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Volume III: Peripherals

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CS/80 Disk Diagnostic

Introduction

The CS/80 Disk Diagnostic (`CS80DIAG`) is designed to provide a means of testing CS/80 disks on any system that supports the Online Diagnostic Subsystem. The disks that are tested using this diagnostic are those that utilize the Command Set 80 (CS/80) message protocol for communication with the SPU. The types of tests that are provided can:

- Perform an extensive fault isolating diagnostic trouble tree on the disk and it's system interface. Defects encountered are relayed to the user.
- Verify the integrity of the HPIB data path to the selected disk.
- Identify the product type of the selected disk.
- Perform the internal selftest on the disk.
- Obtain and decode status messages from the disk.
- Test common transactions that are used in communication between the disk and CPU to determine the integrity of these transactions.

In addition, an external exerciser has been implemented, which provides an interactive environment through which the user can access internal disk diagnostics, logs and utilities .

`CS80DIAG` tests the following disk drives:

- HP7907A
- HP7911, 7912, 7914
- HP7933H, 7933XP, 7935H, 7935XP, 7936H, 7936XP, 7937H, 7937XP
- HP7957A, 7957B, 7958A, 7958B, 7959B
- HP7961B, 7962B, 7963B
- HPC2200A, HPC2202A, HPC2203A

Note

This diagnostic does not test the HP9122D, 9122S, and the 9127A SS/80 disk drives. Refer to the SS/80 Disk Diagnostic (`SS80DIAG`) in this manual to test those drives.

Also, this diagnostic does not test the HPC2201A, HPC2204A, HP7936FL or HP7937FL Flex disk drives. Refer to the Fiber Link Exchange (FLEX) Disk Diagnostic (`FLEXDIAG`) in this manual to test these drives.

This diagnostic runs on any HP Precision Architecture RISC computer system that supports Online Diagnostic Subsystem programs and is capable of detecting failures of one or more Field Replaceable Units (FRUs). The CS/80 Disk Diagnostic will:

- Identify the product type of the selected disk
- Run internal diagnostics on the disk (including selftest)
- Obtain and decode status messages from the disk
- Obtain and decode information from the disk error logs
- Isolate and identify one or more defective FRUs.
- Test common transactions used in communication between the disk and CPU to determine their integrity.
- Test certain CS/80 functions with a reserve area if available.
- Provide a CS/80 Disk External Exerciser

Defects and Enhancements

Submit defect reports and enhancement requests concerning this diagnostic through the STARS database referencing product number 30600-10001.

Minimum Configuration

The hardware required to run the diagnostic consists of an HP Precision Architecture RISC computer system with a supported (see above) CS/80 disk drive connected to it. The CS/80 disk under test must contain internal selftests that are capable of detecting failed Field Replaceable Units (FRU's) in the disk drive.

Operating Instructions

There is no special security level needed in order to run this diagnostic. However, any sections or steps of the diagnostic that have the potential to compromise system integrity will be restricted to certain security levels. Refer to the section on the DUI for information on the available security levels and test modes, and how each are determined.

Default Tests

If the user did not specify sections and steps to be run, the default section will be executed. The default section is section 10, the fault isolating diagnostic trouble tree.

```
Section 10    Diagnostic Trouble Tree
```

RUN Command

To bring up the Online Diagnostic subsystem, enter the following command to the MPE XL system prompt:

```
SYSDIAG
```

To bring up the Online Diagnostic subsystem, enter the following command to the HP-UX system prompt:

```
% /usr/diag/bin/sysdiag
```

The system responds with the following Diagnostic User Interface prompt:

```
DUI >
```

Typing HELP causes a summary of the DUI and its commands to be printed. Refer to the DUI Section of this manual for details.

Note

The device to be tested must be powered up and on line. Device physical locations (pdev) shown in the RUN commands are those of the devices on the "typical A1002A" system configuration described in the chapter on DUI. The pdev value entered must be correct for the system being tested.

For example, to run the diagnostic, you might enter:

```
DUI >RUN CS80DIAG pdev=4.1.0 <RUN Command Options>
```

none required for default test suite

insert physical location of device to be tested here; for MPE XL, type the ldev number; for HP-UX, type the devfile name

Test Execution

Various error options are used by the RUN command. A detailed description can be obtained by referring to the DUI section of this chapter. Enter the desired run parameters at this point. The diagnostic responds with the following header and welcome message:

```
*********************************************************
*****                                                ***
*****              CS/80 DISC DIAGNOSTIC             ***
*****                                                ***
***** (C) Copyright Hewlett Packard Co. 1987,1988,1989 ***
*****                All Rights Reserved.            ***
*****                    Version A.02.01             ***
*****                                                ***
*********************************************************
Welcome, Today is FRI, Aug 5, 1982  7:39 AM
```

At this point, the diagnostic calls *IO_Path_Test,* which is a diagnostic procedure that tests the I/O path to the device. If the status returned from this procedure call is `fail`, the following message will be output:

```
*** WARNING -- THE I/O PATH TO THE DISK MAY NOT BE FUNCTIONING
PROPERLY (CS80ERR 100)
```

Otherwise, the diagnostic issues a **describe** to the specified device to determine whether or not it is a CS/80 disk. If the device does not respond to the **describe** command, the following message will be output:

```
***  DEVICE FAILED TO RESPOND TO DESCRIBE COMMAND IN ALLOTTED TIME
(CS80ERR 101)
```

A second **describe** command is then issued. If this command fails, the following messages are displayed:

```
*** DEVICE FAILED TO RESPOND TO DESCRIBE COMMAND IN ALLOTTED TIME
(CS80ERR 101)

*** CS/80 DESCRIBE COMMAND FAILED.  DEVICE MAY NOT BE CS/80 OR
DESCRIBE INFORMATION RETURNED MAY BE ERRONEOUS.  CS80DIAG MAY NOT
FUNCTION PROPERLY (CS80ERR 207)

Do you wish to continue (Y/N) [N]?
```

If the user answers no, the diagnostic will terminate immediately.

At this point, the sections specified by the user will be executed, and the results will be output. If the user did not specify sections to be run, the default section (Section 10, the fault isolating diagnostic trouble tree) will be executed. If CS80DIAG is run as an autodiagnostic by the system, the default section will be run. If at any time, the number of errors generated reaches the limit specified by the user in the ERRCOUNT parameter of the run command, the following message will be output:

```
*** THE MAXIMUM NUMBER OF ERROR MESSAGES HAS BEEN EXCEEDED
    (CS80ERR 110)
```

The diagnostic will then terminate execution. If the ERRPAUSE option of the run command was set "on", the diagnostic will stop after each error is generated and ask the user if the test should continue:

```
Continue (Y/N) ? [Y]
```

If the response is "Y", then the test will be resumed if possible; if the response is "N", the diagnostic will terminate. The "[Y]" indicates that "Y" will be the default response if the user hits <CR> in reply to the prompt. If the sections and steps specified by the user were executed the number of times specified in the LOOP parameter of the run command without the number of errors exceeding the ERRNUM value, the diagnostic will terminate normally and the following message will be output:

```
CS80DIAG Disk Diagnostic Exiting ...
```

Upon termination of CS80DIAG, control will return to the diagnostic subsystem.

Test Section Descriptions

There are two diagnostic program sections which are available for user selection.

```
Section 10          Diagnostic Trouble Tree
Section 17          CS/80 External Exerciser (Interactive Section)
```

A description of each section will be given, along with the expected output from that section.

Section 10—DIAGNOSTIC TROUBLE TREE

This section will execute the fault isolating diagnostic trouble tree. The algorithm follows:

1. Perform a Write Loopback followed by a Read Loopback to test the channel.
2. Issue an internal power-on SELFTEST to the device.
3. Read sector twice and compare the data.
4. Read the device FAULT LOGS and decode any entries.
5. Read the device RUN LOGS, if entries exist perform an RO ERT on the suspect block. If the RO ERT generates an error type output the block address and the error type generated.

Output:

```
        Section 10 -- Diagnostic Trouble Tree

        Write Loopback Completed

        Read Loopback Completed

        Device Selftest Completed

        Read Sector Completed

FAULT LOG

        No Drive Faults To Report
                  {or}
  {For HP791X, HP7933/35}
        There are nnnn entries in this log

        Fault log values:

             Current              Target
        Cyl   Head  Sect    Cyl   Head  Sect      HFR       Fault Code
        ====  ====  ====    ====  ====  ====    ========    ==========
      * nnnn  nnnn  nnnn  * nnnn  nnnn  nnnn    BBBBBBBB    DERR nnnn
                                                    {or}
                                                TERR nnnn
        .
        .  Repeat for each entry in the log
        .
        nnnn  nnnn  nnnn    nnnn  nnnn  nnnn    BBBBBBBB    DERR nnnn
                                                    {or}
                                                TERR nnnn

        "*" Indicates a PHYSICAL address -- DO NOT attempt
            to spare this address
```

```
{If any entries were printed}
   The HFR values are:
      01234567
      ========
      XXXXXXX1  The spindle speed is down
      XXXXXX1X  The heads are off track
      XXXX1XXX  Track follower PLL error
      XXX1XXXX  The top door is open
      XX1XXXXX  Emergency Retract is set
      X1XXXXXX  Power failure occurred
      1XXXXXXX  Read/Write fault occurred

{Note: The above table is specific to HP7933/35 drives.
       The values in this table will be changed
       appropriately for other drive types.}

   RUN Log

   No Drive Run Log Entries
              {or}
   Performing RO ERT On Run Log Entries
{If error type found}
        Logical          Error
   Cyl   Head  Sect   Type    Count   Error
   ====  ====  ====   =====   =====  ========
   nnnn  nnnn  nnnn    XXX    nnnn   BBBBBBBB
   nnnn  nnnn  nnnn    XXX    nnnn   BBBBBBBB
   .
   .   Repeat for each entry generated
   .
   nnnn  nnnn  nnnn    XXX    nnnn   BBBBBBBB


The error types are:
         COR = ECC correctable error
         UNC = ECC uncorrectable error
         CRC = only CRC detected an error
         F/S = formatter/separator error
         *** = decode error manually
```

```
The Error values are :
   XXXXXX00  ECC found correctable error
   XXXXXX01  ECC found uncorrectable error
   XXXXXX10  ECC did not detect an error
   XXXXX1XX  error is in sector header not body
   XXXX1XXX  CRC did not detect an error
   XXX1XXXX  first retry didn't get data
   XX1XXXXX  extra offset was used
   X1XXXXXX  Formatter/Separator error
```

{*Note: The above table is specific to HP7933/35 drives. The values in this table will be changed appropriately for other drive types.*}

```
End of Section 10 -- Diagnostic Trouble Tree
```

Possible Error Messages:

```
*** ERROR IN TRANSMISSION DETECTED DURING READ
    LOOPBACK TEST: (CS80ERR 115)
```

Byte #	Octal Value Transmitted	Octal Value Received	Bit Positions In Error 01234567
12	56	54	00000010
33	127	63	01100100
.			
.			
.			
241	74	72	00000110

{Note: -- entries in the preceding table will be printed for as many errors as were detected, unless the ERRNUM value is ezceeded}

```
*** DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE
    CS/80 INITIATE DIAGNOSTIC COMMAND (CS80ERR 109)
    STATUS = { status }
```

{Note: -- This status printout will include the failing field replaceable unit(s) as specified by the device}

```
*** IDENTICAL READS FROM DISK RETURNED NON-IDENTICAL
    DATA (CS80ERR 121)
```

Section 17—CS/80 External Exerciser

The CS/80 External Exerciser is an interactive section that provides the user with access to the set of internal diagnostics, logs, and utilities within a CS/80 disk. This section explains what different kinds of data the exerciser can provide, how that information is generated and describes the commands available to the user. To run the External Exerciser select Section 17 of the CS/80 diagnostic. The `CS80DIAG>` prompt appears indicating that the Exerciser is waiting for a command from the user. Refer to the Command Descriptions and the Exerciser Command Format explanations below for further details.

Error-Rate Testing

Error-rate tests are powerful tools used to determine media integrity within a CS/80 device. These tests can find correctable and uncorrectable read errors and provide information concerning each error, such as the address where the error occurred, the type of error, and the number of times it has occurred. This information can be displayed to the user and/or logged on the disk maintenance tracks, which are reserved for such use. These tracks provide non-volatile storage, not only for error-rate test errors, but also for spare track addresses, drive faults, and special worst case data patterns which are written on the disk in certain error-rate tests.

All error rate tests allow the user to input a loop count when requesting the test. Each time an error is detected during the test, the test will stop, report the error, and then resume testing until the loop count has been satisfied. The loop count is not a count of the number of errors, but rather the number of passes the device will execute during the error-rate test. The following information will be reported for each error that occurs:

- The current logical address.
- The error type.
- The loop count when the error occurred.
- An error information byte.

There are two general types of error rate tests that can be performed. The first type, called a read only error rate test, is a non-destructive test which reads data from the disk and attempts to detect any read errors that occur. There are two tests available in this category:

1. **Read Only Error-Rate Test**—Sequentially reads the current data on the disk in a specified area of the media.
2. **Random Read Only Error-Rate Test**—Reads 256 random sectors of random length data. This allows read errors to be detected on a large portion of the media in a minimum amount of time.

The second type of error-rate test, called a write-then-read error-rate test, is a destructive test which writes data onto the media and subsequently reads it back, attempting to detect such things as sensitive bit patterns, read errors, and media defects. When requesting an error-rate test in this category, the user is allowed to specify a pattern to be used in the test. This pattern can be defined and edited via the `SET PATTERN` command. If the user chooses not to enter a pattern, a choice will also be given to use worst case data patterns already residing on the disk maintenance tracks, or random data generated by the disk. There are three types of write-then-read error rate tests available to the user:

1. **Pattern Write-Then-Read Error-Rate Test**—Sequentially writes a specified data pattern over a specified area of the media and then reads back all of the data that was written.
2. **Random Write-Then-Read Error-Rate Test**—Writes-then-reads 256 randomly generated data patterns of random length at random locations on the media. This test locates errors that occur over a large area of the media in a minimum amount of time.
3. **Short Write-Then-Read Error-Rate Test**—Executes a combination of random error-rate tests on the inner 100 cylinders of the disk. This test provides a quick verification of the media (For HP791X and HP793X drives only).

Error Logging

During run-time, the error correction circuitry of the drive is enabled. If an error is detected that cannot be corrected by this circuitry, it will be logged to an area of random access memory (RAM) on the drive is used to record up to 5 uncorrectable data errors. If this area becomes full during run-time, which is defined to be any time in which a test, diagnostic, or utility is not being performed, the device requests release so that it can log the error information in the run-time drive error log on the maintenance tracks. All error logging is done automatically by the drive.

When error-rate tests are run, the error correction circuitry is disabled, thus allowing correctable and uncorrectable errors to be logged. These errors are logged in the same manner as run-time errors, assuming the user requested errors to be logged, except when the RAM is full in which case the drive requests release and logs the errors to the error-rate test log, also on the maintenance tracks. When the error-rate test begins, a preset drive utility is issued, which forces any errors recorded in the RAM area to be logged to the maintenance tracks, and then the RAM area is cleared, thus avoiding confusion between old errors and ones detected during the error-rate test.

In addition to run-time and error-rate test logging capabilities, an error summary is maintained by HP791X drives, which is an accumulation of all test errors (TERRORS) that have occurred since the last time the logs were cleared. Each device has its own list of TERRORS provided in the service manual for that particular device.

One additional log exists on the maintenance tracks that has not been mentioned, the fault log. This log is used to store all drive and controller faults which have occurred since the last time the logs were cleared.

Sparing

All CS/80 disk drives provide the means to replace defective sectors or tracks with good ones. This operation is referred to as "sparing". Each track on a CS/80 drive contains one extra sector which does not appear in the user's data space. This sector is set aside as a spare sector to be used in the event that a bad sector is found somewhere on the track and needs to be removed. By using the CS/80 SPARE BLOCK command, the spare sector can be substituted for the bad sector. If more than one bad sector appears on the track, the entire track would be spared using one of several spare tracks on the disk set aside for this purpose. An option is provided with the SPARE BLOCK command to either retain data or not. If data retention is specified, all data on the track will be retained, with the exception of the target sector that is being spared. If no data retention is specified, no data on the track being spared will be retained.

The **CS80DIAG EXTERNAL EXERCISER SPARE** command attempts to perform pseudo intelligent sparing. Following is the data retention portion of the spare algorithm:

1. Attempt to read the data from the target sector to be spared.
2. Spare the sector retaining track data.
3. Attempt to write the target sector data back to the new address of thespared sector.
4. If spare retaining data fails, and user has DESTRUCTIVE ACCESS prompt to perform a spare not retaining data.

HP7907 drives provide the option of sparing a maintenance track. Two types of maintenance tracks can be spared, logging or scratch. Scratch maintenance tracks are used by the sparing operation to hold the data of the target track while the operation takes place. Logging maintenance tracks are used by the drive to store ERT patterns and drive logs.

The **CS80DIAG EXTERNAL EXERCISER SPARE** command will conform to the following algorithm:

{*The following is for MPE/XL only*}

1. Attempt to read the data from the target sector.
2. If data was recovered, then attempt a spare retaining data command.
3. If the spare retaining data command was successful, rewrite the data to the target sector.

{*The following is executed for DESTRUCTIVE access*}

1. If an HP7907, ask user if a maintenance track should be spared.
2. If not a maintenance track spare, then attempt to recover target sector data.
3. If data was recovered, perform a spare retaining track data and rewrite target sector data.
4. If data was not recovered, warn of data loss and prompt to continue.
5. If spare retaining data failed, warn of data loss and prompt to perform a spare not retaining track data.
6. Attempt a spare not retaining data command.

Command Descriptions

When the external exerciser is invoked, the following prompt will be displayed to the user:

```
CS80DIAG>
```

When the prompt appears, the exerciser is waiting for a command from the user. The available commands are listed in this section in alphabetical order accompanied by descriptions. Each command description is in the following format:

COMMAND NAME

Explanation of what the command does and when it should be used.

Input:

```
CS80DIAG>COMMAND NAME
```

The prompt for this exerciser is "CS80DIAG>". The appearance of this prompt indicates that the exerciser is waiting for the user to input a command.

Output:

Information printed as a result of this command being executed

Any error messages that may be worth noting are listed in this area.

There are several conventions used throughout this section in the command formats. They are as follows:

nnnn	refers to a decimal number of any magnitude that is output by the diagnostic.
vvvv	refers to a decimal number of variable magnitude that must be input by the user.
H	refers to a hexadecimal digit (0-F).
O	refers to an octal digit (0-8).
B	refers to a binary digit (0-1).

Any text enclosed in parenthesis indicates that the user is expected to input that text in response to a query from the diagnostic. Text enclosed in square brackets indicates the default response that will be assumed if the user simply hits (Return) in response to the query. For example, the user may be asked if the program should continue by the following question:

```
Do you wish to continue (Y/N)[ N ]?
```

The text enclosed in the parenthesis (i.e. "Y / N") indicates that the user is to type either a "Y" or an "N" in response to the question. Each option is separated by a "/". The default response in this case would be "N", as indicated by the [N] prior to the question mark. If there is no default response listed (enclosed in square brackets), the user will not be allowed to "default" the input by only entering a (Return).

Comments in the input and output sequences are enclosed in curly brackets and are not output by the program. For example, following the question in the previous example, the input sequence would probably look something like the following:

{*if response was N this command will terminate*}

Error messages will be preceded by three asterisks (***) and will be in all upper case letters. Other messages will not be all upper case and will not be preceded by the asterisks.

If the user enters a command in response to a prompt and that command is not recognized as an exerciser command, the following message will be displayed:

```
***YOUR RESPONSE WAS INVALID

CS80DIAG>
```

This message simply means that the command entered is not part of the command set for the external exerciser.

When the user enters a command that is recognized by the external exerciser, that command will be processed according to the corresponding command description given in the following sections of this document. If an error is encountered as a result of issuing a CS/80 command to the device, the status that is returned by the device will be displayed to the user. The status display will consist of some device identification information followed by several categorized error messages. The categories are:

Reject Errors indicate illegal interaction with the device such as an opcode error. These errors result when commands are sent to the device but not recognized by it.

Fault Errors indicate hardware failures.

Access Errors indicate media absence, formatting problems, or operator intervention.

Information Errors indicate potential problems or performance irregularities in the device.

The format of the output status message follows:

```
Status =

Unit = nnnn       Volume = nnnn

No units with pending status
          or
Unit nnnn has status pending
```

{*One or more of the following status messages may be printed*}

```
>>>>>>>>>> REJECT ERRORS <<<<<<<<<<
Received a command without odd parity
Received an unrecognized opcode
Received an illegal volume or unit address
Received an address which exceeds device bounds
Received an illegal parameter
Received a parameter of the wrong length
Received a message out of sequence
Received a message of the wrong length

>>>>>>>>>> FAULT ERRORS <<<<<<<<<<
Error occurred during copy data transaction --
   Units experiencing errors are :
      nnnn, nnnn, nnnn, nnnn
Controller hardware fault
Unit hardware fault
Hardware failed diagnostic --
   Failed part numbers are : nnnn, nnnn
   Test error numbers = nnnn, nnnn
Power failed or drive just powered on
Auto Release has been completed -- Retransmit last command

>>>>>>>>>> ACCESS ERRORS <<<<<<<<<<
Illegal parallel operation
Media has not been initialized or is unusable
Spare Block cannot be executed -- No spare media available
Drive is not ready for access
The selected volume is write protected
A block accessed during a read has not been written
Multiple unrecoverable data errors have occurred
Unrecoverable data has been detected --
   Address of bad data is:
   Block address = nnnn
            or
   Vector address =
      Cylinder = nnnn     Head = nnnn     Sector = nnnn
End of file encountered
End of volume encountered
```

```
>>>>>>>>>> INFORMATION ERRORS <<<<<<<<<<
Device is requesting operator release
Device is requesting diagnostic release
Device is requesting maintenance release
Only one spare track remains on the disc
A latency was introduced during the transfer due to slow
   transfer rate or seek retry
A defective block has been automatically spared
Multiple recoverable data errors have occurred
A latency was introduced to correct a data error --
   Address of bad block is:
   Block address = nnnn
              or
   Vector address =
      cylinder = nnnn     head = nnnn     sector = nnnn

New Target address is:
   Block address = nnnn
              or
   Vector address =
      cylinder = nnnn     head = nnnn     sector = nnnn
```

{if one of the drive errors is a 64 (for HP791X/HP793X) then the following messages will be output:}

```
  Hardware Fault Register = BBBBBBBB
  The Hardware Fault Register values should be interpreted as:
 HFR
========
XXXXXXX1  The spindle speed is down
XXXXXX1X  The heads are off track
XXXX1XXX  Track follower PLL error
XXX1XXXX  The top door is open
XX1XXXXX  Emergency retract is set
X1XXXXXX  Power failure occurred
1XXXXXXX  Read/Write fault occurred
```

The above table is specific to HP7933/35 drives. The values in this table will be changed appropriately for other types of drives.

Only the portions of the above status display that correspond to errors indicated by the hardware status variable will be output. This means, for example, that if no Access Errors were indicated by the status, none of the messages listed under that heading would be output.

In order to exit the exerciser, the EXIT command should be entered (see EXIT command description).

Command Summary

The following is a list and brief description of each of the commands available to the CS/80 External Exerciser:

ADDRESS	Allows the user to convert block addresses to 3-vector addresses and vice versa.
AHA	Issues a **PRESET** command, followed by a Read-Only Error-Rate Test (RO ERT).
CACHE LOG	Allows the user to access the Cache Memory Error Test Log.
CACHEOFF	Allows the user to disable the disk controller cache memory.
CACHEON	Allows the user to enable the disk controller cache memory.
CACHE SIZE	Allows the host to change the read cache page size.
CLEAR COMMAND	Performs a CLEAR operation on the disk.
CACHE STATS	Allows the user to access the Cache Statistic Table.
CLEAR LOGS	Clears the Run-Time Data Error Log, the Error-Rate Test Data Log and the Drive Fault Log.
DESCRIBE	Obtains a CS/80 describe message from the device being tested and displays the contents to the user in text form.
DIAG	Initiates internal diagnostic tests which reside in the disk drive.
ERRSUM	Lists all test errors that have occured in the device.
ERT LOG	Allows the user to access the Error-Rate Test Data Error Log.
EXIT	Terminates the External Exerciser.
FAULT LOG	Allows the user to access the Drive Fault Log.
HELP	Provides access to information concerning the commands that are available in the external exerciser.
INIT MEDIA	Allows the user to format the disk media.
LOOPBACK	Performs a write loopback of 256 bytes of data.
MEDIA TEST	Enables the user to test the hardware/data path of the drive.
PRESET	Forces errors stored in the drives RAM to be logged to the maintenance track.
PRINT PHYSICAL	Enables the printing of *physical* addresses in the FAULT logs.

READ	Allows the user to access any data block on the selected device.
READCACHEOFF	Allows the user to disable the disk controller read cache memory.
READCACHEON	Allows the user to enable the disk controller read cache memory.
RESET STATS	Resets the Cache Statistics Table.
REV	Allows the user to read the revision numbers of the ROMs.
RFSECTOR	Allows the user to read a full sector of data from the disk starting at any valid address.
RO ERT	Initiates a read only error-rate test.
RUN LOG	Allows the user to access the Run-Time Data Error Log.
SENSE	Allows the user to read the Hardware and Read/Write Fault registers.
SERVO TEST	Executes the drives internal butterfly seek routine.
SET PATTERN	Allows the user to define and edit a pattern to be used in the write-then-read error-rate tests.
SPARE	Allows the user to spare a block or sector to an address which is reserved for sparing.
SUSPEND	Suspends `CS80DIAG` and returns to the DUI.
TABLES	Provides access to information tables which reside in the drive.
UNIT	Allows the user to set the unit number within the drive.
WRITECACHEOFF	Allows the user to disable disk controller write cache memory.
WRITECACHEON	Allows the user to enable disk controller write cache memory.
WTR ERT	Initiates a write then read error-rate test.

The following pages provide a detailed description of the available CS/80 External Exerciser commands. The description includes information about input and output command formats, and possible error messages.

ADDRESS

The ADDRESS command is a **Normal Mode** command which allows the user to convert block addresses to 3-vector addresses and vice versa. The conversion will be made using the maximum address for the device that is currently selected. This maximum address will be obtained via the CS/80 DESCRIBE command which will be issued before the conversion is made if it has not been done so earlier.

Input:

```
CS80DIAG>ADDRESS

Convert from block or 3-vector
   addresses (B/V) [V]?

     {if response was B}
Enter block address (<cr> to keep current value) --
    Block address = nnnn?

     {if response was V}
Enter 3-vector address (<cr> to keep current values) --
    Cylinder address = nnnn?
    Head address     = nnnn?
    Sector address   = nnnn?
```

Output:

```
ADDRESS UTILITY
Selected device is an HPXXXX disk drive

  {for block addresses to 3-vector addresses}
Block address nnnn is equivalent to 3-vector address:
    Cylinder = nnnn    Head = nnnn    Sector = nnnn

    {for 3-vector addresses to block addresses}
3-vector address:
   Cylinder = nnnn    Head = nnnn    Sector = nnnn
   is equivalent to block address nnnn

ADDRESS UTILITY COMPLETED
```

AHA

This **Normal Mode** command, unique to HP7933 and HP7935 disk drives, issues a PRESET command, followed by a Read-Only Error-Rate Test (RO ERT). The error-rate test che cks random addresses.

Input:

```
CS80DIAG> AHA

   Input the loop count (nnnn <= count <= nnnn) [nnnn]?
```

Output:

```
AUTO HEAD ALIGNMENT UTILITY
Selected device is an HPXXXX disk drive.

AUTO HEAD ALIGNMENT UTILITY COMPLETED
```

CACHE LOG

This **Normal Mode** command allows the user to access the Cache Memory Error Test Log which contains the number of cache memory correctable errors and cache memory uncorrectable errors.

Input:

```
CS80DIAG> CACHE LOG
```

Output:

```
READ CACHE ERROR LOG UTILITY
Selected device is an HPXXXX disk drive.

Cache Memory Error Test Log
===========================
Number of cache memory correctable errors = nnnn
Number of cache memory uncorrectable errors = nnnn

READ CACHE ERROR LOG UTILITY COMPLETED
```

CACHEOFF

This **Normal Mode** command allows the user to disable disk controller cache memory.

Input:

```
CS80DIAG> CACHEOFF
```

Output:

```
   CACHE CONTROL UTILITY
   Selected device is an HPXXXX disk drive.

{If write cache is present}
   Write cache stopped
   Read cache stopped

   CACHE CONTROL UTILITY COMPLETED
```

CACHEON

This **Normal Mode** command allows the user to enable disk controller cache memory.

Input:

```
CS80DIAG> CACHEON
```

Output:

```
   CACHE CONTROL UTILITY
   Selected device is an HPXXXX disk drive.

   Read cache started
{If write cache is present}
   Write cache started

   CACHE CONTROL UTILITY COMPLETED
```

CACHE SIZE

This **Normal Mode** command allows the user to modify the read cache page size for HPC2202A disk products.

