR H line. Serves as the parity bit for the WRTDAT register (D3-R), or as a PE WRITE OPERATION DONE flag
5	Power OK	When set, the TA78 power supply has not signaled an AC LO condition.
6	USART Receiver Ready (RX)	When clear, ASCII port USART has received a byte which is available in the receiver buffer.
7	Interrupt timer (MCLK)	When clear, the M8970 interrupt timer has timed out. First interrupt is 600 us after timer is started and subsequent interrupts are at 1.2 ms intervals until timer is reset.

20.4.52 TU78 Status (TADR00)

TU78 Status is the high byte of word 47. Table 20-52 describes TU78 Status.

Table 20-52 TU78 Status

Bit	Name	Description
0	File Protect	The tape reel currently loaded does not have the Write Enable ring in place
1	EOT	The EOT marker on the tape is or was positioned at the EOT sensor during a forward operation with Ready set. EOT status clears when: • The EOT marker is positioned at the EOT sensor during a reverse operation with Ready set. • The tape unit is commanded to rewind tape. • A CLR EOT command is written into the TU CMD B location.
2	BOT	The BOT marker on the tape is positioned at the BOT sensor and ready is set.
3	PES	The tape unit is currently set to Phase-encoded Recording format. If reset, the tape unit is set to Group-coded Recording format.
4	Rewinding	The tape unit is currently rewinding.

Table 20-52 (Cont.) TU78 Status

Bit	Name	Description
5	Online	The tape unit has been placed online; if ready, it will respond to motion commands issued from the formatter.
6	Ready On	Ready has undergone a transition to the set state. It is cleared by a CLR TU command.
7	Ready	The tape unit is online, not rewinding, not loading or unloading, and all pneumatic interlocks are made.

20.4.53 MIA Status A (TADR01)

MIA Status A is the low byte of word 48. Table 20-53 describes MIA Status A.

Table 20-53 MIA Status A

Bit	Name	Description
0	DSE	A DSE command has been written into the TU CMD B location. It clears when EOT sets, or when a CLR TU command is written into TU CMD B.
1	MOT	The capstan servo motor is turning.
2	LWR	The state of the loop write-to-read command bit.
3	Write inhibit	The state of the write inhibit command bit.
4	Write	The state of the write command bit.
5	Reverse	The state of the reverse command bit.
6	Forward	The forward command bit has been written with a 1, or a DSE command has been written into the TU CMD B location.
7	Manual test	The manual test switch is in the MAN TEST position.

20.4.54 MIA Status B (TADR02)

MIA Status B is the high byte of word 48. Table 20-54 describes MIA Status B.

Table 20-54 MIA Status B

Bit	Name	Description
2:0	Mode select 2,1,0	The position of the multiposition mode select switch on the tape unit operator panel is indicated. The bits are meaningful only when the mode select bits in the threshold command location have been written to ones. **Bit**

Table 20-54 (Cont.) MIA Status B

Bit	Name	Description			
		Position			Meaning
		2	1	0	
		1	1	0	Position 0 (Normal)
		1	0	1	Position 1 (Maintenance)
		0	1	1	Position 2 (Maintenance)
		1	1	1	Position 3 (Maintenance)
4:3	Speed 1:0	This 2-bit field indicates the speed of a tape unit; TU78 = 2 (125 in/sec).			
5	ARA error	During a GCR operation, from 24.1 cm (9.5 in) after BOT, the read amplifier gains failed to achieve the required value. This bit is valid only if Ready is set.			
6	PEC	A SET PE command has been sent to TU CMD B. Assuming proper hardware operation, this bit is the same as PES in TU STATUS.			
7	CMD PE	A command or CMD/STA address has been received by the tape unit with even parity, or a TEST command has been written into TU CMD B. Clears when a CLR TU command is received, whether parity is correct (odd) or not. This bit drives the TU bus CMD PE L line.			

20.4.55 Serial Number A (TADR03)

Serial Number A is the low byte of word 49. Table 20-55 describes Serial Number A.

Table 20-55 Serial Number A

Bit	Name	Description
3:0	SN HU 3:0	The hundreds BCD digit of the tape unit serial number.
7:4	SN TH 3:0	Most significant (thousands) BCD digit of the tape unit serial number.

20.4.56 Serial Number B (TADR04)

Serial Number B is the high byte of word 49. Table 20-56 describes Serial Number B.

Table 20-56 Serial Number B

Bit	Name	Description
3:0	SN ones 3:0	Least significant (ones) BCD digit of the tape unit serial number.

Table 20-56 (Cont.) Serial Number B

Bit	Name	Description
7:4	SN tens 3:0	The tens BCD digit of the tape unit serial number.

20.4.57 Tape Unit Diagnostic (TADR05)

Tape Unit Diagnostic is the low byte of word 50. Table 20-57 describes Tape Unit Diagnostic.

Table 20-57 Tape Unit Diagnostic

Bit	Name	Description
1:0	AMTIE THR 1:0	Indicates the value of the AMTIE threshold field in the THRESHOLD command location.
2	-	Zero
3	TACH	The state of the output from the capstan motor digital tachometer.
4	EOT DET	The tape EOT tab is positioned at the EOT sensor. Not valid unless ready = 1.
5	Read enable	The state of the Read Enable bit in the THRESHOLD command location.
6	Write	Current is not flowing through the write or erase heads.
7	Write bit 4	The state (polarity) of the write driver for physical track 4 head.

CHAPTER 21
TK50

21.1 INTRODUCTION

Chapter 21 covers the TK50 controller and drive information used to report errors, including:

- Controller Internal Status Byte (Section 21.1.1)
- Drive Error Code Byte (Section 21.1.2)
- Drive Flags (Section 21.1.3)
- U/Q Port Generic SA Error Codes (Section 21.1.4)
- Controller Specific SA Error Codes (Section 21.1.5)
- Recoverable Drive Fault (Section 21.1.6)
- Unrecoverable Drive Faults (Section 21.1.7)

21.1.1 TK50 Controller Internal Status Byte

Controller internal status bytes are shown in Table 21-1.

Table 21-1 TK50 Controller Internal Status Byte

Value		
Oct	Hex	Controller Internal Status
0	0	Done
2	2	Retry
4	4	Hard error
6	6	Tape mark read
10	8	Logical EOT detected
12	A	End of media
14	C	Drive error
16	E	Communication exception
20	10	End of data
22	12	Failed to find append target
24	14	Leaving EOT trailer region

Table 21-1 (Cont.) TK50 Controller Internal Status Byte

Value Oct	Hex	Controller Internal Status
26	16	ECC correction on data
30	18	ECC correction on tape mark
32	1A	BOT encountered
34	1C	Data Synchronization error
36	1E	EOT detected
40	20	Seek aborted
42	22	Unload

21.1.2 TK50 Drive Error Code Byte

Table 21-2 contains drive error bytes.

Table 21-2 TK50 Drive Error Code Byte

Value Oct	Hex	Drive Error Code
1	1	Hardware write protect
2	2	Drive fault
4	4	Communication exception
6	6	Wrong track
20	10	Sync failure
23	13	Communications error
42	22	Positioning error
45	23	Channel B overrun
47	27	Channel A overrun

21.1.3 TK50 Drive Flags

Table 21-3 contains drive flags.

Table 21-3 TK50 Drive Flags

Bit Mask		
Oct	Hex	Drive Flags
1	1	Cartridge present
2	2	Head at Track zero
4	4	Tape unloaded
10	8	Hardware write protected
20	10	Positioned at BOT
40	20	Drive in run state

NOTE
Bits 5 and 6 together indicate the drive is rewinding to BOT.

21.1.4 TK50 U/Q Port Generic SA Error Codes

The U/Q Port Generic SA Error codes or Lastfail code indicate what the controller perceives the failure to be. See Table 21-4.

Table 21-4 TK50 U/Q Port Generic SA Error Codes

Value		
Oct	Hex	Failure Code
1	1	Envelope/Packet read (parity or timeout)
2	2	Envelope/Packet write (parity or timeout)
3	3	Controller ROM and RAM parity
4	4	Controller RAM parity
5	5	Controller ROM parity
6	6	Queue read (parity or timeout)
7	7	Queue write (parity or timeout)
10	8	Interrupt master
11	9	Host access timeout
12	A	Credit limit exceeded

Table 21-4 (Cont.) TK50 U/Q Port Generic SA Error Codes

Value		
Oct	Hex	Failure Code
13	B	Bus Master error
14	C	Diagnostic Controller Fatal error
15	D	Instruction loop timeout
16	E	Invalid connection identifier
17	F	Interrupt Write error
20	10	Maintenance R/W invalid region identifier
21	11	Maintenance write load to nonloadable controller
22	12	Controller RAM error (nonparity)
23	13	INIT Sequence error
24	14	High Level Protocol Incompatibility error
25	15	Purge/poll Hardware failure
26	16	Mapping Register Read error (parity or timeout)
27	17	Attempt to set port data transfer mapping when option not present

21.1.5 TK50 Controller Specific SA Error Codes

The Controller Specific SA Error Codes indicate what the controller perceives the failure to be. See Table 21-5.

Table 21-5 TK50 Controller Specific SA Error Codes

Value		
Oct	Hex	Failure Code
1130	258	Divide Interrupt error
1131	259	Single Interrupt error
1132	25A	Nonmaskable Interrupt error
1133	25B	Breakpoint Interrupt error
1134	25C	INT0 Detected Interrupt error
1135	25D	Array Bound Interrupt error
1136	25E	Unused Opcode Interrupt error
1137	25F	ESC Opcode Interrupt error

Table 21-5 (Cont.) TK50 Controller Specific SA Error Codes

Value Oct	Hex	Failure Code
1141	261	Reserved Interrupt error
1144	264	INT0 Interrupt error
1161	271	ROM Checksum error
1162	272	MPU error
1163	273	RAM error (odd byte)
1164	274	RAM error (even byte)
1165	275	MPU Timer error
1166	276	Miscellaneous Register Wrap error
1167	277	Gap detection circuitry
1170	278	USART Wrap Mode error
1171	279	USART Wrap Mode error (good CRC)
1172	27A	USART Wrap Mode error (bad CRC)
1173	27B	Drive Cable error
1174	27C	FPLS Buffer error—Nibble 1
1175	27D	FPLS Buffer error—Nibble 2
1176	27E	FPLS Buffer error—Nibble 3
1177	27F	FPLS Buffer error—Nibble 4
1200	280	Word Count error
1201	281	FPLS Test error
1213	28B	Reserved—ECC
1214	28C	Write Sequence fault
1215	28D	ECC Logic Error Type 1
1216	28E	ECC Logic Error Type 2
1217	28F	ECC data structure consistency failure

21.1.6 TK50 Recoverable Drive Fault

Table 21-6 contains recoverable drive faults.

Table 21-6 TK50 Recoverable Drive Fault

Value Oct	Hex	Recoverable Drive Fault Code
220	90	8155 RAM failure in self-test.
221	91	8155 timer failure.
222	92	Read amplitude (HD1) too low in calibrate.
223	93	Read amplitude (HD2) too low in calibrate.
225	95	EOT sensed in R/W/S state.
226	96	BOT sensed in R/W/S state.
227	97	Drive block address overflow.
230	98	Drive block address underflow.
231	99	Servo error—Excessive speed variation.
232	9A	Failure in tracking.
233	9B	Command error—Command not recognized.
234	9C	Illegal command—Incompatible with drive state.
235	9D	Write Lock error.
236	9E	WRITE GATE at wrong time.
237	9F	No WRITE GATE for Cal Track write.
240	A0	Error sensing Cal Track 1—bad head.
241	A1	Error sensing Cal Track 2—bad head.
242	A2	Detection of edges of Cal Track 1 out of spec.
243	A3	Detection of edges of cal track 2 out of spec.
244	A4	Offset of Cal Track 2 from Cal Track 1 is too large.
245	A5	Search of bottom tape edge failed.
246	A6	Bottom tape edge tolerance error.

Table 21-6 (Cont.) TK50 Recoverable Drive Fault

Value		
Oct	Hex	Recoverable Drive Fault Code
247	A7	Drive is overheating.
250	A8	No current in LED of BOT sensor.
251	A9	Hall switch sense lines Motor A questionable.
252	AA	Tachometer failure.

21.1.7 TK50 Unrecoverable Drive Faults

Table 21-7 contains unrecoverable drive faults.

Table 21-7 TK50 Unrecoverable Drive Faults

Value		
Oct	Hex	Unrecoverable Drive Faults
201	81	Failure to load to BOT.
202	82	Failure to unload tape into cartridge.
203	83	General motor or tach failure.
204	84	Motor A failure.
205	85	Motor B failure.
206	86	Drive lost control of tape or bad tach.
207	87	Excessive drag in tape tranport.
210	88	Failure to stop tape or remain stopped.
211	89	Cartridge Insert error.
212	8A	Cartridge Extract error.
213	8B	CU attempted to move tape with drive in error.
214	8C	Deceleration Timeout error.
215	8D	Second attempt to balance reels in init failed.

CHAPTER 22
UDA50

22.1 INTRODUCTION
Chapter 22 covers the UDA50 controller information used to report errors.

22.2 UDA50 STATUS/ADDRESS (SA) REGISTER ERROR REPORTS
This type of error log entry is NOT a packet. The Status/Address (S/A register (normally UNIBUS Address 172152) reports serious controller errors by putting a specific error code in the register and asserting an interrupt on the UNIBUS. The host makes an error log entry with this information (S/A register error code). Many operating systems make an S/A-register-reported error look like a packet, but the packet presented is either garbage or all zeros. If the error report ever shows the S/A register with something in it, then it is likely an S/A register error code.

22.2.1 UDA50 S/A Register Online Error
The UDA50 S/A register uses this format when the controller is online to the normal host operation. See Figure 22-1. See Table 22-1 for S/A error code descriptions.