Input:

```
CS80DIAG> CACHE SIZE

     ****************************************************
     *                    CAUTION                       *
     *      This command may affect system performance. *
     ****************************************************

     Do you wish to continue (Y/N) [N]?
```

{If response was Y}

```
     Read Cache Page Sizes:
       2 - 4096 bytes
       3 - 8192 bytes
       4 - 16384 bytes
       5 - 32768 bytes
     Input cache size (2 <= size <= 5) [2]?
```

Output:

```
     SET READ CACHE PAGE SIZE UTILITY
     Selected device is an HPXXXX disk drive

     Cache Page Size Has Been Set

     SET READ CACHE PAGE SIZE UTILITY COMPLETED
```

CACHE STATS

This **Normal Mode** command allows the user to access the Cache Statistic Table.

Input:

```
CS80DIAG> CACHE STATS
```

Output:

```
    CACHE STATISTICS TABLE UTILITY
    Selected device is an HPXXXX disk drive.

    Cache Statistic Table
    ---------------------
    Read cache enabled
    {if write cache is present}
    Write cache enabled

    Cache page size (bytes) = nnnn
    number of pages = nnnn

    number of reads = nnnn
    number of read hits = nnnn

{If write cache is present}
   number of writes = nnnn
{If write cache is present}
   number of write hits = nnnn

{If write cache is present}
   number of write cache hits = nnnn

   read hit % = nnnn
{If write cache is present}
   write hit % = nnnn
{If write cache is present}
   write cache hit % = nnnn
   read %  = nnnn

   CACHE STATISTICS TABLE UTILITY COMPLETED
```

CLEAR COMMAND

This **Destructive Mode** command performs a CLEAR operation on the disk. It basically resets the disk to its power-on state. Prior to issuing the CLEAR COMMAND, a CS/80 PRESET command is issued to force all errors currently stored in RAM to be logged. This is necessary because the CLEAR COMMAND will clear this RAM. The CLEAR COMMAND sent will be a CS/80 SELECTED DEVICE CLEAR. The following actions are taken as a result of executing this section:

- Log all errors stored in the drive RAM to the error logs on the maintenance tracks.
- Clear all clearable device or interface conditions currently asserted.
- Reset all complementary parameters to their power-on values.
- Reset the status reported from the device.

Input:

```
CS80DIAG> CLEAR COMMAND
```

Output:

```
CLEAR COMMAND UTILITY
Selected device is an HPXXXX disk drive.

CLEAR COMMAND UTILITY COMPLETED
```

CLEAR LOGS

This **Normal Mode** command is used to clear the Run-Time Data Error Log, the Error-Rate Test Data Error Log, the Cache Error Log and the Drive Fault Log.

Input:

```
CS80DIAG> CLEAR LOGS

   ************************************************
   *                  CAUTION                     *
   *  This command will destroy service related   *
   *  information.                                *
   ************************************************

   Do you wish to continue (Y/N) [N]?
   Clear logs:
     0 - all logs
     1 - ERT logs
{For HP7907, HP795X or HP796X}
     2 - run and fault logs
{For cache drives}
     3 - cache error log
   Which log [0]?
```

Output:

```
   CLEAR LOGS UTILITY
   Selected device is an HPXXXX disk drive.

   All logs cleared
         or
   ERT logs cleared
         or
   RUN/FAULT logs cleared
         or
   Cache logs cleared

   CLEAR LOGS UTILITY COMPLETED
```

DESCRIBE

The DESCRIBE command is a **Normal Mode** command used to obtain a CS/80 describe message from the device being tested and display the contents to the user in text form. The information in the describe message includes such things as device parameters that are used by system drivers.

Input:

```
CS80DIAG> DESCRIBE
```

Output:

```
DESCRIBE UTILITY
Selected device is an HPXXXX disk drive.

Describe Information:
Unit nnnn installed
Maximum transfer rate = nnnn Kbytes per second
Controller type =
                    Integrated Single-Unit
                {or} Integrated Multi-Unit
                {or} Integrated Multi-Port
Device is a nnnn fixed-disc
                {or} removable disc
Block size = nnnn bytes
Buffer size = nnnn blocks
Burst mode is not recommended
        {or}
Recommended burst size = nnnn bytes
Block transfer time = nnnn microseconds
Average transfer rate = nnnn Kbytes per second
Optimal retry time = nnnn 10's of milliseconds
Maximum access time to data = nnnn 10's of milliseconds
Maximum interleave = nnnn
Fixed volumes nnnn installed
        {or}
There are no fixed volumes
Removable volume nnnn installed
        {or}
There are no removable volumes

     Maximum Addresses                Sector
 Cyl       Head     Sect     Block    Interleave
====       ====     ====   ========   ==========
nnnn       nnnn     nnnn     nnnn         nnnn

DESCRIBE UTILITY COMPLETED
```

DIAG

The DIAG command is a **Normal Mode** command used to initiate internal diagnostic tests which reside in the disk drive. The tests which can be run are device dependent and are described in the disk drive manuals.

Input:

```
CS80DIAG> DIAG

************************************************
*                  CAUTION                     *
*      This command MAY tie up the system for  *
*      long as it takes to fo finish the test. *
************************************************

Do you wish to continue (Y/N) [Y]?
```

{*If response was Y*}

```
Input the diag # (nnnn <= diag <= nnnn) [nnnn]?
Input the loop count (nnnn <= count <= nnnn) [nnnn]?
```

Output:

```
INITIATE DIAGNOSTIC UTILITY
Selected device is an HPXXXX disk drive.

Loop = nnnn, Diag # = nnnn, Unit # = nnnn

INITIATE DIAGNOSTIC UTILITY COMPLETED
```

Possible Error Messages:

```
***  DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE
CS/80 INITIATE DIAGNOSTIC COMMAND
```

{*status - including failing FRU if any*}

ERRSUM

The **ERRSUM** command, a **Normal Mode** command unique to HP 791X drives, outputs a list of all test errors (TERRORS) which have occurred since the last power-on sequence or s elf test operation. The device keeps a record of the last four error summaries on the disk maintenance tracks. The CLEAR LOGS command clears the error summar ies only if the disk unit is selected. These summaries provide useful informat ion for intermittent problems.

Input:

```
CS80DIAG> ERRSUM

Do you want the current of previous summaries (C/P)? [C]
```

Output:

```
ERROR SUMMARY UTILITY
Selected device is an HPXXXX disk drive

  {If response was C}
Current Error Summary

There are no error summary values
          or
The following errors have occurred:

HHH  HHH  HHH  HHH  HHH  HHH  HHH  HHH
    ... until all errors are displayed

    {If response was P}
Previous Error Summary #1

There are no error summary values
          or
The following errors have occurred:

HHH  HHH  HHH  HHH  HHH  HHH  HHH  HHH
    ... until all errors are displayed


Previous Error Summary #2
            . . .

Previous Error Summary #3
            . . .

Previous Error Summary #4
            . . .
ERROR SUMMARY UTILITY COMPLETED
```

ERT LOG

The ERT LOG command is a **Normal Mode** command used to access the Error-Rate Test Data Error Log which contains an accumulation of all read errors which were detected during error-rate tests. These errors accumulate until the CLEAR LOGS command is used to clear them. The errors in this log are organized according to head number.

Input:

```
CS80DIAG> ERT LOG

Display the errors for all heads (Y/N)[Y]?
      {if response was N}
Input head number (nnnn <= head <= nnnn) [nnnn]?
```

Output:

```
ERT LOG UTILITY
Selected device is an HPXXXX disk drive

Error Rate Test Log values
==========================

Head number = nnnn
Number of sectors read = nnnn
{For HP791X or HP793X)
Correctable errors = nnnn
{For HP791X or HP793X)
Uncorrectable errors = nnnn

There are no log entries
                {or}

     Logical      Error
 Cyl  Head  Sect  Type   Count   Error
================  =====  =====  ========
nnnn  nnnn  nnnn   XXX   nnnn   BBBBBBBB
nnnn  nnnn  nnnn   XXX   nnnn   BBBBBBBB
   .
   .    Repeat for each entry in the log
   .
nnnn  nnnn  nnnn   XXX   nnnn   BBBBBBBB

     {if any entries were printed}
Do you wish to see error byte decoding information (Y/N)[N]?
     {if yes}
```

```
The error types are:
    COR = ECC correctable error
    UNC = ECC uncorrectable error
    CRC = only CRC detected the error
    F/S = formatter/separator error
    *** = decode error manually

The Error values are:

  XXXXXX00 ECC found correctable error
  XXXXXX01 ECC found uncorrectable error
  XXXXXX10 ECC did not detect an error
  XXXXX1XX error is in sector header not body
  XXXX1XXX CRC did not detect an error
  XXX1XXXX first retry didn't get data
  XX1XXXXX extra offset was used
  X1XXXXXX Formatter/Separator error
```

{*Note: The above table is specific to 7933/7935 drives. The values in this table will be changed appropriatley for other drive types.*}

```
   ERT LOG UTILITY COMPLETED
```

EXIT

The `EXIT` command is a **Normal Mode** command used to terminate execution of the CS80 External Exerciser.

Input:

```
CS80DIAG> EXIT
```

Output:

```
End of Section 17 - External Exerciser
```

FAULT LOG

The FAULT LOG command is a **Normal Mode** command used to access the Drive Fault Log which contains an accumulation of all faults that have occured on the drive since the last Clear Logs command was executed. Note, that if the cylinder address in any of the log entries has an "*" following it, then the address is physical. Thus, a spare must not be attempted using this address since the spare command uses only logical addresses. Fault Code values are displayed in decimal.

Input:

```
CS80DIAG> FAULT LOG
```

Output:

```
FAULT LOG UTILITY
Selected device is an HPXXXX disk drive.

No drive faults to report
```

{*or*}

```
There are nnnn entries in this log

Fault log values:

        Current              Target
   Cyl   Head  Sect     Cyl   Head  Sect    HFR        Fault Code
  ================    ================  =======     ============
* nnnn   nnnn  nnnn  * nnnn   nnnn  nnnn  BBBBBBBB     DERR nnnn
                                                          or
  .                                                     TERR nnnn
  .   Repeat for each entry in the log
  .
  nnnn   nnnn  nnnn    nnnn   nnnn  nnnn  BBBBBBBB     DERR nnnn
                                                          or
                                                       TERR nnnn

* Indicates a Physical address -- DO NOT attempt
  to spare this address
```

```
{if any entries were printed}
Do you wish to see HFR decoding information (Y/N)[N]?
{if response was Y}
   The HFR values are:
   01234567
   ========
   XXXXXXX1  The spindle speed is down
   XXXXXX1X  The heads are off track
   XXXX1XXX  Track follower PLL error
   XXX1XXXX  The top door is open
   XX1XXXXX  Emergency Retract is set
   X1XXXXXX  Power failure occurred
   1XXXXXXX  Read/Write fault occurred
```

{Note: The above table is specific to HP7933/35 drives. The values in this table will be changed appropriately for other drive types.}

```
FAULT LOG UTILITY COMPLETED
```

HELP

The HELP command is a **Normal Mode** command used to access information concerning the commands that are available in the CS/80 external exerciser. The user may request a list of the available commands accompanied by a brief description of each, or a description of any individual command.

Input:

```
CS80DIAG> HELP  [command name or <cr>]
```

Output:

```
    {If no command name was given (i.e. <cr>)}
The following commands are available:

ADDRESS - converts block addresses to 3-vector and visa versa
AHA     - auto head alignment (7933/35)
   .
   .
   .
WTR ERT - performs a write-then-read error rate test on
          the device

    {If a command was given}
Do you want a description or just syntax (D/S)[D]?

    {If response was D}
COMMAND DESCRIPTION:
Description of the command
Syntax of the command

    {If response was S}
COMMAND SYNTAX:
Syntax of the command
```

INIT MEDIA

The **INIT MEDIA** command is used to format the disk media. **Initialize Maintenance Tracks** is the **Normal Mode** command; all other options are **Destructive Mode** commands. The user will be given the option to retain all spares that have been made on the disk, or retain only factory spares. For HP791X and HP793X devices, the maintenance track intialization option is provided. For HP795X and HP796X devices, the read/write header intialization option is provided. All data on the disk may be destroyed by this command. It is essential that extensive error-rate testing be performed and all questionable sectors spared after executing this command.

Input:

```
CS80DIAG> INIT MEDIA
```

{*If NORMAL mode access*}

```
Initialize maintenance tracks (Y/N) [N]?
```

{*or*}

{*If DESTRUCTIVE mode access*}

```
*****************************************************
*                    CAUTION                        *
*     This command may destroy user data.           *
*****************************************************

  Do you wish to continue (Y/N) [N]?

  Do you want to:
    A = retain all spares
    P = retain only primary spares
{For HP791X or HP793X}
    M = initialize the maintenance tracks
{For HP795X or HP796X}
    R = read/write headers (destructive)
Which option would you like [A]?
```

Output:

```
 INIT MEDIA UTILITY

 format - retain all spares
          {or}
 format - retain primary spares
          {or}
 format - initialize maintenance tracks
          {or}
 format - read/write headers (destructive)

 Media is being initialized -- may take several minutes

 Media has been successfully initialized.

 INIT MEDIA UTILITY COMPLETED
```

LOOPBACK

This **Normal Mode** command will perform a write loopback of 256 bytes of data on the channel using the pattern—255,0,1, ... ,254. This operation will be followed by a read loopback of 256 bytes, which will be compared with the expected pattern to verify correct transmission. The pattern sent in the read loopback is generated from Read-Only Memory (ROM) in the disk drive, and should be the same as the pattern specified in the write loopback above.

Input:

```
CS80DIAG> LOOPBACK
```

Output:

```
LOOPBACK UTILITY
Selected drive is an HPXXXX disk drive

Write Loopback Completed

Read Loopback Completed

LOOPBACK UTILITY COMPLETED
```

POSSIBLE ERROR MESSAGES

```
*** ERROR IN TRANSMISSION DETECTED DURING READ
    LOOPBACK TEST: (CS80ERR 115)
```

Byte #	Octal Value Transmitted	Octal Value Received	Bit Positions In Error 01234567
12	56	54	00000010
33	127	63	01100100
.			
.			
.			
241	74	72	00000110

{*Note: -- entries in the preceding table will be printed for as many errors as were detected, unless the ERRNUM value is exceeded*}

MEDIA TEST

This **Destructive Mode** command enables the user to test the hardware/data path of the drive. This is done by performing variable length and variable location writes followed by reads of the same length and location. The user is given the choice of testing a selected area or a random area. The option is also provided of selecting internal pattern, user input pattern, or random pattern data to be used in the test. This command will destroy data on the disk.

Input:

```
CS80DIAG> MEDIA TEST

   ***************************************************
   *                      WARNING                    *
   *          This command may destroy user data     *
   ***************************************************

   Do you wish to continue (Y/N)[N]?

   Clear the drive logs (Y/N)[N]?

   Types of media tests:
     P = selected area media test
     R = random area media test
   Enter the test type [P]?

{If not random area}
   Do you want block or 3-vector addresses (B/V)[V]?

{If response was B}
   Enter new address (<cr> to keep current value)
      Block address (nnnn - nnnn) = nnnn?

{If response was V}
  Enter new address (<cr> to keep current value)
     Cylinder address (nnnn - nnnn) = nnnn?
     Head address (nnnn - nnnn) = nnnn?
     Sector address (nnnn - nnnn) = nnnn?
```

```
  Test Area:
{For HP7907 drives}
     V = volume
     T = track
     S = sector
{For Other drives}
     V = volume
     H = head
     C = cylinder
     T = track
     S = sector
  Enter the test area [T]?

  Do you want:
    R = random transfer length
    U = user input transfer length
  Which option would you like (R/U) [U]?

{If response was U}
   Input transfer length (nnnn <= sectors <= nnnn) [nnnn]?

   The sources for the data pattern to be used here:
     I - Internal pattern
     R - Random pattern
     U - User input pattern
   Which pattern source would you like (I/R/U)[I]?

{If response was U}
   Input the pattern in hex

   Input the loop count (nnnn<= count <=nnnn)[nnnn]?
```

Output:

```
MEDIA TEST UTILITY
Selected device is an HPXXXX disk drive

Preset in progress ...
Preset was successful

{If clear logs}
  All log(s) cleared

  Test Area = Volume starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
                        {or}
  Test Area = Head starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
                        {or}
  Test Area = Cyl starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
                        {or}
  Test Area = Track starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
                        {or}
  Test Area = Track starting at Cyl = nnnn, Head = nnnn, Sec = nnnn

{If no errors detected}
  No errors were detected in the media test

  MEDIA TEST UTILITY COMPLETED
```

Possible Error Messages:

```
{If errors were detected}
*** ERROR IN TRANSMISSION DETECTED DURING WRITE/READ
    MEDIA TEST: (CS80ERR 124)

                                    Bit
                          Hex   Hex  Positions
                          Value Value In Error
Cyl  Hd  Sect  Byte      Trns  Recd  01234567     Time Error Occurred
================== ==== ==== ========  ==================
nnnn nnnn nnnn nnnn   HH    HH   BBBBBBBB     FRI, DEC 16, 1988 9:03 PM
nnnn nnnn nnnn nnnn   HH    HH   BBBBBBBB     FRI, DEC 16, 1988 9:03 PM
.
.  Repeat for each occurrence
.
nnnn nnnn nnnn nnnn   HH    HH   BBBBBBBB     FRI, DEC 16, 1988 9:03 PM

     MEDIA TEST UTILITY COMPLETED
```

PRESET

This **Normal Mode** command is used to force the errors stored in the drives RAM to be logged to the maintenance track.

Input:

```
CS80DIAG> PRESET
```

Output:

```
PRESET DRIVE UTILITY
Selected device is an HPXXXX disk drive

PRESET DRIVE UTILITY COMPLETED
```

PRINT PHYSICAL

This **Normal Mode** command is used to enable the printing of PHYSICAL addresses in the RUN, ERT, and FAULT logs.

Input:

```
CS80DIAG> PRINT PHYSICAL
```

Output:

```
Print physical address enabled
        {or}
Print physical address disabled
```

READ

The READ command is a **Normal Mode** command used to access any data block on the selected device. Due to a potential security compromise, the user is required to posses level 0 security to use this command.

Input:

```
CS80DIAG> READ

Do you want block or 3-vector addresses (B/V)[V]?

      {if response was B}
Enter new address (<cr> to keep current value) --
   Block address = nnnn?

      {if response was V}
Enter new address (<cr> to keep current value) --
   Cylinder address = nnnn?
   Head address     = nnnn?
   Sector address   = nnnn?
```

Output:

```
READ UTILITY
Selected device is an HPXXXX disk drive

The data follows (Hex):

     0  1  2  3  4  5  6  7  8  9
  0: HH HH HH HH HH HH HH HH HH HH.... .... . .
 10: HH HH HH HH HH HH HH HH HH HH.... .... . .
   .
   .
   .
250  HH HH HH HH HH HH.... . .
```

{NOTE -- the dots in the preceding table represent non-alpha-numeric ASCII characters. Alpha-numeric characters will be printed}

```
 READ UTILITY COMPLETED
```

READCACHEOFF

This **Normal Mode** command allows the user to disable disk controller read cache memory.

Input:

```
CS80DIAG> READCACHEOFF
```

Output:

```
CACHE CONTROL UTILITY
Selected device is an HPXXXX disk drive

Read cache stopped

CACHE CONTROL UTILITY COMPLETED
```

READCACHEON

This **Normal Mode** command allows the user to enable disk controller read cache memory.

Input:

```
CS80DIAG> READCACHEON
```

Output:

```
CACHE CONTROL UTILITY
Selected device is an HPXXXX disk drive

Read cache started

CACHE CONTROL UTILITY COMPLETED
```

RESET STATS

This **Normal Mode** command allows the user to reset the Cache Statistic Table.

Input:

```
CS80DIAG> RESET STATS

**************************************************
*                  CAUTION                       *
*     This command will destroy performance      *
*     related information.                       *
**************************************************

    Do you wish to continue (Y/N) [N]?
```

Output:

```
    CLEAR CACHE STATISTICS UTILITY
    Selected device is an HPXXXX disk drive

    Cache Statistic Table cleared

    CLEAR CACHE STATISTICS UTILITY COMPLETED
```

REV

The REV command is a **Normal Mode** command allows the user to read the revision numbers of the firmware ROMs installed in the device. The command is not supported on the HP7907.

Input:

```
CS80DIAG> REV
```

Output:

```
REVISION UTILITY
Selected device is an HPXXXX disk drive

Firmware Revision Values:
   Part Number      Revision Number
   ===========      ===============
     nnnn               nnnn - nnnn
     nnnn               nnnn - nnnn
       .                     .
       .                     .
       .                     .
       .                     .
     nnnn               nnnn - nnnn

  REVISION UTILITY COMPLETED
```

RFSECTOR

The RFSECTOR command is a **Normal Mode** command used to read a full sector of data from the disk starting at any valid address. This command is unique to HP791X, HP793X, and HPC220XA drives. The sector header, as well as the data field, is displayed. Due to potential security compromises, the user will need to possess level 0 security to use this command.

Input:

```
CS80DIAG> RFSECTOR

{For HP7936/7937 and HPC220XA}
Do you want to access PHYSICAL addresses (Y/N) [N]?

{If response was Y}
   Enter new address (<cr> to keep current value)
PHYSICAL cylinder address (nnnn - nnnn) = nnnn?
PHYSICAL head address (nnnn - nnnn) = nnnn?
PHYSICAL sector address (nnnn - nnnn) = nnnn?

{For non PHYSICAL addresses and HP791X/33/35}
Do you want block or 3-vector addresses (B/V) [V]?

{if response was B}
Enter new address (<cr> to keep current value)
   Block address (nnnn - nnnn) = nnnn?

{if response was V}
Enter new address (<cr> to keep current value)
   Cylinder address (nnnn - nnnn) = nnnn?
   Head address (nnnn - nnnn) = nnnn?

{For HP7936/37 and HPC220XA drives}
   PHYSICAL sector address   (nnnn - nnnn) = nnnn?

{For other drives}
   Sector address (nnnn - nnnn) = nnnn?
```

Output:

```
READ FULL SECTOR UTILITY
Selected device is an HPXXXX disk drive

Physical spare = nnnn
Physical sector = nnnn
Head = nnnn
```

{*For HP7933/7935*}

```
Physical Cylinder = nnnn
Logical spare = nnnn
No sector sparing has occurred
```

{*NOTE -- Sector Status will be 1 for tracks that have not used the spare sector. Otherwise it will be the physical spare sector*}

```
Header values(Hex):

     0   1   2   3   4   5
 0:  81  3F  00  69  00  5C

The data follows (Hex):

     0   1   2   3   4   5   6   7   8   9

  0:HH  HH  HH  HH  HH  HH  HH  HH  HH  HH.... .... . .
 10:HH  HH  HH  HH  HH  HH  HH  HH  HH  HH.... .... . .
    .
    .
    .
250 HH  HH  HH  HH  HH  HH.... . .
```

{*NOTE -- the dots in the preceding table represent non-alpha-numeric ASCII characters, Alpha-numeric characters will be printed*}

```
READ FULL SECTOR UTILITY COMPLETED
```

RO ERT

The RO ERT command is a **Normal Mode** command used to initiate a read only error-rate. Two types of tests are available through this command. The first is standard read only error-rate test which allows the user to specify the address at which the test is to start. This test will sequentially read data starting at this address in an attempt to detect any read errors. The second type of test is a random read only error-rate test which uses random addresses and lengths of reads in attempt to detect any read errors.

Input:

```
CS80DIAG> RO ERT

**************************************************
*                  CAUTION                       *
*      This command MAY tie up the system for    *
*      long as it takes to fo finish the test.   *
**************************************************

Do you wish to continue (Y/N) [Y]?

Clear the ERT logs (Y/N)[N]?

    Types of RO ERT's:
      S = selected area
      R = random area
    Enter the test type (S/R)[S]?

    Do you want block or 3-vector addresses (B/V)[V]?

{If response was B}
    Enter new address (<cr> to keep current value) --
       Block address (nnnn - nnnn) = nnnn?

{If response was V}
    Enter new address (<cr> to keep current value) --
       Cylinder address (nnnn - nnnn) = nnnn?
       Head address (nnnn - nnnn) = nnnn?
       Sector address (nnnn - nnnn) = nnnn?
```

```
    Test Area:

{For HP7907 drives}
      V = volume
      T = track
      S = sector

{For Other drives}
      V = volume
      H = head
      T = track
      C = cylinder
      S = sector

    Enter the test area [T]?

    Input the loop count (nnnn<= count <=nnnn)[nnnn]?

{For HP791X, HP7933/35}
    Do you want to enter an offset (Y/N)[N]?
{If response was Y}
    Enter desired offset (nnnn<= offset <= nnnn)[nnnn]?

    Log or Print errors (L/P)[P]?
```

Output:

```
RO ERT UTILITY
Selected device is an HPXXXX disk drive

Preset in progress ...
Preset was successful!
```

{If clear ERT logs}

```
ERT log(s) cleared

Test Area = Volume starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
                    {or}
Test Area = Head starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
                    {or}
Test Area = Cyl starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
                    {or}
Test Area = Track starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
                    {or}
Test Area = Sec starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
```

{If no errors detected}

```
No errors were detected in the ERT
```

{If errors were detected}

```
RO ERT results:

      Logical          Error   Loop
Cyl   Head  Sect       Type    Count    Error
====  ====  ====       =====   =====  ========
nnnn  nnnn  nnnn        XXX    nnnn   BBBBBBBB
nnnn  nnnn  nnnn        XXX    nnnn   BBBBBBBB
.
.   Repeat for each entry in the log
.
nnnn  nnnn  nnnn        XXX    nnnn   BBBBBBBB
```

{If any errors were printed}

```
Do you wish to see error byte decoding information(Y/N)[N]?
```

{*If yes*}

```
The error types are:
    COR = ECC correctable error
    UNC = ECC uncorrectable error
    CRC = only CRC detected an error
    F/S = formatter/separator error
    *** = decode error manually

The Error values are :
   XXXXXX00  ECC found correctable error
   XXXXXX01  ECC found uncorrectable error
   XXXXXX10  ECC did not detect an error
   XXXXX1XX  error is in sector header not body
   XXXX1XXX  CRC did not detect an error
   XXX1XXXX  first retry didn't get data
   XX1XXXXX  extra offset was used
   X1XXXXXX  Formatter/Separator error
```

{*Note: The above table is specific to HP7933/35 drives. The values in this table will be changed appropriately for other drive types.*}

```
RO ERT UTILITY COMPLETED
```

RUN LOG

This RUN LOG command is a **Normal Mode** command used to access the Run-Time Data Error Log which contains an accumulation of all run-time data errors that have been logged since the last time the log was cleared.

Input:

```
CS80DIAG> RUN LOG

Do you wish to see the errors for all heads (Y/N)[Y]?
            {if response was N}
Input the head number (nnnn <= head <= nnnn) [nnnn]?
```

Output:

```
RUN LOG UTILITY

Head number = nnnn
Number of sectors read = nnnn
{For HP791X or HP793X}
Correctable errors = nnnn
{For HP791X or HP793X}
Uncorrectable errors = nnnn
There are no entries for this head
            {or}

       Logical       Error
  Cyl  Head  Sect  Type   Count   Error
 ================  =====  =====  ========
 nnnn  nnnn  nnnn   xxx   nnnn   BBBBBBBB
 nnnn  nnnn  nnnn   xxx   nnnn   BBBBBBBB
  .
  .   Repeat for each entry in the log
  .
 nnnn  nnnn  nnnn   xxx   nnnn   BBBBBBBB

            {if any entries were printed}
Do you wish to see error byte decoding information (Y/N)[N]?
            {if yes}

The error types are:
    COR = ECC correctable error
    UNC = ECC uncorrectable error
    CRC = only CRC detected the error
    F/S = formatter/separator error
    *** = decode error manually
```

```
The error values are:
    XXXXXX00  ECC found correctable error
    XXXXXX01  ECC found uncorrectable error
    XXXXXX10  ECC did not detect an error
    XXXXX1XX  error is in sector header not body
    XXXX1XXX  CRC did not detect an error
    XXX1XXXX  first retry didn't get data
    XX1XXXXX  extra offset was used
    X1XXXXXX  Formatter/Separator error
```

{NOTE -- The above table is specific to 7933/7935 drives. The values in this table will be changed appropriately for other drive types.}

```
RUN LOG UTILITY COMPLETED
```

SENSE

The SENSE command is a **Normal Mode** command used to read the values of the temperature and pressure sensors in the drive as well as the Hardware and Read/Write Fault Registers. This command is unique to 793X drives.

Input:

```
CS80DIAG> SENSE
```

Output:

```
READ SENSORS UTILITY
Selected device is an HPXXXX disk drive

Exhaust temperature = nnnn deg. C (+/- 3 deg. C)
Actuator coil temperature = nnnn deg. C (+/- 3 deg. C)
Hardware fault register value(s) are: BBBBBBBB
Read/Write fault register = BBBBBBBB
The HFR value should be interpreted as:

The HFR values are:
01234567
========
XXXXXXX1  The spindle speed is down
XXXXXX1X  The heads are off track
XXXX1XXX  Track follower PLL error
XXX1XXXX  The top door is open
XX1XXXXX  Emergency Retract is set
X1XXXXXX  Power failure occurred
1XXXXXXX  Read/Write fault occurred

The Read/Write Fault Register should be interpreted as:

 RFWR

01234567
========
XXXXXXX1  Write without AC write current
XXXXXX1X  DC write current without write
XXXXX1XX  Write without DC write current
XXXX1XXX  Multiple heads are selected

READ SENSORS UTILITY COMPLETED
```

SERVO TEST

The SERVO TEST command is a **Normal Mode** command which allows the user to execute the drives internal butterfly seek routine. For HP7936/37 drives, it will allow the test to be performed on one or all of the drive heads. There is no data transferred with use of this command. Command is not supported on HP791X or HP7933/35 drives.

Input:

```
CS80DIAG> SERVO TEST

      ****************************************************
      *                    CAUTION                       *
      *      This command MAY tie up the system for      *
      *      long as it takes to fo finish the test.     *
      ****************************************************

      Do you wish to continue (Y/N) [Y]?

      Input the loop count (nnnn <= count <= nnnn) [nnnn]?
```

{*For HP7936/37 drives:*}

```
       Test all heads(Y/N) [N] ?
          {if response was N}
       Input head number (nnnn <= head <= nnnn) [nnnn]?
```

Output:

```
      SERVO TEST UTILITY
      Selected device is an HPXXXX disk drive
```

{*For HP7907, HP795X and HP796X drives:*}

```
          nnnn seeks completed

          SERVO TEST UTILITY COMPLETED
```

SET PATTERN

The SET PATTERN command is a **Normal Mode** commmand used to define and edit a pattern to be used in write-then-read error-rate tests. The pattern must be input in hex and is restricted to 64 digits in length. If less than 64 digits are input, the pattern that was input will be duplicated as many times as necessary to produce 64 digits. If no pattern has been defined, the pattern that is input will be stored for use in a *WTR ERT*. If a pattern has been previously defined, via this command, that pattern will be displayed and the user can then edit that string. Valid edit characters are:

R for replace.
R will replace the characters in the pattern with the characters following the R, starting at the pattern character under which the R is typed.

I for insert.
I will insert the characters following the I into pattern following the character in the pattern under which the I is typed.

D for delete.
D will delete the pattern character under which the D is typed. Multiple D's may be typed to delete a succession of characters and other editing characters may follow a D (i.e. DIab" will delete one character and insert the string "ab" at that point in the pattern).

Following each typed edit string, the resulting edited pattern will be re-displayed and the user will be given another opportunity to edit it. This process may be terminated by simply inputting a (Return) for the edit string.

Input:

```
CS80DIAG> SET PATTERN

{if no previous pattern has been defined}
Input the pattern in hex:

{if pattern contains all valid hex characters this
 command will terminate}

{if a previous pattern has been defined or the initial pattern
 input contained invalid characters}

Input the changes (<cr> to stop):
    {previous pattern is displayed here}

{if the input edit pattern is not valid then the pattern will
 again be displayed and a new edit string will be requested}

{this process will be repeated until user inputs a <cr>
 only for the edit string}
```

Output

```
SET PATTERN UTILITY
Selected device is an HPXXXX disk drive

SET PATTERN UTILITY COMPLETED
```

SPARE

The SPARE command (a **Normal Mode** command for MPE/XL; a **Destructive Mode** command for HP-UX) is used to spare a block or sector to an address which is reserved for sparing. The user is given the option to retain data or to not retain data from the area affected by the spare. This command should not be used unless the block or sector being spared is known to be defective. This implies that error-rate tests have been run on the suspected area and it consistently generates errors.

For HP7907 drives, the user is giving the option of sparing a maintenance track. Two types of maintenance tracks exist on an HP7907, logging or scratch. Logging maintenance tracks are used by the drive to store ERT test patterns and drive logs. Scratch maintenance tracks are used in the sparing operation to store the data of the target track during the operation.

Input:

```
CS80DIAG> SPARE

   {If MPE/XL and NORMAL MODE access}
Do you want block or 3-vector addresses(B/V)[V]?
   {If response was B}
Enter new address (<cr> to keep current value)
   Block address (nnnn - nnnn) = nnnn?

   {If response was V}
Enter new address (<cr> to keep current values --
   Cylinder address (nnnn - nnnn) = nnnn?
   Head address (nnnn - nnnn) = nnnn?
   Sector address (nnnn - nnnn) = nnnn?
   {For DESTRUCTIVE MODE access}
   ************************************************
   *                  CAUTION                     *
   *       This command may destroy data          *
   ************************************************

      Do you wish to continue (Y/N)[N]?
```

```
{For HP7907 drives}
   Do you wish to spare a maintenance track (Y/N)[N]?
{If response was Y}
   Logging or Scratch maintenance track (L/S)[L]?

{For HP795XB drives}
   Auto sparing is being disabled.  Do not break from this command

{If not a maintenance track spare}
   Do you want block or 3-vector addresses(B/V)[V]?

{If response was B}
   Enter new address (<cr> to keep current value) --
      Block address (nnnn - nnnn) = nnnn?

{If response was V}
   Enter new address (<cr> to keep current values) --
      Cylinder address (nnnn - nnnn) = nnnn?
      Head address (nnnn - nnnn) = nnnn?
      Sector address (nnnn - nnnn) = nnnn?

   Number of read retries (1 <= retries <= 10)[1]?

{If target sector data not recovered}

   ************************************************************
   * The SECTOR could not be read.  If you continue, the DATA *
   * IN THE TARGET SECTOR WILL NOT BE RECOVERED, and DATA     *
   * RECOVERY PROCEDURES MUST BE PERFORMED                    *
   ************************************************************

   Do you wish to continue (Y/N)[N]?

{If spare retaining track data failed}
   Spare (retain data) failed --
   Do you wish to perform a spare without retaining track
   data (Y/N)[N]?
```

Output:

```
   SPARE UTILITY

   Attempting to read data of target sector ...

{If data was not recovered and not DESTRUCTIVE mode}
   Data was not recovered from target sector.  Destructive
   mode is required to continue

{If data was recovered}
   Data was successfully recovered from target sector

{If continue with target sector data loss or target sector data
was recovered}
   Attempting spare (retain track data option) ...

{If spare retaining no track data}
   Attempting spare (retain no track data option) ...

{If target sector data recovered}
   Data was successfully rewritten to target sector

{If spare was performed}
   Spare (retain track data option) was successful
            {or}
   Spare (not retain track data option) was successful
   Data recovery procedures must be performed
            {or}
   Spare maintenance track operation was successful

   {status -- including address of track affected by spare}

{If no spare performed}
   No spare was performed

{For HP795XB drives}
   Auto sparing enabled

   SPARE UTILITY COMPLETED
```

SUSPEND

The SUSPEND command is a **Normal Mode** command which allows the user to suspend CS80DIAG and return to the DUI. The user enters **RESUME** at the DUI prompt to return to CS80DIAG.

Input:

```
CS80DIAG> SUSPEND
```

Output:

```
DUI>
```

TABLES

The TABLES command is a **Normal Mode** command used to provide access to the various tables which reside in the drive. These tables are the:

Configuration Table	The Configuration table contains a list of current valu es of the complementary variables.
Head Value Table	The Head Value table contains the head alignment values, circumferential skew values, and the current cylinder offset for each head.
Runout Table	The Runout table contains information on the amount of eccentric runout (radial shift) for each head.
Spare Track Table	The Spare Track table contains a list of all logical tracks which have been spared for each head.

Only the 7933/7935 drives have Head Value, Configuration, and Runout tables. All others have only the Spare Track table.

Input:

```
CS80DIAG> TABLES
```

{*For HP7933 or HP7935:*}

```
The available drive tables are:
   Spare Track Table
   Head Value Table
   Configuration Table
   Runout Table

Which table do you want (S/H/C/R)[S]?
```

{*Other drives output the spare track table*}

{*For spare track table*}

```
Do you want to see the spare sectors (Y/N)[N]?
```

{*If response is Y*}

```
**************************************************
*                  CAUTION                       *
*      This command MAY tie up the system for    *
*      long as it takes to fo finish the test.   *
**************************************************

Do you wish to continue (Y/N) [N]?
```

Output:

```
TABLES UTILITY
Selected device is an HPXXXX disk drive

Spare Track Table:
```

{for each head}

```
Head Number = nnnn
Number of spare operations = nnnn
Number of spare tracks used = nnnn
Number of logical tracks spared = nnnn
```

{for each cylinder/scalar}

CYL	TYPE	SCALAR
nnnn	secondary	nnnn
nnnn	primary	nnnn

{If spare sectors option}

```
Locations of spared sectors:
```

Logical Cyl	Head	Sect	Spare Type
nnnn	nnnn	nnnn	secondary
nnnn	nnnn	nnnn	primary
.			
. Repeat for each entry			
.			
nnnn	nnnn	nnnn	primary

```
Head Value Table:

   Head Alignment Offset Table:
```

Head	Band 0	Delta 0-1	Band 1	Delta 1-2	Band 2
nnnn	nnnn	nnnn	nnnn	nnnn	nnnn
nnnn	nnnn	nnnn	nnnn	nnnn	nnnn
.					
. For each entry in the table					
.					
nnnn	nnnn	nnnn	nnnn	nnnn	nnnn

```
Circumferential Skew Table:

       Band   Delta   Band   Delta   Band
Head    0      0-1     1      1-2     2
====   ====   =====   ====   =====   ====
nnnn   nnnn   nnnn    nnnn   nnnn    nnnn
nnnn   nnnn   nnnn    nnnn   nnnn    nnnn
.
. For each entry in the table
.
nnnn   nnnn   nnnn    nnnn   nnnn    nnnn

Current Cylinder Offset Table:

Head   Offset
====   ======
nnnn   nnnn
.
. For each entry in the table
.
nnnn   nnnn

Band 0 = outside diameter
Band 1 = middle diameter
Band 2 = inside diameter
All numbers represent 6.25 microinch increments
         ============================
```

```
Configuration Table:

Transfer Length = nnnn bytes of Full Volume
Burst Length = nnnn blocks
Retry Time = nnnn 10's of milliseconds
Status Mask = !HH HH HH HH HH HH HH HH hex
RPS is disabled
    {or}
RPS Window = nnnn microseconds
RPS Time to Target = nnnn microseconds
Device Will (or Will Not) Automatically Release During Idle Time
Release Timeout is enabled (or disabled)
Options flag = BBBBBBBB
Burst with EOI Flag is on (or off)
Return Addressing Mode is block (or 3-vector)
            ============================

Runout Table:

Head    Runout
====    ======
 0       nnnn
 1       nnnn
 2       nnnn
 3       nnnn
 4       nnnn
 5       nnnn
 6       nnnn
 7       nnnn
 8       nnnn
 9       nnnn
10       nnnn
11       nnnn
12       nnnn

TABLES UTILITY COMPLETED
```

UNIT

The UNIT command is a **Normal Mode** command used to set the unit number within the drive. This command is required for multi-unit drives so that the user can specify which unit is to be tested.

Input:

```
CS80DIAG> UNIT

Input unit number (nnnn <= unit <= nnnn) [nnnn]?
```

Output:

```
SET UNIT UTILITY
Selected device is an HPXXXX disk drive

Unit nnnn of the device has been successfully set

SET UNIT UTILITY COMPLETED
```

WRITECACHEOFF

This **Normal Mode** command allows the user to disable disk controller write cache memory.

Input:

```
CS80DIAG>WRITECACHEOFF
```

Output:

```
CACHE CONTROL UTILITY
Selected device is an HPXXXX disk drive

Write cache stopped

CACHE CONTROL UTILITY COMPLETED
```

WRITECACHEON

This **Normal Mode** command allows the user to enable disk controller write cache memory.

Input:

```
CS80DIAG>WRITECACHEON
```

Output

```
CACHE CONTROL UTILITY
Selected device is an HPXXXX disk drive

Write cache started

CACHE CONTROL UTILITY COMPLETED
```

WTR ERT

The WTR ERT command is a **Destructive Mode** command used to initiate a write-then-read error-rate test. Three types of tests are available through this command (all three of which will destroy data on the disk):

Pattern ERT	performs incremental writes followed by reads across a data area specified by the user.
Random ERT	performs random length writes followed by reads at random locations on the disk.
Short ERT	performs a short combination of the first two tests. In this test, a series of random writes and reads are performed, as in the first type of test, followed by a series of incremental writes and reads, like the second type of test, starting at a predefined inner cylinder which is device dependent.

Input:

```
 CS80DIAG> WTR ERT

**************************************************
*                  CAUTION                       *
*      This command may destroy user data        *
**************************************************

Do you wish to continue (Y/N) [Y]?

Clear the ERT logs (Y/N)[N]?

Types of RO ERT's:
  P = selected area pattern WTR ERT
  R = random area WTR ERT
{For HP791X and HP793X}
  S = short WTR ERT

  Enter the test type [P]?

 {If not random area}
    Do you want block or 3-vector addresses (B/V)[V]?

 {If response was B}
    Enter new address (<cr> to keep current value) --
       Block address (nnnn - nnnn) = nnnn?

 {If response was V}
    Enter new address (<cr> to keep current value) --
       Cylinder address (nnnn - nnnn) = nnnn?
       Head address (nnnn - nnnn) = nnnn?
       Sector address (nnnn - nnnn) = nnnn?
```

```
Test Area:

      {For HP7907 drives}
           V = volume
           T = track
           S = sector

      {For Other drives}
           V = volume
           H = head
           C = cylinder
           T = track
           S = sector

         Enter the test area [T]?

         The sources for the data pattern to be used are:
           I - Internal pattern
           R - Random pattern
           U - User input pattern
         Which pattern source would you like (I/R/U)[I]?

      {For HP795X or HP796X if user pattern}
         Available patterns:
            1 = 39CE7
            2 = C30
            3 = 30E61CC3987
            4 = B8F32E3CC
            5 = CC
            6 = DB6
            7 = 33F94CFE5

      {For HP7907 if user pattern}
         Available patterns:
            1 = CD
            2 = E739
            3 = 33
            4 = DB6DB6
            5 = 4933
            6 = FF
            7 = 00

         Input pattern number (1 <= pattern <= 7)[1]?

      {For other devices if user pattern}
  Input the pattern in hex:

         Input the loop count (nnnn<= count <=nnnn)[nnnn]?
```

```
{For HP791X, HP7933/35}
   Do you want to enter an offset (Y/N)[N]?
{If response was Y}
   Enter desired offset (nnnn<= offset <= nnnn)[nnnn]?

   Log or Print errors (L/P)[P]?
```

Output:

```
   WTR ERT UTILITY
   Selected device is an HPXXXX disk drive

   Preset in progress ...

   Preset was successful!

{If clear ERT logs}
   ERT log(s) cleared

   Test Area = Volume starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
                        {or}
   Test Area = Head starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
                        {or}
   Test Area = Cyl starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
                        {or}
   Test Area = Track starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
                        {or}
   Test Area = Sec starting at Cyl = nnnn, Head = nnnn, Sec = nnnn

{If no errors detected}
   No errors were detected in the ERT

{If errors were detected}
   WTR ERT results:

        Logical          Error   Loop
   Cyl   Head  Sect      Type    Count   Error
   ====  ====  ====      =====   =====   ========
   nnnn  nnnn  nnnn       XXX    nnnn    BBBBBBBB
   nnnn  nnnn  nnnn       XXX    nnnn    BBBBBBBB
   .
   .   Repeat for each entry in the log
   .
   nnnn  nnnn  nnnn       XXX    nnnn    BBBBBBBB

{If any errors were printed}
   Do you wish to see error byte decoding information(Y/N)[N]?
```

{*If yes*}

```
The error types are:
     COR = ECC correctable error
     UNC = ECC uncorrectable error
     CRC = only CRC detected an error
     F/S = formatter/separator error
     RET = first retry didn't get data
     *** = decode error manually

The Error values are :
   XXXXXX00  ECC found correctable error
   XXXXXX01  ECC found uncorrectable error
   XXXXXX10  ECC did not detect an error
   XXXXX1XX  error is in sector header not body
   XXXX1XXX  CRC did not detect an error
   XXX1XXXX  first retry didn't get data
   XX1XXXXX  extra offset was used
   X1XXXXXX  Formatter/Separator error
```

{*Note: The table above is specific to HP7933/35 drives. The values in this table will be changed appropriately for other drive types.*}

```
WTR ERT UTILITY COMPLETED
```

Error Messages

The following is a list of error messages which may appear when using CS80DIAG. Other diagnostic error messages may appear at any time. Error messages without the (CS80ERR #) trailer are generated by the Online diagnostic subsystem or the operating system. Listed below each error message are a probable cause and recommended action statement. The actual cause and action may differ from this list depending upon the particular circumstances of a given situation. The "!" indicates that a parameter of some sort will replace the exclamation point when the message is displayed.

100	***** WARNING -- THE I/O PATH MAY NOT BE FUNCTIONING PROPERLY (CS80ERR 100)**
CAUSE	An error was detected by the Io_Path_Test service while testing the modules on the i/o path preceding the selected device.
ACTION	Execute the appropriate diagnostics on the modules preceding the selected device on the i/o path, especially on those that may have been reported as faulty in error messages immediately preceding this message. Note that the results of the execution of this instance of CS80DIAG may be invalid.
101	***** DEVICE FAILED TO RESPOND TO ! COMMAND IN ALLOTTED TIME (CS80ERR 101)**
CAUSE	No response to an i/o was received prior to the expiration of the allotted time.
ACTION	Verify that the selected disk drive is actually connected to the system. Run SYSMAP, if available, to confirm the presence of the device.
102	***** CS80DIAG IS UNABLE TO DIAGNOSE THE SELECTED DEVICE (CS80ERR 102)**
CAUSE	The selected device identified itself as something other than a CS/80 drive.
ACTION	Determine type of selected device and run the appropriate diagnostic on it.
103	***** CS/80 DISC DIAGNOSTIC TERMINATING (CS80ERR 103)**
CAUSE	A fatal error has been encountered.
ACTION	The specific error that was encountered should have been reported immediately prior to this message. Follow the action instructions for that error message.
104	***** A RESERVE AREA IS NOT AVAILABLE ON THIS DRIVE -- NO OPERATION WAS PERFORMED. (CS80WARN 104)**
CAUSE	There is no available area on the disk that can be written to without corrupting user data. This can happen if no such area is provided by the system, or if the diagnostic is running in destructive mode, in which the location of the reserve area is unknown to the system since the drive is locked for diagnostics.
ACTION	For systems which do not support a reserve area (e.g. HP-UX), reserve area operations are not supported.

106	*** DESTRUCTIVE MODE REQUIRED TO EXECUTE THIS COMMAND (CS80ERR 106)
CAUSE	The diagnostic does not have access to the drive in the mode necessary to execute the selected command.
ACTION	The mode granted to a diagnostic for a selected device is system dependent. Use the HELP LDEV command at the DUI for more information.

108	*** ! COMMAND IS NOT IMPLEMENTED ON THIS DRIVE/SYSTEM (CS80ERR 108)
CAUSE	The selected operation is either not implemented on the selected drive or the system does not provide access to it.
ACTION	This operation is unavailable.

109	*** DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE CS/80 ! COMMAND (CS80ERR 109)
CAUSE	The drive reported an error as a result of executing the selected operation.
ACTION	The hardware status that is displayed immediately following this message should indicate what sort of problem occurred, including a failing FRU if one is reported. If an FRU is reported, replace it and re-execute this diagnostic.

110	*** THE MAXIMUM NUMBER OF ERRORS HAS BEEN EXCEEDED (CS80ERR 110)
CAUSE	The user specified error limit has been reached.
ACTION	If more errors are desired, re-run the diagnostic assigning a larger value to the ERRCOUNT parameter of the run command.

111	*** UNRECOGNIZED COMMAND -- TYPE "HELP" FOR A LIST OF VALID COMMANDS (CS80ERR 111)
CAUSE	The specified command is not a valid command.
ACTION	Use the help facility to obtain a list of the commands that are valid and enter the desired command.

112	*** UNRECOGNIZED REPLY WAS FOUND (CS80ERR 112)
CAUSE	The reply that was entered in response to a prompt by the diagnostic is not valid.
ACTION	Refer to the prompt that was displayed and enter a response that is within the specified list of valid responses.

113	*** A NUMERICAL INPUT WAS EXPECTED BUT NOT RECEIVED (CS80ERR 113)
CAUSE	The reply that was entered in response to a prompt by the diagnostic is not a valid number.
ACTION	Re-enter number using only numeric characters and valid special characters (e.g. +, -, , etc.).

114 ***** AN UNEXPECTED ERROR OCCURRED IN THE IO_CS80 DAR (CS80ERR 114)**

CAUSE A call to the CS/80 device access routine resulted in an unexpected status return.

ACTION Please enter an SR. Within the text of the SR report all information returned by the Diagnostic User Interface. Also state operating system, version number, DUI version and diagnostic version.

---

115 ***** ERROR IN TRANSMISSION DETECTED DURING READ LOOPBACK TEST: (CS80ERR 115)**

Byte #	Octal Value Transmitted	Octal Value Received	Bit Positions In Error 01234567
======	==========	==========	==========

CAUSE One or more bytes of data that were received from the disk as a result of a loopback operation did not contain the expected value(s).

ACTION Data is most likely being corrupted along the data path between the host and the drive. Check all cable connections along the path and re-execute the diagnostic. If errors persist, execute appropriate diagnostics against the modules that lay in the path between the host and the device.

---

118 ***** ERROR -- EXPECTED ! BYTES FROM THE DEVICE AND RECEIVED ! BYTES (CS80ERR 118)**

CAUSE The number of bytes in the reply from the device was not what was expected. This is most likely a result of executing the diagnostic on a drive which is not supported by it.

ACTION Verify that the selected device is in the list of supported devices for the diagnostic (LIST ALL from the DUI). If it is, report the problem to support personnel.

---

119 ***** THIS COMMAND IS NOT SUPPORTED ON THIS DEVICE (CS80ERR 119)**

CAUSE The specified operation is not supported by the selected device.

ACTION While other devices supported by the diagnostic may support the specified command, the selected device does not.

---

120 ***** FILE SYSTEM ERROR ENCOUNTERED WHILE RETRIEVING A MESSAGE (CS80ERR 120)**

CAUSE An error was returned while attempting to obtain a message from the catalog. The actual error will have been displayed prior to this message.

ACTION Please enter an SR. Within the text of the SR report all information returned by the Diagnostic User Interface. Also state operating system, version number, DUI version and diagnostic version.

---

121 ***** IDENTICAL READS FROM DISC RETURNED NON-IDENTICAL DATA (CS80ERR 121)**

CAUSE A read operation was performed on the same sector twice and the data from both reads did not match exactly.

ACTION This is most likely a hardware problem with the drive. If loopback executes correctly, the read/write board in the drive is the probable cause of the error.

---

122 ***** DATA READ FROM DISC DID NOT MATCH DATA PREVIOUSLY WRITTEN (CS80ERR 122)**

CAUSE A sector was written to the disk and immediately read back. The data read did not match exactly the data written.

ACTION This is most likely a hardware problem with the drive. If loopback executes correctly, the read/write board in the drive is the probable cause of the error.

---

123 ***** SELECTED DEVICE IS NOT A RECOGNIZED HP DEVICE (CS80ERR 1123)**

CAUSE The selected device does not identify itself with a recognized Hewlett-Packard product number or the version of diagnostic does not recognize or support the product.

---

124 ***** ERROR IN TRANSMISSION DETECTED DURING READ/WRITE MEDIA TEST: (CS80ERR 124)**

Cyl	Hd	Sect	Byte	Hex Value Trns	Hex Value Recd	Bit Positions In Error 01234567	Time Error Occurred
====	==	====	====	====	====	========	==================

CAUSE Data written to the disk does not agree with the data read.

ACTION Verify the data path to the device using the **LOOPBACK** command and **WTR ERT** on the target sector.

---

140 ***** NO OPERATION WAS PERFORMED (CS80ERR 140)**

CAUSE Due to a previous error, which has already been reported, no operation was performed.

ACTION Refer to action instructions for previously reported error.

---

200 ***** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO SEND/RECEIVE INFORMATION FROM THE USER (CS80ERR 200)**

CAUSE Due to a previous error, which has already been reported, the diagnostic was unable to communicate with the user interface process.

ACTION Refer to action instructions for previously reported error.

201	***** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO RETRIEVE A MESSAGE FROM THE CATALOG (CS80ERR 201)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to extract a message from its message catalog.
ACTION	Refer to action instructions for previously reported error.

202	***** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO CONVERT A NUMBER TO A STRING (CS80ERR 202)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to convert a number to a string.
ACTION	Refer to action instructions for previously reported error.

203	***** AN ERROR WAS ENCOUNTERED IN ATTEMPTING A BIT EXTRACTION OPERATION (CS80ERR 203)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to extract one or more bits from a number.
ACTION	Refer to action instructions for previously reported error.

204	***** THE SELECTED DEVICE COULD NOT BE OBTAINED FOR TESTING (CS80ERR 204)**
CAUSE	The DUI was unable to obtain access to the device. Device may be held exclusively by another process.
ACTION	Determine the access status of the device and make the corrective requirements.

205	***** DUE TO PROBLEMS WITH RETURN ADDRESSING MODE, ADDRESSES REPORTED WITH STATUS INFORMATION MAY BE INACCURATE (CS80ERR 205)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to set the return address mode on the drive.
ACTION	Refer to action instructions for previously reported error. Also, if hardware status is displayed later in the diagnostic run, the address portion of the status could be displayed in both block and 3-vector formats since the diagnostic cannot determine the mode that the disk is currently in.

206	***** DUE TO PROBLEMS WITH SET BLOCK DISPLACEMENT, CS80DIAG WILL TERMINATE TO AVOID POTENTIAL DESTRUCTION OF USER DATA (CS80ERR 206)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully set the block displacement value on the drive. Since the diagnostic no longer knows what the displacement value is, it must terminate to avoid destroying data.
ACTION	Refer to action instructions for previously reported error.

207	***** CS/80 DESCRIBE COMMAND FAILED. DEVICE MAY NOT BE CS/80 OR DESCRIBE INFORMATION RETURNED MAY BE ERRONEOUS. CS80DIAG MAY NOT FUNCTION PROPERLY (CS80ERR 207)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully obtain describe data from the drive. Since the diagnostic needs this information to function correctly.
ACTION	Verify that the disk is in fact a CS/80 device and that the hardware path specified is valid.
208	***** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO COMMUNICATE WITH THE DIAGNOSTIC SYSTEM (CS80ERR 208)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully perform a function which requires communication with the diagnostic system.
ACTION	Refer to action instructions for previously reported error.
209	***** YOUR RESPONSE WAS INVALID (CS80ERR 209)**
CAUSE	The data entered in response to a prompt was not valid.
ACTION	Refer to the prompt to determine the valid responses for the particular situation and enter one of the specified valid responses.
210	***** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO OBTAIN DATA FROM AN I/O BUFFER (CS80ERR 210)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to get data from its i/o buffer and, therefore cannot obtain data from the device.
ACTION	Refer to action instructions for previously reported error.
211	***** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO PLACE DATA INTO AN I/O BUFFER (CS80ERR 211)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable place data into its i/o buffer and, therefore, cannot send data to the device.
ACTION	Refer to action instructions for previously reported error.
212	***** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO OBTAIN AN I/O BUFFER (CS80ERR 212)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable obtain an i/o buffer and therefore, cannot send/receive data to/from the device.
ACTION	Refer to action instructions for previously reported error.

215	***** HIGHER SECURITY IS NEEDED TO PERFORM THIS OPERATION (CS80ERR 215)**
CAUSE	The user requested an operation which is restricted to users with higher security than the user possesses.
ACTION	Contact system administrator if higher security level is desired.

216	***** ! BYTES WERE EXPECTED TO HAVE BEEN SENT FROM THE DISC, BUT ONLY ! WERE RECEIVED (CS80ERR 216)**
CAUSE	Data returned from the device in response to a command consisted of a different number of bytes than were expected.
ACTION	This is either a firmware problem or a diagnostic software problem.

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CS-80 On-Line Optical Diagnostic

Introduction

The Optical Diagnostic (`OPDIAG`) is designed to provide a means of testing CS/80 optical devices on any system that supports the online diagnostics subsystem. The devices that tested using this diagnostic are those that utilize the Command Set 80 (CS/80) message protocol for commnication with the SPU. The tests provided are:

- Verify the integrity of the HP-IB data path to the selected device.
- Identify the product type of the selected device.
- Perform Write/Read Loopback tests.
- Perform the internal selftest on the device.
- Obtain and decode status messages from the device.
- Locate and read a sector of data from the test disk.

Defects and Enhancements

Submit defect reports and enhancement requests concerning this diagnostic through the STARS database referencing product number 30600-10034.

Minimum Configuration

The hardware that is running beneath `OPDIAG` is of no concern to the diagnostic. As long as the online diagnostics subsystem is supported and there is at least one optical device configured on the system, `OPDIAG` will run. Each optical device that is tested must contain internal selftests that are capable of determining failing Field Replaceable Units in the device.