Figure 22-1 UDA50 S/A Register Online Error

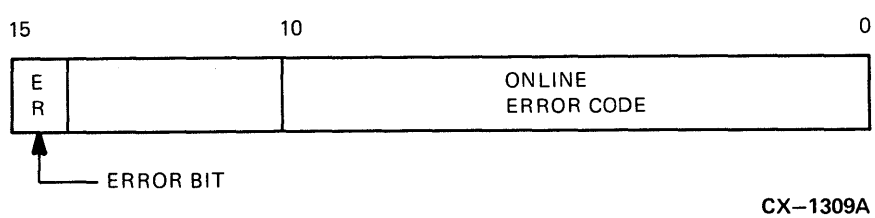


Table 22-1 UDA50 SA Register Error Code

Error Code Octal	Error Description
100001	UNIBUS Packet Read error
100002	UNIBUS Packet Write error
100003	UDA ROM or RAM Parity error
100004	UDA RAM Parity error
100005	UDA ROM Parity error
100006	UNIBUS Ring Read error
100007	UNIBUS Ring Write error
100010	UNIBUS Interrupt Master failure
100011	Host Access Timeout error
100012	Command limit exceeded by host
100013	UDA SI Hardware Fatal error
100014	DM XFC Fatal error
100015	Hardware timeout of instruction loop
100016	Invalid Virtual Circuit identifier
100017	Interrupt Write error on UNIBUS
104000	Fatal Sequence error
104040	D Processor ALU
104041	D Processor Control ROM Parity error
105102	D Processor with no BD #2, or RAM Parity error
105105	D Processor RAM Buffer error
105152	D Processor SDI error
105153	D Processor Write Mode Wrap SERDES error
105154	D Processor Read Mode SERDES, RSGEN & ECC error
106040	U Processor ALU error
106041	U Processor Control Register error
106042	U Processor DFAIL/control ROM parity/BD #1 test CNT

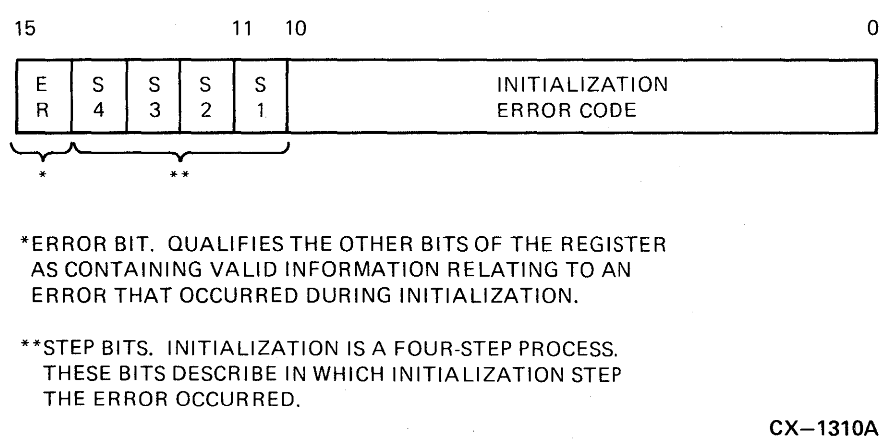
Table 22-1 (Cont.) UDA50 SA Register Error Code

Error Code Octal	Error Description
106047	U Processor Constant PROM error with D processor running SDI test
106055	Unexpected trap found, abort diagnostic
106071	U Processor Constant PROM error
106072	U Processor Control ROM parity error
106200	Step 1 Data error (MSB not set)
107103	U Processor RAM Parity error
107107	U Processor RAM Buffer error
107115	Wrong test count (BD #2)
112300	Step 2 error
122240	NPR error
122300	Step 3 error
142300	Step 4 error

22.2.2 UDA50 S/A Register Initialization Error

The UDA50 S/A register presents this format to the controller during initialization operation. See Figure 22-2.

Figure 22-2 UDA50 S/A Register Initialization Error



22.2.2.1 Initialization Steps

The initialization procedure begins with a hard initialization from the host (writing the IP register or issuing a Bus Init). Following the hard initialization, the controller runs preliminary diagnostics. If these diagnostics fail, the host is to retry initialization. If the diagnostics succeed, the following four steps are performed.

1. The host writes the lengths of the queues and the address of the interrupt vector into the S/A register if interrupts are to be armed. Then the controller runs a complete internal integrity check and signals either success or failure.
2. The host reads an echo of the queue lengths from the S/A register and then writes the low order portion of the port communications area address and whether the host requires purge interrupts into the S/A register area address.
3. The interrupt vector address and the master interrupt arming signal are echoed in the S/A register. The host then writes the high order portion of the port communications area base address to the S/A register along with a signal that conditionally triggers an immediate test of the queue access and adapter purge functions of the controller. Next, the controller tests the ability of the I/O bus to complete DMA transfers and performs a memory test of the communications area. Following successful completion of the test, the port zeros the entire communications area.
4. Then the port signals the host that initialization is complete. At this point, the port driver sets the response slot ownership bits so the port owns all the slots. After that, the controller waits for a signal from the host to begin normal operation.

At each step, the port informs the host of either failure (requiring a restart of the initialization sequence) or success (ability to progress to the next initialization step). The host maintains timeouts on the various controller responses. At various points, information is echoed by the port to the host. The intent here is to echo all bit positions but not necessarily to echo all fields.

22.3 UDA50 CONTROLLER ERROR FORMAT

UDA50 internal error code is word 11 of the controller error log message. If there is a 12 in the status/event code of the controller error log message, word 11 contains an internal error code. See Table 22-2 for the internal error codes.

Table 22-2 UDA50 Internal Error Codes

Code	Description
1	ER.PRD—UNIBUS Packet Read error occurs when the UDA50 microcode times out while attempting to read the MSCP command packet from the host. The microcode has already read the command descriptor from the command ring and should have a valid MSCP Packet pointer.
2	ER.PWR—UNIBUS Packet Write error occurs when the UDA50 microcode times out while attempting to write an MSCP response packet to the host. The microcode has already read the command descriptor from the command ring and should have a valid MSCP Packet pointer.
3	ER.RRP—UDA50 ROM and RAM Parity error occurs when the data within the RAM data buffer and the Control Store ROM (CROM) is invalid.
4	ER.RAP—UDA50 RAM Parity error occurs when the data within the RAM data buffer is invalid.

Table 22-2 (Cont.) UDA50 Internal Error Codes

Code	Description
5	ER.ROP—UDA50 ROM Parity error occurs when the data within the CROM is invalid.
6	ER.RRD—UNIBUS Ring Read error occurs when the UDA50 microcode times out while attempting to read the command descriptor from the host. The command descriptor resides in the command and response ring buffer.
7	ER.RWR—UNIBUS Ring Write error occurs when the UDA50 microcode times out while attempting to update response or command descriptors in the host ring buffer. The descriptors are updated by a DMA write from the UDA50.
8	ER.INT—UNIBUS Interrupt Master failure occurs if the UDA50 does not gain bus mastership when it attempts to interrupt the host. At the beginning of every interrupt sequence, the UDA50 stores this error code in RAM in case the error occurs. If the error does occur, the UDA50 waits for the bus until the host intervenes by initializing the UDA50. The host performs this initialization when its controller timeout value expires.
9	ER.HTO—Host Access Timeout error guarantees that dual port drives are accessible from a second controller (the other port) if the communications path between a host and the first controller fails when one or more drives are UNIT-ONLINE to the first controller. Normally, the drives would be inaccessible to the second controller because they are UNIT-ONLINE to the first controller. The host access timeout, if enabled, eliminates this problem by causing the first controller to automatically release all drives if it doesn't receive a command within a specified host timeout interval. The default host timeout interval for the UDA50 is one minute.
A	ER.NIM—Host Exceeded Command Limit occurs if a nonimmediate command is loaded in LOG PKT space.
B	ER.MST—Bus Master error occurs if the UDA50 fails to become bus master during the start up of a UNIBUS Read or a UNIBUS Write.
C	ER.DMX—DM XFC Fatal error is possible when the UDA50 is in Diagnostic Machine (DM) mode. DM mode is used to write drive-oriented diagnostics and is down-line loaded from host memory into UDA50 RAM space. If a Read or a Write from or to UNIBUS memory is attempted (DM XFC 11 or 12), and the buffer address where RAM is to be accessed is less than the beginning of the DM RAM memory space, the DM XFC Fatal error occurs.
E	ER.VCI—Invalid Virtual Circuit Identifier occurs if the Virtual Circuit Identifier does not agree with the current operating mode of the UDA50. In other words, to process MSCP commands, the virtual circuit must equal one. To process Diagnostic Utility Protocol (DUP) commands, the virtual circuit must equal zero. Therefore, the error occurs if an MSCP command is attempted when the virtual circuit is zero or if a DUP command is attempted when the virtual circuit is one.
F	ER.IWR—Interrupt Write error on UNIBUS occurs if the UDA50 cannot write to the host, which sets the Response ring not zero.
17	ER.SUN—Too Many Subunits on UDA50 occurs when trying to get a subunit characteristics buffer and none are available.

CHAPTER 23
KDA50-Q

23.1 INTRODUCTION

Chapter 22 covers the KDA50-Q controller information used to report errors.

23.2 KDA50-Q STATUS/ADDRESS (SA) REGISTER ERROR REPORTS

This type of error log entry is NOT a packet. The Status/Address (S/A register reports serious controller errors by putting a specific error code in the register. The host makes an error log entry with this information (S/A register error code). Many operating systems make an S/A-register-reported error look like a packet, but the packet presented is either garbage or all zeros. If the error report ever shows the S/A register with something in it, it is likely an S/A register error code.

23.2.1 KDA50-Q S/A Register Online Error

The KDA50-Q S/A register uses this format when the controller is online to the normal host operation. See Figure 23-1. See Table 23-1 for an S/A error code description.

Figure 23-1 KDA50-Q S/A Register Online Error

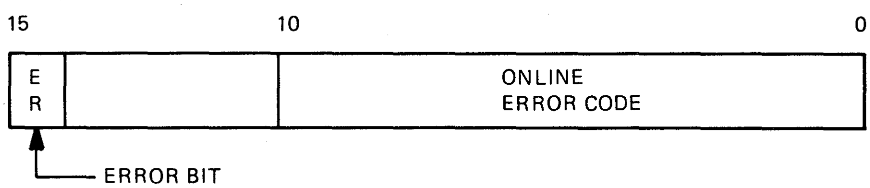


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Table 23-1 SA Register Error Codes

Code	Description
100001	xBUS [1] Packet Read error
100002	xBUS [1] Packet Write error
100003	Controller ROM or RAM Parity error
100004	Controller RAM Parity error
100005	Controller ROM Parity error
100006	xBUS [1] Ring Read error
100007	xBUS [1] Ring Write error
100010	xBUS [1] Interrupt Master Failure
100011	Host Access Timeout error
100012	Host Exceeded Command Limit
100013	QBUS Master Failure
100014	DM XFC Fatal error
100015	Hardware Timeout of Instruction Loop
100016	Invalid Virtual Circuit Identifier
100017	Interrupt Write error on xBUS
104000	Fatal Sequencer error
104040	D Processor ALU Test error
104041	D Processor ROM Parity Test error or Timeout Test error
105102	D Processor with no SDI Module, or D Processor Control Register Test error, or D Processor RAM Parity error
105105	D Processor RAM Buffer error
105152	D Processor SDI error
105153	D Processor Write Mode Wrap, Wrap SERDES 16 error
105154	D Processor Read Mode, SERDES 16, 10 RSGEN and ECC Circuitry error
106040	U Processor ALU Test error or DFAIL Test error or Unexpected Trap error
106041	U Processor Control Register Test error

[1] xBUS = bus controller on.

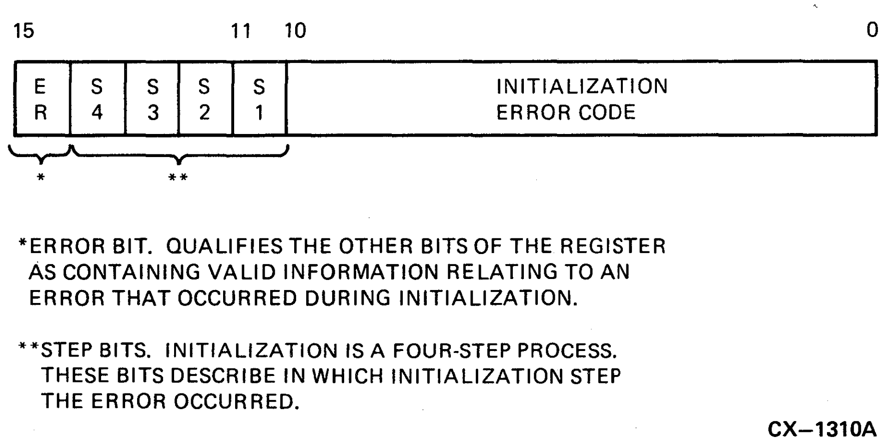
Table 23-1 (Cont.) SA Register Error Codes

Code	Description
106042	U Processor Parity error set erroneously or CROM Parity Test error
106055	Unexpected trap found—abnormal termination of diagnostics
106071	Log, Anti-log RAM Checksum error
106072	U Processor ROM Parity Test error
106200	Step 1 Data error (MSB wasn't set)
107103	U Processor RAM Parity error
107107	U Processor RAM Buffer error
112300	Step 2 INIT error
122240	DMA Test error
122300	Step 3 INIT error
142300	Step 4 INIT error

23.2.2 KDA50-Q S/A Register Initialization Error

The KDA50-Q S/A register uses this format when the controller during initialization operation. See Figure 23-2. See Table 23-1 for an S/A error code description.

Figure 23-2 KDA50-Q S/A Register Initialization Error



The initialization procedure begins with a hard initialization from the host (writing the IP register or issuing a Bus Init). Following the hard initialization, the controller runs preliminary diagnostics. If these diagnostics fail, the host tries initialization. If the diagnostics succeed, the following four steps are performed.

1. The host writes the lengths of the queues into the S/A register whether interrupts are to be armed and, if so, the address of the interrupt vector. The controller then runs a complete internal integrity check and signals either success or failure.
2. The host reads an echo of the queue lenghths from the S/A register and then writes the low order portion of the port communication into the S/A register area address and whether the host requires purge interrupts.
3. The Interrupt Vector address and the Master Interrupt Arming signal are echoed in the SA register. Then the host writes the high order portion of the port communications area base address to the S/A register along with a signal that conditionally triggers an immediate test of the queue access and adapter purge functions of the controller. Next, the controller tests the ability of the I/O bus to complete DMA transfers and performs a memory test of the communications area. Following successful completion of the test, the port zeros the entire communications area.
4. The port signals the host that initialization is complete. At this point, the port driver sets the response slot ownership bits so that the port owns all the slots. The controller then waits for a signal from the host to begin normal operation.

At each step, the port informs the host of either failure (requiring a restart of the initialization sequence) or success (and therefore willingness to progress to the next initialization step). The host maintains timeouts on the various controller responses. At various points, information is echoed by the port to the host. The intent here is to echo all bit positions but not necessarily to echo all fields.

23.3 KDA50-Q CONTROLLER ERROR FORMAT

KDA50-Q Internal Error code is word 11 of the controller error log message. If there is a 12 in the status/event code of the controller error log message, word 11 contains an internal error code. See Table 23-2 for the internal error codes.

Table 23-2 KDA50-Q Internal Error Codes

Code	Description
1	ER.PRD—QBUS Packet Read error occurs when the KDA50-Q microcode times out while attempting to read the MSCP command packet from the host. The microcode has already read the command descriptor from the command ring and should have a valid MSCP Packet pointer.
2	ER.PWR—QBUS Packet Write error occurs when the KDA50-Q microcode times out while attempting to write an MSCP response packet to the host. The microcode has already read the command descriptor from the command ring and should have a valid MSCP Packet pointer.
3	ER.RRP—KDA50-Q ROM and RAM parity error occurs when the data within the RAM data buffer and the Control Store ROM (CROM) is invalid.
4	ER.RAP—KDA50-Q RAM parity error occurs when the data within the RAM data buffer is invalid.
5	ER.ROP—KDA50-Q ROM parity error occurs when the data within the CROM is invalid.

Table 23-2 (Cont.) KDA50-Q Internal Error Codes

Code	Description
6	ER.RRD—QBUS ring read error occurs when the KDA50-Q microcode times out while attempting to read the command descriptor from the host. The command descriptor resides in the command and response ring buffer.
7	ER.RWR—QBUS ring write error occurs when the KDA50-Q microcode times out while attempting to update response or command descriptors in the host ring buffer. The descriptors are updated by a DMA write from the KDA50-Q.
8	ER.INT—QBUS interrupt master failureoccurs if the KDA50-Q does not gain bus mastership whe it attempts to interrupt the host. At the beginning of every interrupt sequence, the KDA50-Q stores this error code in RAM in case the error occurs. If the error does occur, the KDA50-Q waits for the bus until the host intervenes by initializing the KDA50-Q. The host performs this initialization when its controller timeout value expires.
9	ER.HTO—Host access timeout error guarantees that dual port drives are accessible from a second controller (the other port) if the communications path between a host and the first controller fails when one or more drives are UNIT-ONLINE to the first controller. Normally, the drives would be inaccessible to the second controller because they are UNIT-ONLINE to the first controller. The host access timeout, if enabled, eliminates this problem by causing the first controller to automatically release all drives if it doesn't receive a command within a specified host timeout interval. The default host timeout interval for the KDA50-Q is one minute.
A	ER.NIM—Host exceeded command limit occurs if a nonimmediate command is loaded in LOG PKT space.
B	ER.MST—Bus master error occurs if the KDA50-Q fails to become bus master during the start up of a QBUS Read or a QBUS Write.
C	ER.DMX—DM XFC fatal error is possible when the KDA50-Q is in Diagnostic Machine (DM) mode. DM mode is used to write drive oriented diagnostics and is down-line loaded from host memory into KDA50-Q RAM space. If a read or a write from or to QBUS memory is attempted (DM XFC 11 or 12), and the buffer address where RAM is to be accessed is less than the beginning of the DM RAM memory space, the DM XFC Fatal Error occurs.

Table 23-2 (Cont.) KDA50-Q Internal Error Codes

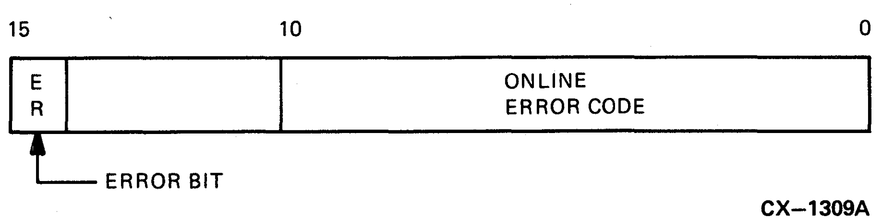
Code	Description
D	ER.TMO—KDA50-Q hardware error occurs during a diagnostic check of the DPROC timeout circuit or during a Read or Write operation. During the diagnostic check, it indicates the timeout circuit is not accurate. During the read or write operation, it indicates the DPROC sequencer on the SDI module has experienced an instruction timeout.
E	ER.VCI—Invalid virtual circuit identifier occurs if the virtual circuit identifier does not agree with the current operating mode of the KDA50-Q. In other words, to process MSCP commands, the virtual circuit must equal one. To process Diagnostic Utility Protocol (DUP) commands, the virtual circuit must equal zero. Therefore, the error occurs if an MSCP command is attempted when the virtual circuit is zero or if a DUP command is attempted when the virtual circuit is one.
F	ER.IWR—Interrupt write error on QBUS occurs if the KDA50-Q cannot write to the host, which sets the Response ring not zero.
16	ER.MRR—Mapping Register Read error occurs when a fatal QBUS error (either timeout or parity) occurs while the KDA50-Q tries to read the value of the Mapping register via a DMA transfer from host memory.

CHAPTER 24
KDB50

24.1 INTRODUCTION
Chapter 24 covers the KDB50 controller information used to report errors.

24.1.1 KDB50 S/A Register Online Error
The KDB50 S/A register presents this format when the controller is online to normal host operation. See Figure 24-1. See Table 24-1 for S/A error code descriptions.

Figure 24-1 KDB50 S/A Register Online Error



24.1.2 KDB50 S/A Register Initialization Error
The KDB50 S/A register presents this format during initialization operation. See Figure 24-2. See Table 24-1 for S/A error code descriptions.

Figure 24-2 KDB50 S/A Register Initialization Error

*ERROR BIT. QUALIFIES THE OTHER BITS OF THE REGISTER AS CONTAINING VALID INFORMATION RELATING TO AN ERROR THAT OCCURRED DURING INITIALIZATION.

**STEP BITS. INITIALIZATION IS A FOUR-STEP PROCESS. THESE BITS DESCRIBE IN WHICH INITIALIZATION STEP THE ERROR OCCURRED.

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24.1.3 KDB50 INITIALIZATION

Upon powerup or when the host sets the Start Self-test (SST) bit in the KDB50 BICSR register, the KDB50 runs its internal diagnostic sequence followed by four initialization steps. These steps establish an MSCP connection between the KDB50 MSCP-server microcode and the host class-driver software.

After completing the internal diagnostic, the KDB50 must decide whether to rerun the diagnostic or enter initialization step 1. To make the decision, the BPROC writes initialization Step 1 data in the (Status and Address Host Read register (S/Ar) and waits for the host to respond with Step 1 ddat in the Status and Address Host Write register (S/Aw). It checks S/Aw for this host response data five times at ten millisecond intervals. If none of these checks yield Host Step 1 data, both the BPROC and DPROC jump to the beginning of the internal diagnostic program and reexecute the diagnostic. However, if the host has written step 1 data in SAw, the BPROC enters the initialization routine while the DPROC enters functional microcode and initializes any connected drive(s).

24.1.4 KDB50 Initialization Step 1

Once the host writes S/Aw with initialization data, the BPROC stores the information in RAM and continues to Step 2 unless the WRAP bit (bit 14) is set in the host response data. If the WRAP bit is set, data sent to S/Aw is read from S/Ar (the data is wrapped). The BPROC stays in this state until reinitialized by the host, or until powerdown. If the WRAP bit is not set, the BPROC continues with initialization.

Step 1 data from the host provides the BPROC with the following information:

- Length of the host ring area.
- Interrupt Vector address.
- Whether to interrupt the host at the completion of Steps 2, 3, and 4 (IE bit).

24.1.5 KDB50 Initialization Step 2

To continue the initialization procedure, the BPROC writes Step 2 data into the S/Ar register. In response, the host writes S/Aw with Step 2 response data. This data provides the KDB50 with information.

- Low order address of the host ring buffer.
- Adapter purge interrupt request.

24.1.6 KDB50 Initialization Step 3

To continue the initialization procedure, the BPROC writes Step 3 data into the S/Ar register. In response, the host writes S/Aw with Step 3 response data. This data provides the KDB50 with information.

- High order address of the host ring buffer.
- Purge and Poll test request.

If the host does not request purge and poll tests, the initialization continues. However, if the tests are requested, the host executes a Purge test (write zero to S/Aw) and Poll test (read the IP register) within 10 milliseconds.

To complete Step 3, the BPROC performs a DMA test. During this test, the BPROC writes (and then verifies by reading) a walking one and zero data pattern to each location in the host ring buffer. This test requires actual VAXBI octaword DMA transfers. If an error occurs, the S/A register contains the error code and the red LEDs indicate a processor module failure.

24.1.7 KDB50 Initialization Step 4

To continue the initialization procedure, the BPROC writes Step 4 data into the S/Ar register and awaits a host response. The host responds by sending Step 4 response data which provides the KDB50 with the following information:

- Maximum burst value that the host allows.
- Last-fail response packet request.
- GO bit, if the KDB50 should enter functional microcode.

The BPROC waits for the host to set the GO bit before entering functional microcode. When the GO bit sets, the BPROC blinks the processor module LSB LED which indicates functional code is running. If the LSB LED on the processor module does not blink or stops blinking, an error has occurred.

24.2 KDB50 SA REGISTER ERROR CODES

Table 24-1 lists the S/A register error codes. These are applicable to both error log entries from the S/Ar register and the Last Fail Error Log Message Error Code field.

Table 24-1 S/A Register Error Codes

Code	Description
8001	Packet Read error
8002	Packet Write error
8003	BI Parity error
8004	Controller RAM Parity error
8005	Controller ROM Parity error
8006	Ring Read error
8007	Ring Write error
8008	Interrupt Master failure
8009	Host Access Timeout error
800A	Host exceeded credit limit
800B	Bus Master error
800C	DM XFC Fatal error
800D	Hardware timeout of instruction loop
800E	Invalid connection identifier
800F	Interrupt Write error
8010	Maintenance read/write invalid region identifier
8011	Maintenance write load to non-loadable controller
8012	Controller RAM error
8013	INIT Sequence error
8014	High Level Protocol Incompatibility error
8015	Purge/poll hardware failure
8016	Mapping Register Read error (parity or timeout)
8017	Attempt to set port data transfer mapping when option not present
8040	BI Master error
8041	KDB50 BIIC Detected error
8042	KDB50 detected VAXBI STOP command

Table 24-1 (Cont.) S/A Register Error Codes

Code	Description
8800	Fatal Sequencer error
8820	DPROC ALU Test error
8821	DPROC ROM Parity Test error or Timeout Test error
8A42	DPROC with no SDI Module or DPROC Control Register Test error or DPROC RAM Parity error
8A45	DPROC RAM buffer error
8A6A	DPROC SDI error
8A6B	DPROC Write Mode Wrap, Wrap SERDES 16 error
8A6C	DPROC Read Mode, SERDES 16, 10 RSGEN and ECC Circuitry error
8C20	BPROC ALU Test error or DFAIL Test error or Unexpected Trap error
8C21	BPROC Control Register Test error
8C22	BPROC Parity error set erroneously or CROM Parity Test error
8C2D	Unexpected trap found - abnormal termination of diagnostics
8C39	Log, Anti-log RAM Checksum error
8C3A	BPROC ROM Parity Test error
8C80	Step 1 Data error (MSB wasn't set)
8CE0	VAXBI 10 Second Command Timeout error or BIIC Self-test Failed error
8CE1	BCAI Buffer error (loopback mode)
8CE2	VAXBI Parity Test error (loopback mode)
8CE3	BIIC Buffer error (loopback mode)
8CE4	BIIC Buffer error (normal mode)
8CE5	Poll Test error (normal mode)
8CFF	BI Master error
8E43	BPROC RAM Parity error
8E47	BPROC RAM Buffer error

Table 24-1 (Cont.) S/A Register Error Codes

Code	Description
94C0	Step 2 INIT error
A4A0	DMA Test error
A4C0	Step 3 INIT error
C4C0	Step 4 INIT error

CHAPTER 25
HSC50

25.1 INTRODUCTION

Chapter 25 contains Controller Dependent Error Log message information for the HSC50.