Operating Instructions

There is no special security level needed in order to run this diagnostic. However, any sections or steps of the diagnostic that have the potential to compromise system integrity will be restricted to certain security levels. Refer to the section on the DUI for information on the available security levels and test modes, and how each are determined.

Default Tests

All sections and steps run under default conditions:

```
Section 2     Clear

Section 3     Describe

Section 4     Loopback
  Step 6        Write data loopback
  Step 7        Read data loopback

Section 5     Selftest

Section 6     Status
  Step 10       Request status
  Step 11       Decode status

Section 8     Common System Operations
  Step 16       Locate and read
```

RUN Command

To bring up the Online Diagnostic subsystem, enter the following command to the MPE XL system prompt:

```
SYSDIAG
```

To bring up the Online Diagnostic subsystem, enter the following command to the HP-UX system prompt:

```
% /usr/diag/bin/sysdiag
```

The system responds with the following Diagnostic User Interface prompt:

```
DUI >
```

Typing HELP causes a summary of the DUI and its commands to be printed. Refer to the DUI Section of this manual for details.

Note

The device to be tested must be powered up and on line. Device physical locations (pdev) shown in the RUN commands are those of the devices on the "typical A1002A" system configuration described in the chapter on DUI. The pdev value entered must be correct for the system being tested.

For example, to run the diagnostic, you might enter:

```
DUI >RUN OPDIAG pdev=4.1.0 <RUN Command Options>
```

none required for default test suite

insert physical location of device to be tested here; for MPE XL, type the ldev number; for HP-UX, type the devfile name

Test Execution

When OPDIAG is run, the following header and welcome message will be displayed:

```
**********************************************************************
******                                                          ******
******                   OPTICAL DEVICE DIAGNOSTIC              ******
******                                                          ******
******         (C) Copyright Hewlett-Packard Co.  1989          ******
******                   All Rights Reserved                    ******
******                     Version  A.01.02                     ******
******                                                          ******
**********************************************************************

Welcome, Today is THR  July 06, 1989  4:00 PM
```

At this point, the diagnostic calls IO_Path_Test which is a diagnostic procedure that tests the I/O path to the device. If the status returned from this procedure call is "fail", the following message will be output:

```
*** WARNING -- THE I/O PATH TO THE DEVICE MAY NOT BE FUNCTIONING
      PROPERLY (OPDIAGERR 100)
```

Otherwise,the diagnostic issues an "identify" to the specified device to determine whether or not it is a CS/80 device. If the device does not respond to the identify command, the following message will be output:

```
*** DEVICE FAILED TO RESPOND TO IDENTIFY COMMAND (OPDIAGERR 101)
```

If a response was obtained, then the returned status is examined to determine if the device is an OPTICAL DEVICE. If not, the following message is displayed:

```
*** THE SPECIFIED DEVICE IS NOT AN OPTICAL DEVICE -- RETURNED ID%
      CODE WAS XXXX (OPDIADGERR 102)
```

If either of these two messages are generated, the diagnostic terminates immediately.

At this point, the sections and steps specified by the user executes and the results output. If the user did not specify sections and steps to be run, the default section executes. If at any time, the number of errors generated reaches the limit specified by the user in the ERRCOUNT parameter of the run command, the following message is displayed:

```
*** THE MAXIMUM NUMBER OF ERROR MESSAGES HAS BEEN EXCEEDED%   (OPDIAGERR 110)
```

The diagnostic then terminates execution. If the ERRPAUSE parameter of the RUN command was assigned a value of "on", then this diagnostic stops after each error is generated and asks the user if the test should continue:

```
Do you wish to continue (Y/N)?
```

If the response is "Y", then the test resumes (if possible), and if the response is "N", this diagnostic will terminate. The "[Y]" indicates that "Y" is the default response if the user simply hits <CR> in response to the prompt. If the sections and steps specified by the user were executed the number of times specified in the LOOP parameter of the run command without the number of errors exceeding the ERRNUM value, the diagnostic will terminate normally and the following message displays:

```
OPTICAL DEVICE Diagnostic Exiting ...
```

Upon termination of this diagnostic, control will return to the Diagnostic system.

Detailed Test Descriptions

This section is devoted to explaining each section of OPDIAG, as well as each step within a section. For each section/step, this explanation will consist of a description of the section/step, including the actions performed therein, the expected output from that section/step, and any error messages that may be generated that are worth noting. Please note that in regard to the error messages, all possible error messages that may be generated are not listed. The only error messages that are listed are those that are considered to be of special significance. For a complete list of error messages that may be generated while running OPDIAG, please refer to "Optical Error Messages", at the end of this chapter.

The following sections and steps are available for user selection:

```
Section 2     Clear

Section 3     Describe

Section 4     Loopback
  Step 6        Write data loopback
  Step 7        Read data loopback

Section 5     Selftest

Section 6     Status
  Step 10       Request status
  Step 11       Decode status

Section 8     Common System Operations
  Step 16       Locate and read
```

Section 2—CLEAR

This section performs a CLEAR operation on the device that was specified in the RUN command. This command basically resets the device to its power-on state. Prior to issuing the clear command, a CS/80 PRESET command is issued. The command that is sent to clear the device is a CS/80 SELECTED DEVICE CLEAR. The following actions are taken as a result of executing this section:

- Clear all clearable device or interface conditions currently asserted.
- Reset all complementary parameters to their power-on values.
- Reset the status reported from the device.

OUTPUT :

```
Section 2 -- CLEAR

        End of Section 2 -- Clear
```

Section 3—DESCRIBE

This section issues a DESCRIBE command to the selected device to determine whether it is responding to commands and whether it is an OPTICAL device.

OUTPUT :

```
Section 3 -- DESCRIBE

        The following unit(s) are installed:
             0          15
Maximum transfer rate = 400 kbytes per second
Controller type =
Device is an HP50710 Optical Read-only Disk.
Block size = 2048 bytes
Buffer size = 6 blocks
Recommended burst size = 8 bytes
Block transfer time = 13333 microseconds
Average transfer rate = 153 kbytes per second
Optimal retry time = 90 10's of milliseconds
Maximum access time to data = 9000 10's of milliseconds
Maximum interleave = 0
There are no fixed volumes
Removeable volumes installed are:
     0
Maximum cylinder address = 19
Maximum head address     = 59
Maximum sector address   = 74
Maximum block address    = 89999
Current sector interleave = 0


        End of Section 3 -- DESCRIBE
```

Section 4—LOOPBACK

This section performs a write loopback of 256 bytes of data on the channel using the pattern—255,0,1, ... ,254. This operation is followed by a read loopback of 256 bytes which is compared with the expected pattern generated from Read-Only Memory (ROM) in the device and should be the same as the pattern specified above in the write loopback.

```
Step 6 - Write data loopback.

Step 7 - Read data loopback.
```

OUTPUT :

```
Section 4 -- LOOPBACK

   Step 6 - Write Loopback Completed

   Step 7 - Read Loopback Completed

End of Section 4 -- Loopback
```

POSSIBLE ERROR MESSAGES :

```
*** ERROR IN TRANSMISSION DETECTED DURING READ
  LOOPBACK TEST: (CS80ERR 115)
```

Byte #	Octal Value Transmitted	Octal Value Received	Bit Positions In Error 01234567
12	56	54	00000010
33	127	63	01100100
.			
.			
.			
241	74	72	00000110

```
(Note: -- entries in the preceding table will be printed
          for as many errors as were detected, unless the
          ERRNUM value is exceeded)
```

Section 5—SELFTEST

This section initiates the internal power-on selftest on the device and reports the status of the test to the user. The test is initiated by issuing an INITIATE DIAGNOSTIC command specifying Diagnostic 0 as the test to be performed, which is the power-on selftest used by the device.

OUTPUT :

```
Section 5 -- SELFTEST

        End of Section 5 -- SELFTEST
```

POSSIBLE ERROR MESSAGES:

```
*** DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE
    OPTICAL INITIATE DIAGNOSTIC COMMAND (OPDIAGERR 109)

    STATUS = { status }

(Note: -- This status printout will include the failing field
          replaceable unit(s) as specified by the device.)
```

Section 6—STATUS

This section obtains the STATUS from the device, then decodes and displays the STATUS. If a error has occurred, the most suspect FRU number will be displayed.

OUTPUT :

```
Section 6 -- STATUS

   Step 10 - REQUEST STATUS Completed

Status =

Unit = 0    Volume = 0

No units with status pending

New target address is :

   Step 11 - DECODE STATUS Completed

End of Section 6 -- STATUS
```

POSSIBLE ERROR MESSAGES:

```
*** DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE
    OPTICAL STATUS COMMAND (OPDIAGRR 109)
```

Section 8—COMMON SYSTEM OPERATIONS

This section initiates the COMMON SYSTEM OPERATIONS on the device and reports the status of the test to the user. The test is initiated by running Step 16. Step 16 locates a sector on the Test Disk. It issues two consecutive reads to the sector. If the two reads compare, the data is then compared with the data that is expected at that address.

```
Step 16 -- LOCATE and READ
```

OUTPUT:

```
Section 8 -- COMMON SYSTEM OPERATIONS

                Step 16 - Locate and Read Completed.

            End of Section 8 Common system operations.
```

POSSIBLE ERROR MESSAGES:

```
*** DATA RECEIVE WAS NOT THE DATA EXPECTED. CHECK THAT THE%
    PROPER TEST DISK IS INSTALLED.  IF THE PROPER TEST DISK%
    IS INSTALLED, CHECK FIRST THE DISK MECHANISM, THEN THE%
    CONTROLLER PCA.  (OPDIAGERR 141)
```

Error Messages

This section gives a complete list of the error messages that may be generated by OPDIAG along with brief explanations of the meaning of the messages. The messages are listed in numerical order and are exactly as they appear in the message catalog. An "!" indicates that a parameter of some sort is placed in the location marked by the exclamation point. An "&" indicates that the line below is attached to the end of the line with the ampersand. A "%" means that the line below is a continuation of the message, but not to be attached as with the ampersand.

100	***** WARNING -- THE I/O PATH MAY NOT&** **BE FUNCTIONING PROPERLY (OPDIAGERR 100)%**
CAUSE	An error was detected by the Io_Path_Test service while testing the modules on the I/O path preceding the selected device.
ACTION	Execute the appropriate diagnostics on the modules preceding the selected device on the I/O path, especially on those that may have been reported as faulty in error messages immediately preceding this message. Note that the results of the execution of this instance of OPDIAG may be invalid.

101	***** DEVICE FAILED TO RESPOND TO ! COMMAND (OPDIAGERR 101)%**
CAUSE	No response to an I/O was received prior to the expiration of the allotted time.
ACTION	Verify that the selected device is actually connected to the system. Run SYSMAP, if available, to confirm the presence of the device.

102	***** OPDIAG IS UNABLE TO DIAGNOSE THE SELECTED DEVICE&** **(OPDIAGERR 102)%**
CAUSE	The selected device identified itself as something other than an Optical device.
ACTION	Determine type of selected device and run the appropriate diagnostic on it.

103	***** OPTICAL DIAGNOSTIC TERMINATING (OPDIAGERR 103)%**
CAUSE	A fatal error has been encountered.
ACTION	The specific error that was encountered should have been reported immediately prior to this message. Follow the action instructions for that error message.

106	***** ! MODE REQUIRED TO EXECUTE THIS COMMAND%** **(OPDIAGERR 106)%**
CAUSE	The diagnostic does not have access to the device in the mode necessary to execute the selected command.
ACTION	The mode granted to a diagnostic for a selected device is system dependent. For MPE-XL, for example, the volume label must be scratched in order to access the device destructively.

108	***** ! COMMAND IS NOT IMPLEMENTED ON THIS DEVICE/SYSTEM%** **(OPDIAGERR 108)%**
CAUSE	The selected operation is either not implemented on the selected device or the system does not provide access to it.
ACTION	This operation is unavailable.

109	***** DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE%** **OPDIAG ! COMMAND (OPDIAGERR 109)%**
CAUSE	The device reported an error as a result of executing the selected operation.
ACTION	The hardware status that is displayed immediately following this message should indicate what sort of problem occurred, including a failing FRU if one is reported. If an FRU is reported, replace it and re-execute this diagnostic.

110	***** THE MAXIMUM NUMBER OF ERRORS HAS BEEN EXCEEDED%** **(OPDIAGERR 110)%**
CAUSE	The user specified error limit has been reached.
ACTION	If more errors are desired, re-run the diagnostic assigning a larger value to the ERRCOUNT parameter of the run command.

111	***** UNRECOGNIZED COMMAND --%** **TYPE "HELP" FOR A LIST OF VALID COMMANDS (OPDIAGERR 111)%**
CAUSE	The specified command is not a valid command.
ACTION	Use the help facility to obtain a list of the commands that are valid and enter the desired command.

112 ***** UNRECOGNIZED REPLY WAS FOUND (OPDIAGERR 112)%**

CAUSE The reply that was entered in response to a prompt by the diagnostic is not valid.

ACTION Refer to the prompt that was displayed and enter a response that is within the specified list of valid responses.

---

113 ***** A NUMERICAL INPUT WAS EXPECTED BUT NOT RECEIVED&**

(OPDIAGERR 113)%

CAUSE The reply that was entered in response to a prompt by the diagnostic is not a valid number.

ACTION Re-enter number using only numeric characters and valid special characters (e.g., +, -, , etc.).

---

114 ***** AN UNEXPECTED ERROR OCCURRED IN THE IO_OPTICAL DAR%**

(OPDIAGERR 114)%

CAUSE A call to the OPDIAG device access routine resulted in an unexpected status return.

ACTION The specific status generated by Io_CS/80 should have been displayed immediately prior to this error message. Report this set of error messages to support personnel.

---

115 ***** ERROR IN TRANSMISSION DETECTED DURING&**

READ LOOPBACK TEST: (OPDIAGERR 115)%

Byte #	Octal Value Transmitted	Octal Value Received	Bit Positions In Error 01234567
======	==========	==========	==========

CAUSE One or more bytes of data that were received from the device as a result of a loopback operation did not contain the expected value(s).

ACTION Data is most likely being corrupted along the data path between the host and the device. Check all cable connections along the path and re-execute the diagnostic. If errors persist, execute appropriate diagnostics against the modules that lay in the path between the host and the device.

---

116 ! ! ! !

118	*** ERROR -- EXPECTED ! BYTES FROM THE DEVICE AND% RECEIVED ! BYTES (OPDIAGERR 117)%
CAUSE	The number of bytes in the reply from the device was not the expected number. This is most likely a result of executing the diagnostic by an unsupported device.
ACTION	Verify that the selected device is in the list of supported devices for the diagnostic (LIST ALL from the DUI). If it is, report the problem to support personnel.

119	*** THIS COMMAND IS NOT SUPPORTED ON THIS DEVICE% (OPDIAGERR 119)%
CAUSE	The specified operation is not supported by the selected device.
ACTION	While other devices supported by the diagnostic may support the specified command, the selected device does not.

120	*** FILE SYSTEM ERROR ENCOUNTERED WHILE& RETRIEVING A MESSAGE (OPDIAGERR 120)%
CAUSE	An error was returned while attempting to obtain a message from the catalog. The actual error will have been displayed prior to this message.
ACTION	This is a software error. Report to support personnel.

121	*** IDENTICAL READS FROM DEVICE& RETURNED NON-IDENTICAL DATA (OPDIAGERR 121)%
CAUSE	A read operation was performed on the same sector twice and the data from both reads did not match exactly.
ACTION	This is most likely a hardware problem with the device. If loopback executes correctly, the read/write board in the device is the probable cause of the error.

123	*** UNIT WAS SET TO 15 BUT STATUS DOES NOT INDICATE THE% CURRENT UNIT AS 15 (OPDIAGERR 122)%
CAUSE	A set unit command was sent to the device specifying unit 15 and hardware status was immediately requested. The unit field of the status was not 15.
ACTION	This is definitely a device problem—probably firmware.

124	*** THE ADDRESS THAT WAS SET ON THE DEVICE IS NOT% EQUIVALENT TO THE ADDRESS RETURNED IN STATUS% (OPDIAGERR 124)%
CAUSE	A set address command was sent to the device immediately followed by a status request. The address reported in the hardware status did not match the address that was set.
ACTION	This is definitely a device problem—probably firmware.

128	*** THE ADDRESS RETURNED IN STATUS INDICATES % THAT THE DEVICE ERRONEOUSLY CONVERTED THE ADDRESS % WHEN CHANGING ADDRESSING MODE (OPDIAGERR 128)%
CAUSE	A set address command was issued to the device followed by a set return address mode to the opposite of the current mode. Status was then requested and the current target address did not match the address that was set, implying that the address conversion performed by the drive was incorrect.
ACTION	This is definitely a device problem—probably firmware.

129	*** AN ERROR WAS ENCOUNTERED WHEN READING AFTER RETRY% TIME WAS SET TO A RANDOM VALUE (OPDIAGERR 129)%
CAUSE	A set retry time was issued to the device with a random time value followed by a read command. The device reported an error.
ACTION	This is definitely a device problem—probably firmware.

130	*** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO SEND A% RELEASE COMMAND TO THE DEVICE (OPDIAGERR 130)%
CAUSE	A release command was sent to the device and the device returned an error.
ACTION	This is definitely a device problem—probably firmware.

131	*** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO SEND A% RELEASE DENIED COMMAND TO THE DEVICE (CS80ERR 131)%
CAUSE	A release denied command was sent to the device and the device returned an error.
ACTION	This is definitely a device problem—probably firmware.

133	***** AN INVALID OPCODE WAS SENT TO THE DEVICE, BUT THE% ILLEGAL OPCODE BIT OF THE STATUS MESSAGE WAS NOT SET% (OPDIAGERR 133)%**
CAUSE	A command was sent to the device with an invalid op code and the device did not report the expected error.
ACTION	This is definitely a device problem—probably firmware.

134	***** A SET UNIT COMMAND WAS ISSUED WITH A UNIT% NUMBER OF 1, BUT THE MODULE ADDRESSING BIT OF % THE STATUS MESSAGE WAS NOT SET (OPDIAGERR 134)%**
CAUSE	A set unit command was sent to the device with a unit number of 1, which is an invalid unit number. The device did not report the expected error.
ACTION	This is definitely a device problem—probably firmware.

135	***** A SET ADDRESS COMMAND WAS ISSUED TO AN ADDRESS GREATER% THAN THE MAXIMUM FOR THE DEVICE, BUT THE ADDRESS% BOUNDS BIT OF THE STATUS MESSAGE WAS NOT SET% (OPDIAGERR 135)%**
CAUSE	A set address command was sent to the device with an address greater than the maximum allowable. The device did not report the expected error.
ACTION	This is definitely a device problem—probably firmware.

136	***** THE STATUS MASK WAS SET TO MASK ALL UNMASKABLE % BITS, BUT THE PARAMETER BOUNDS BIT OF THE STATUS % MESSAGE WAS NOT SET (OPDIAGERR 136)%**
CAUSE	A set status mask command was sent to the device specifying that all bits be masked that are not allowable (unmaskable). The device did not report the expected error.
ACTION	This is definitely a device problem—probably firmware.

137	*** A SET LENGTH COMMAND WAS ISSUED WITH ONLY 1 PARAMETER%
	BYTE INSTEAD OF THE 4 EXPECTED BY THE DEVICE, BUT THE%
	ILLEGAL PARAMETER BIT OF THE STATUS MESSAGE WAS NOT SET%
	(OPDIAGERR 137)%
CAUSE	A set length command was sent to the device with fewer bytes than are expected by the device for that command. The device did not report the expected error.
ACTION	This is definitely a device problem—probably firmware.

140	*** NO OPERATION WAS PERFORMED (OPDIAGERR 140) %
CAUSE	Due to a previous error, which has already been reported, no operation was performed.
ACTION	Refer to action instructions for previously reported error.

141	*** DATA RECEIVE WAS NOT THE DATA EXPECTED. CHECK THAT THE%
	PROPER TEST DISK IS INSTALLED. IF THE PROPER TEST DISK%
	IS INSTALLED, CHECK FIRST THE DISK MECHANISM, THEN THE%
	CONTROLLER PCA. (OPDIAGERR 141)%
CAUSE	Two consecutive reads were sent to the device. The data was then compared. This compare was sucessful. The data received was then compared with the data expected at that location. This compare failed.
ACTION	Check that the proper TEST DISK is installed. If it is, check the disk mechanism, then the controller PCA.

200	*** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO%
	SEND/RECEIVE INFORMATION FROM THE USER%
	(OPDIAGERR 200)%
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to communicate with the user interface process.
ACTION	Refer to action instructions for previously reported error.

201	***** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO RETRIEVE A% MESSAGE FROM THE CATALOG (OPDIAGERR 201)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to extract a message from its message catalog.
ACTION	Refer to action instructions for previously reported error.

202	***** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO CONVERT A% NUMBER TO A STRING (OPDIAGERR 202)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to convert a number to a string.
ACTION	Refer to action instructions for previously reported error.

203	***** AN ERROR WAS ENCOUNTERED IN ATTEMPTING A BIT% EXTRACTION OPERATION (OPDIAGERR 203)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to extract one or more bits from a number.
ACTION	Refer to action instructions for previously reported error.

205	***** DUE TO PROBLEMS WITH RETURN ADDRESSING MODE,% ADDRESSES REPORTED WITH STATUS INFORMATION MAY BE% INACCURATE (OPDIAGERR 205)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to set the return address mode on the device.
ACTION	Refer to action instructions for previously reported error. Also, if hardware status is displayed later in the diagnostic run, the address portion of the status could be displayed in both block and 3-vector formats since the diagnostic cannot determine the device's mode.

206	***** DUE TO PROBLEMS WITH SET BLOCK DISPLACEMENT, OPDIAG% WILL TERMINATE TO AVOID POTENTIAL DESTRUCTION OF % USER DATA (OPDIAGERR 206)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully set the block displacement value on the device. Since the diagnostic no longer knows what the displacement value is, it must terminate to avoid destroying data.
ACTION	Refer to action instructions for previously reported error.

207	***** DUE TO PROBLEMS WITH DESCRIBE, OPDIAG CANNOT FUNCTION% PROPERLY AND WILL THEREFORE TERMINATE (OPDIAGERR 207)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully obtain describe data from the device. Since the diagnostic needs this information to function correctly, it must terminate.
ACTION	Refer to action instructions for previously reported error.

208	***** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO COMMUNICATE% WITH THE DIAGNOSTIC SYSTEM (OPDIAGERR 208)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully perform a function which requires communication with the diagnostic system.
ACTION	Refer to action instructions for previously reported error.

209	***** YOUR RESPONSE WAS INVALID (OPDIAGERR 209)%**
CAUSE	The data entered in response to a prompt was not valid.
ACTION	Refer to the prompt to determine the valid responses for the particular situation and enter one of the specified valid responses.

210	***** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO OBTAIN% DATA FROM AN I/O BUFFER (OPDIAGERR 210)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to get data from its I/O buffer and, therefore cannot obtain data from the device.
ACTION	Refer to action instructions for previously reported error.

211	*** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO PLACE% DATA INTO AN I/O BUFFER (OPDIAGERR 211)%
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable place data into its I/O buffer and, therefore, cannot send data to the device.
ACTION	Refer to action instructions for previously reported error.

212	*** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO OBTAIN% AN I/O BUFFER (OPDIAGERR 212)%
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable obtain an I/O buffer and therefore, cannot send/receive data to/from the device.
ACTION	Refer to action instructions for previously reported error.

215	*** HIGHER SECURITY IS NEEDED TO PERFORM THIS OPERATION % (OPDIAGERR 215) %
CAUSE	The user requested an operation which is restricted to users with higher security than the user possesses.
ACTION	Contact a system administrator if higher security level is desired.

216	*** ! BYTES WERE EXPECTED TO HAVE BEEN SENT FROM THE DEVICE,% BUT ONLY ! WERE RECEIVED (OPDIAGERR 216) %
CAUSE	Data returned from the device in response to a command consisted of a different number of bytes than were expected.
ACTION	This is probably a firmware problem in the device.

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20

SS/80 Disk Diagnostic

Introduction

The SS/80 Disk Diagnostic (SS80DIAG) tests the HP9122D, HP9122S, and the HP9127A SS/80 disk drives.

This diagnostic does **not** test the following disk drives:

- HP7907A, 7908
- HP7911, 7912, 7914
- HP7933, 7935, 7936, 7937
- HP7957B, 7958B
- HP7961B, 7962B, 7963B

These drives are tested by the CS/80 Disk Diagnostic. Refer to CS80DIAG in this manual.

SS80DIAG runs on any HP Precision Architecture RISC computer system that supports Online Diagnostic Subsystem programs and is capable of detecting failures of one or more Field Replaceable Units (FRUs). The SS/80 Disk Diagnostic will:

- Verify the integrity of the HPIB data path to the selected disk
- Identify the product type of the selected disk
- Run the internal diagnostics on the disk (including selftest)
- Obtain and decode status messages from the disk
- Test common transactions that are used in communication between the disk and CPU to determine the integrity of these transactions
- Force certain errors to occur on the disk and verify that the disk reports them appropriately
- Provide a SS/80 Disk External Exerciser

Defects and Enhancements

Submit defect reports and enhancement requests for this diagnostic through the STARS database referencing product number 30600-10008.

Minimum Configuration

The hardware required to run the diagnostic consists of an HP Precision Architecture Computer with a SS/80 disk drive connected to it. The SS/80 disk under test must contain internal selftests that are capable of detecting failed FRU's in the disk drive. In addition, the disk must have a reserve area of at least 4 sectors set aside for use by diagnostics. The location of this area will be determined by the operating system and since it will be used by SS80DIAG, the data will be destroyed.

Operating Instructions

There is no special security level needed in order to run this diagnostic. However, any sections or steps of the diagnostic that have the potential to comprise system integrity will be restricted to certain security levels. Refer to the Security section on the DUI for information on the available security levels and test modes, and how each are determined.

Default Tests

If the user does not specify sections and steps to be run, the following default sections, including all steps, will be executed:

Section 2	Clear
Section 3	Identify
Section 4	Loopback
Section 5	Selftest
Section 8	Common System Operations
Section 9	Status Tests

RUN Command

To bring up the Online Diagnostic subsystem, enter the following command to the HP-UX system prompt:

```
%/usr/diag/bin/sysdiag
```

The system responds with the following prompt indicating that access has been gained to the Online Diagnostic User Interface (DUI).

```
DUI >
```

Typing `HELP` causes a summary of the DUI and its commands to be printed. Refer to the DUI Section of this manual for details.

Note

The device to be tested must be powered up and on line. Device physical locations (pdev) shown in the `RUN` commands are those of the devices on the "typical A1002A" system configuration described in the chapter on DUI. The pdev value entered must be correct for the system being tested.

For example, to run the diagnostic, you might enter:

```
DUI >RUN SS80DIAG pdev=4.1.0 <RUN Command Options>
```

insert physical location of device to be tested here; alternatively, for MPE XL, type the ldev number; or for HP-UX, type the devfile name

none required for default test suite

Test Execution

When SS80DIAG is run, the following header and welcome message will be displayed:

```
*********************************************************
*****                                                ***
*****              SS/80 DISC DIAGNOSTIC             ***
*****                                                ***
*****    (C) Copyright Hewlett Packard Co. 1987      ***
*****                All Rights Reserved.            ***
*****                    Version A.00.00             ***
*****                                                ***
*********************************************************

Welcome, Today is MON, May 22, 1987, 9:00 AM
```

During system initialization various messages can be output by SS80DIAG. Error messages are listed at the back of this document.

The diagnostic calls IO_Path_Test, which is a diagnostic procedure that tests the I/O path to the device. If the status returned from this procedure call is "fail", the following message will be output:

```
*** WARNING -- THE I/O PATH TO THE DISC MAY NOT BE FUNCTIONING
    PROPERLY (SS80ERR 100)
```

Otherwise, the diagnostic issues an identify to the specified device to determine whether or not it is a SS/80 disk. If the device does not respond to the identify command, the following message will be output:

```
DEVICE FAILED TO RESPOND TO IDENTIFY COMMAND (SS80ERR 101)
```

If a response was obtained, then the returned status is examined to determine if the device is a SS/80 disk. If not, the following message will be displayed:

```
THE SPECIFIED DEVICE IS NOT A SS/80 DISC --
RETURNED ID CODE WAS XXXX (SS80ERR 102)
```

If either of these two messages is generated, the diagnostic will terminate immediately after outputting them.

If access to the SS/80 disk is granted, the sections and executed and the results output. If the user has provided a value for the ERRCOUNT parameter of the **RUN** command, the following message will be output when the number of errors reaches or exceeds that value:

```
THE MAXIMUM NUMBER OF ERROR MESSAGES HAS BEEN EXCEEDED (SS80ERR 110)
```

The diagnostic will then terminate execution. If the ERRPAUSE parameter of the **RUN** command was assigned a value of "on", the diagnostic will stop after each error is generated and ask the user if the test should continue:

```
Do you wish to continue (Y/N)[Y]?
```

If the response is "Y" or [Return], the test will be resumed (if possible), and if the response is "N", this diagnostic will terminate. If the sections and steps specified by the user were executed the number of times specified in the LOOP parameter of the **RUN** command without the number of errors exceeding the ERRNUM value, the diagnostic will terminate normally and the following message output:

```
SS/80 Disc Diagnostic Exiting ...
```

Upon termination of this diagnostic, control will return to the Diagnostic system.