25.2 HSC50 CONTROLLER DEPENDENT INFORMATION

The HSC50 controller dependent error log message information contains the following:

- Original Error Flag field (Section 25.2.1)
- Error Recovery Flag field (Section 25.2.2)
- Recovery Level Retry field (Section 25.2.3)
- Buffer Data Memory Address field (Section 25.2.4)
- Source Requester field (Section 25.2.5)
- Detecting Requester field (Section 25.2.6)

25.2.1 Original Error Flag Field

Original Error Flag field is word 11 in a controller error log message and word 22 in a disk transfer error log message. See Table 25-1 for bit definition of the Original Error Flag field.

Table 25-1 Original Error Flag Field

Bit #	Description
15	ECC error
14	SERDES Overrun error
13	SDI Response/data Line Pulse error
12&11	Suspected Position error—low header mismatch
12	Header sync timeout
11	Header Compare error
10	Data Sync timeout
9	Drive Clock timeout
8	SDI State Line Pulse error
7	Data Bus overrun

Table 25-1 (Cont.) Original Error Flag Field

Bit #	Description
6	Data Memory Parity error
5	Data Memory NXM
4	EDC error
3&2	R/W ready at end of sector
3	Lost R/W ready before transfer started
2	Lost Receiver Ready before transfer started
1	Forced error
0	Drive inoperative

25.2.2 Error Recovery

Error Recovery is the low byte of word 12 of a controller error log message or low byte of word 23 of disk transfer error log message. See Table 25-2 for bit definition of the Error Recovery.

Table 25-2 Error Recovery

Bit #	Description
0	The LBN should be replaced.
1	The current error should be logged on the console and to the host if connection is present.
2	Revectoring and replacement should be suppressed.
3	An entry for the desired LBN was found in the RCT.
4	An error log message has already been generated for the current error.
5	The error count reported by the ILEXER should be updated.

25.2.3 Recovery Level Retry

Recovery Level Retry is the high byte of Word 12. Recovery Level Retry field contains the following:

- A—Simple retry. FRB not placed in error state. Examples are primary revector and header sync timeout.
- B—Requires SDI intervention such as SDI clear, send DCB, and SDI recalibrate. FRB goes to error state. An example is a positioner error.
- C—Requires SDI error recovery. FRB goes to error state. An example is uncorrectable ECC.
- D—Requires RCT access. FRB goes to error state. K.sdi takes ownership of drive. Examples are nonprimary revector and BBR.

The number after the letter indicates the recovery level. See Table 25-3.

Table 25-3 Error Recovery Level

HSC50	What Happens	V200 V250	V300
6-8 Symbol error		7	0
Uncorrectable recover on retry		7	0
Recover Level 7	Decrease threshold	6	7
Recover Level 6		5	6
Recover Level 5	Skew Read Gate	4	5
Recover Level 4		3	4
Recover Level 3		2	3
Recover Level 2		1	2
Recover Level 1	Everything possible	0	1

25.2.4 Buffer Data Memory Address

The Buffer Data Memory address field is the HSC buffer address where the error was detected.

25.2.5 Source Requestor

The Source Requester field is the requester that originally requested the buffer from the free buffer queue.

25.2.6 Detecting Requestor

The Detecting Requester is the requester that detected the error.

NOTE

If you suspect a controller error, check the HSC console log for more information.

CHAPTER 26
HSC70

26.1 INTRODUCTION

This chapter contains controller dependent error log message information for the HSC70.

26.2 HSC70 CONTROLLER DEPENDENT INFORMATION

The HSC70 controller dependent information contains the following information:

- Original Error Flag field. (Section 26.2.1)
- Error Recovery Flag field. (Section 26.2.2)
- Recovery Level Retry field. (Section 26.2.3)
- Buffer Data Memory Address field. (Section 26.2.4)
- Source Requester field. (Section 26.2.5)
- Detecting Requester field. (Section 26.2.6)

26.2.1 Original Error Flag Field

Original Error Flag Field is Word 11 in a controller error log message and Word 22 in a disk transfer error log message. See Table 26-1 for bit definition of the Original Error Flag field.

Table 26-1 Original Error Flag Field

Bit #	Description
15	ECC error
14	SERDES Overrun error
13	SDI Response/data Line Pulse error
12&11	Suspected Position error-low header mismatch
12	Header sync timeout
11	Header Compare error
10	Data sync timeout
9	Drive clock timeout
8	SDI State Line Pulse error
7	Data bus overrun

Table 26-1 (Cont.) Original Error Flag Field

Bit #	Description
6	Data Memory Parity error
5	Data memory NXM
4	EDC error
3&2	R/W ready at end of sector
3	Lost R/W ready before transfer started
2	Lost receiver ready before transfer started
1	Forced error
0	Drive inoperative

26.2.2 Error Recovery

Error Recovery is the low byte of Word 12 of a controller error log message or low byte of Word 23 of disk transfer error log message. See Table 26-2 for bit definition of the Error Recovery.

Table 26-2 Error Recovery Bit Definition

Bit #	Description
0	The LBN should be replaced.
1	The current error should be logged on the console and to the host if connection is present.
2	Revectoring and replacement should be suppressed.
3	An entry for the desired LBN was found in the RCT.
4	An error log message has already been generated for the current error.
5	The error count reported by the ILEXER should be updated.

26.2.3 Recovery Level Retry

Recovery Level Retry is the high byte of Word 12. Recovery Level Retry field contains the following:

- A—Simple retry. FRB not placed in error state. Examples are primary revector and header sync timeout.
- B—Requires SDI intervention such as SDI clear, send DCB, and SDI recalibrate. FRB goes to error state. An example is a positioner error.
- C—Requires SDI error recovery. FRB goes to error state. An example is uncorrectable ECC.
- D—Requires RCT access. FRB goes to error state. K.sdi takes ownership of drive. Examples are nonprimary revector and BBR.

The number after the letter indicates the recovery level. See Table 26-3.

Table 26-3 Error Recovery Level

HSC70	What Happens	V200 V250	V300
6-8 Symbol error		7	0
Uncorrectable recover on retry		7	0
Recover Level 7	Decrease threshold	6	7
Recover Level 6		5	6
Recover Level 5	Skew Read Gate	4	5
Recover Level 4		3	4
Recover Level 3		2	3
Recover Level 2		1	2
Recover Level 1	Everything possible	0	1

26.2.4 Buffer Data Memory Address

The buffer data memory address field is the HSC buffer address where the error was detected.

26.2.5 Source Requestor

The source requester field is the requester that originally requested the buffer from the free buffer queue.

26.2.6 Detecting Requestor

The detecting requester is the requester that detected the error.

NOTE

If you suspect a controller error, check the HSC console log for more information.

CHAPTER 27
RC25

27.1 INTRODUCTION

The RC25 generates two kinds of error log messages: Host Buffer Access Error Log messages and Small Disk Error Log messages. Chapter 27 explains the device dependent area of Host Buffer Access Error Log messages and Small Disk Error Log messages. See the following section for device dependent information:

- Host Buffer Access Error Log Message (Section 27.2)
- Small Disk Error Log Message Not Drive or Positioner Error (Section 27.3)
- Small Disk Error Log Message With Drive or Positioner Error (Section 27.4)
- Fatal Error Codes in SA Register (Section 27.5)

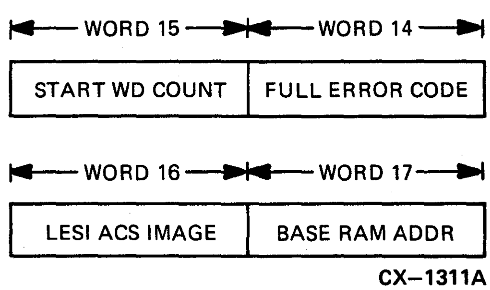
27.2 RC25 HOST BUFFER ACCESS ERROR

The following errors are reported in the Host Buffer Access Error Log message format:

- Event Code Controller Error/EDC Error—Logged in a Host Buffer Access error log message since this format of error log message contains the internal RAM address and some LESI related information best suited for this error.
- Event Code Compare Error—Logged in a Host Buffer Access error log message since it best describes the error. Note, this error is only be logged if it is the result of a read or write with compare. A compare host data does not log a compare error.

RC25 status information for the RC25 Host Buffer Access Error log begins at word 14. Word references are to RC25 status in the Host Buffer Access Error Log message. See Figure 27-1.

Figure 27-1 RC25 Host Buffer Access Status Words



27.2.1 Full Error Code

Full Error Code is word 14 of Host Buffer Access Error Log message. Full Error code is a copy of the event code earlier in the message and is only for compatibility with the RC25 Full Error code described in Table 27-1.

Table 27-1 RC25 Full Error Code

Hex	Octal	Class	Description
0000	00000	Success	Normal success (no error).
0020	00040		Spindown command ignored.
0040	00100		Still connected.
0080	00200		Online duplicated (duplicated unit select number).
0100	00400		Already online.
0001	00001	Invalid command	High byte contains byte offset to field in error.
0002	00002	Command aborted	No substatus codes apply.
0003	00003	Unit offline	Unit unknown or online to another controller.
0023	00043		No volume mounted or drive disabled via Run button.
0043	00103		Unit is inoperative.
0083	00203		Duplicate Unit Select number.
0103	00403		Disabled by field service or internal diagnostic.
0004	00004	Unit available	No substatus codes apply.
00A5	00245	Media format error	Disk not formatted with 512-byte sectors.
00C5	00305		Disk not formatted or factory control table (FCT) corrupted.
0105	00405		Replacement and Caching table (RCT) corrupted.
0125	00445		No Replacement block available.
1006	10006	Write protected unit	Unit is software write protected.
2006	20006		Unit is hardware write protected.
0007	00007	Compare error	No substatus codes apply.
0008	00010	Data error	Sector written with forced error modifier.
0048	00110		Header compare error (valid header not found).
0088	00210		ECC field corrections only.

Table 27-1 (Cont.) RC25 Full Error Code

Hex	Octal	Class	Description
00E8	00350		Uncorrectable ECC error.
0108	00410		1-symbol ECC error.
0128	00450		2-symbol ECC error.
0148	00510		3-symbol ECC error.
0168	00550		4-symbol ECC error.
0188	00610		5-symbol ECC error.
01A8	00650		6-symbol ECC error.
01C8	00710		7-symbol ECC error.
01E8	00750		8-symbol ECC error.
0029	00051	Host Buffer Access error	Odd byte transfer address.
0049	00111		Odd byte count.
0069	00151		Nonexistent memory.
0089	00211		Host Bus/Memory parity error.
00A9	00251		Valid (V) bit not set for memory mapping (indicates a host software error).
002A	00052	Controller error	SERializer/DESerializer(SERDES) over/under run error.
004A	00112		Nonforced Error Detection code (EDC) error.
00AA	00252		LESI Interface Parity error (input).
00CA	00312		LESI Interface Parity error (output).
00EA	00352		Cable-in-place signal (T2) deasserted.
006B	00153	Drive error or Positioner error	Positioner error (misseek).
00EB	00353		Drive Detected error.
010B	00413		Seek into guard band.
020B	01013		Negative track difference.
030B	01413		Distance traveled.
040B	02013		Not 1 track away.

Table 27-1 (Cont.) RC25 Full Error Code

Hex	Octal	Class	Description
050B	02413		Not 0 tracks away.
060B	03013		Drive off track.
070B	03413		Servo Sample Parity error.
080B	04013		Head Switch Dead band.
0A0B	05013		Servo Sample error (SSE).
0B0B	05413		A/D Conversion timeout.
0C0B	06013		Head Switch Servo Sample Ready timeout.
0D0B	06413		Head Switch Servo Sample error.
0E0B	07013		Head Switch error (least five track address bits of servo burst do not match).
0F0B	07413		Analog Servo timeout or Servo Positioning Timer error.
012B	00453	Drive Detected error	Drive Status Register Disable Write error.
022B	01053		Analog Control register reported Servo timeout.
032B	01453		D Processor Servo Sample Ready (SSR) timeout.
042B	02053		D Processor Found Servo Sample error.
052B	02453		D Processor Index timeout.
062B	03053		SERializer/DESerializer Parallel Ready timeout.
072B	03453		Residue Ready (RRDY EARLY) timeout.
082B	04053		Header Word Rate Clock timeout.
092B	04453		Data Word Rate Clock timeout.
0A2B	05053		Replace Found Positioner error.
0B2B	05453		Attempt to revector Nonlogical Block number.
0C2B	06053		Replacement and Caching Table Seek, Read, or Error Detection Code failed.
0D2B	06453		Replacement Block number (RBN) not found in Replacement and Caching table.
0E2B	07053		Seek to Replacement Block number failed.
0F2B	07453		Seek back to orignal block failed.

Table 27-1 (Cont.) RC25 Full Error Code

Hex	Octal	Class	Description
102B	10053		Write command found Nonzero Servo Offset.
132B	11453		Drive ACLO asserted.
142B	12053		Drive over temperature.
152B	12453		Duplicate Unit Select Number detected.
162B	13053		Operator Panel Loopback failed.
172B	13453		Wrong stopped state.
182B	14053		Spindown timed out.
192B	14453		Wrong speed state.
1A2B	15053		Spinup timed out.
1B2B	15453		Heads not over the disk.
1C2B	16053		Heads home timed out.
1D2B	16453		Heads home never went away.
1E2B	17053		Unsafe attempt to unlock door.
1F2B	17453		Cartridge or door error.
202B	20053		Adaptive runout correction system (ARCS) seek hard error.
212B	20453		ARCS Sector Hard error.
222B	21053		ARCS Detent Hard error.
232B	21453		Servo Error too high.
242B	22053		Spindle machine failed to initialize servo.
282B	24053		Track Position Detector (TPD) diagnostics failed.
292B	24453		TPD Data Bus check failed.
2A2B	25053		A/D Offset timing failed.
2B2B	25453		D/A Offset timing failed.
2C2B	26053		A/D-D/A linearity failed.

Table 27-1 (Cont.) RC25 Full Error Code

Hex	Octal	Class	Description
2D2B	26453		Integrator offset failed.
2E2B	27053		Drive module failed initialization test.
2F2B	27453		Drive module (master or slave) cable not in place.
302B	30053		Seek error rate too high.
312B	30453		Read/Write error rate too high.

27.2.2 Start Word Count

Start word Count is word 15 of the Host Buffer Access error log message. Start Word Count is the starting word count for the DMA transfer that failed. Normally this is 256(10) unless a partial sector was written or read.

27.2.3 Base RAM addr

Base RAM addr is word 16 of the Host Buffer Access error log message. Base RAM addr is the internal RAM address used for the DMA transfer that failed and normally points to an intermediate sector buffer in the controller.

27.2.4 LESI ACS image

LESI ACS image is word 17 of the Host Buffer Access error log message. LESI ACS image is the LESI ACS register value at the time of the error. See Figure 27-2 for format of this register, and Table 27-2 for description of the bits.

Figure 27-2 RC25 LESI ACS Image

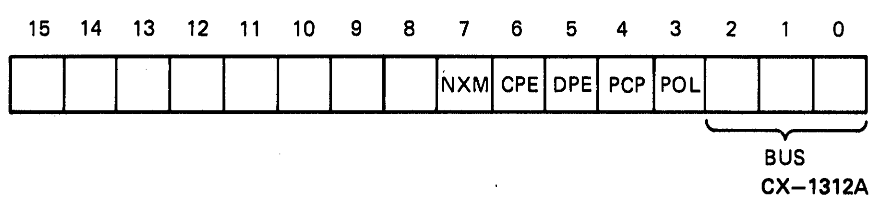


Table 27-2 RC25 LESI ACS Image

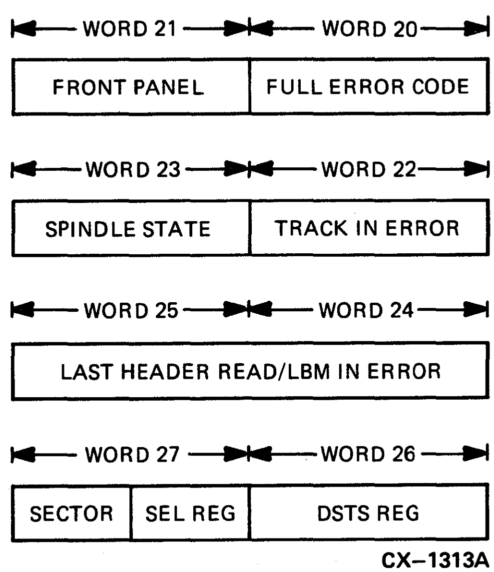
Name	Mask	Description
NXM	200	The last transfer had a NXM.
CPE	100	Cable Parity error on write to adapter.
DPE	40	Data Parity error asserted on host bus.
PCP	20	Purge is complete (for VAX hosts).
POL	10	Host has read the poll register.
BUS	7	Host bus type field (1 = UNIBUS, 2 = Q/Q-22).

27.3 RC25 SMALL DISK ERROR

If the event code is not a drive or positioner error, the RC25 Small Disk error contains the event code of a SERDES Over/Under Run error logged in a small disk error message and not a controller error message.

RC25 status information for the RC25 small disk error log begins at word 20. Word references are to RC25 status in the Small Disk Error Log message. See Figure 27-3.

Figure 27-3 RC25 Small Disk Status Words (Not Drive/Positioner Error)



27.3.1 Full Error Code

Full Error Code is word 20 of the Small Disk Error Log message. Full Error code is a copy of the event code earlier in the message and is only for compatibility with the RC25 Full Error code described in Table 27-3.

Table 27-3 RC25 Full Error Code

Hex	Octal	Class	Description
0000	0000	Success	Normal success(no error).
0020	00040		Spindown command ignored.
0040	00100		Still connected.
0080	00200		Online duplicated (duplicated unit select number).
0100	00400		Already online.
0001	00001	Invalid command	High byte contains byte offset to field in error.
0002	00002	Command aborted	No substatus codes apply.
0003	00003	Unit offline	Unit unknown or online to another controller.
0023	00043		No volume mounted mounted or drive disabled via Run button.
0043	00103		Unit is inoperative.
0083	00203		Duplicate Unit Select number.
0103	00403		Disabled by field service or internal diagnostic.
0004	00004	Unit available	No substatus codes apply.
00A5	00245	Media format error	Disk not formatted with 512-byte sectors.
00C5	00305		Disk not formatted or Factory Control table (FCT) corrupted.
0105	00405		Replacement and Caching table (RCT) corrupted.
0125	00445		No Replacement block available.
1006	10006	Write protected unit	Unit is software write protected.
2006	20006		Unit is hardware write protected.
0007	00007	Compare error	No substatus codes apply.
0008	00010	Data error	Sector written with forced error modifier.
0048	00110		Header Compare error (valid header not found).
0088	00210		ECC field corrections only.

Table 27-3 (Cont.) RC25 Full Error Code

Hex	Octal	Class	Description
00E8	00350		Uncorrectable ECC error.
0108	00410		1-symbol ECC error.
0128	00450		2-symbol ECC error.
0148	00510		3-symbol ECC error.
0168	00550		4-symbol ECC error.
0188	00610		5-symbol ECC error.
01A8	00650		6-symbol ECC error.
01C8	00710		7-symbol ECC error.
01E8	00750		8-symbol ECC error.
0029	00051	Host Buffer Access error	Odd Byte Transfer address.
0049	00111		Odd Byte count.
0069	00151		Nonexistent memory.
0089	00211		Host Bus/Memory Parity error.
00A9	00251		Valid (V) bit not set for memory mapping (indicates a host software error).
002A	00052	Controller error	SERializer/DESerializer(SERDES) over/under run error.
004A	00112		Nonforced Error Detection code (EDC) error.
00AA	00252		LESI Interface Parity error (input).
00CA	00312		LESI Interface Parity error (output).
00EA	00352		Cable-in-place signal (T2) deasserted.
006B	00153	Drive error or Positioner error	Positioner error (misseek).
00EB	00353		Drive Detected error.
010B	00413		Seek into guard band.
020B	01013		Negative track difference.
030B	01413		Distance traveled.
040B	02013		Not 1 track away.

Table 27-3 (Cont.) RC25 Full Error Code

Hex	Octal	Class	Description
050B	02413		Not 0 tracks away.
060B	03013		Drive off track.
070B	03413		Servo Sample Parity error.
080B	04013		Head Switch Dead band.
0A0B	05013		Servo Sample error (SSE).
0B0B	05413		A/D Conversion timeout.
0C0B	06013		Head Switch Servo Sample Ready timeout.
0D0B	06413		Head Switch Servo Sample error.
0E0B	07013		Head Switch error (least five track address bits of servo burst do not match).
0F0B	07413		Analog Servo timeout or Servo positioning Timer error.
012B	00453	Drive Detected error	Drive status register disable write error.
022B	01053		Analog Control register reported servo timeout.
032B	01453		D Processor Servo Sample Ready (SSR) timeout.
042B	02053		D Processor Found Servo Sample error.
052B	02453		D Processor Index timeout.
062B	03053		SERializer/DESerializer Parallel Ready timeout.
072B	03453		Residue Ready (RRDY EARLY) timeout.
082B	04053		Header Word Rate Clock timeout.
092B	04453		Data Word Rate Clock timeout.
0A2B	05053		Replace Found Positioner error.
0B2B	05453		Attempt to revector Nonlogical Block number.
0C2B	06053		Replacement and Caching Table Seek, Read, or Error Detection code failed.
0D2B	06453		Replacement Block number (RBN) not found in Replacement and Caching table.
0E2B	07053		Seek to Replacement Block number failed.
0F2B	07453		Seek back to orignal block failed.

Table 27-3 (Cont.) RC25 Full Error Code

Hex	Octal	Class	Description
102B	10053		Write command found Nonzero Servo offset.
132B	11453		Drive ACLO asserted.
142B	12053		Drive over temperature.
152B	12453		Duplicate Unit Select number detected.
162B	13053		Operator Panel loopback failed.
172B	13453		Wrong stopped state.
182B	14053		Spindown timed out.
192B	14453		Wrong speed state.
1A2B	15053		Spinup timed out.
1B2B	15453		Heads not over the disk.
1C2B	16053		Heads Home timed out.
1D2B	16453		Heads Home never went away.
1E2B	17053		Unsafe attempt to unlock door.
1F2B	17453		Cartridge or Door error.
202B	20053		Adaptive runout correction system (ARCS) seek hard error.
212B	20453		ARCS Sector Hard error.
222B	21053		ARCS Detent Hard error.
232B	21453		Servo error too high.
242B	22053		Spindle machine failed to initialize servo.
282B	24053		Track Position Detector (TPD) Diagnostics failed.
292B	24453		TPD Data Bus check failed.
2A2B	25053		A/D Offset timing failed.
2B2B	25453		D/A Offset timing failed.
2C2B	26053		A/D-D/A linearity failed.

Table 27-3 (Cont.) RC25 Full Error Code

Hex	Octal	Class	Description
2D2B	26453		Integrator offset failed.
2E2B	27053		Drive module failed initialization test.
2F2B	27453		Drive module (master or slave) cable not in place.
302B	30053		Seek error rate too high.
312B	30453		Read/Write error rate too high.

27.3.2 Front Panel

Front Panel is word 21 of the Small Disk Error Log message. Front Panel field contains the current state of the front panel (switches and unit plug) at the time of the error. See Table 27-4.

Table 27-4 Front Panel Code

Code	Description
0 0 0 x x	**AMBIGUOUS & SPARE**
0 0 0 0 0	Ambiguous #1.
0 0 0 0 1	Ambiguous #2.
0 0 0 1 0	Ambiguous #3.
0 0 0 1 1	Spare fault code.
0 0 1 x x	**CONTROLLER**
0 0 1 0 0	Ambiguous #4.
0 0 1 0 1	Controller diagnostics failed.
0 0 1 1 0	Controller detected DM failure.
0 0 1 1 1	Controller internal inconsistency.
0 1 0 x x	**ADAPTER & HOST**
0 1 0 0 0	Ambiguous #5.
0 1 0 0 1	Adapter card diagnostics.
0 1 0 1 0	Port related item failed.
0 1 0 1 1	MSCP related item failed.

Table 27-4 (Cont.) Front Panel Code

Code	Description
0 1 1 x x	**ENVIRONMENT & FRONT PANEL**
0 1 1 0 0	Drive ACLO.
0 1 1 0 1	Drive over temp.
0 1 1 1 0	Duplicate unit number.
0 1 1 1 1	Front panel loop-back failed.
1 0 0 x x	**FRONT PANEL DIAGNOSTICS**
1 0 0 0 0	Ambiguous #6.
1 0 0 0 1	Spare front panel diagnostic fault code.
1 0 0 1 0	Functional test failed (Example, seek/read/write.).
1 0 0 1 1	Margin test failed (Example, jitter/offset).
1 0 1 x x	**DRIVE STATUS**
1 0 1 0 0	Wrong stopped state (DS.STP) + spin down timed out.
1 0 1 0 1	Wrong speed state (DS.SPE) + spin up timed out.
1 0 1 1 0	Heads not over disk (DS.HDH) + heads home timed out + heads home never went away.
1 0 1 1 1	Unsafe attempt to unlock door (DS.STP!DS.HDH).
1 1 0 x x	**SERVO SYSTEM & 1 DRIVE STATUS**
1 1 0 0 0	Cartridge or door error (DS.COD).
1 1 0 0 1	ARCS seek, sector, or detent error.
1 1 0 1 0	Servo/seek/read/write error rate too high.
1 1 0 1 1	Spindle machine failed init servo.
1 1 1 x x	**DRIVE CARD & CABLES**
1 1 1 0 0	Read/write diagnostics.
1 1 1 0 1	Drive card diagnostics.
1 1 1 1 0	Drive card failed init test.
1 1 1 1 1	Drive cable not in place.

27.3.3 Track in Error

Track in Error is word 22 of the Small Disk Error Log message. Track in Error field contains the track number at the time of the error.

27.3.4 Spindle State

Spindle State is word 23 of the Small Disk Error Log message. Spindle State field contains the spindle state machine address at the time of the error. This field contains the spindle state values which may be used to determine the exact reason for an error. For example, Wrong Stopped State. Numbers are in octal. See Table 27-9.

Table 27-9 Spindle State Machine Addresses

Code	Description
00	Online
01	I/O rundown
02	Begin unload
03	Heads home wait
04	End unload
05	Spindown wait
06	Stopped
07	Check door
10	Spinup wait
11	Purge wait
12	Begin load
13	Load wait
14	Init servo
15	Offline
16	Initial spinup

27.3.5 Last Header Read/LBN in Error

Last Header Read/LBN in Error is word 24 and 25 of the Small Disk Error Log message. Last Header Read/LBN in Error field contains either the last header read if the error log message does not relate to a command. For example, the command reference number is zero) or the LBN in error (if the error log message relates to a command).

27.3.6 Drive Status Register

Drive Status Register is word 26 of the Small Disk Error Log message. Drive Status Register field contains the value of the drive status register at the time of the error. See Figure 27-4 and Table 27-6.