Test Section Descriptions

The following nine diagnostic program sections are available. The user can run individual steps within sections 4, 6, 8, and 9.

Section 2	Clear
Section 3	Identify
Section 4	Loopback
Step 6	Write Loopback
Step 7	Read Loopback
Section 5	Selftest
Section 6	Status
Step 10	Request Status
Step 11	Decode Status
Section 8	Common System Operations
Step 15	Locate and Verify Command
Step 16	Locate and Read Command
Step 17	Locate and Write
Step 18	Set Unit
Step 19	Set Address
Step 21	Set Length
Step 23	Set Status Mask
Section 9	Status Tests
Step 40	Illegal Opcode
Step 41	Module Addressing
Step 42	Address Bounds
Step 43	Parameter Bounds
Step 44	Illegal Parameter
Step 45	Message Sequence
Step 46	Message Length
Section 17	External Exerciser (Interactive Section)

A description of each section and step will be given along with the expected output from that section and step.

Section 2—CLEAR

This section performs a clear operation on the disk that was specified in the RUN command. This command resets the disk to its power-on state. The command that will be sent to clear the disk will be a SS/80 selected device clear. The following actions are taken as a result of executing this section:

- Clear all clearable device or interface conditions currently asserted.
- Reset all complementary parameters to their power-on values.
- Reset the status reported from the device.

If no errors are encountered, the diagnostic will output the following message:

```
Section 2 -- CLEAR
End of Section 2 -- Clear
```

Section 3—IDENTIFY

This section issues an identify command to the selected disk to determine whether it is responding to commands and whether it is an SS/80 disk. If no errors are encountered, the diagnostic will output the following message:

```
Section 3 -- IDENTIFY
   The selected device has been identified as an HPXXXX disc.
End of Section 3 -- Identify
```

Section 4—LOOPBACK

This section will perform a write loopback of 256 bytes of data on the channel using the pattern—255,0,1, ... ,254. This operation will be followed by a read loopback of 256 bytes which will be compared with to the expected pattern to verify correct transmission. The pattern sent in the read loopback is generated from Read-Only Memory (ROM) in the disk drive and should be the same as the pattern specified above in the write loopback. The user can select one or both of the following steps:

Step 6	**Write data loopback**
Step 7	**Read data loopback**

If no errors are encountered, the diagnostic will output the following message:

```
Section 4 -- LOOPBACK
   Step 6 - Write Loopback Completed
   Step 7 - Read Loopback Completed
End of Section 4 -- Loopback
```

Section 5—SELFTEST

This section initiates the internal power-on selftest on the disk and reports the status of the test to the user. The test will be initiated by issuing an initiate diagnostic command specifying diagnostic 0 as the test to be performed, which is the power-on selftest used by the device. If no errors are encountered, the diagnostic will output the following message:

```
Section 5 -- SELFTEST
End of Section 5 -- Selftest
```

Section 6—STATUS

This section requests status from the disk and outputs the status to the user. This is a two step process, one step to get the status and one step to decode it. This structure is used so that the system can supply a status to be decoded rather than always obtaining it from the disk. The user can select one of two steps:

Step 10 **Request Status:** Issues a request status command to the disk and gets the hardware status that is returned.

Step 11 **Decode Status:** Decodes the last status that was obtained from the disk, or the status provided by the system.

```
Section 6 -- STATUS
   Step 10 - Request Status Completed
     Status =
     Unit = nnnn       Volume = nnnn
     No units with pending status

                    or

     Unit nnnn has status pending
```

{One or more of the following status messages may be printed}

```
     >>>>>>>>>> REJECT ERRORS <<<<<<<<<<
     Received a command without odd parity
     Received an unrecognized opcode
     Received an illegal volume or unit address
     Received an address which exceeds device bounds
     Received an illegal parameter
     Received a parameter of the wrong length
     Received a message out of sequence
     Received a message of the wrong length

     >>>>>>>>>> FAULT ERRORS <<<<<<<<<<
     Error occurred during copy data transaction --
        Units experiencing errors are :
           nnnn, nnnn, nnnn, nnnn
     Controller hardware fault
     Unit hardware fault
     Hardware failed diagnostic --
        Failed part numbers are : nnnn, nnnn
        Test error numbers = nnnn, nnnn
     Power failed or drive just powered on
     Auto Release has been completed -- Retransmit last command
```

```
>>>>>>>>>> ACCESS ERRORS <<<<<<<<<<
Media has not been initialized or is unusable
Spare Block cannot be executed -- No spare media available
Drive is not ready for access
The selected volume is write protected
A block accessed during a read has not been written
Multiple unrecoverable data errors have occurred
Unrecoverable data has been detected --
   Address of bad data is:
   Block address = nnnn
            or
   Vector address =
      Cylinder = nnnn     Head = nnnn     Sector = nnnn
End of file encountered
End of volume encountered

>>>>>>>>>> INFORMATION ERRORS <<<<<<<<<<
Only one spare track remains on the disc
A latency was introduced during the transfer due to slow
   transfer rate or seek retry
A defective block has been automatically spared
Multiple recoverable data errors have occurred
A latency was introduced to correct a data error --
   Address of bad block is:
   Block address = nnnn
               or
   Vector address =
      cylinder = nnnn     head = nnnn     sector = nnnn

New Target address is:
   Block address = nnnn
               or
   Vector address =
      cylinder = nnnn     head = nnnn     sector = nnnn

   Step 11 - Decode Status Completed
End of section 6 -- Status
```

Section 8—COMMON SYSTEM OPERATIONS

This section will execute all SS/80 commands applicable to disks with the exception of initialize media and spare block, both of which are accessible in the External Exerciser section. The purpose of this section is to verify that these commands are functioning properly. The tests will be as thorough as possible while still allowing them to be automated. The user can select any of the following steps:

Step 15	**Locate and Verify:** This step sends a SS/80 locate and verify command to the disk to verify 2k bytes of data at a random address.
Step 16	**Locate and Read:** This step reads a sector of data twice and then compares the data received from both.
Step 17	**Locate and Write:** This step writes a sector of random data to the reserve area on the disk, reads that data back and compares it to the data written.
Step 18	**Set Unit:** This step sends a SS/80 set unit command to the disk to set unit 15 on it, requests a hardware status from the device, and verifies that the unit reported in status is 15.
Step 19	**Set Address:** This step sends a SS/80 set address command to the disk to set the current address to some random value, requests a hardware status from the device, and verifies that the current address in the status is the same as the address that was just set.
Step 21	**Set Length:** This step sends a SS/80 locate and read command to the disk to read 256 bytes of data at the current address.
Step 23	**Set Status Mask:** This step sends a SS/80 set status mask command to mask out the address bounds error bit of the hardware status. An address bounds error will then be forced to occur by sending a SS/80 set address command to the disk to set an address that is greater than the maximum allowed.

If no errors are encountered, the diagnostic will output the following message:

```
Section 8 -- Common System Operations
End of Section 8 -- Common System Operations
```

Section 9—STATUS TESTS

This section will force several errors to occur on the disk and then verify that the correct error bit was set in the hardware status returned from the drive.

Step 40	**Invalid Opcode:** This step sends an invalid opcode bit to the disk, and then verifies that it was set in the status that was returned from the device.
Step 41	**Module Addressing:** This step sets the unit to an invalid number using the set unit command, and then verifies that the module addressing error bit was set in the status that was returned from the device.
Step 42	**Address Bounds:** This step sends a CS/80 set address command to the disk, sets the address to a value greater than the maximum allowed by the device, and then verifies that the address bounds bit was set in the status that was returned from the device.
Step 43	**Parameter Bounds:** This step sends a CS/80 set status mask command to the disk, sets the status mask to all unmaskable bits, and then verifies that the parameter bounds error bit was set in the status that was returned from tbe device.
Step 44	**Illegal Parameter:** This step sends a CS/80 set length command to the disk, giving it one byte for the length instead of the four bytes that the drive expects and then verifies that the illegal parameter bit was set in the status that was returned from the drive.
Step 45	**Message Sequence:** This step sends a locate and write command while requesting that it return an execution message (instead of providing an execution message as was expected) and then verifies that the message sequence error bit was set in the status returned from the device.
Step 46	**Message Length:** This step sends a CS/80 locate and write command to the disk, sets a length in the command phase and uses a different length in the execution phase. It then verifies that the message length bit was set in the status returned from the device.

```
Section 9 -- Status Tests
End of Section 9 -- Status Tests
```

Section 17—EXTERNAL EXERCISER

The SS/80 External Exerciser is an interactive program which provides the user with access to the set of internal diagnostics and utilities within a SS/80 disk. This section explains what different kinds of data the exerciser can provide, how that information is generated and describes the commands available to the user. Refer to the SS/80 Reference Manual (P/N 5958-4129) for further information on the SS/80 instruction set. To run the External Exerciser select Section 17 of the SS80DIAG diagnostic. The SS80DIAG prompt appears indicating that the Exerciser is waiting for a command from the user. Refer to the Command Descriptions and the Exerciser Command Format explanations below for further details.

Command Descriptions

When the external exerciser is invoked, the following prompt will be displayed to the user:

```
SS80DIAG>
```

When the prompt appears, the exerciser is waiting for a command from the user. The available commands are listed in this section in alphabetical order accompanied by descriptions. Each command description is in the following format:

COMMAND NAME

Description:

Explanation of what the command does and when it should be used.

Input:

```
SS80DIAG>COMMAND NAME
```

The prompt for this exerciser is `SS80DIAG>`. The appearance of this prompt indicates that the exerciser is waiting for the user to input a command.

Output:

- Information printed as a result of this command being executed.
- Any error messages that may be worth noting are listed in this area.

There are several conventions used throughout this section in the command formats. They are as follows:

nnnn	refers to a decimal number of any magnitude that is output by the diagnostic.
vvvv	refers to a decimal number of variable magnitude that must be input by the user.
H	refers to a hexadecimal digit (0-F).
O	refers to an octal digit (0-8).
B	refers to a binary digit (0-1).

Any text enclosed in parentheses indicates that the user is expected to input that text in response to a query from the diagnostic. Text enclosed in square brackets indicates the default response that will be assumed if the user simply hits (Return) in response to the query. For example, the user may be asked if the program should continue by the following question:

```
Do you wish to continue (Y/N)[ N ]?
```

The text enclosed in the parentheses (i.e., "Y/N") indicates that the user is to type either a "Y" or an "N" in response to the question. Each option is separated by a "/". The default response in this case would be "N", as indicated by the [N] prior to the question mark. If there is no default response listed (enclosed in square brackets), the user will not be allowed to "default" the input by only entering a Return.

Comments in the input and output sequences are enclosed in curly brackets and are not output by the program. For example, following the question in the previous example, the input sequence would probably look something like the following:

{if response was N this command will terminate}

Error messages will be preceded by three asterisks (***) and will be in all upper case letters. Other messages will not be all upper case and will not be preceded by the asterisks.

If the user enters a command in response to a prompt and that command is not recognized as an exerciser command, the following message will be displayed:

```
***YOUR RESPONSE WAS INVALID

SS80DIAG>
```

This message simply means that the command entered is not part of the command set for the external exerciser.

When the user enters a command that is recognized by the external exerciser, that command will then be processed as according to the corresponding command description given in one of the following sections of this document. If an error is encountered as a result of issuing a SS/80 command to the device, the status that is returned by the device will be displayed to the user. The status display will consist of some device identification information followed by several categorized error messages. The categories are reject errors, fault errors, access errors, and information errors. Reject errors indicate illegal interaction with the device such as an opcode error. These errors result when commands are sent to the device but not recognized by it. Fault errors indicate hardware failures. Access errors indicate media absence, formatting problems, or operator intervention. Information errors indicate potential problems or performance irregularities in the device. The format of the output status message follows:

```
Status =

Unit = nnnn       Volume = nnnn

No units with pending status
          or
Unit nnnn has status pending
```

{One or more of the following status messages may be printed}

```
>>>>>>>>>> REJECT ERRORS <<<<<<<<<<
Received a command without odd parity
Received an unrecognized opcode
Received an illegal volume or unit address
Received an address which exceeds device bounds
Received an illegal parameter
Received a parameter of the wrong length
Received a message out of sequence
Received a message of the wrong length

>>>>>>>>>> FAULT ERRORS <<<<<<<<<<
Error occurred during copy data transaction --
   Units experiencing errors are :
      nnnn, nnnn, nnnn, nnnn
Controller hardware fault
Unit hardware fault
Hardware failed diagnostic --
   Failed part numbers are : nnnn, nnnn
   Test error numbers = nnnn, nnnn
Power failed or drive just powered on
Auto Release has been completed -- Retransmit last command

>>>>>>>>>> ACCESS ERRORS <<<<<<<<<<
Media has not been initialized or is unusable
Spare Block cannot be executed -- No spare media available
Drive is not ready for access
The selected volume is write protected
A block accessed during a read has not been written
Multiple unrecoverable data errors have occurred
Unrecoverable data has been detected --
   Address of bad data is:
   Block address = nnnn
            or
   Vector address =
      Cylinder = nnnn     Head = nnnn     Sector = nnnn
End of file encountered
End of volume encountered

>>>>>>>>>> INFORMATION ERRORS <<<<<<<<<<
Only one spare track remains on the disc
A latency was introduced during the transfer due to slow
   transfer rate or seek retry
A defective block has been automatically spared
Multiple recoverable data errors have occurred
A latency was introduced to correct a data error --
   Address of bad block is:
```

```
   Block address = nnnn
            or
   Vector address =
      cylinder = nnnn     head = nnnn     sector = nnnn

New Target address is:
   Block address = nnnn
            or
   Vector address =
      cylinder = nnnn     head = nnnn     sector = nnnn
```

Only the portions of the above status display that correspond to errors indicated by the hardware status variable will be output. This means, for example, that if no Access Errors were indicated by the status, none of the messages listed under that heading would be output.

In order to exit the exerciser, the **EXIT** command should be entered (see **EXIT** command description).

ADDRESS

This command allows the user to convert block addresses to 3-vector addresses and visa versa. This conversion will be made using the maximum address for the device that is currently selected. This maximum address will be obtained via the SS/80 (extended) DESCRIBE command, which will be issued before the conversion is made if it has not been issued thus far.

Input:

```
SS80DIAG>ADDRESS

     Do you want to convert from block or 3-vector
        addresses (B/V)[ B ]?

                        {if response was B}
     Enter block address (<cr> to keep current value) --
        Block address(nnnn - nnnn) = nnnn?

                        {if response was V}
     Enter 3-vector address (<cr> to keep current values) --
        Cylinder address(nnnn - nnnn) = nnnn?
        Head address(nnnn - nnnn)     = nnnn?
        Sector address(nnnn - nnnn)   = nnnn?
```

Output:

```
          {for block addresses to 3-vector addresses}
     Block address nnnn is equivalent to 3-vector address:
        Cylinder = nnnn   Head = nnnn   Sector = nnnn

          {for 3-vector addresses to block addresses}
     3-vector address:
         Cylinder = nnnn   Head = nnnn   Sector = nnnn
         is equivalent to block address nnnn
```

CICLEAR

This command clears the selected device in a manner independent of the channel to which it is connected. Destructive Mode will be required to execute this command. This command causes the current disk operation to abort without any data corruption, all clearable devices or interface conditions to be cleared, all complementary parameters to be set to their power-on values, and the status reported from the device to be cleared.

Input:

```
SS8ODIAG>CICLEAR
```

Output:

```
        Device has been cleared successfully
```

DESCRIBE

This command will obtain a SS/80 (extended) describe message from the device being tested and display the contents to the user in text form. The information in the describe message includes such things as device parameters that are used by system drivers.

Input:

```
SS80DIAG>DESCRIBE
```

Output:

```
Describe Information
--------------------
The following unit(s) are installed:
    nn  nn ... nn
Maximum transfer rate = nnnn Kbytes per second
Controller type =
                  Integrated Single-Unit
               or Integrated Multi-Unit
               or Integrated Multi-Port
Port ID = nnnn
Number of host ports provided by controller = nnnn
Unit number = nnnn
Device is a nnnn fixed-disc
            or removable disc
            or tape
Block size = nnnn bytes
Buffer size = nnnn blocks
Burst mode is not recommended

                    {or}
Recommended burst size = nnnn bytes
Block transfer time = nnnn microseconds
Average transfer rate = nnnn Kbytes per second
Optimal retry time = nnnn 10's of milliseconds
Maximum access time to data = nnnn 10's of milliseconds
Maximum interleave = nnnn
Maximum cylinder address = nnnn
Maximum head address = nnnn
Maximum sector address = nnnn
Maximum block address = nnnn
Current sector interleave = nnnn
Volume number = nnnn
```

DIAG

This command will initiate internal diagnostic tests which reside in the disk drive. The tests which can be selected are device dependent and are fully described in the support documentation for each type of drive.

Input:

```
SS80DIAG>DIAG

Input the loop count to be used (1<=loop<=65535)[ 1 ]?
```

Output:

```
Internal diagnostic 0 has completed successfully

   POSSIBLE ERROR MESSAGES:

   *** DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE
       INITIATE DIAGNOSTIC COMMAND
          {status - including failing FRU if any}
```

EXIT

This command terminates execution of the External Exerciser. It may be entered any time the `SS80DIAG>` prompt appears.

Input:

```
SS80DIAG>EXIT
```

Output:

```
        End of Section 17 - External Exerciser
```

HELP

This command provides the user with access to information concerning the commands that are available in the external exerciser. The user may request a list of the available commands accompanied by a brief description of each, or individual command descriptions. For individual commands, the user can request a description and syntax or just the syntax.

Input:

```
SS8ODIAG>HELP [ command name or <cr> ]
```

Output:

{If no command name was given (i.e.[RETURN])}

```
The following commands are available:

ADDRESS - converts block addresses to 3-vector and visa versa
CICLEAR - issues a SS/80 Channel Independent Clear
   .
   .
   .
UNIT - Sets the unit number on the device
```

{If a command was given}

```
Do you want a description or just syntax (D/S)[ D ]?
```

{If response was D}

```
COMMAND DESCRIPTION:
Description of the command
Syntax of the command
```

{If response was S}

```
COMMAND SYNTAX:
Syntax of the command
```

INIT MEDIA

This command allows the user to format the disk's media. The user will be given the option to retain all spares that have been made on the disk, or retain only factory spares. All data on the disk may be destroyed by this command. It is essential that extensive error-rate testing be performed and all questionable sectors spared after executing this command.

Input:

```
SS8ODIAG>INIT MEDIA

      Do you want to:
         P = retain only primary spares
         A = retain all spares

      Which option would you like[A]?

      What interleave factor would you like (1<=interleave<=32)[1]?

         {if other than 1}
      ***WARNING -- an interleave factor other than 1 may severely
                    degrade system performance
      Do you wish to continue(Y/N)[N]?

           {if N}
      What interleave factor would you like (1<=interleave<=32)[1]?

      This test will destroy current data on the disc
      Do you wish to continue (Y/N)[N]?
           {responding N will terminate this command}
```

Output:

```
        format - retain all spares
                 or
        format - retain primary spares

        Media is being initialized -- may take several minutes

        Media has been successfully initialized
```

READ

This command allows the user to access any data block on the selected device. Due to obvious potential security compromise, the user will need to possess Level 0 security to use this command.

Input:

```
SS80DIAG>READ

     Do you want block or 3-vector addresses (B/V)[ B ]?

               {if response was B}
     Enter new address (<cr> to keep current value) --
        Block address(nnnn - nnnn) = nnnn?

               {if response was V}
     Cylinder address(nnnn - nnnn) = nnnn?
     Head address(nnnn - nnnn)     = nnnn?
     Sector address(nnnn - nnnn)   = nnnn?
```

Output:

```
     The data follows(hex):

          0   1   2   3   4   5   6   7   8   9

       0: HH  HH  HH  HH  HH  HH  HH  HH  HH  HH.... .... .
      10: HH  HH  HH  HH  HH  HH  HH  HH  HH  HH.... .... .
          .
          .
          .
     250: HH  HH  HH  HH  HH  HH.... ...
```

Note

The dots in the preceding table represent non-alpha-numeric ASCII characters. Alpha-numeric characters will be printed.

SDCLEAR

This command clears the device to its power-on state using the SS/80 selected device clear command. In order to execute this command, the user must be in Destructive Mode. This command causes the current disk operation to abort without any data corruption, all complementary parameters to be set to their power-on values, and the status reported from the device to be cleared.

Input:

```
SS80DIAG>SDCLEAR
```

Output:

```
        Device has been cleared successfully.
```

UNIT

This command allows the user to set the unit number within the drive. This command is required for multi-unit drives so that the user can specify which unit is to be tested.

Input:

```
SS80DIAG>UNIT

What unit number do you wish to select (0-15)[ 0 ]?
```

Output:

```
        Unit nnnn of the device has been successfully set
```

Error and Warning Messages

The following error and warning messages are generated by SS80DIAG. For other errors, consult the DUI section of this manual and the operating system manuals. The "!" indicates that a parameter of some sort replaces the exclamation point when the message is displayed. The following messages are listed in numerical order.

100	**WARNING -- THE I/O PATH MAY NOT BE FUNCTIONING PROPERLY (SS80ERR 100)**
CAUSE	An error was detected by the Io_Path_Test service while testing the modules on the I/O path preceding the selected device.
ACTION	Execute the appropriate diagnostics on the modules preceding the selected device on the I/O path, especially on those that may have been reported as faulty in error messages immediately preceding this message. The results of the execution of this instance of SS80DIAG may be invalid.

101	**DEVICE FAILED TO RESPOND TO ! COMMAND (SS80ERR 101)**
CAUSE	No response to an I/O was received prior to the expiration of the allotted time.
ACTION	Verify that the selected disk drive is actually connected to the system. Run SYSMAP, if available, to confirm the presence of the device.

102	**SS80DIAG IS UNABLE TO DIAGNOSE THE SELECTED DEVICE (SS80ERR 102)**
CAUSE	The selected device identified itself as something other than a SS/80 drive.
ACTION	Determine type of selected device and run the appropriate diagnostic on it.

103	**SS/80 DISC DIAGNOSTIC TERMINATING (SS80ERR 103)**
CAUSE	A fatal error has been encountered.
ACTION	The specific error that was encountered should have been reported immediately prior to this message. Follow the action instructions for that error message.

104	**A RESERVE AREA IS NOT AVAILABLE ON THIS DRIVE -- NO OPERATION WAS PERFORMED. (CS80WARN 104)**
CAUSE	There is no available area on the disk that can be written to without corrupting user data. This can happen if no such area is provided by the system, or if the diagnostic is running in destructive mode, in which the location of the reserve area is unknown to the system since the drive is locked for diagnostics.
ACTION	For systems which do not support a reserve area (e.g. HP-UX), reserve area operations are not supported. Otherwise, execute the diagnostic selecting only section 8.

106	**! MODE REQUIRED TO EXECUTE THIS COMMAND (SS80ERR 106)**
CAUSE	The diagnostic does not have access to the drive in the mode necessary to execute the selected command.
ACTION	The mode granted to a diagnostic for a selected device is system dependent. For MPE XL, for example, the volume label must be scratched in order to access the disk destructively.

108	**! COMMAND IS NOT IMPLEMENTED ON THIS DRIVE/SYSTEM (SS80ERR 108)**
CAUSE	The selected operation is either not implemented on the selected drive or the system does not provide access to it.
ACTION	This operation is unavailable.

109	**DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE SS/80 ! COMMAND (SS80ERR 109)**
CAUSE	The drive reported an error as a result of executing the selected operation.
ACTION	The hardware status that is displayed immediately following this message should indicate what sort of problem occurred, including a failing FRU if one is reported. If an FRU is reported, replace it and re-execute this diagnostic.

110	**THE MAXIMUM NUMBER OF ERRORS HAS BEEN EXCEEDED (SS80ERR 110)**
CAUSE	The user specified error limit has been reached.
ACTION	If more errors are desired, re-run the diagnostic assigning a larger value to the ERRCOUNT parameter of the **RUN** command.

111	**UNRECOGNIZED COMMAND -- TYPE "HELP" FOR A LIST OF VALID COMMANDS (SS80ERR 111)**
CAUSE	The specified command is not a valid command.
ACTION	Use the help facility to obtain a list of the commands that are valid and enter the desired command.

112	**UNRECOGNIZED REPLY WAS FOUND (SS80ERR 112)**
CAUSE	The reply that was entered in response to a prompt by the diagnostic is not valid.
ACTION	Refer to the prompt that was displayed and enter a response that is within the specified list of valid responses.

113 **A NUMERICAL INPUT WAS EXPECTED BUT NOT RECEIVED (SS80ERR 113)**

CAUSE The reply that was entered in response to a prompt by the diagnostic is not a valid number.

ACTION Re-enter number using only numeric characters and valid special characters (e.g. +, -, , etc.).

---

114 **AN UNEXPECTED ERROR OCCURRED IN THE IO_CS80 DAR (SS80ERR 114)**

CAUSE A call to the SS/80 device access routine resulted in an unexpected status return.

ACTION Please enter an SR. Within the text of the SR report all information returned by the Diagnostic User Interface. Also state operating system, version number, DUI version and diagnostic version.

---

115 **ERROR IN TRANSMISSION DETECTED DURING READ LOOPBACK TEST: (SS80ERR 115)**

Byte #	Octal Value Transmitted	Octal Value Received	Bit Positions In Error 01234567
======	==========	==========	==========

CAUSE One or more bytes of data that were received from the disk as a result of a loopback operation did not contain the expected value(s).

ACTION Data is most likely being corrupted along the data path between the host and the drive. Check all cable connections along the path and re-execute the diagnostic. If errors persist, execute appropriate diagnostics against the modules that lay in the path between the host and the device.

---

118 **ERROR -- EXPECTED ! BYTES FROM THE DEVICE AND RECEIVED ! BYTES (SS80ERR 118)**

CAUSE The number of bytes in the reply from the device was not what was expected. This is most likely a result of executing the diagnostic on a drive which is not supported by it.

ACTION Verify that the selected device is in the list of supported devices for the diagnostic (LIST ALL from the DUI). If it is, report the problem to support personnel.

---

119 **THIS COMMAND IS NOT SUPPORTED ON THIS DEVICE (SS80ERR 119)**

CAUSE The specified operation is not supported by the selected device.

ACTION While other devices supported by the diagnostic may support the specified command, the selected device does not.

120	**FILE SYSTEM ERROR ENCOUNTERED WHILE RETRIEVING A MESSAGE (SS80ERR 120)**
CAUSE	An error was returned while attempting to obtain a message from the catalog. The actual error will have been displayed prior to this message.
ACTION	Please enter an SR. Within the text of the SR report all information returned by the Diagnostic User Interface. Also state operating system, version number, DUI version and diagnostic version.

121	**IDENTICAL READS FROM DISC RETURNED NON-IDENTICAL DATA (SS80ERR 121)**
CAUSE	A read operation was performed on the same sector twice and the data from both reads did not match exactly.
ACTION	This is most likely a hardware problem with the drive. If loopback executes correctly, the read/write board in the drive is the probable cause of the error.

122	**DATA READ FROM DISC DID NOT MATCH DATA PREVIOUSLY WRITTEN (SS80ERR 122)**
CAUSE	A sector was written to the disk and immediately read back. The data read did not match exactly the data written.
ACTION	This is most likely a hardware problem with the drive. If loopback executes correctly, the read/write board in the drive is the probable cause of the error.

123	**UNIT WAS SET TO 15 BUT STATUS DOES NOT INDICATE THE CURRENT UNIT AS 15 (SS80ERR 123)**
CAUSE	A set unit command was sent to the disk specifying unit 15 and hardware status was immediately requested. The unit field of the status was not 15.
ACTION	This is definitely a drive problem—probably firmware.

124	**THE ADDRESS THAT WAS SET ON THE DISC IS NOT EQUIVALENT TO THE ADDRESS RETURNED IN STATUS (SS80ERR 124)**
CAUSE	A set address command was sent to the disk immediately followed by a status request. The address reported in the hardware status did not match the address that was set.
ACTION	This is definitely a drive problem—probably firmware.

125	**BLOCK DISPLACEMENT WAS SET TO 1 BUT THE ADDRESS RETURNED IN STATUS DOES NOT INDICATE THAT THE DISPLACEMENT IS BEING USED (SS80ERR 125)**
CAUSE	A set block displacement command was sent to the disk immediately followed by a status request. The current block displacement did not match that which was set.
ACTION	This is definitely a drive problem—probably firmware.

126	DATA READ FROM THE DISC IN BURST MODE DID NOT MATCH DATA THAT WAS PREVIOUSLY WRITTEN IN BURST MODE (SS80ERR 126)
CAUSE	The drive was placed in burst mode and a write was done immediately followed by a read. The data read back did not match exactly the data that was written.
ACTION	This is definitely a drive problem—probably firmware.