Figure 27-4 Drive Status Register

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
FDI								ACL	STO	SPE	STP	HDH	TMP	COD	DIW

CX–1314A

Table 27-6 Drive Status Register

Name	Mask	Description
FDI	100000	Front panel serial data in.
ACL	200	Status of the selected drive's ACLO. Note, this bit does NOT occur in hardware but rather is inserted by microcode before DSTS is seen by host error log packets.
STO	100	Servo timeout high. Set if the ANL register has not been written in 1.3 milliseconds, and the drive card has shut down the actuator power amp. Clear if the microcode is properly writing the ANL at least every 1.3 milliseconds.
SPE	40	Speed error high. Set if the spindle is not spinning at the proper speed. Clear otherwise.
STP	20	Spindle stopped high. Set if the spindle has stopped spinning. Clear otherwise.
HDH	10	Heads Home high. Set if heads are at their home position. Clear otherwise.
TMP	4	Over temperature high. Set if the temperature in the drive exceeds safe limits. Clear otherwise.
COD	2	Cartridge or door not OK. Set if the removable cartridge is missing or the front door is open.
DIW	1	Disable write. Set to disable writing on the disk by many error conditions and by microcode during certain operations (see FLT bus destination).

27.3.7 Select Register

Select Register is the Low Byte word 27 of the Small Disk Error Log message. Select Register field contains the low order 8 bits of the SELECT register. See Figure 27-5 and Table 27-7. Note, the active head at the time of the error is encoded into two bits in this register.

Figure 27-5 Select Register

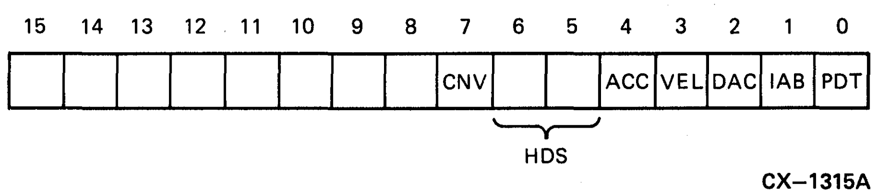


Table 27-7 Select Register

Name	Mask	Description
CNV	200	Start A/D conversion when clear.
HDS	140	Head select. Selects active head on chosen spindle.
HD0	000	Head 0 (removable, top surface).
HD1	040	Head 1 (removable, bottom surface).
HD2	100	Head 2 (fixed, top surface).
HD3	140	Head 3 (fixed, bottom surface).
ACC	20	Select actuator current to A/D when clear for diagnosis. (200mV/amp).
VEL	10	Select actual tachometer velocity feedback to A/D when clear. For diagnosis. (200mV/ips).
DAC	4	Select DAC mode when clear—input to A/D is half the output of the D/A.
IAB	2	Select early-late integrals when clear—input to A/D is MINUS the early-late servo burst integrals.
PDT	1	Select peak detected read threshold when clear. Used to detect erasure during testing/formatting.

27.3.8 Sector

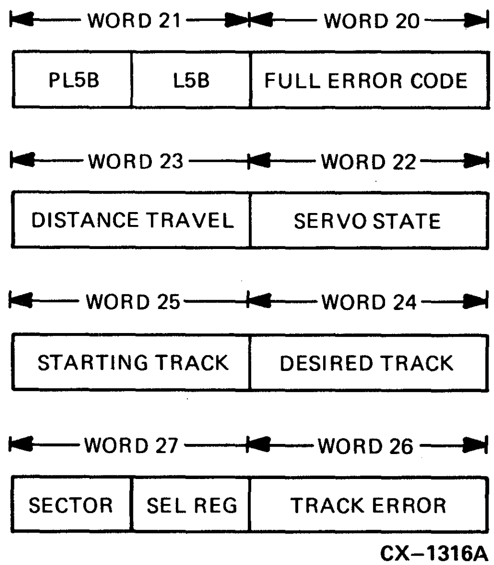
Sector is the High Byte word 27 of the Small Disk Error Log message. Sector field contains the sector number at the time of the error, or 255(10) if the sector is unknown.

27.4 RC25 SMALL DISK ERROR

This format is the error reported in the Small Disk Error Log message with event code Drive Error/Positioner Error.

RC25 status information for the RC25 small disk error log begins at word 20. Word references are to RC25 status in the Small Disk Error Log message. See Figure 27-6.

Figure 27-6 RC25 Small Disk Status Words (Drive/Positioner Error)



27.4.1 Full Error Code

Full Error Code is word 20 of the Small Disk Error Log message. Full Error Code is a copy of the event code earlier in the message and is only for compatibility with the RC25 Full Error Code described in Table 27-8.

Table 27-8 RC25 Full Error Code

Hex	Octal	Class	Description
0000	00000	Success	Normal success (no error).
0020	00040		Spindown command ignored.
0040	00100		Still connected.
0080	00200		Online duplicated (duplicated unit select number).
0100	00400		Already online.
0001	00001	Invalid command	High byte contains byte offset to field in error.

Table 27-8 (Cont.) RC25 Full Error Code

Hex	Octal	Class	Description
0002	00002	Command aborted	No substatus codes apply.
0003	00003	Unit offline	Unit unknown or online to another controller.
0023	00043		No volume mounted mounted or drive disabled via run button.
0043	00103		Unit is inoperative.
0083	00203		Duplicate unit select number.
0103	00403		Disabled by field service or internal diagnostic.
0004	00004	Unit available	No substatus codes apply.
00A5	00245	Media format error	Disk not formatted with 512-byte sectors.
00C5	00305		Disk not formatted or Factory Control table (FCT) corrupted.
0105	00405		Replacement and Caching table (RCT) corrupted.
0125	00445		No replacement block available.
1006	10006	Write protected unit	Unit is software write protected.
2006	20006		Unit is hardware write protected.
0007	00007	Compare error	No substatus codes apply.
0008	00010	Data error	Sector written with forced error modifier.
0048	00110		Header Compare error (valid header not found).
0088	00210		ECC field corrections only.
00E8	00350		Uncorrectable ECC error.
0108	00410		1-symbol ECC error.
0128	00450		2-symbol ECC error.
0148	00510		3-symbol ECC error.
0168	00550		4-symbol ECC error.
0188	00610		5-symbol ECC error.
01A8	00650		6-symbol ECC error.
01C8	00710		7-symbol ECC error.

Table 27-8 (Cont.) RC25 Full Error Code

Hex	Octal	Class	Description
01E8	00750		8-symbol ECC error.
0029	00051	Host Buffer Access error	Odd byte transfer address.
0049	00111		Odd Byte count.
0069	00151		Nonexistent memory.
0089	00211		Host Bus/Memory Parity error.
00A9	00251		Valid (V) bit not set for memory mapping (indicates a host software error).
002A	00052	Controller error	SERializer/DESerializer(SERDES) over/under run error.
004A	00112		Nonforced Error Detection code (EDC) error.
00AA	00252		LESI Interface Parity error (input).
00CA	00312		LESI Interface Parity error (output).
00EA	00352		Cable-in-place signal (T2) deasserted.
006B	00153	Drive error or Positioner error	Positioner error (misseek).
00EB	00353		Drive Detected error.
010B	00413		Seek into guard band.
020B	01013		Negative track difference.
030B	01413		Distance traveled.
040B	02013		Not 1 track away.
050B	02413		Not 0 tracks away.
060B	03013		Drive off track.
070B	03413		Servo Sample Parity error.
080B	04013		Head Switch Dead band.
0A0B	05013		Servo Sample error (SSE).
0B0B	05413		A/D Conversion timeout.
0C0B	06013		Head Switch Servo Sample Ready timeout.
0D0B	06413		Head Switch Servo Sample error.

Table 27-8 (Cont.) RC25 Full Error Code

Hex	Octal	Class	Description
0E0B	07013		Head Switch error (least five track address bits of servo burst do not match).
0F0B	07413		Analog Servo timeout or Servo Positioning Timer error.
012B	00453	Drive Detected error	Drive Status Register Disable Write error.
022B	01053		Analog Control register reported Servo timeout.
032B	01453		D Processor Servo Sample Ready (SSR) timeout.
042B	02053		D Processor Found Servo Sample error.
052B	02453		D Processor Index timeout.
062B	03053		SERializer/DESerializer Parallel Ready timeout.
072B	03453		Residue Ready (RRDY EARLY) timeout.
082B	04053		Header Word Rate Clock timeout.
092B	04453		Data Word Rate Clock timeout.
0A2B	05053		Replace Found PositionER error.
0B2B	05453		Attempt to revector Nonlogical Block number.
0C2B	06053		Replacement and Caching Table Seek, Read, or Error Detection code failed.
0D2B	06453		Replacement Block number (RBN) not found in Replacement and Caching table.
0E2B	07053		Seek to replacement Block number failed.
0F2B	07453		Seek back to orignal block failed.
102B	10053		Write command found nonzero servo offset.
132B	11453		Drive ACLO asserted.
142B	12053		Drive over temperature.
152B	12453		Duplicate Unit Select number detected.
162B	13053		Operator Panel Loopback failed.
172B	13453		Wrong stopped state.
182B	14053		Spindown timed out.
192B	14453		Wrong speed state.

Table 27-8 (Cont.) RC25 Full Error Code

Hex	Octal	Class	Description
1A2B	15053		Spinup timed out.
1B2B	15453		Heads not over the disk.
1C2B	16053		Heads Home timed out.
1D2B	16453		Heads Home never went away.
1E2B	17053		Unsafe attempt to unlock door.
1F2B	17453		Cartridge or Door error.
202B	20053		Adaptive Runout Correction system (ARCS) Seek Hard error.
212B	20453		ARCS Sector Hard error.
222B	21053		ARCS Detent Hard error.
232B	21453		Servo error too high.
242B	22053		Spindle machine failed to initialize servo.
282B	24053		Track Position Detector (TPD) diagnostics failed.
292B	24453		TPD Data Bus check failed.
2A2B	25053		A/D Offset timing failed.
2B2B	25453		D/A Offset timing failed.
2C2B	26053		A/D-D/A linearity failed.
2D2B	26453		Integrator offset failed.
2E2B	27053		Drive module failed initialization test.
2F2B	27453		Drive module (master or slave) cable not in place.
302B	30053		Seek error rate too high.
312B	30453		Read/Write error rate too high.

27.4.2 L5B

L5B is the Low Byte of word 21 of the Small Disk Error Log message. L5B field contains the low 5 bits of the track address as read by the servo system at the time of the error.

27.4.3 PL5B

PL5B is the High Byte of word 21 of the Small Disk Error Log message. PL5B field contains the previous low 5 bits of the track address from the previous servo sample processed by the servo system.

27.4.4 Servo State

Servo State is word 22 of the Small Disk Error Log message. Servo State field contains the servo state address. While this information is not useful in interpreteting errors, it indicates what the servo state machine was doing at the time of the error. Table 27-9 contains the values defined for this field (in octal).

Table 27-9 Servo State

State	Description
00	Fast seek
01	Medium seek
02	Slow seek
03	One track away
04	Zero tracks away
05	Detente
06	RTZ in progress
07	Error state
10	Fake samples (head load/unload)

27.4.5 Distance Traveled

Distance Traveled is word 23 of the Small Disk Error Log message. Distance Traveled field contains the last distanced traveled (in tracks) from the previous servo sample to the current servo sample (the one in error).

27.4.6 Desired Track

Desired Track is word 24 of the Small Disk Error Log message. Desired Track field contains the desired track for a seek, if a seek is in progress.

27.4.7 Starting Track

Starting Track is word 25 of the Small Disk Error Log message. Starting Track field contains the starting track for a seek, if a seek is in progress.

27.4.8 Track Error Value

Track Error Value is word 26 of the Small Disk Error Log message. Track Error Value field contains the sum of the A/D track error and the servo correction number of the last sample. This field is only valid when the servo state machine is in the Detente state. See Figure 27-7 and Table 27-10.

Figure 27-7 A/D Converter Register

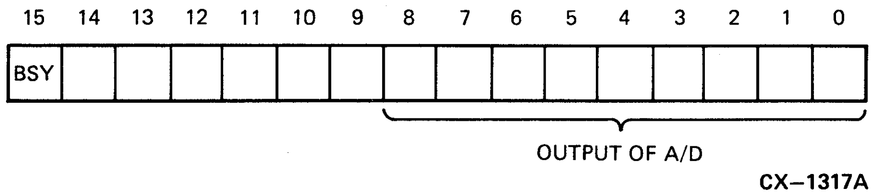


Table 27-10 A/D Converter Register

Name	Mask	Description
BSY	100000	A/D busy high. Set if the A/D is still converting. Clear when bits 0-8 are valid.
PLS	400	Set means the A/D value is positive.
VAL	777	Value of the A/D conversion. This is a 256 offset binary number. The resolution of 1 bit is 40 mV.

27.4.9 Select Register

Select Register is the Low Byte word 27 of the Small Disk Error Log message. Select Register field contains the low order 8 bits of the SELECT register. See Figure 27-8 and Table 27-11. Note that the active head at the time of the error is encoded into two bits in this register.

Figure 27-8 Select Register

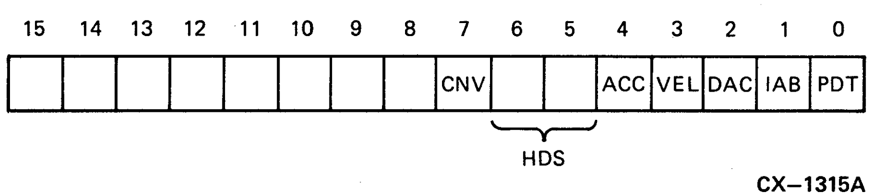


Table 27-11 Select Register

Name	Mask	Description
CNV	200	Start A/D conversion when clear.
HDS	140	Head select. Selects active head on chosen spindle.
HD0	000	Head 0 (removable, top surface).
HD1	040	Head 1 (removable, bottom surface).
HD2	100	Head 2 (fixed, top surface).
HD3	140	Head 3 (fixed, bottom surface).
ACC	20	Select actuator current to A/D when clear. For diagnosis. (200mV/amp).
VEL	10	Select actual tachometer velocity feedback to A/D when clear. For diagnosis. (200mV/ips).
DAC	4	Select DAC mode when clear—input to A/D is half the output of the D/A.
IAB	2	Select early-late integrals when clear—input to A/D is MINUS the early-late servo burst integrals.
PDT	1	Select peak detected read threshold when clear. Used to detect erasure during testing/formatting.

27.4.10 Sector

Sector is the High Byte word 27 of the Small Disk Error Log message. Sector field contains the sector number at the time of the error, or 255(10) if the sector is unknown.

27.5 FATAL ERROR CODES IN SA

If the initialization microdiagnostics or the operational mode internal consistency checks discover a problem, the RC25 microcode tries to leave a fatal error code in the S/A register for the host to read. These fatal condition codes all include Bit 15 set which indicates to the host that RC25 has detected one of these fatal conditions. Note, while RC25 also lights the controller LED and faults the master drive upon detecting an error, this section only deals with the S/A fatal error codes. A list of these fatal error codes is found in Table 27-12.

Table 27-12 SA Register Error Code

Code	Description
100001	Host Bus Packet Read error
100002	Host Bus Packet Write error
100006	Host Bus Ring Read error
100007	Host Bus Ring Write error
100010	Host bus interrupt failure
100011	Host access timeout
100016	Invalid virtual circuit ID
100017	Error on interrupt write (to ring-2/ring-4)
100022	RC25 RAM error (on write/read check)
100023	Init Sequence error
100024	Wrong MSCP version
100026	Map Table Entry Read error
100310	DMA error on interrupt purge notification
100311	Inconsistency at U.BFIL
100312	Inconsistency at U.BMTY
100313	Inconsistency at U.ALOC
100314	Inconsistency at servo entry (PIP set)
100315	Inconsistency at servo entry (ERR set)
100316	Inconsistency at U.SEND
100317	Inconsistency at U.RECV
100320	Inconsistency at U.ATTN
100321	Inconsistency at U.ONLN
100322	Illegal D request (U.QDRQ)
100323	Fence-post error at PROTAB
100324	Bad packet dequeued at U.DONE
100325	DM program illegal memory store

Table 27-12 (Cont.) SA Register Error Code

Code	Description
100326	DUP packet D-Q failed (XFC 34/35)
100327	Inconsistency at U.HTST
100330	Inconsistency at U.SEKO
100331	Inconsistency at U.CKSV
100332	D.OPCD found illegal opcode
100334	Unknown bad drive status at D.DSTS
100335	Illegal XFC executed by DM
100336	D picked up a zero SCB.DB
100337	Inconsistency at D idle loop
100340	DM Word Count error on host DMA/SEND/RECV
100341	Unknown display fault code at D.DFLT
100342	Drive not faulting in P.OFLN state
100343	U power up diagnostics failed
100344	D power up diagnostics failed
100345	Adapter card failure
100346	EC.TMR timed out
100350	Unknown WAITRV reason at D.RVCT
100351	D.ARCS did not find closest undone zone
100352	U.SEEK found seek to illegal track
100353	U.HTST init diag DMA write failed
100354	U.HTST init diag DMA compare failed
100355	U.SYDR found SS.DER set and SS.SPN not set
100356	Master drive's ACLO asserted
100357-100377	Unassigned, but reserved for RC25

CHAPTER 28
RQDX3

28.1 INTRODUCTION

Chapter 28 contains controller dependent information of the RQDX3 that is logged in the Small Disk Error Log message. This chapter helps you decode the controller dependent information of the RQDX3.

28.2 RQDX3 CONTROLLER DEPENDENT INFORMATION

The RQDX3 contains the following controller dependent information:

- Chip Status register (Section 28.2.1).
- Interrupt Status register (Section 28.2.2).
- Desired Sector register (Section 28.2.3).
- Drive Status register (Section 28.2.4).
- Current Cylinder register (Section 28.2.5).
- Current Head register (Section 28.2.6).
- SA Register codes (Section 28.3).

28.2.1 RQDX3 Chip Status Register

Chip status register is the Low Byte of word 20 of the Small Disk Error Log message. See Figure 28-1 and Table 28-1.

Figure 28-1 Chip Status Register

7	6	5	4	3	2	1	0
RETRY REQ	ECC CORR ATTEMP	CRC / ECC ERR	DEL DATA MARK R	SYNC ERR	COM - PARE ERR	PRESENT DRIVE SELECTED	

CX–1318A

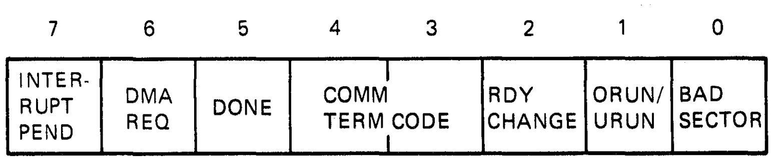
Table 28-1 Chip Status Register

Bit	Name	Description
0-1	Present drive selected	These bits indicate the currently selected drive.
2	Compare error	This bit indicates the information contained in the Desired Head and Desired Cylinder registers does not match the information contained in the ID field on the disk.
3	Sync error	This bit indicates a sync mark was not encountered when attempting to read an ID or data field.
4	Deleted data mark	This bit indicates a deleted data mark was read in the ID field.
5	CRC/ECC error	This bit indicates a CRC or ECC error was detected.
6	ECC correction attempted	This bit indicates the internal ECC circuitry has attempted to correct a bad sector.
7	Retry required	This bit indicates a retry was attempted during the execution of any read or write command.

28.2.2 RQDX3 Interrupt Status Register

Interrupt status register is the High Byte of word 20 of the Small Disk Error Log message. See Figure 28-2 and Table 28-2.

Figure 28-2 Interrupt Status Register



CX–1319A

Table 28-2 Interrupt Status Register

Bit	Name	Description
0	Bad sector	A bad sector has been encountered.
1	Over-run/Under-run	An over-run or under-run condition has occurred during a read or write command. These conditions occur when the controller does not receive an acknowledge to a DMA request by the time a byte is ready for transfer to or from the processor.
2	Ready change	A drive has changed state.
3-4	Command termination code	The command termination conditions:
	Bit 4 Bit 3	**Condition**
	0 0	Successful command termination
	0 1	Execution error in Read ID sequence
	1 0	Execution error in Seek sequence
	1 1	Execution error in Data field
5	Done	The current command is completed.
6	DMA request	The controller requires a data transfer to or from the the data register.
7	Interrupt pending	Either the Done bit or Ready Change is active.

28.2.3 RQDX3 Desired Sector Register

Desired sector register is the Low Byte of word 21 of the Small Disk Error Log message. If the controller terminates a command because of an error, this register will contain the bad sector number.

28.2.4 RQDX3 Drive Status Register

Drive status register is the High Byte of word 21 of the Small Disk Error Log message. See Figure 28-3 and Table 28-3.

Figure 28-3 Drive Status Register

7	6	5	4	3	2	1	0
ECC ERR	INDEX	SEEK COMP	TRACK 0 0	USER DEFIN ACTIVE	WRITE PROTEC ACTIVE	DRIVE RDY	WRITE FAULT

CX–1320A

Table 28-3 Drive Status Register

Bit	Name	Description
0	Write Fault	A write fault condition from the selected drive.
1	Drive Ready	The selected drive is ready.
2	Write Protect	The selected drive is write protected.
3	User Defined	The selected drive has a user defined signal active.
4	Track 00	The selected drive has the head positioned over Track 0.
5	Seek Complete	The selected drive has completed a seek, and the heads are settled over the desired track.
6	Index	The selected drive is detecting index pulses.
7	ECC Error	An ECC error is generated by an external ECC chip, if present.

28.2.5 RQDX3 Current Cylinder Register

Current cylinder register is the Low Byte of word 22 of the Small Disk Error Log message. This register contains the 8 LSB of the cylinder ID number.

28.2.6 RQDX3 Current Head Register

Current Head register is the High Byte of word 22 of the Small Disk Error Log message. This register contains the following:

- Bits 0—3 current head number (Bit 3 MSB)
- Bits 4—6 MSB current cylinder number (Bit 6 MSB)
- Bit 7
- 1 = Last sector read had Bad Sector bit set
- 0 = Last sector read had Bad Sector bit reset

28.3 RQDX3 S/A REGISTER CODE

This type of error log entry is NOT a packet. The Status/Address (S/A) register reports serious controller errors by putting a specific error code in the register and asserting an interrupt on the BUS. The host makes an error log entry with this information (S/A register error code). Many operating systems make an S/A-register-reported error look like a packet, but the packet is either garbage or all zeros. If the error report ever shows the S/A register with something in it, then it is likely an S/A register error code.

28.3.1 RQDX3 S/A Register on Line Error

The RQDX3 S/A register presents this format when the controller is online to the normal host operation. See Figure 28-4 and Table 28-4 for S/A error code description.

Figure 28-4 RQDX3 S/A Register Online Error

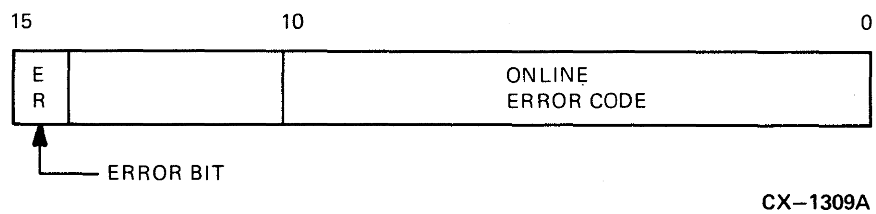


Table 28-4 RQDX3 S/A Register Online Error

Code	Description
1	Packet Read error
2	Packet Write error
6	Queue Read error
7	Queue Write error
11	Host Access timeout
16	Invalid Connection Identifier
24	Protocol Incompatibility error
25	Purge/Poll failure
26	Map Read error
703	Begin Power-up self-test
704	ROM checksum
705	QBUS DMA pointer (low)—read only

Table 28-4 (Cont.) RQDX3 S/A Register Online Error

Code	Description
706	QBUS DMA pointer (high)—read only
707	QBUS Interrupt Vector—read only
710	QBUS DMA CSR—read only
711	QBUS DMA Word count—read only
712	Data Recovery CSR—read only
713	Memory DMA Pointer—read only
714	Ram
715	Check for clip
716	Begin Port Initialization self-test
717	QBUS DMA CSR—R/W
720	Memory DMA pointer—R/W
721	Data Recovery CSR—R/W
722	QBUS DMA Word count—R/W
723	SMC9224 Register File pointer—R/W
724	SMC9224 Register File value—R/W
725	SMC9224 interrupt
726	RAM (not T-11 only)
733	Illegal interrupt (T-11 failure)
734	DUP Send Data failure
735	DUP Receive Data failure

Glossary

This is a generic DSA glossary. Some of the following terms may not appear in this manual but are found in other DSA product manuals.

ABORTED COMMAND: From the viewpoint of a class driver, any command for which the driver has issued an ABORT command. From the viewpoint of an MSCP server, a command for which the server has received an ABORT command, located the specified command, and taken explicit action to abort it. An aborted command will be either rejected or terminated.

ADAPTER: A device that adapts information from the host bus format to a different bus format. Sometimes controllers are referred to as adapters because they adapt information from the host bus format to the tape or disk drive bus (STI, SDI) format.

ATTENTION CONDITION: A status change in the drive significant enough to warrant controller interaction.

BAD BLOCK: A block containing a defect that:

- Exceeds the correction capability of the subsystem error correction scheme.
- Exceeds a drive-specified error threshold. Once a block exceeds this threshold, data integrity is not guaranteed.
- Imposes too great a strain on system performance. In this case, the subsystem still assures data integrity, but the extensive error correction required for each block access causes too great a strain on system performance.

BAD BLOCK REPLACEMENT: The process of replacing a bad block on a disk done in one of two ways: A bad block determined because, on being read, it produced a header error, an ECC error that is incorrectable, or an ECC error that exceeds the symbol level set for that particular drive but is correctable. The two types of replacement are:

- Primary—When the bad block has an ECC error (not a header error) and the replacement block (RBN - Refer to Block) is available at the end of the current track.
- Nonprimary—When the bad block has a header error or its RBN is not available at the end of the track.

BAD BLOCK REVECTORING: The process of finding the RBN for a bad block that has been replaced (see BAD BLOCK REPLACEMENT) indicating by the header of the block prior to reading or writing it. The header either has a code to indicate it is bad and which type of replacement was used or the header is bad. If the header code indicates a primary replacement, it is only necessary for the controller to wait until the RBN is available at the end of the track and use that block. If it reads a bad header, or the code indicates a nonprimary, the controller must reference the RCT to find the address of the RBN and then seek the drive to that block. If a bad header is read, and the RCT does not have a valid RBN for it, bad block replacement must take place before it is used.

BIT: The term bit stands for Binary Digit. A binary digit assumes one of two possible states: 0 or 1. Sometimes, the terms false and true, deasserted and asserted, or low and high are substituted for 0 and 1. However, care must be taken not to assume these terms are always synonymous. For example, a signal may be true when low, and therefore asserted. However, the physical logic level would be the low logic level which is usually associated with 0.

BLOCK: Block is synonymous with sector. A block is the smallest data unit addressable on a subunit. It occupies a specific physical position relative to the index, and it is available for reading or writing once per disk rotation. Five types of blocks follow:

- Diagnostic Block—Used for drive read/write diagnostics. This area is not visible to the host operating system. However, it is visible to the controller. Diagnostic block addresses are 28-bits wide and are called Diagnostic Block Numbers (DBNs).
- External Block—Contains the format control tables. The external block area is not visible to the host operating system. However, it is visible to the controller. External block addresses are 28-bits wide and are called External Block Numbers (XBNs).
- Logical Block—Contains the host applications area and the replacement and caching table. All logical blocks are visible to the host operating system. Logical block addresses are 28-bits wide and are called Logical Block Numbers (LBNs).
- Physical Block—Contains all the blocks on a subunit. DBNs, LBNs, RBNs, and XBNs are subsets of the physical block area. Physical block addresses are 28-bits wide and are called Physical Block Numbers (PBNs).
- Replacement Block—A reserved block used as a replacement for a bad block on a subunit. Replacement block addresses are 28-bits wide and are called Replacement Block Numbers (RBNs).