127	THE ADDRESS BOUNDS BIT IN STATUS WAS MASKED, BUT THE DEVICE SET IT WHEN AN ADDRESS BOUNDS ERROR WAS FORCED (SS80ERR 127)
CAUSE	The set status mask command was used to mask address bounds errors and then a set address command was issued with an address that exceeded the maximum. The drive reported the error even though the status was masked.
ACTION	This is definitely a drive problem—probably firmware.

128	THE ADDRESS RETURNED IN STATUS INDICATES THAT THE DEVICE ERRONEOUSLY CONVERTED THE ADDRESS WHEN CHANGING ADDRESSING MODE (SS80ERR 128)
CAUSE	A set address command was issued to the drive followed by a set return address mode to the opposite of the current mode. Status was then requested and the current target address did not match the address that was set, implying that the address conversion performed by the drive was incorrect.
ACTION	This is definitely a drive problem—probably firmware.

129	AN ERROR WAS ENCOUNTERED WHEN READING AFTER RETRY TIME WAS SET TO A RANDOM VALUE (SS80ERR 129)
CAUSE	A set retry time was issued to the drive with a random time value followed by a read command. The drive reported an error.
ACTION	This is definitely a drive problem—probably firmware.

130	AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO SEND A RELEASE COMMAND TO THE DEVICE (SS80ERR 130)
CAUSE	A release command was sent to the drive and the drive returned an error.
ACTION	This is definitely a drive problem—probably firmware.

131	AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO SEND A RELEASE DENIED COMMAND TO THE DEVICE (SS80ERR 131)
CAUSE	A release denied command was sent to the drive and the drive returned an error.
ACTION	This is definitely a drive problem—probably firmware.

132	**AN ERROR WAS ENCOUNTERED WHILE DOING A READ AFTER RPS WAS ENABLED (SS80ERR 132)**
CAUSE	A set rps command was sent to the drive to enable rps followed by a read operation. The drive reported an error on the read.
ACTION	This is definitely a drive problem—probably firmware.

133	**AN INVALID OPCODE WAS SENT TO THE DEVICE, BUT THE ILLEGAL OPCODE BIT OF THE STATUS MESSAGE WAS NOT SET (SS80ERR 133)**
CAUSE	A command was sent to the drive with an invalid op code and the drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.

134	**A SET UNIT COMMAND WAS ISSUED WITH A UNIT NUMBER OF 1, BUT THE MODULE ADDRESSING BIT OF THE STATUS MESSAGE WAS NOT SET (SS80ERR 134)**
CAUSE	A set unit command was sent to the drive with a unit number of 1, which is an invalid unit number. The drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.

135	**A SET ADDRESS COMMAND WAS ISSUED TO AN ADDRESS GREATER THAN THE MAXIMUM FOR THE DEVICE, BUT THE ADDRESS BOUNDS BIT OF THE STATUS MESSAGE WAS NOT SET (SS80ERR 135)**
CAUSE	A set address command was sent to the drive with an address greater than the maximum allowable. The drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.

136	**THE STATUS MASK WAS SET TO MASK ALL UNMASKABLE BITS, BUT THE PARAMETER BOUNDS BIT OF THE STATUS MESSAGE WAS NOT SET (SS80ERR 136)**
CAUSE	A set status mask command was sent to the drive specifying that all bits be masked that are not allowable (unmaskable). The drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.

137	**A SET LENGTH COMMAND WAS ISSUED WITH ONLY 1 PARAMETER BYTE INSTEAD OF THE 4 EXPECTED BY THE DEVICE, BUT THE ILLEGAL PARAMETER BIT OF THE STATUS MESSAGE WAS NOT SET (SS80ERR 137)**
CAUSE	A set length command was sent to the drive with fewer bytes than are expected by the drive for that command. The drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.

138	**A WRITE COMMAND WAS ISSUED TO THE DEVICE FOLLOWED BY A REQUEST FOR AN EXECUTION MESSAGE INSTEAD OF SENDING ONE, BUT THE MESSAGE SEQUENCE BIT OF THE STATUS MESSAGE WAS NOT SET (SS80ERR 138)**
CAUSE	The SS/80 protocol was violated by sending a write command and specifying the wrong type of execution message. The drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.
139	**A WRITE COMMAND WAS ISSUED WITH THE LENGTH SET TO 10, FOLLOWED BY AN EXECUTION MESSAGE OF ONLY 6 BYTES, BUT THE MESSAGE LENGTH BIT OF THE STATUS MESSAGE WAS NOT SET (SS80ERR 139)**
CAUSE	The SS/80 protocol was violated by sending a write command which specified that more bytes be written than were actually provided in the execution message. The drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.
140	**NO OPERATION WAS PERFORMED (SS80ERR 140)**
CAUSE	Due to a previous error, which has already been reported, no operation was performed.
ACTION	Refer to action instructions for previously reported error.
200	**AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO SEND/RECEIVE INFORMATION FROM THE USER (SS80ERR 200)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to communicate with the user interface process.
ACTION	Refer to action instructions for previously reported error.
201	**AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO RETRIEVE A MESSAGE FROM THE CATALOG (SS80ERR 201)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to extract a message from its message catalog.
ACTION	Refer to action instructions for previously reported error.
202	**AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO CONVERT A NUMBER TO A STRING (SS80ERR 202)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to convert a number to a string.
ACTION	Refer to action instructions for previously reported error.

203	**AN ERROR WAS ENCOUNTERED IN ATTEMPTING A BIT EXTRACTION OPERATION (SS80ERR 203)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to extract one or more bits from a number.
ACTION	Refer to action instructions for previously reported error.

204	**THE SELECTED DEVICE COULD NOT BE OBTAINED FOR TESTING (SS80ERR 204)**
CAUSE	The DUI was unable to obtain access to the device. Device may be held exclusively by another process.
ACTION	Determine the access status of the device and make the corrective requirements.

205	**DUE TO PROBLEMS WITH RETURN ADDRESSING MODE, ADDRESSES REPORTED WITH STATUS INFORMATION MAY BE INACCURATE (SS80ERR 205)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to set the return address mode on the drive.
ACTION	Refer to action instructions for previously reported error. Also, if hardware status is displayed later in the diagnostic run, the address portion of the status could be displayed in both block and 3-vector formats since the diagnostic cannot determine the mode that the disk is currently in.

206	**DUE TO PROBLEMS WITH SET BLOCK DISPLACEMENT, SS80DIAG WILL TERMINATE TO AVOID POTENTIAL DESTRUCTION OF USER DATA (SS80ERR 206)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully set the block displacement value on the drive. Since the diagnostic no longer knows what the displacement value is, it must terminate to avoid destroying data.
ACTION	Refer to action instructions for previously reported error.

207	**DUE TO PROBLEMS WITH DESCRIBE, SS80DIAG CANNOT FUNCTION PROPERLY AND WILL THEREFORE TERMINATE (SS80ERR 207)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully obtain describe data from the drive. Since the diagnostic needs this information to function correctly, it must terminate.
ACTION	Refer to action instructions for previously reported error.

208	**AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO COMMUNICATE WITH THE DIAGNOSTIC SYSTEM (SS80ERR 208)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully perform a function which requires communication with the diagnostic system.
ACTION	Refer to action instructions for previously reported error.

209	**YOUR RESPONSE WAS INVALID (SS80ERR 209)**
CAUSE	The data entered in response to a prompt was not valid.
ACTION	Refer to the prompt to determine the valid responses for the particular situation and enter one of the specified valid responses.

210	**AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO OBTAIN DATA FROM AN I/O BUFFER (SS80ERR 210)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to get data from its I/O buffer and, therefore cannot obtain data from the device.
ACTION	Refer to action instructions for previously reported error.

211	**AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO PLACE DATA INTO AN I/O BUFFER (SS80ERR 211)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable place data into its I/O buffer and, therefore, cannot send data to the device.
ACTION	Refer to action instructions for previously reported error.

212	**AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO OBTAIN AN I/O BUFFER (SS80ERR 212)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable obtain an I/O buffer and therefore, cannot send/receive data to/from the device.
ACTION	Refer to action instructions for previously reported error.

215	**HIGHER SECURITY IS NEEDED TO PERFORM THIS OPERATION (SS80ERR 215)**
CAUSE	The user requested an operation which is restricted to users with higher security than the user possesses.
ACTION	Contact system administrator if higher security level is desired.

216	**! BYTES WERE EXPECTED TO HAVE BEEN SENT FROM THE DISC, BUT ONLY ! WERE RECEIVED (SS80ERR 216)**
CAUSE	Data returned from the device in response to a command consisted of a different number of bytes than were expected.
ACTION	This is probably a firmware problem in the drive.

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21

FLEX Disk Diagnostic

Introduction

The FLEX Diagnostic (`FLEXDIAG`) is designed to provide a means of testing HP-FL disk drives. This diagnostic runs on any HP Precision Architecture computer system that supports Online Diagnostic Subsystem programs and is capable of detecting failures of one or more Field Replaceable Units (FRUs). The FLEX Diagnostic will:

- Perform an extensive fault isolating diagnostic trouble tree on the disk and its system interface. Defects encountered will be relayed to the user.
- Verify the integrity of the data path through the HP-FL subsystem.
- Identify the product type of the selected disk drive.
- Run the internal diagnostics on the disk (including self-test).
- Obtain and decode status from the disk.
- Obtain and decode information from the disk error logs.
- Test common transactions that are used in communication between the disk and CPU.
- Provide a FLEX Disk External Exerciser

Minimum Configuration

The hardware required to run the diagnostic consists of an HP Precision Architecture Computer system with an HP-FL interface card configured and installed, as well as at least one FLEX disk drive connected across the HP-FL interface.

Defects and Enhancements

Submit defect reports and enhancement requests concerning this diagnostic through the STARS database referencing product number 30600-10005.

Operating Instructions

There is no special security level needed in order to run this diagnostic. However, any portion of the diagnostic that has the potential to comprise system integrity will be restricted to certain security levels. Refer to the section on the DUI for information on the available security levels and test modes, and how each are determined.

Default Tests

If the user did not specify sections to be run, the following default section, will be executed:

```
Section 10     Diagnostic Trouble Tree
```

RUN Command

To bring up the Online Diagnostic subsystem, enter the following command to the MPE XL system prompt:

```
SYSDIAG
```

To bring up the Online Diagnostic subsystem, enter the following command to the HP-UX system prompt:

```
%/usr/diag/bin/sysdiag
```

The system responds with the following prompt indicating that access has been gained to the Online Diagnostic User Interface (DUI).

```
DUI >
```

Typing **HELP** causes a summary of the DUI and its commands to be printed. Refer to the DUI Section of this manual for details.

Note

The device to be tested must be powered up and on line. Device physical locations (pdev) shown in the **RUN** commands are those of the devices on the "typical A1002A" system configuration described in the chapter on DUI. The pdev value entered must be correct for the system being tested.

For example, to run the diagnostic, you might enter:

```
DUI >RUN FLEXDIAG pdev=4.6.1 <RUN Command Options>
                             |          |
                             |  none required for
                             |  default test suite
                             |
                    insert physical location of
                    device to be tested here;
                    alternatively, for MPE XL,
                    type the ldev number;
                    or for HP-UX, type the devfile name
```

Test Execution

Enter the desired RUN parameters. The diagnostic responds with a header and welcome message:

```
*********************************************************
*****                                                ***
*****               FLEX DISC DIAGNOSTIC             ***
*****                                                ***
*****  C) Copyright Hewlett Packard Co. 1987,1988,1989 ***
*****               All Rights Reserved.             ***
*****                  Version A.02.01               ***
*****                                                ***
*********************************************************
Welcome, Today is MON, August 10, 1987 at 12:30 PM
```

During system initialization various messages can be output by **FLEXDIAG**. Error messages can be distinguished from other messages by three ***'s preceding the text of the message (i.e., MESSAGE*** is an error message and "Message" is not). (Refer to the error message listing at the back of this document for cause and action information).

The diagnostic then verifies that the I/O path to the selected device is functioning properly. If any problems occur in the path, the following message will be displayed:

```
*** WARNING THE I/O PATH TO THE SELECTED DEVICE MAY NOT BE FUNCTIONING
    PROPERLY  (FLEXERR 100).
```

Whether or not IO_PATH_TEST reported an error, the diagnostic will continue.

If at any time the number of errors generated reaches the limit specified by the user in the ERRCOUNT parameter of the **RUN** command, the following message will be output:

```
THE MAXIMUM NUMBER OF ERROR MESSAGES HAS BEEN EXCEEDED (FLEXERR 110)
```

The diagnostic will then terminate execution. If the ERRPAUSE parameter of the RUN command was assigned a value of "on", then this diagnostic will stop after each error is generated and ask the user if the test should continue:

```
Do you wish to continue (Y/N)[N]?
```

If the response is "Y" (or only a Return), the test will be resumed (if possible), and if the response is "N", the diagnostic will terminate. If the sections and steps specified by the user were executed the number of times specified in the LOOP parameter of the RUN command without the number of errors exceeding the ERRNUM value, the diagnostic will terminate normally and the following message output:

```
FLEX Disc Diagnostic Exiting ...
```

Upon termination of this diagnostic, control will return to the diagnostic subsystem.

Test Section Descriptions

There are three diagnostic program sections available. The descriptions of each section provide the expected output from that section and step.

The following sections are available for use:

```
Section 10      Diagnostic Trouble Tree
Section 11      Flex Sparing Trouble Tree
Section 17      External Exerciser (Interactive Section)
```

Section 10—DIAGNOSTIC TROUBLE TREE

This section will execute the fault isolating diagnostic trouble tree. The algorithm follows:

1. Perform a Write Loopback followed by a Read Loopback to test the channel.
2. Issue an internal power-on SELFTEST to the device.
3. Read sector twice and compare the data.
4. Read the device FAULT LOGS and decode any entries.
5. Read the device RUN LOGS; if entries exist, perform an RO ERT on the suspect block. If the RO ERT generates an error type, output the block address and the error type generated.

Output:

```
Section 10 -- Diagnostic Trouble Tree

Write Loopback Completed

Read Loopback Completed

Device Selftest Completed

Read Sector Completed

FAULT LOG

No Drive Faults To Report
    {or}
There are nnnn entries in this log

Fault log values:

Current            Target
  Cyl   Head  Sect   Cyl   Head  Sect   HFR      Fault Code  Act
  ====  ====  ====   ====  ====  ====  ========  ========== =====
* nnnn  nnnn  nnnn * nnnn  nnnn  nnnn BBBBBBBB  DERR nnnn  nnnn
         {or}
                                               TERR nnnn
  .
  .  Repeat for each entry in the log
  .
* nnnn  nnnn  nnnn * nnnn  nnnn  nnnn BBBBBBBB  DERR nnnn  nnnn
         {or}
                                               TERR nnnn

  "*" Indicates a PHYSICAL address -- DO NOT attempt
      to spare this address
```

{If any entries were printed}

```
   The HFR values are:
      01234567
      ========
      XXXXXXX1  Spin-up failed
      XXXXXX1X  Servo timing error
      XXXXX1XX  Heads off track
      XXXX1XXX  AGC error
      XXX1XXXX  Sector timing error
      XX1XXXXX  Data overrun
      X1XXXXXX  Unused
      1XXXXXXX  Unused

   Any (E) after the fault code indicates an event,
   and an (F) indicates a fault.

   Activity indicator values:
     0 = no seeks
     1 = 1 seek
     2 = 2 seeks
     3 = 3 seeks
     4 = 4 seeks
     5 = 5 - 7 seeks                    (1 sec)
     6 = 8 - 200 seeks                  (1 - 30 sec)
     7 = 201 - 2000 seeks               (30 sec - 5 min)
     8 = 2,001 - 12,000 seeks           (5 - 30 min)
     9 = 12,001 - 25,000 seeks          (30 - 60 min)
    10 = 25,001 - 150,000 seeks         (1 - 6 hours)
    11 = 150,001 - 600,000 seeks        (6 - 24 hours)
    12 = 600,001 - 4,000,000 seeks      (1 - 7 days)
    13 = 4,000,001 - 16,000,000 seeks   (1 - 4 weeks)
    14 = 16,000,001 - 100,000,000 seeks (1 - 6 months)
    15 = > 100,000,000 seeks            (> 6 months)
```

{Note: The above table is specific to HP7936/37 drives. The values in this table will be changed appropriately for other drive types.}

```
RUN LOG

No Drive Run Log Entries
    {or}
Performing RO ERT On Run Log Entries
{If error type found}
     Logical          Error
Cyl   Head  Sect   Type    Count   Error
====  ====  ====   =====   =====  ========
nnnn  nnnn  nnnn    XXX    nnnn   BBBBBBBB
nnnn  nnnn  nnnn    XXX    nnnn   BBBBBBBB
.
.  Repeat for each entry generated
.
nnnn  nnnn  nnnn    XXX    nnnn   BBBBBBBB


The error types are:
    COR = ECC correctable error
    UNC = ECC correctable error
    UNR = unrecoverable error
    *** = decode error manually

The Error values are:

   XXXXXXX0  ECC found correctable error
   XXXXXXX1  ECC found uncorrectable error
   XXXXXX1X  not used
   XXXXX1XX  Error found in sector header
   XXXX1XXX  Error found in sector body
   XXX1XXXX  CRC byte(s) in error
   XX1XXXXX  Parity error bit set
   X1XXXXXX  data underrun detected
   1XXXXXXX  ECC byte(s) in error
```

{Note: The above table is specific to HP7936/37 drives. The values in this table will be changed appropriately for other drive types.}

```
End of Section 10 -- Diagnostic Trouble Tree
```

Section 11—FLEX SPARING TROUBLE TREE

This section is designed to determine if the drive read/write PCA or a sensitive data pattern is the probable cause of excessive sparing or excessive entries in the run log.

Output:

```
Section 10 -- Flex Sparing Trouble Tree

{if ERRONLY is not on}
    This section may take several minutes to complete and
    should be run only when drive sparing problems are
    suspected.

    Do you wish to continue (Y/N) [N]?

{if continue}
    No Problem Found
         {or}
    Suspect Read/Write PCA Defect
         {or}
    HP7936/37FL Read/Write PCA Sensitive To The Following
    Pattern:

   0:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH
  10:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH
       .
       .
       .
 250:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH

    Please Contact The HP7936/37 Support Engineer And
    Relay The Above Information.
              {or}
    Performing an extensive WTR ERT on suspect block

    nnnn% completed
    nnnn% completed
  .
  .
  .
    nnnn% completed

    Media Defect Detected By Extensive WTR ERT.  Media Defect
    Not Detected by HP7936/37FL Sparing Algorithm.

    Please Contact The HP7936/37 Support Engineer And
    Relay The Above Information.

{if spare was performed}
    Status -- including address affected by spare
```

```
                {or}
      Performing an extensive WTR ERT on suspect block

      nnnn% completed
      nnnn% completed
     .
     .
     .
      nnnn% completed

      HP7936/37FL media sensitive to the following pattern:

       0:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH
      10:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH
           .
           .
           .
     250:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH

      Please Contact The HP7936/37 Support Engineer And
      Relay The Above Information.

   {if spare was performed}
      Status -- including address affected by spare

   End of Section 10 -- Flex Sparing Trouble Tree
```

Possible Error Messages:

```
Data was not recoverable and was lost.  If data recovery
is needed, it should be performed.
  Address:
   Cylinder = nnnn
   Head     = nnnn
   Sector   = nnnn
```

Section 17—EXTERNAL EXERCISER

The Flex External Exerciser is an interactive program which provides the user with access to the set of internal diagnostics and utilities within a Flex disk. This section explains what different kinds of data the exerciser can provide, how that information is generated and describes the commands available to the user. To run the External Exerciser select Section 17 of the FLEXDIAG diagnostic. The FLEXDIAG prompt appears indicating that the Exerciser is waiting for a command from the user. Refer to the Command Descriptions and the Exerciser Command Format explanations below for further details.

Error-Rate Testing

Error-rate tests are powerful tools used to determine media integrity within a FLEX device. These tests can find correctable and uncorrectable read errors and provide information concerning each error, such as the address where the error occurred, the type of error, and the number of times it has occurred. This information can be displayed to the user and/or logged on the disk maintenance tracks, which are reserved for such use. These tracks provide nonvolatile storage, not only for error-rate test errors, but also for spare track addresses, drive faults, and special worst case data patterns which are written on the disk in certain error-rate tests.

All error rate tests allow the user to input a loop count when requesting the test. Each time an error is detected during the test, the test will stop, report the error, and then resume testing until the loop count has been satisfied. The loop count is not a count of the number of errors, but rather the number of passes the device will execute during the error-rate test. The following information will be reported for each error that occurs:

- An error information byte
- The loop count when the error occurred
- The current physical address
- The current logical address
- The byte number at which the error begins
- A bit map of the bits that were in error

There are two general types of error rate tests that can be performed. The first type, called a read only error rate test, is a nondestructive test which reads data from the disk and attempts to detect any read errors that occur. There are two error-rate tests available in this category:

Read Only Error-Rate Test	Sequentially reads the current data on the disk in a specified area of the media.
Random Read Only Error-Rate Test	Reads 256 random sectors of random length data. This test allows read errors to be detected on a large portion of the media in a minimum amount of time.

The second type of error-rate test, called a write-then-read error-rate test, is a destructive test which writes data onto the media and subsequently reads it back, attempting to detect such things as sensitive bit patterns, read errors, and media defects. When requesting an error-rate test in this category, the user is allowed to specify a pattern to be used in the test. This pattern can be defined and edited via the SET PATTERN command. If the user chooses not to enter a pattern, a choice will also be given to use worst case data patterns already residing on the disk maintenance tracks, or random data generated by the disk. There are two types of write-then-read error-rate tests available to the user:

Pattern Write-Then-Read Error-Rate Test	Sequentially writes a specific data pattern over a specified area of the media and then reads back all of the data that was written.
Random Write-Then-Read Error-Rate Test	Writes-then-reads 256 randomly generated data patterns of random length at random locations on the media. This test locates errors that occur over a large area of the media in a minimum amount of time.

Error Logging

During run-time, the error correction circuitry of the drive is enabled. If an error is detected that cannot be corrected by this circuitry, it will be logged to an area of random access memory (RAM) on the drive that is used to record up to 5 uncorrectable data errors. If this area becomes full during run-time, which is defined to be any time in which a test, diagnostic, or utility is not being performed, the device requests release so that it can log the error information in the run-time drive error log on the maintenance tracks. All error logging is done automatically by the drive.

When error-rate tests are run, the error correction circuitry is disabled, thus allowing correctable and uncorrectable errors to be logged. These errors are logged in the same manner as run-time errors, assuming the user requested errors to be logged, except when the RAM is full, in which case the drive requests release and logs the errors to the error-rate test log, also on the maintenance tracks. When the error-rate test begins, a preset drive utility is issued, which forces any errors recorded in the RAM area to be logged to the maintenance tracks, and then the RAM area is cleared, thus avoiding confusion between old errors and ones detected during the error-rate test.

One additional log, the fault log, exists on the maintenance tracks. This log is used to store all drive and controller faults which have occurred since the last time the logs were cleared.

Sparing

All FLEX disk drives provide the means to replace defective sectors or tracks with good ones. This operation is referred to as "sparing". Each track on a FLEX drive contains one extra sector which does not appear in the user's data space. This sector is set aside as a spare sector to be used in the event that a bad sector is found somewhere on the track and needs to be removed. By using the SPARE command, the spare sector can be substituted for the bad sector. If more than one bad sector appears on the track, the entire track would be spared using one of several spare tracks on the disk set aside for this purpose.

The SPARE operation is very different for FLEX drives than with CS/80 drives. An option is provided with the SPARE command to either execute a spare retaining data with ERT or a spare retaining data without ERT. The following algorithm will explain these options.

Spare retaining data with ERT.

1. The target sector is read into the data buffer saving the current ECC syndrome which indicates uncorrectable (read full sector).
2. Get a spare track.
3. Read the target track into the buffer.
4. Place the target track on the spare track keeping the uncorrectable sectors. The number of passes over the spare and target tracks depend on the number of uncorrectable errors.
5. Do a read and verify of the spare track matching the uncorrectable errors with those of the target track.
6. Perform a WTR ERT on the target sector.
7. If the ERT passes, the media is good. Restore the data, return good status, and free up the spare track.
8. If the ERT detected uncorrectable errors, continue sparing.
9. If the spare sector was available on the original target track then place the data back on the original target track using the spare sector, read and verify the original target track and mark the spare track available.
10. If the spare sector is not available on the original target track then mark the original target track as spared.
11. Return good status.

Spare retaining data without ERT is the same except no WTR ERT is performed on the target sector.

The data in the target sector will always be rewritten. If the data is ECC uncorrectable, it will be rewritten as unrecoverable. A write must now be performed to this sector to remove this error.

Command Descriptions

When the external exerciser is invoked, the following prompt will be displayed to the user:

```
FLEXDIAG>
```

When the prompt appears, the exerciser is waiting for a command from the user. The available commands are listed in this section in alphabetical order accompanied by descriptions. Each command description is in the following format:

COMMAND NAME

Description:

Explanation of what the command does and when it should be used.

Input :

```
FLEXDIAG>COMMAND NAME
```

The prompt for this exerciser is FLEXDIAG>. The appearance of this prompt indicates that the exerciser is waiting for the user to input a command.

Output :

Information printed as a result of this command being executed

There are several conventions used throughout this section in the command formats. They are as follows:

nnnn	refers to a decimal number of any magnitude that is output by the diagnostic.
vvvv	refers to a decimal number of variable magnitude that must be input by the user.
H	refers to a hexadecimal digit (0-F).
O	refers to an octal digit (0-8).
B	refers to a binary digit (0-1).

Any text enclosed in parenthesis indicates that the user is expected to input that text in response to a query from the diagnostic. Text enclosed in square brackets indicates the default response that will be assumed if the user simply hits (Return) in response to the query. For example, the user may be asked if the program should continue by the following question:

```
Do you wish to continue (Y/N)[ N ]?
```

The text enclosed in the parenthesis (i.e. "Y / N") indicates that the user is to type either a "Y" or an "N" in response to the question. Each option is separated by a "/". The default response in this case would be "N", as indicated by the [N] prior to the question mark. If there is no default response listed (enclosed in square brackets), the user will not be allowed to "default" the input by only entering a (Return).

Comments in the input and output sequences are in *italics* and are not output by the program. For example, following the question in the previous example, the input sequence would probably look something like the following:

{if response was N this command will terminate}

Error messages will be preceded by three asterisks (***) and will be in all upper case letters. Other messages will not be all upper case and will not be preceded by the asterisks.

If the user enters a command in response to a prompt and that command is not recognized as an exerciser command, the following message will be displayed:

```
***YOUR RESPONSE WAS INVALID
FLEXDIAG>
```

This message simply means that the command entered is not part of the command set for the external exerciser.

When the user enters a command that is recognized by the external exerciser, that command will then be processed as according to the corresponding command description given in one of the following sections of this document. If an error is encountered as a result of issuing a FLEX command to the device, the status that is returned by the device will be displayed to the user. Status information is returned via two methods, a twelve byte Status Message or a four byte IMS message. Status messages are used to indicate a problem occurred in the transaction, but the transaction was able to continue to report phase. The IMS message is used to indicate a problem that did not allow a transaction to continue to the report phase. Both messages use the same basic format, and any common errors have the same values.

Status message categories:

- Hardware Error
- Access Error
- Information Error

IMS message categories

- Cancel Error
- Command Error
- Message Length
- Reset
- Resource Information
- Hardware Error
- Link Protocol
- Port Events

The format of the output status message follows:

{*One of the following status messages may be printed*}

{*IMS MESSAGES*}

```
>>>>>>>>>>>>>>> Cancel Errors <<<<<<<<<<<<<<
Command was canceled

>>>>>>>>>>>>>>> Command Error <<<<<<<<<<<<<<
Received an unrecognized opcode
Received an illegal volume or unit address
Received an address which exceeds device bounds
Parameter bounds error
Received an illegal parameter
Received a message out of sequence

>>>>>>>>>>>>>>> Message Length <<<<<<<<<<<<<<
Received a message of the wrong length

>>>>>>>>>>>>>>> Reset <<<<<<<<<<<<<<
Power failed or drive just powered on
Initiate diagnostics

>>>>>>>>>>>>>>> Resource Information <<<<<<<<<<<<<<
Resource available
Non responding host
Resource unavailable
Virtual circuit in use

>>>>>>>>>>>>>>> Hardware Error <<<<<<<<<<<<<<<<
Parity error - device to host
    Device ID = nnnn
Parity error - host to device
Diagnostic failure
Unit hardware fault
Controller hardware fault

>>>>>>>>>>>>>>> Link Protocol <<<<<<<<<<<<<<<
Link Protocol Error

>>>>>>>>>>>>>>> Port Events <<<<<<<<<<<<<<
Link error overflow
Pronto protocol error
```

{STATUS MESSAGE}

```
>>>>>>>>>>>>>>> Hardware Error <<<<<<<<<<<<<<
Diagnostic failure
Unit hardware fault
Controller hardware fault

>>>>>>>>>>>>>>> Access Error <<<<<<<<<<<<<<
Spare Block cannot be executed -- No spare media available
Defective spare has been detected
    Address of defective block is:
    Block address = nnnn
          or
    Vector address =
        Cylinder = nnnn     Head = nnnn     Sector = nnnn
Unrecoverable data overflow
Address of first defective block is:
    Block address = nnnn
          or
    Vector address =
        Cylinder = nnnn     Head = nnnn     Sector = nnnn
Unrecoverable data has been detected
    Address of defective block is:
    Block address = nnnn
          or
    Vector address =
        Cylinder = nnnn     Head = nnnn     Sector = nnnn
End of volume encountered
Sparing Error -- To Many Auto Spares

>>>>>>>>>>>>>>> Information Error <<<<<<<<<<<<<<
Only one spare track remains on the disc
Marginal data recovered with much difficulty
    Address of defective block is:
    Block address = nnnn
          or
    Vector address =
        Cylinder = nnnn     Head = nnnn      Sector = nnnn
Error and fault log areas (maintenance tracks) are full
A defective block has been spared
    Address of defective block is:
    Block address = nnnn
          or
    Vector address =
        Cylinder = nnnn     Head = nnnn       Sector = nnnn

>>>>>>>>>>>>>>>>>> DERRORS <<<<<<<<<<<<<<<<<<
Drive error numbers = nnnn, nnnn, nnnn, nnnn
```

ADDRESS

This **Normal Mode** command allows the user to convert block addresses to 3-vector addresses and vice versa. This conversion will be made using the maximum address for the device that is currently selected. This maximum address will be obtained via the FLEX (extended) describe command.

Input :

```
FLEXDIAG>ADDRESS

        Do you want to convert from block or 3-vector
           addresses (B/V)[ V ]?

                  {if response was B}
        Enter block address (<cr> to keep current value) --
           Block address(nnnn - nnnn) = nnnn?

                  {if response was V}
        Enter 3-vector address (<cr> to keep current values) --
           Cylinder address(nnnn - nnnn) = nnnn?
           Head address(nnnn - nnnn)     = nnnn?
           Sector address(nnnn - nnnn)   = nnnn?
```

Output :

```
        ADDRESS UTILITY
        Selected device is an HPXXXX disk drive

          {for block addresses to 3-vector addresses}
        Block address nnnn is equivalent to 3-vector address:
           Cylinder = nnnn   Head = nnnn   Sector = nnnn

          {for 3-vector addresses to block addresses}
        3-vector address:
           Cylinder = nnnn   Head = nnnn   Sector = nnnn
           is equivalent to block address nnnn

        ADDRESS UTILITY COMPLETED
```

CLEAR COMMAND

This **Destructive Mode** command provides the user with the means of performing several different types of clear operations on the selected drive. Prior to issuing the clear command, a FLEX PRESET command will be issued to force logging of all errors that are currently stored in RAM. This is necessary since the clear command will clear this RAM.

Input :

```
FLEXDIAG>CLEAR COMMAND

   The clear options are:
      C - Configure Clear
      R - Reset Clear

    Which clear do you want (C/R)[ C ]?
```

Output :

```
        CLEAR COMMAND UTILITY
        Selected device is an HPXXXX disk drive

        Preset completed successfully

     {if reset clear}
        Reset clear was successful

        Configure clear was successful

        CLEAR COMMAND UTILITY COMPLETED
```

CLEAR LOGS

This **Normal Mode** command is used to clear the Run-Time Drive Error Log, the Error-Rate Test Drive Error Log, and the Drive Fault Log. The user will be given the option of clearing all of the logs or just the Error-Rate Test Drive Error Log, which would allow the logging of multiple executions of error-rate tests.

Input :

```
FLEXDIAG>CLEAR LOGS

        ************************************************
        *                     CAUTION                  *
        *      This command will destroy service related   *
        *      information.                            *
        ************************************************


   Do you wish to continue(Y/N)[ N ]?

       {if yes}
   Clear logs
     0 - all logs
     1 - ert logs

   Which log[0]?
```

Output :

```
   CLEAR LOGS UTILITY
   Selected device is an HPXXXX disk drive

   All log(s) cleared
        {or}
   ERT log(s) cleared

   CLEAR LOGS UTILITY COMPLETED
```

DESCRIBE

This **Normal Mode** command will obtain a FLEX (extended) describe message from the device being tested and display the contents to the user in text form. The information in the describe message includes such things as device parameters that are used by system drivers.

Input :

```
FLEXDIAG>DESCRIBE
```

Output :


```
DESCRIBE UTILITY
Selected device is an HPXXXX disk drive

Describe Information:
The following unit(s) are installed:
    nnnn   nnnn
Maximum transfer rate = nnnn Kbytes per second
Controller type =
                  Integrated Single-Unit
               or Integrated Multi-Unit
               or Integrated Multi-Port
        or PBUS Only
Port ID = nnnn
Number of host ports provided by controller = nnnn
{If UNIT TEST LEVEL}
Unit number = nnnn
{If MECHANISM TEST LEVEL}
Device is a nnnn fixed-disk
            or removable disk
Block size = nnnn bytes
Buffer size = nnnn blocks
{If UNIT TEST LEVEL}
Burst mode is not recommended

               {or}
Recommended burst size = nnnn bytes
{If MECHANISM TEST LEVEL}
ESDI Interface
       {or}
SCSI Interface
Block transfer time = nnnn microseconds
Average transfer rate = nnnn Kbytes per second
```

```
{If UNIT TEST LEVEL}
Optimal retry time = nnnn 10's of milliseconds
{If UNIT TEST LEVEL}
Maximum access time to data = nnnn 10's of milliseconds
Maximum interleave = nnnn
Volume number = nnnn

      Maximum Addresses                    Sector
 Cyl      Head      Sect      Block       Interleave
====      ====      ====      =====       ==========
nnnn      nnnn      nnnn      nnnn        nnnn

DESCRIBE UTILITY COMPLETED
```

DIAG

This **Normal Mode** command will initiate internal diagnostic tests which reside in the disk drive. The tests which can be selected are device dependent and are fully described in the support documentation for each type of drive.

Input :

```
FLEXDIAG>DIAG

        ***************************************************
        *                   CAUTION                       *
        *      This command MAY tie up the system for     *
        *      long as it takes to fo finish the test.    *
        ***************************************************

        Do you wish to continue (Y/N) [N]?

        Input the loop count (nnnn <=  count  <=  nnnn) [nnnn]?
```

Output :

```
        INITIATE DIAGNOSTIC UTILITY
        Selected device is an HPXXXX disk drive

        Loop = nnnn, Diag # = nnnn, Unit # = nnnn

        INITIATE DIAGNOSTIC UTILITY COMPLETED
```

Possible Error Messages:

```
     *** DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE
         FLEX INITIATE DIAGNOSTIC COMMAND

         STATUS = { status }
```

ERT LOG

This **Normal Mode** command allows the user to access the Error-Rate Test Data Error Log which contains an accumulation of all read errors which were detected during error-rate tests. These errors accumulate until the CLEAR LOGS command is used to clear them. The errors in this log are organized according to head number.

Input :

```
FLEXDIAG>ERT LOG

   Display the errors for all heads (Y/N)[ Y ]?

   {if response was N}
   Input the head number [nnnn] (nnnn - nnnn)?
```

Output :

```
   ERT LOG UTILITY
   Selected device is an HPXXXX disk drive

   Error Rate Test Log Values
   ==========================

   Head number = nnnn
   Number of sectors read = nnnn
   Correctable errors = nnnn
   Uncorrectable errors = nnnn

   There are no log entries for this head
                  or

         Logical      Error
   Cyl   Head  Sect  Type1   Count    Error
   ====  ====  ====  =====   =====   ========
   nnnn  nnnn  nnnn   XXX    nnnn    BBBBBBBB
   nnnn  nnnn  nnnn   XXX    nnnn    BBBBBBBB
   .
   .   Repeat for each entry in the log
   .
   nnnn  nnnn  nnnn   XXX    nnnn    BBBBBBBB
```

```
                {if any entries were printed}
Do you wish to see error byte decoding information(Y/N)[ N ]

                {if yes}
 The error types are:
    COR = ECC correctable
    UNC = ECC uncorrectable
    UNR = unrecoverable error
    "   = decode error manually

The Error values are :

   00000000  ECC found correctable error
   00000001  ECC found uncorrectable error
   00000010  not used
   00000100  Error found in sector header
   00001000  Error found in sector body
   00010000  CRC byte(s) in error
   00100000  Parity error bit set
   01000000  data underrun detected
   10000000  ECC byte(s) in error
```

{Note: The above table is specific to HP7936/37 drives. The values in this table will be changed appropriately for other drive types.}

```
    ERT LOG UTILITY COMPLETED
```

EXIT

This **Normal Mode** command terminates execution of the External Exerciser. It may be entered any time the **FLEXDIAG>** prompt appears.

Input :

```
FLEXDIAG>EXIT
```

Output :

```
   End of Section 17 - External Exerciser
```

FAULT LOG

This **Normal Mode** command allows the user to access the Drive Fault Log which contains an accumulation of all faults that have occurred on the drive since the last CLEAR LOGS command was executed. If the cylinder address in any of the entries is followed by a *, this indicates that the address is physical. Thus, a spare MUST NOT be attempted using this address since the SPARE command uses only logical addresses. Fault Code values are displayed in decimal.

Input :

```
FLEXDIAG>FAULT LOG
```

Output :

```
FAULT LOG UTILITY
Selected device is an HPXXXX disk drive

No drive faults to report
       {or}
There are nnnn entries in this log

Fault log values:

          Current              Target
     Cyl   Head  Sect   Cyl   Head  Sect    HFR      Fault Code
     ====  ====  ====   ====  ====  ====  ========  ==========
  *  nnnn  nnnn  nnnn * nnnn  nnnn  nnnn  BBBBBBBB   DERR nnnn
                                                        or
     .                                                TERR nnnn
     .  Repeat for each entry in the log
     .
     nnnn  nnnn  nnnn   nnnn  nnnn  nnnn  BBBBBBBB   DERR nnnn
                                                        or
                                                      TERR nnnn

     *** Indicates a PHYSICAL address -- DO NOT attempt
         to spare this address

           {if any entries were printed}
Do you wish to see HFR decoding information(Y/N)[ N ]?
```

```
          {if Yes}
    The HFR values are:
  01234567
  ========
  00000001  spin-up failed
  00000010  servo timing error
  00000100  heads off track
  00001000  AGC error
  00010000  sector timing error
  00100000  data overrun
  01000000  unused
  10000000  unused

Any (E) after the fault code indicates an event,
and an (F) indicates a fault.

Activity indicator values:
  0 = no seeks
  1 = 1 seek
  2 = 2 seeks
  3 = 3 seeks
  4 = 4 seeks
  5 = 5 - 7 seeks                      (1 sec)
  6 = 8 - 200 seeks                    (1 - 30 sec)
  7 = 201 - 2000 seeks                 (30 sec - 5 min)
  8 = 2,001 - 12,000 seeks             (5 - 30 min)
  9 = 12,001 - 25,000 seeks            (30 - 60 min)
  10 = 25,001 - 150,000 seeks          (1 - 6 hours)
  11 = 150,001 - 600,000 seeks         (6 - 24 hours)
  12 = 600,001 - 4,000,000 seeks       (1 - 7 days)
  13 = 4,000,001 - 16,000,000 seeks    (1 - 4 weeks)
  14 = 16,000,001 - 100,000,000 seeks  (1 - 6 months)
  15 = > 100,000,000 seeks             (> 6 months)
```

{Note: The above table is specific to HP7936/37 drives. The values in this table will be changed appropriately for other drive types.}

```
    FAULT LOG UTILITY COMPLETED
```

HELP

This **Normal Mode** command provides the user with access to information concerning the commands that are available in the external exerciser. The user may request a list of the available commands accompanied by a brief description of each, or individual command descriptions. For individual commands, the user can request a description and syntax or just the syntax.

Input :

```
FLEXDIAG>HELP [ command name or <cr> ]
```

Output :

{If no command name was given (i.e.[RETURN])}

```
The following commands are available:

ADDRESS - converts block addresses to 3-vector and visa versa
CLEAR COMMANDS - provides access to Configure Clear or ...
   .
   .
   .
WTR ERT - performs a write-then-read error rate test on
          the device
```

{If a command was given}

```
Do you want a description or just syntax (D/S)[ D ]?
```

{If response was D}

```
COMMAND DESCRIPTION:
Description of the command
Syntax of the command
```

{If response was S}

```
COMMAND SYNTAX:
Syntax of the command
```

INIT MEDIA

This command (**Normal Mode** for the *Initialize Maintenance Tracks* option; **Destructive Mode** for all other options) allows the user to format the disk's media. The user has the option of retaining all spares that have been made on the disk, or of retaining only factory spares. The user also has the option of initializing maintenance tracks. All data on the disk may be destroyed by this command. It is essential that extensive error-rate testing be performed and that all questionable sectors be spared after executing this command.

Input :

```
FLEXDIAG>INIT MEDIA
```

{If NORMAL mode access}

```
   Initialize maintenance tracks (Y/N) [N]?
```

{or}

{If DESTRUCTIVE mode access}

```
      ****************************************************
      *                   CAUTION                        *
      *      This command may destroy user data.         *
      ****************************************************

      Do you wish to continue (Y/N) [N]?
```

{if yes}

```
   Do you want to:
      M = initialize the maintenance tracks
      P = retain only primary spares
      A = retain all spares

   Which option would you like [ A ] ?
```

Output :

```
         INIT MEDIA UTILITY
         Selected device is an HPXXXX disk drive
```

{if response was M}

```
   format - initialize maintenance tracks
```

{if response was A}

```
   format - retain all spares
```

{if response was P}

```
   format - retain only primary spares

   Media is being initialized -- may take several minutes

          Media has been successfully initialized

          INIT MEDIA UTILITY COMPLETED
```

LOOPBACK

This **Normal Mode** command will perform a write loopback of 256 bytes of data on the channel using the pattern—255,0,1, ... ,254. This operation will be followed by a read loopback of 256 bytes, which will be compared with the expected pattern to verify correct transmission. The pattern sent in the read loopback is generated from Read-Only Memory (ROM) in the disk drive, and should be the same as the pattern specified above in the write loopback.

Input:

```
FLEXDIAG> LOOPBACK
```

Output:

```
LOOPBACK UTILITY
Selected device is an HPXXXX disk drive

LOOPBACK UTILITY COMPLETED
```

Possible Error Messages:

```
*** ERROR IN TRANSMISSION DETECTED DURING READ
    LOOPBACK TEST:  (FLEXERR 115)
       Bit Positions
              Octal Value       Octal Value      In Error
Byte #        Transmitted       Received            01234567
======        ===========       ==========       ============
 12             56                54               00000010
 33            127                63               01100100
 .
 .
 .
241             74                72               00000110
```

{Note: -- entries in the preceding table will be printed for as many errors as were detected, unless the ERRNUM value is exceeded}

MEDIA TEST

This **Destructive Mode** command enables the user to test the hardware/data path of the drive. This is done by performing variable length and variable location writes, followed by reads of the same length and location. The user is given the choice of testing a selected area or a random area. The option is also provided of selecting an internal pattern, or random pattern data, to be used in the test. This command will destroy data on the disk.

Input:

```
FLEXDIAG> MEDIA TEST

     ***************************************************
     *                   CAUTION                       *
     *      This command may destory user data.        *
     ***************************************************

     Do you wish to continue (Y/N) [N]?

     Clear the drive logs (Y/N) [N]?

     Types of media tests:
       P = selected area media test
       R = random area media test
     Enter the test type [P]?

{If not random area}
     Do you want block or 3-vector addresses (B/V)[V]?

{If response was B}
     Enter new address (<cr> to keep current value)
 Block address (nnnn - nnnn) = nnnn?

{If response was V}
     Enter new address (<cr> to keep current value)
 Cylinder address (nnnn - nnnn) = nnnn?
 Head address (nnnn - nnnn) = nnnn?
 Sector address (nnnn - nnnn) = nnnn?
```

```
    Test Area:
      V = volume
      H = head
      C = cylinder
      T = track
      S = sector
    Enter the test area [T]?

    Do you want:
      R = random transfer length
      U = user input transfer length
    Which option would you like (R/U) [U]?
```

{*If response was U*}

```
    Input transfer length (nnnn <= sectors <= nnnn) [nnnn]?

    The sources for the data pattern to be used are:
      I - Internal pattern
      R - Random pattern
      U - User input pattern
    Which pattern source would you like (I/R/U) [I]?
```

{*If reply was U*}

```
    Input the pattern in hex:

    Input the loop count (nnnn<= count <=nnnn) [nnnn]?
```

Output:

```
MEDIA TEST UTILITY
Selected device is an HPXXXX disk drive

Preset in progress ...
Preset was successful
```

{If clear logs}

```
All log(s) cleared

Test Area = Volume starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
```

{or}

```
Test Area = Head starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
```

{or}

```
Test Area = Cyl starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
```

{or}

```
Test Area = Track starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
```

{or}

```
Test Area = Sec starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
```

{If no errors detected}

```
No errors were detected in the media test

MEDIA TEST UTILITY COMPLETED
```

Possible Error Messages:

{If errors were detected}

```
*** ERROR IN TRANSMISSION DETECTED DURING WRITE/READ
    MEDIA TEST:  (FLEXERR 124)

                 Bit
                          Hex   Hex   Positions
                          Value Value In Error
 Cyl   Hd   Sect   Byte   Trns  Recd  01234567        Time Error Occurred
 ======================   ====  ====  ========    ==========================
nnnn  nnnn  nnnn   nnnn    HH    HH   BBBBBBBB    FRI, DEC 16, 1988 9:03 PM
nnnn  nnnn  nnnn   nnnn    HH    HH   BBBBBBBB    FRI, DEC 16, 1988 9:03 PM
.
.  Repeat for each occurrence
.
nnnn  nnnn  nnnn   nnnn    HH    HH   BBBBBBBB    FRI, DEC 16, 1988 9:03 PM
```

PRESET DRIVE

This **Normal Mode** command is used to force the errors in the drive's RAM to be logged. This type of operation is necessary before issuing a **RESET CLEAR** command which will result in these logs being cleared.

Input :

```
FLEXDIAG>PRESET DRIVE
```

Output :

```
        PRESET DRIVE UTILITY
        Preset completed successfully

        PRESET DRIVE UTILITY COMPLETED
```

PRINT PHYSICAL

This **Normal Mode** command is used to enable the printing of PHYSICAL addresses in the FAULT logs.

Input:

```
FLEXDIAG> PRINT PHYSICAL
```

Output:

```
Print physical address enabled
   {or}
Print physical address disabled
```

READ

This **Normal Mode** command allows the user to access any data block on the selected device. Due to obvious potential security compromise, the user will need to possess Level 0 security to use this command.

Input :

```
FLEXDIAG>READ

   Do you want block or 3-vector addresses (B/V)[V]?

            {if response was B}
   Enter new address (<cr> to keep current value) --
      Block address(nnnn - nnnn) = nnnn?

            {if response was V}
   Enter new address (<cr> to keep current value) --
      Cylinder address(nnnn - nnnn) = nnnn?
      Head address(nnnn - nnnn)     = nnnn?
      Sector address(nnnn - nnnn)   = nnnn?
```

Output :

```
   READ UTILITY
   Selected device is an HPXXXX disk drive

   The data in hex follows:

         0   1   2   3   4   5   6   7   8   9

     0:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH.... .... .
    10:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH.... .... .
        .
        .
        .
   250:  HH  HH  HH  HH  HH  HH.....  ...
```

{Note: the dots in the preceding table represent non-alpha-numeric ASCII characters. Alpha-numeric characters will be printed.}

```
   READ UTILITY COMPLETED
```

REV

This **Normal Mode** command allows the user to read the revision numbers of the ROM's that contain the firmware installed in the device.

Input :

```
FLEXDIAG>REV
```

Output :

```
REVISION UTILITY
Selected device is an HPXXXX disk drive

   Firmware Revision Values:
Part Number     Revision Number
===========     ===============
   nnnn             nnnn - nnnn
   nnnn             nnnn - nnnn
   nnnn             nnnn - nnnn
   nnnn             nnnn - nnnn
   nnnn             nnnn - nnnn
   nnnn             nnnn - nnnn
   nnnn             nnnn - nnnn

REVISION UTILITY COMPLETED
```

RFSECTOR

This **Normal Mode** command allows the user to read a full sector of data from the disk starting at any valid address. The sector header is displayed along with the data in the sector. Due to obvious potential security compromise, the user will need to possess Level 0 security to use this command.

Input :

```
FLEXDIAG>RFSECTOR

   Do you want to access PHYSICAL addresses (Y/N) [N]?

                    {if response was Y}
         Enter new address (<cr> to keep current value) --
            PHYSICAL cylinder address (nnnn - nnnn) = nnnn?
            PHYSICAL head address (nnnn - nnnn) = nnnn?
            PHYSICAL sector address (nnnn - nnnn) = nnnn?

                    {if response was N}
         Enter new address (<cr> to keep current value) --
            Cylinder address (nnnn - nnnn) = nnnn?
            Head address (nnnn - nnnn) = nnnn?
            PHYSICAL Sector address (nnnn - nnnn) = nnnn?
```

Output :

```
      READ FULL SECTOR UTILITY
      Selected device is an HPXXXX disk drive

      Physical spare = nnnn
      Physical sector = nnnn
      Head = nnnn
      Logical Cylinder = nnnn
      No sector sparing has occurred
```

{Note: Sector Status will be 1 for tracks that have not used spare sector. Otherwise it will be the physical spare sector.}

```
Header values (Hex):
      0   1   2   3   4   5

  0:  HH  HH  HH  HH  HH  HH

The data follows (Hex):

0   1   2   3   4   5   6   7   8   9

  0:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH.... .... .
 10:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH.... .... .
    .
    .
    .
250:  HH  HH  HH  HH  HH  HH....  ...
```

{Note: the dots in the preceding table represent non-alpha-numeric ASCII characters. Alpha-numeric characters will be printed.}

```
READ FULL SECTOR UTILITY COMPLETED
```

RO ERT

This **Normal Mode** command is used to initiate a read only error-rate test. Two types of tests are available through this command. The first is standard read only error-rate test which allows the user to specify the address at which the test is to start. This test will sequentially read data starting at this address in an attempt to detect any read errors. The second type of test is a random read only error-rate test which uses random addresses and lengths of reads in attempt to detect any read errors.

Input :

```
FLEXDIAG>RO ERT

   ***************************************************
   *                    CAUTION                      *
   *      This command MAY tie up the system for     *
   *      long as it takes to fo finish the test.    *
   ***************************************************

   Do you wish to continue (Y/N) [Y]?

   Clear the ERT logs (Y/N)[N]?

   Types of RO ERTs:
     S = selected area
     R = random area
   Enter the test type (S/R) [S]?

   Do you want block or 3-vector addresses (B/V)[V]?
              {if response was B}
   Enter new address (<cr> to keep current value) --
      Block address(nnnn - nnnn) = nnnn?

              {if response was V}
   Enter new address (<cr> to keep current value) --
      Cylinder address(nnnn - nnnn) = nnnn?
      Head address(nnnn - nnnn)     = nnnn?
      Sector address(nnnn - nnnn)   = nnnn?

   Test Area:
     V = volume
     H = head
     T = track
     C = cylinder
     S = sector
   Enter the test area [T]?

   Input the loop count (nnnn<= count <= nnnn) [nnnn]?

   Log or Print errors (L/P) [P]?
```

Output :

```
RO ERT UTILITY
Selected device is an HPXXXX disk drive

Preset in progress ...
Preset was successful!

{If clear ERT logs}
ERT log(s) cleared

Test Area = Volume starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
      {or}
Test Area = Head starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
      {or}
Test Area = Cyl starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
      {or}
Test Area = Track starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
      {or}
Test Area = Sec starting at Cyl = nnnn, Head = nnnn, Sec = nnnn

      {if no errors detected}
   No errors were detected in the ERT

      {if errors were detected}
RO ERT results:

      Logical        Error
   Cyl   Head  Sect   Type    Count   Error
   ====  ====  ====   =====   =====  ========
   nnnn  nnnn  nnnn    XXX    nnnn   BBBBBBBB
   nnnn  nnnn  nnnn    XXX    nnnn   BBBBBBBB
   .
   .   Repeat for each entry in the log
   .
   nnnn  nnnn  nnnn    XXX    nnnn   BBBBBBBB
```

{if any errors were printed}

```
Do you wish to see error byte decoding information(Y/N)[ N ]
```

{if yes}

```
      The error types are:
         COR = ECC correctable error
         UNC = ECC uncorrectable error
         UNR = unrecoverable error
         " = decode error manually

      The Error values are :

         00000000  ECC found correctable error
         00000001  ECC found uncorrectable error
         00000010  not used
         00000100  Error found in sector header
         00001000  Error found in sector body
         00010000  CRC byte(s) in error
         00100000  Parity error bit set
         01000000  data underrun detected
         10000000  ECC byte(s) in error
```

{Note: The above table is specific to HP7936/37 drives.
The values in this table will be changed
appropriately for other drive types.}

```
RO ERT UTILITY COMPLETED
```

RUN LOG

This **Normal Mode** command allows the user to access the Run-Time Data Error Log which contains an accumulation of all run-time data errors that have been logged since the last time the log was cleared.

Input :

```
FLEXDIAG>RUN LOG

   Do you wish to see the errors for all heads (Y/N)[ Y ]?

                    {if response was N}
   Input the head number (nnnn <= head <= nnnn) [nnnn]?
```

Output :

```
   RUN LOG UTILITY
   Selected device is an HPXXXX disk drive

   Head number = nnnn
   Number of sectors read = nnnn
   Correctable errors = nnnn
   Uncorrectable errors = nnnn
      There are no log entries
                    or

         Logical          Error
    Cyl   Head  Sect   Type    Count   Error
    ====  ====  ====   =====   =====  ========
    nnnn  nnnn  nnnn    XXX    nnnn   BBBBBBBB
    nnnn  nnnn  nnnn    XXX    nnnn   BBBBBBBB
    .
    .   Repeat for each entry in the log
    .
    nnnn  nnnn  nnnn    XXX    nnnn   BBBBBBBB

           {if any errors were printed}
   Do you wish to see error byte decoding information(Y/N)[ N ]

                     {if yes}
   The error types are:
        COR = ECC correctable error
        UNC = ECC uncorrectable error
        UNR = unrecoverable error
        '' = decode error manually
```

```
The Error values are :

   00000000  ECC found correctable error
   00000001  ECC found uncorrectable error
   00000010  not used
   00000100  Error found in sector header
   00001000  Error found in sector body
   00010000  data not recovered on first retry
   00100000  CRC byte(s) in error
   01000000  ECC byte(s) in error
   10000000  Unrecoverable error
```

{Note: The above table is specific to HP7936/37 drives. The values in this table will be changed appropriately for other drive types.}

```
   RUN LOG UTILITY COMPLETED
```

SERVO TEST

This **Normal Mode** command allows the user to execute the drive's internal butterfly seek routine. It will allow the test to be performed on one or all of the drive heads. There is no data transferred with use of this command.

Input :

```
FLEXDIAG>SERVO TEST

        ************************************************
        *                  CAUTION                     *
        *      This command MAY tie up the system for  *
        *      long as it takes to fo finish the test. *
        ************************************************

        Do you wish to continue (Y/N) [N]?

        Input the loop count (1 <= count <= 254) [1] ?

        Test all heads(Y/N) [N] ?
```

{If the response was N}

```
        Input head (nnnn <= head <= nnnn) [nnnn]?
```

Output :

```
       SERVO TEST UTILITY
       Selected device is an HPXXXX disk drive

       SERVO TEST UTILITY COMPLETED
```

SET PATTERN

This **Normal Mode** command will allow the user to define and edit a pattern to be used in write-then-read error-rate tests. The pattern must be input in hex and is restricted to 64 digits in length. If less than 64 digits are input, the pattern that was input will be duplicated as many times as necessary to produce 64 digits. If no pattern has yet been defined, the pattern that is input will be stored for use in a `WTR ERT`. If a pattern has been previously defined, via this command, that pattern will be displayed and the user can then edit that string. Valid edit characters are:

R — for replace.
R will replace the characters in the pattern with the characters following the R, starting at the pattern character under which the R is typed.

I — for insert.
I will insert the characters following the I into pattern following the character in the pattern under which the I is typed.

D — for delete.
D will delete the pattern character under which the D is typed. Multiple D's may be typed to delete a succession of characters and other editing characters may follow a D (i.e., DIab" will delete one character and insert the string "ab" at that point in the pattern).

Following each edit string typed in, the resulting edited pattern will be re-displayed and the user will be given another opportunity to edit it. This process may be terminated by simply imputing a (Return) for the edit string.