BYTE: A byte is a group of eight bits. For example, 10010101.

CLASS DRIVER: A class driver is a piece of software residing in the host that communicates with a class of devices, such as a disk class. The communication occurs via a port driver and MSCP messages. Hosts generally have a class driver for each class of device: disks, tapes, and the controller itself (for maintenance commands). For example, a disk class driver can communicate with a disk subsystem that has any combination of SDI disks. Contrast this with a device driver that can communicate with only one type of disk.

CLOCKS: Any signal that supplies timing or initiates an action on one or more devices can be considered a clock. A clock does not have to be continuous. Pertaining to the SDI bus: The clock signal for all the SDI lines is embedded within the SDI data pattern. Therefore, any data pattern (ones, zeros, or combination) generates a clock at the receiving device.

COMMAND AND RESPONSE RING BUFFER: For UNIBUS, QBUS, and some BI controllers: An area in host memory that the controller and host use for communication. The ring buffer points to the location in host memory that contains command messages from the host and response messages from the controller.

COMMAND CATEGORIES: All MSCP commands fall into one of the following four command categories:

- Immediate commands
- Nonsequential commands
- Sequential commands
- Special commands

Each command category has certain constraints on when they may be executed, thus limiting the scope of controller optimizations.

COMMAND TIMER AND RESPONSE TIMER: Mechanisms in the drive and the controller that monitor controller/drive communication. They signal (timeout) when controller/drive communication breaks down. Basically, if the drive doesn't receive a command from the controller, or if the controller doesn't receive a response from the drive, within the appropriate time, the command or response timer signals a breakdown in controller/drive communication.

COMMUNICATIONS PROTOCOL: A set of rules and conventions that devices use when communicating. For example, MSCP or SDI.

COMPLETED COMMAND: A command that the MSCP server executes entirely. The completed response is either SUCCESSFUL or ERROR.

CONNECTION: A software term indicating useful MSCP communication exists between the intelligent controller microcode and the class driver. Refer to CONTROLLER ONLINE, CONTROLLER OFFLINE, and CONTROLLER AVAILABLE.

CONTROL MESSAGE: A set of sequentially transmitted frames that begin with a start frame and terminate with an end frame. The message contents convey information between the controller and drive. Control messages from the drive are called responses and control messages from the controller are called commands.

CONTROLLER: An interface between the host computer and I/O peripherals. A controller communicates with the hosts via the Mass Storage Control Protocol and to the peripherals through the STI or SDI. Sometimes called an adapter because it adapts information from the host bus format to the SDI or STI format.

CONTROLLER AVAILABLE: State of the controller if its connection is not made but the controller recognizes a connection can be made.

CONTROLLER BYTE: One of the standard drive status bytes outside the generic status. It is used by the controller to record information necessary for the proper operation of the MSCP protocol.

CONTROLLER OFFLINE: Controller state if its connection is not made and the controller recognizes a connection cannot be made.

CONTROLLER ONLINE: Condition of the controller if it has a functioning connection to the class driver.

CONTROLLER TIMEOUT INTERVAL: A time interval, measured in seconds, supplied by the controller or MSCP server in the end message of the SET CONTROLLER CHARACTERISTICS command. Controllers or MSCP servers guarantee the completion of all immediate commands, plus some measurable amount of useful work on their oldest outstanding nonimmediate command within the controller timeout interval.

CYLINDER: See *DISK GEOMETRY*

DATA BIT TIME: At specific data rates, the time from data clock edge to data clock edge. For example, at 1 MHz the data bit time is 1/1MHz or 1 microsecond.

DATAGRAM COMMUNICATION SERVICE: A communication service used across the connection between a class driver and an MSCP server (controller). This service is used for MSCP error log messages. It must deliver messages with very high probability. Messages may (with very low probability) be delivered out of sequence, lost, or duplicated. The datagram communication service supports messages of at least 384 bytes.

DIAGNOSTIC BLOCK NUMBER (DBN): See *BLOCK*

DISK GEOMETRY: Disk geometry, in this case, refers to how a physical disk geometry is organized into a logical disk geometry. All SDI disks are organized into logical tracks, logical groups, and logical cylinders. The following describes the logical track, group, and cylinder interrelationships: A logical cylinder represents a collection of groups. A group represents a collection of tracks. A track represents sets of sectors which occupy contiguous physical disk locations. Cylinders, groups, and tracks are all related by access time; not by any physical properties. The following list relates cylinder, group, and track by their relative access times:

- Cylinder—It takes longer than one disk revolution (in time) to access a logical cylinder. A cylinder change requires a level 2 INITIATE SEEK command from the controller.
- Group—It takes less than one disk revolution (in time) to access a logical group. A group change requires a level 1 select GROUP type command from the controller.
- Track—A logical track can be accessed within the intersector time. (Intersector time is from the end of the current sector to the beginning of the next read/write sector.) A track change requires a level 1 select TRACK type command from the controller.

Since different drives have different access properties, they have a different logical geometries. Three examples follow:

- The RA80 has 4 platters and 7physical oxide surfaces used for data. Each data surface has two data heads for a total of 14. Any of the 14 data heads may be selected within the intersector time. Therefore, the RA80 has 14 tracks. These 14 tracks make up a group. A one PHYSICAL cylinder seek requires less than one revolution to perform. Therefore, the RA80 has 2 groups; the one its on and the group that is one PHYSICAL cylinder away. Any further positioning takes longer than one disk revolution so anything else is a logical cylinder change. Thus, the RA80 has a logical geometry of 14 tracks/group, 2 groups/cylinder, and 279 cylinders.

- Like the RA80, the RA81 has 4 platters and seven physical oxide surfaces used for data. Each data surface has two data heads for a total of 14. However, unlike the RA80, the RA81 servo technology requires head settling time greater than the intersector time when a head switch is performed. Therefore, the RA81 has only one track per group. The RA81 has 14 groups per cylinder because switching heads takes greater than the intersector time, but less than the disk revolution time. Any further positioning requires greater than one revolution to complete, and therefore constitutes a logical cylinder change. Thus, the RA81 has a logical geometry of 1 track/group, 14 groups/cylinder, and 1258 cylinders.

DRIVE-AVAILABLE: A drive state relative to the controller. The drive is operational, but is not currently drive online to any controller.

DRIVE-OFFLINE: A drive state relative to the controller. The drive is not operational and may not communicate with the controller via the drive control protocol.

DRIVE-ONLINE: A drive state relative to the controller. The drive is dedicated to the exclusive use of a particular controller and is not available to any other controller.

DRIVE-UNAVAILABLE: A drive state relative to the controller. The drive is operational and online to another controller.

EMBEDDED-CONTROLLER: A controller that does not use a standard interconnect with its devices, but instead is usually integrated with them. Such a controller must contain implicit knowledge of the characteristics of its devices.

END MESSAGES: The last frame of a sequentially transmitted message that began with a start frame. The end frame contains a checksum for all the data fields of the message start and continuation frames.

ERROR BYTE: One of the status bytes in the get status response the controller receives from the disk drive.

ERROR CORRECTION CODE: The error correction code is a code that is added to the end of a block of data when it is written onto the disk. This code is generated by the controller the data is sent out to the disk and is added to the block as part of the data stream. This code is used to identify and correct data bit errors that occur between the controller writing the data and when reading it back again.

ERROR LOG MESSAGES: Error Log messages pass error information from the controller to the host.

EXCHANGE: A pair of control messages. The first control message in an exchange is a command issued by the controller. The second control message in an exchange is a response sent by the drive.

EXTENDED STATUS: The additional set of status information maintained by the drive that is of interest to a host error log. Extended status is drive-type specific and is not utilized by the controller except as input to the host error log and diagnostic processes.

EXTERNAL BLOCK NUMBER (XBN): See *BLOCK*

FORCED ERROR: A forced error indicates data in a block is unreliable. A forced error is one which is generated by reading a block and getting an incorrectable ECC error. When the block is replaced, the replacement block (RBN), although good in itself, has bad data in it and is therefore said to have a forced error in it. Some form of flag is then set in that block to indicate the forced error status (refer to FORCED ERROR INDICATOR). The forced error status is removed when the RBN is written into again.

FORCED ERROR INDICATOR: The logical flag, present in each disk block, used to record the presence of a Forced error. Depending upon the detailed, low level format of the disk device, this may be implemented as an actual bit flag or as a special pattern (such as the complement of the normal value) of error-correcting and/or error-detecting codes.

FRAME: Frame refers to serial data streams. For the SDI it is a 16-bit quantity. It is the smallest unit of control information, command information, or response information passed between the controller and the disk drive by the interface hardware.

GENERIC STATUS: A subset of the status information maintained by the drive that is independent of drive type. It provides the basic information necessary for normal drive operation.

GROUP: See *DISK GEOMETRY*

HOST: The central processing unit connected to the controller.

IMMEDIATE COMMANDS: Commands that MSCP servers should execute immediately, without waiting for any other commands to complete. Immediate commands are typically status inquiries and must be completed within the controller timeout interval.

LEVEL 0, LEVEL 1, LEVEL 2: Refers to layers of the Standard Disk Interface (SDI).

- Level 0—The electrical interface.
- Level 1—The Real-time SDI operations. These operations include the protocol associated with the Real-time Controller State (RTCS) line and the Real-time Drive State (RTDS) line. It also refers to Level 1 Real-time data commands, such as Select Group. These commands do not have the start-continue-end frame format associated with the Level 2 commands. Level 1 commands also do not require a response from the drive.
- Level 2—The SDI command and response protocol. Level 2 commands require the start-continue-end frame format. Also, for each level 2 command the drive receives, the drive must respond with a level 2 response.

LOGICAL BLOCK NUMBER (LBN): See *BLOCK*

LOGICAL CYLINDER: See *DISK GEOMETRY*

LOGICAL GROUP: See *DISK GEOMETRY*

LOGICAL TRACK: See *DISK GEOMETRY*

MASS STORAGE CONTROL PROTOCOL (MSCP): A set of messages that allows the host to communicate with intelligent controllers.

MESSAGE: A nonreal-time exchange of frames between a controller and disk drive. It is comprised of a command (which the controller sends to the disk drive) and its response (which the drive sends to the controller). See LEVEL 0, LEVEL 1, LEVEL 2.

MODE BYTE : One of the status bytes in the generic status. It is used to store the current state of drive-operating modes that the controller can alter.

MSCP SERVER: Server that processes host MSCP commands and sends responses to host commands back to the issuing class driver.

MULTI-UNIT DRIVES: A single drive attached to the controller via a single SDI cable which has media divided into multiple independent subunits, each subunit representing a distinct logical unit to the host. The SDI limits the number of multiple subunits to four.

NONSEQUENTIAL COMMANDS: MSCP servers may rearrange execution of nonsequential commands to optimize performance. The optimization may not move a nonsequential command past the barrier imposed by a sequential command.

PHYSICAL BLOCK NUMBER (PBN): See *BLOCK*

PORT DRIVER : A software message handler that passes MSCP messages between the class driver and a specific controller.

PRIMARY REPLACEMENT BLOCK: See *BAD BLOCK REVECTORING*

PROTOCOL: See *COMMUNICATIONS PROTOCOL*

READ DATA: Relative to a particular device, read data is data it receives. The term read data may also indicate data read from the disk surface, relative to any device.

REAL-TIME COMMANDS: Level 1 frames sent from the controller to the drive.

REINITIALIZATION: Resetting all devices in a system to a known state. Intelligent subsystems generally execute minimum integrity diagnostics before entering the proper idle state.

REJECTED COMMAND: A command the MSCP server rejects, discards, aborts, or otherwise finishes before it begins the command execution.

REPLACEMENT BLOCK NUMBER (RBN): See *BLOCK*

REQUEST BYTE: One of the status bytes in the generic status. It is used to signal requests from the drive for controller action.

RESPONSE TIMER: Implemented by the controller to detect a nonfunctioning disk drive.

SDI-CONTROLLER: A controller that attaches to drives via the SDI interconnect.

SECTOR: See *BLOCK*

SEQUENTIAL COMMANDS: Commands MSCP servers must execute in the exact order as received from class drivers. Sequential commands typically change a unit's state or context.

SPECIAL COMMANDS: Commands that have both the execution order constraints of nonsequential commands, plus certain special, command-dependent execution order constraints.

STANDARD DISK INTERFACE (SDI) BUS : The SDI bus is a four-signal radial bus that uses messages and protocol to communicate with the disk drives.

STATE BIT TIME: See *DATA BIT TIME*

SUMMARY STATUS: This is a partial set of the available status.

SYMBOL: A group of bits of data that can, using the ECC (see ERROR CORRECTION CODE) dat on a block and a correction algorithm, be in error and be corrected. Each type of DSA disk has a different number of symbols that can be in error in a block before that block is said to bad and needs replacing after the correction has taken place. There is a different and higher level of symbols that can be in error, and the controller cannot correct all of the data; this is said to be incorrectable.

SYNC CHARACTER: Can be any recognizable character (bit) or series of characters in a serial data stream that synchronizes the receiver circuitry so that meaningful data is received.

TERMINATED COMMAND: A command the MSCP server terminates after it has been partially executed.

TRACK: See *DISK GEOMETRY*

WRITE DATA: Relative to a particular device, write data is data that it transmits. The term write data may also indicate data recorded on the disk surface, relative to any device.

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