Input :

```
FLEXDIAG>SET PATTERN
```

{if no previous pattern has been defined}

```
Input the pattern in hex:
```

{if pattern contains all valid hex characters this command will terminate}

{if a previous pattern has been defined or the initial pa input contained invalid characters}

```
Input the changes (<cr> to stop):
```

{previous pattern is displayed here}

```
>
```

{if the input edit pattern is not valid then the pattern will again be displayed and a new edit string will be requested}

{this process will be repeated until user inputs a [RETURN] only for the edit string}

Output:

```
SET PATTERN UTILITY
Selected device is an HPXXXX disk drive

SET PATTERN UTILITY COMPLETED
```

SPARE

This command (**Normal Mode** for MPE/XL; **Destructive Mode** for HP-UX) will allow the user to spare a block or sector to an address which s reserved for sparing. The command will perform a Spare Retaining Data with an ERT. If the media of the target sector is determined to be good, the user will be given the option of performing a Spare Retaining Data without ERT. Refer to the section entitled "SPARING" in this document for the details on the sparing algorithm.

Input :

```
FLEXDIAG>SPARE

        ************************************************
        *                  WARNING                     *
        *      This command may destroy data.          *
        ************************************************

        Do you wish to continue (Y/N) [N]?

        Do you want block or 3-vector addresses (B/V)[ V ]?

   {if response was B}
        Enter new address (<cr> to keep current value) --
           Block address(nnnn - nnnn) = nnnn?

   {if response was V}
        Enter new address (<cr> to keep current values) --
           Cylinder address(nnnn - nnnn) = nnnn?
           Head address(nnnn - nnnn)     = nnnn?
           Sector address(nnnn - nnnn)   = nnnn?

   {If the ERT determined that the media is good}
        The WTR ERT performed on the target block determined that
        the media is good -- MEDIA WAS NOT SPARED.  If you wish to
        spare this media anyway, perform a spare (retain data)
        without ERT.

        Do you wish to perform a spare (retain data)
        without ERT(Y/N) [ N ]?
```

Output :

```
    SPARE UTILITY
    Selected device is an HPC2204A disk drive

 {If spare was performed}
    {status -- including address of track affected by spare}

 {If data could not be recovered}
 ************************************************************
 *                          WARNING                         *
 * Data recovery was attempted on the target sector but the *
 * data was not ECC correctable.  When this data was        *
 * rewritten, the ECC field was modified to flag the sector *
 * as unrecoverable.  If data retention is needed, it       *
 * should be performed.  To clean up the uncorrectable      *
 * error, a write must be performed to the target sector.   *
 ************************************************************

    SPARE UTILITY COMPLETED
```

SUSPEND

This **Normal Mode** command allows the user to suspend FLEXDIAG and return to the DUI. The user enters RESUME at the DUI prompt to return to FLEXDIAG.

Input:

```
FLEXDIAG> SUSPEND
```

Output:

```
DUI>
```

TSTAT

This **Normal Mode** command allows the user to request a partial status of the drive. This command is useful for determining that the drive is still alive. If the drive is not alive, the status associated with the diagnostic failure is returned.

Input :

```
FLEXDIAG>TSTAT
```

Output :

```
TRANSPARENT STATUS UTILITY
Selected device is an HPXXXX disk drive

No status error messages to report.
 {or}
STATUS = { status }

TRANSPARENT STATUS UTILITY COMPLETED
```

TABLES

This **Normal Mode** command provides access to the various information tables which reside in the drive. At present, the HP7937FL drive only supports the Spare Track table. The spare track table contains a list of all logical tracks which have been spared for each head.

Input :

```
FLEXDIAG>TABLES

     Do you want to see the spare sectors (Y/N) [N]?
```

{*If response is Y*}

```
     ************************************************
     *                  CAUTION                     *
     *      This command MAY tie up the system for  *
     *      long as it takes to fo finish the test. *
     ************************************************

     Do you wish to continue (Y/N) [N]?
```

Output :

```
     TABLES UTILITY
     Selected device is an HPXXXX disk drive

     Spare Track Table:
```

{*for each head*}

```
     Head Number = nnnn

     Number of spare operations = nnnn
     Number of spare tracks used = nnnn
     Number of logical tracks spared = nnnn
```

{*for each cylinder/scalar*}

```
      CYL        TYPE       SCALAR
     =====    ========    ======
     nnnn     secondary   nnnn
     nnnn     primary     nnnn
```

{*If spare sectors option*}

```
Locations of spared sectors

Logical            Spare
  Cyl   Head   Sect       Type
==================       =========
 nnnn   nnnn   nnnn       secondary
 nnnn   nnnn   nnnn       primary
 .
 .  Repeat for each entry
 .
 nnnn   nnnn   nnnn       primary

 TABLES UTILITY COMPLETED
```

TEST LEVEL

This **Normal Mode** command allows the user to select either the unit or mechanism test level. This command is required for multi-mech drives, so that the user can specify which mech is to be tested.

Input:

```
FLEXDIAG> TEST LEVEL

     ****************************************************
     *                    WARNING                       *
     *  Address values set/reported from the UNIT       *
     *  LEVEL ARE NOT the same as those set/reported    *
     *  from the MECHANISM LEVEL.                       *
     *                                                  *
     *  When testing from the mechanism level,          *
     *  address values set/reported are from the        *
     *  perspective of the mechanism.  Do not           *
     *  confuse these values with those set and         *
     *  reported from the unit (host) level.  Please    *
     *  consult your service manual for further         *
     *  details.                                        *
     ****************************************************

     Test from unit or mechanism level (U/M) [U]?
```

{*If response was U*}

```
     What unit do you wish to select (nnnn - nnnn) [nnnn]?
```

{*If response was M*}

```
     What mech do you wish to select (nnnn - nnnnn) [nnnn}?
```

Output:

```
     TEST LEVEL UTILITY
     Selected device is an HPXXXX disk drive
```

{*If response was U*}

```
     Unit nnnn of the device has been successfully set
     Address values are not set/reported from UNIT (HOST) LEVEL
```

{*If response was M*}

```
     Mech nnnn of the device has been successfully set
     Address values are not set/reported from the MECHANISM LEVEL

     TEST LEVEL UTLITY COMPLETED
```

WTR ERT

This **Destructive Mode** command is used to initiate a write-then-read error-rate test. Two types of tests are available through this command.

Note Both of these tests will destroy data on the disk.

Pattern ERT Performs incremental writes followed by reads across a data area specified by the user. The pattern of data that is to be written and read is also specified by the user.

Random ERT Does random length writes followed by reads at random locations on the disk.

Input :

```
FLEXDIAG>WTR ERT

        ****************************************************
        *                   WARNING                        *
        *      This command may destroy data.              *
        ****************************************************

        Do you wish to continue (Y/N) [N]?

        Clear the ERT logs (Y/N)[ N ]?

        Types of WTR ERTs:
          P = selected area pattern WTR ERT
          R = random area WTR ERT
        Enter the test type [P]?

   {If not random area}
        Do you want block or 3-vector addresses (B/V)[V]?

   {if response was B}
        Enter new address (<cr> to keep current value) --
           Block address(nnnn - nnnn) = nnnn?
```

```
{if response was V}
     Enter new address (<cr> to keep current values) --
        Cylinder address(nnnn - nnnn) = nnnn?
        Head address(nnnn - nnnn)     = nnnn?
        Sector address(nnnn - nnnn)   = nnnn?

     Test Area:
       V = volume
       H = header
       C = cylinder
       T = track
       S = sector
     Enter the test area [T]?

     The sources for the data pattern to be used are:
       I - Internal pattern
       R - Random pattern
       U - User input pattern
     Which pattern source would you like (I/R/P)[ I ]?
{If response was U}
     Input the pattern in hex:

     Input the loop count (nnnn <= count <= nnnn) [nnnn]?

     Log or Print errors (L/P) [P]?
```

Output :

```
     WTR ERT UTILITY
     Selected device is an HPXXXX disk drive

     Preset in progress ...

     Preset was successful!

{If clear ERT logs}
     ERT logs cleared

     Test Area = Volume starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
           {or}
     Test Area = Head starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
           {or}
     Test Area = Cyl starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
           {or}
     Test Area = Track starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
           {or}
     Test Area = Sec starting at Cyl = nnnn, Head = nnnn, Sec = nnnn
```

{*if no errors detected*}

```
No errors were detected in the ERT
```

{*if errors were detected*}

```
WTR ERT results:

        Logical         Error
Cyl     Head  Sect      Type     Count    Error
====    ====  ====      =====    =====    ========
nnnn    nnnn  nnnn       XXX     nnnn     BBBBBBBB
nnnn    nnnn  nnnn       XXX     nnnn     BBBBBBBB
.
.   Repeat for each entry in the log
.
nnnn    nnnn  nnnn       XXX     nnnn     BBBBBBBB
```

{*if any errors were printed*}

```
Do you wish to see error byte decoding information(Y/N)[ N ]
```

{*If yes*}

```
The error types are:
   COR = ECC correctable error
   UNC = ECC uncorrectable error
   UNR = unrecoverable error
   " = decode error manually

The Error values are :

   00000000  ECC found correctable error
   00000001  ECC found uncorrectable error
   00000010  not used
   00000100  Error found in sector header
   00001000  Error found in sector body
   00010000  CRC byte(s) in error
   00100000  Parity error bit set
   01000000  data underrun detected
   10000000  ECC byte(s) in error
```

{*Note: The above table is specific to HP7936/37 drives. The values in this table will be changed appropriately for other drive types.* }

```
WTR ERT UTILITY COMPLETED
```

Error and Warning Messages

The following error and warning messages are generated by **FLEXDIAG**. For other errors, consult the DUI section of this manual and the operating system manuals. The "!" indicates that a parameter of some sort will replace the exclamation point when the message is displayed.

100	***** WARNING -- THE I/O PATH MAY NOT BE FUNCTIONING PROPERLY (FLEXERR 100)**
CAUSE	An error was detected by the Io_Path_Test service while testing the modules on the i/o path preceding the selected device.
ACTION	Execute the appropriate diagnostics on the modules preceding the selected device on the i/o path, especially on those that may have been reported as faulty in error messages immediately preceding this message. Note that the results of the execution of this instance of **FLEXDIAG** may be invalid.
101	***** DEVICE FAILED TO RESPOND TO ! COMMAND IN ALLOTTED TIME (FLEXERR 101)**
CAUSE	No response to an i/o was received prior to the expiration of the allotted time.
ACTION	Verify that the selected disk drive is actually connected to the system. Run SYSMAP, if available, to confirm the presence of the device.
102	***** FLEXDIAG IS UNABLE TO DIAGNOSE THE SELECTED DEVICE (FLEXERR 102)**
CAUSE	The selected device identified itself as something other than a FLEX CS/80 drive.
ACTION	Determine type of selected device and run the appropriate diagnostic on it.
103	***** FLEX DISC DIAGNOSTIC TERMINATING (FLEXERR 103)**
CAUSE	A fatal error has been encountered.
ACTION	The specific error that was encountered should have been reported immediately prior to this message. Follow the action instructions for that error message.
104	***** A RESERVE AREA IS NOT AVAILABLE ON THIS DRIVE -- NO OPERATION WAS PERFORMED. (FLEXWARN 104)**
CAUSE	There is no available area on the disk that can be written without corrupting user data. This can happen if no such area is provided by the system, or if the diagnostic is running in destructive mode, in which the location of the reserve area is unknown to the system, since the drive is locked for diagnostics.
ACTION	For systems which do not support a reserve area (e.g., HP-UX),
106	***** DESTRUCTIVE MODE REQUIRED TO EXECUTE THIS COMMAND (FLEXERR 106)**
CAUSE	The diagnostic does not have access to the drive in the mode necessary to execute the selected command.
ACTION	The mode granted to a diagnostic for a selected device is system dependent. Use **HELP LDEV** command at the DUI for more information.

108	***** ! COMMAND IS NOT IMPLEMENTED ON THIS DRIVE/SYSTEM (FLEXERR 108)**
CAUSE	The selected operation is either not implemented on the selected drive or the system does not provide access to it.
ACTION	This operation is unavailable.

109	***** DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE FLEX ! COMMAND (FLEXERR 109)**
CAUSE	The drive reported an error as a result of executing the selected operation.
ACTION	The hardware status that is displayed immediately following this message should indicate what sort of problem occurred, including a failing FRU if one is reported. If an FRU is reported, replace it and re-execute this diagnostic.

110	***** THE MAXIMUM NUMBER OF ERRORS HAS BEEN EXCEEDED (FLEXERR 110)**
CAUSE	The user specified error limit has been reached.
ACTION	If more errors are desired, rerun the diagnostic assigning a larger value to the ERRCOUNT parameter of the run command.

111	***** UNRECOGNIZED COMMAND -- TYPE "HELP" FOR A LIST OF VALID COMMANDS (FLEXERR 111)**
CAUSE	The specified command is not a valid command.
ACTION	Use the help facility to obtain a list of the commands that are valid and enter the desired command.

112	***** UNRECOGNIZED REPLY WAS FOUND (FLEXERR 112)**
CAUSE	The reply that was entered in response to a prompt by the diagnostic is not valid.
ACTION	Refer to the prompt that was displayed and enter a response that is within the specified list of valid responses.

113	***** A NUMERICAL INPUT WAS EXPECTED BUT NOT RECEIVED (FLEXERR 113)**
CAUSE	The reply that was entered in response to a prompt by the diagnostic is not a valid number.
ACTION	Reenter number using only numeric characters and valid special characters (e.g. +, -, , etc.).

114	***** AN UNEXPECTED ERROR OCCURRED IN THE IO_FLEX DAR (FLEXERR 114)**
CAUSE	A call to the FLEX device access routine resulted in an unexpected status return.
ACTION	Please enter an SR. Within the text of the SR report all information returned by the Diagnostic User Interface. Also state operating system, version number, DUI version and diagnostic version.

115	***** ERROR IN TRANSMISSION DETECTED DURING READ LOOPBACK TEST: (FLEXERR 115)**
CAUSE	One or more bytes of data that were received from the disk as a result of a loopback operation did not contain the expected value(s).
ACTION	Data is most likely being corrupted along the data path between the host and the drive. Check all cable connections along the path and re-execute the diagnostic. If errors persist, execute appropriate diagnostics against the modules that lay in the path between the host and the device.

118	***** ERROR -- EXPECTED ! BYTES FROM THE DEVICE AND RECEIVED ! BYTES (FLEXERR 118)**
CAUSE	The number of bytes in the reply from the device was not what was expected. This is most likely a result of executing the diagnostic on a drive which is not supported by it.
ACTION	Verify that the selected device is in the list of supported devices for the diagnostic (LIST ALL from the DUI). If it is, report the problem to support personnel.

119	***** THIS COMMAND IS NOT SUPPORTED ON THIS DEVICE (FLEXERR 119)**
CAUSE	The specified operation is not supported by the selected device.
ACTION	While other devices supported by the diagnostic may support the specified command, the selected device does not.

120	***** FILE SYSTEM ERROR ENCOUNTERED WHILE RETRIEVING A MESSAGE (FLEXERR 120)**
CAUSE	An error was returned while attempting to obtain a message from the catalog. The actual error will have been displayed prior to this message.
ACTION	Please enter an SR. Within the text of the SR report all information returned by the Diagnostic User Interface. Also state operating system, version number, DUI version and diagnostic version.

121	***** IDENTICAL READS FROM DISC RETURNED NON-IDENTICAL DATA (FLEXERR 121)**
CAUSE	A read operation was performed on the same sector twice and the data from both reads did not match exactly.
ACTION	This is most likely a hardware problem with the drive. If loopback executes correctly, the read/write board in the drive is the probable cause of the error.

122	***** DATA READ FROM DISC DID NOT MATCH DATA PREVIOUSLY WRITTEN (FLEXERR 122)**
CAUSE	A sector was written to the disk and immediately read back. The data read did not match exactly the data written.
ACTION	This is most likely a hardware problem with the drive. If loopback executes correctly, the read/write board in the drive is the probable cause of the error.

123	***** SELECTED DEVICE IS NOT A RECOGNIZED HP DEVICE (FLEXERR 123)**
CAUSE	The selected device does not identify itself with a recognized Hewlett-Packard product number or the version of diagnostic does not recognize or support the product.
ACTION	Verify visually the type of product being diagnosed. If the product is a valid Hewlett-Packard product, update the diagnostic to a version that supports the product.

124 *** ERROR IN TRANSMISSION DETECTED DURING READ/WRITE MEDIA TEST: (FLEXERR 124)

Cyl	Hd	Sect	Byte	Hex Value Trns	Hex Value Recd	Bit Positions In Error 01234567	Time Errors Occurred

CAUSE Data written to the disk does not agree with the data read.
ACTION Verify the data path to the device using the **LOOPBACK** command and **WTR ERT** on the target sector.

---

140 *** NO OPERATION WAS PERFORMED (FLEXERR 140)
CAUSE Due to a previous error, which has already been reported, no operation was performed.
ACTION Refer to action instructions for previously reported error.

---

200 *** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO SEND/RECEIVE INFORMATION FROM THE USER (FLEXERR 200)
CAUSE Due to a previous error, which has already been reported, the diagnostic was unable to communicate with the user interface process.
ACTION Refer to action instructions for previously reported error.

---

201 *** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO RETRIEVE A MESSAGE FROM THE CATALOG (FLEXERR 201)
CAUSE Due to a previous error, which has already been reported, the diagnostic was unable to extract a message from its message catalog.
ACTION Refer to action instructions for previously reported error.

---

202 *** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO CONVERT A NUMBER TO A STRING (FLEXERR 202)
CAUSE Due to a previous error, which has already been reported, the diagnostic was unable to convert a number to a string.
ACTION Refer to action instructions for previously reported error.

---

203 *** AN ERROR WAS ENCOUNTERED IN ATTEMPTING A BIT EXTRACTION OPERATION (FLEXERR 203)
CAUSE Due to a previous error, which has already been reported, the diagnostic was unable to extract one or more bits from a number.
ACTION Refer to action instructions for previously reported error.

204	***** THE SELECTED DEVICE COULD NOT BE OBTAINED FOR TESTING (FLEXERR 204)**
CAUSE	The DUI was unable to access the device. Device may be held exclusively by another process.
ACTION	Determine the access status of the device and make the corrective requirements.

205	***** DUE TO PROBLEMS WITH RETURN ADDRESSING MODE, ADDRESSES REPORTED WITH STATUS INFORMATION MAY BE INACCURATE (FLEXERR 205)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to set the return address mode on the drive.
ACTION	Refer to action instructions for previously reported error. Also, if hardware status is displayed later in the diagnostic run, the address portion of the status could be displayed in both block and 3-vector formats since the diagnostic cannot determine the mode that the disk is currently in.

206	***** DUE TO PROBLEMS WITH SET BLOCK DISPLACEMENT, FLEXDIAG WILL TERMINATE TO AVOID POTENTIAL DESTRUCTION OF USER DATA (FLEXERR 206)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully set the block displacement value on the drive. Since the diagnostic no longer knows what the displacement value is, it must terminate to avoid destroying data.
ACTION	Refer to action instructions for previously reported error.

207	***** DUE TO PROBLEMS WITH DESCRIBE, FLEXDIAG CANNOT FUNCTION PROPERLY AND WILL THEREFORE TERMINATE (FLEXERR 207)**
CAUSE	The diagnostic was unable to successfully obtain describe data from the drive. Since the diagnostic needs this information to function correctly, the user must make the determination to continue or terminate.
ACTION	Verify that the disk is in fact a CS/80 device and that the hardware path specified is valid.

208	***** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO COMMUNICATE WITH THE DIAGNOSTIC SYSTEM (FLEXERR 208)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully perform a function which requires communication with the diagnostic system.
ACTION	Refer to action instructions for previously reported error.

209	***** YOUR RESPONSE WAS INVALID (FLEXERR 209)**
CAUSE	The data entered in response to a prompt was not valid.
ACTION	Refer to the prompt to determine the valid responses for the particular situation and enter one of the specified valid responses.

210	***** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO OBTAIN DATA FROM AN I/O BUFFER (FLEXERR 210)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to get data from its i/o buffer and, therefore cannot obtain data from the device.
ACTION	Refer to action instructions for previously reported error.

211	***** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO PLACE DATA INTO AN I/O BUFFER (FLEXERR 211)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable place data into its i/o buffer and, therefore, cannot send data to the device.
ACTION	Refer to action instructions for previously reported error.

212	***** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO OBTAIN AN I/O BUFFER (FLEXERR 212)**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable obtain an i/o buffer and therefore, cannot send/receive data to/from the device.
ACTION	Refer to action instructions for previously reported error.

215	***** HIGHER SECURITY IS NEEDED TO EXECUTE THIS SECTION (FLEXERR 215)**
CAUSE	The user requested an operation which is restricted to users with higher security than the user possesses.
ACTION	Contact system administrator if higher security level is desired.

216	***** ! BYTES WERE EXPECTED TO HAVE BEEN SENT FROM THE DISK, BUT ONLY ! WERE RECEIVED (FLEXERR 216)**
CAUSE	Data returned from the device in response to a command consisted of a different number of bytes than were expected.
ACTION	This is either a firmware problem or a diagnostic software problem.

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HP 7974A/7978A/B Magtape Drive Diagnostic

Introduction

The HP 7974A/7978A/B Magtape Drive Diagnostic will test an HP 7974A or HP 7978A/B Magtape Drive. The diagnostic will run on any HP Precision Architecture RISC computer system which supports the Online Diagnostic subsystem connected to an HP 7974A or HP 7978A/B tape drive to identify and isolate defective Field Replaceable Units (FRUs). The diagnostic is structured so that online tests may be run before tests which require the device to be offline. The user can specify which sections and steps are to be run.

Defects and Enhancements

Submit defect reports and enhancement requests concerning this diagnostic through the STARS database referencing product number 30600-10003.

Minimum Configuration

The hardware required to run the diagnostic consists of an HP Precision Architecture RISC computer system with a supported (see above) Magtape Drive connected to it. The drive under test must contain internal selftests that are capable of detecting failed Field Replaceable Units (FRU's) in the drive.

Auto-Diagnostics

`DIAG7478` can be invoked by the I/O system for auto-diagnostic purposes when a nonrecoverable error has been detected. In auto-diagnostic mode, this diagnostic program will execute the sections and steps listed in the "Default Tests" section of this chapter.

Operating Instructions

Before attempting to run the diagnostics, ensure that the tape drive to be tested is powered on. If the sections which test tape movement and write/read operations are to be run, ensure that a scratch tape is mounted and that the tape drive is placed online.

Default Tests

If the user does not specify sections and steps to be run, the following default sections and steps will be executed:

Section 2	Clear
Section 3	Identify
Section 4	Loopback
Section 6	Hardware Status
Step 65	Display Hardware Status with Text
Section 40	Firmware Utilities
Step 132	Display Firmware Header
Step 133	Display Gains
Step 134	Display Electronic Set-up Values
Section 50	Image Utilities
Step 141	Display Header
Step 142	Display HP-IB Address
Step 143	Display Amount of Tape Across Head
Step 144	Display Master Controller Firmware Revision
Step 145	Eprom Check
Section 55	Display Logs
Step 151	Display Internal Drive Error Log
Step 152	Display Internal Drive Tape Log

For the HP 7974A only:

Section 34	HP 7974A Selftests
Step 118	Power-On Selftest
Step 119	Master Controller Tests
Step 120	Loop Write/Read Test

For the HP7978A/B only:

Section 38	HP7978A/B Selftests
Step 123	Power-on Selftest
Step 124	Master Controller Tests
Step 125	Servo Controller Tests
Step 126	HP-IB Internal Loopback Tests
Step 127	Internal Digital Loopback Tests
Step 128	Write Clock Test

RUN Command

To bring up the Online Diagnostic subsystem, enter the following command to the MPE XL system prompt:

`SYSDIAG`

To bring up the Online Diagnostic subsystem, enter the following command to the HP-UX system prompt:

`%/usr/diag/bin/sysdiag`

The system responds with the following prompt indicating that access has been gained to the Online Diagnostic User Interface (DUI).

`DUI >`

Typing `HELP` causes a summary of the DUI and its commands to be printed. Refer to the DUI chapter of this manual for details.

Note The device to be tested must be powered up and on line. Device physical locations (pdev) shown in the `RUN` commands are those of the devices on the "typical A1002A" system configuration described in the chapter on DUI. The pdev value entered must be correct for the system being tested.

In MPE XL the default magtape LDEV parameter is 7. In HP-UX no default magtape device parameter exists. For example, to run the diagnostic in an MPE XL environment, you might enter:

```
DUI >RUN DIAG7478 pdev=4.2.0 <RUN Command Options>
                         |                |
                         |         none required for
                         |         default test suite
                         |
             insert physical location of
             device to be tested here;
             alternatively, for MPE XL,
             type the ldev number;
             or for HP-UX, type the devfile name
```

Test Execution

The diagnostic displays the following header and welcome message:

```
*********************************************************
*****                                                ***
*****            7974A/7978 TAPE DIAGNOSTIC          ***
*****                                                ***
*****     (C) Copyright Hewlett Packard Co. 1987     ***
*****                  All Rights Reserved.          ***
*****                      Version A.00.00           ***
*****                                                ***
*********************************************************
Welcome, Today is MON, MAY 22, 1987, 9:00AM
```

The diagnostic will then execute all the selected sections and steps. Following the header, DIAG7478 will attempt to access the magnetic tape drive that was specified in the RUN command. If the status returned is "fail", the following error message will be output:

```
*** DIAGNOSTIC COULD NOT OBTAIN ACCESS TO DEVICE (MTDERR 6062)
    7974A/7978A/B MAG TAPE DIAGNOSTIC ABORTING
```

Otherwise, the diagnostic will issue an identify command to the specified device to determine whether it is an HP 7974A or 7978A/B magnetic tape drive. If the device does not respond to the identify command, the following error message will be output:

```
*** DEVICE FAILED TO RESPOND TO IDENTIFY (MTDERR 5034)
    NO IDENTIFY CODE WAS RETURNED TO IDENTIFY REQUEST
    HP7974A/7978 TAPE DIAGNOSTIC TERMINATING ABNORMALLY
```

Next, DIAG7478 will examine the identity code to determine if the device is an HP 7974A or HP 7978A/B. If the identity is not recognized by DIAG7478, it is assumed to be an HP 7974A and the following is output:

```
*** IDENTIFY FAILED (MTDERR 5033)
    ILLEGAL IDENTIFY CODE OF N HEXADECIMAL RETURNED
    ASSUMING THE DEVICE IS AN HP 7974A  MAG TAPE DRIVE
```

The diagnostic will ask whether or not the user wishes to continue the diagnostic assuming that the device to be tested is an HP 7974A:

```
Continue?   enter "Yes" to resume, or "No" to abort
```

If "Yes" then the diagnostic will continue, assuming that the tape drive is an HP 7974A. If "No" or if the diagnostic is in auto-diagnostic mode then the diagnostic will terminate, and the following message will be output:

```
HP 7974A/7978A/B Magnetic Tape Diagnostic Terminating
```

If the tape drive identify succeeds, the sections and the steps specified by the user will be executed in numerical order. If the user did not specify sections and steps or if the diagnostic is being run in auto-diagnostic mode, then the default sections and steps will be executed.

Test Section Descriptions

There are eighteen diagnostic program sections which are available for user selection. The user may also select individual steps to be run for sections 6, 10, 15, 16, 20, 23, 25, 34, 38, 40, 45, 50, and 55.

Section 2	Clear
Section 3	Identify
Section 4	Loopback
Section 6	Hardware Status
Step 65	Interpret Hardware Status
Step 66	Display Hardware Status in Binary
Section 10	Set Tape Density commands
Step 70	Set Density to 800 or 6250 CPI
Step 71	Set Density to 1600 CPI
Section 15	Write/Read Comparison Check (NRZI or GCR)
Step 74	256 1-Byte/Record File
Step 75	Maximum Buffer File
Step 76	Stream Test
Step 77	Worst Case Low Frequency File
Step 78	Worst Case High Frequency File
Step 79	Worst Case Tripole File
Section 16	Write/Read Comparison Check (PE)
Step 80	256 1-Byte Record File
Step 81	Maximum Buffer File
Step 82	Stream Test
Step 83	Worst Case Low Frequency File
Step 84	Worst Case High Frequency File
Step 85	Worst Case Tripole File
Section 20	Selectable Tape Movement Commands
Step 91	Forward Space One File (to end of next EOF mark)
Step 92	Back Space One File (to start of previous EOF)
Step 93	Back Space One Record (to end of next record gap)
Step 94	Forward Space One Record (to start of previous record gap)
Step 95	Write Record Gap
Step 96	Write File Mark
Step 97	Rewind Online
Step 98	Rewind Offline

Section 23	Selectable Tape Read Data Commands
Step 100	Read one file (NRZI or GCR)
Step 101	Read one file (PE)
Section 25	Paces
Step 105	Write Files until EOT (NRZI for 7974A/GCR for 7978A/B)
Step 106	Read Files until EOT (NRZI for 7974A/GCR for 7978A/B)
Step 107	Write Files (PE) until EOT
Step 108	Read Files (PE) until EOT
Step 109	Tape Movements:

1. Back Space 2 Records
2. Forward Space 1 Records
3. Back Space 2 Files
4. Forward Space 1 File
5. Rewind Online
6. Forward Space by record through all records on tape
7. Back Space by record through all records on tape
8. Forward Space by file through all files on tape
9. Back Space by file through all files on tape

Section 34	HP 7974A Selftests
Step 110	Transport Test (online)
Step 111	Transport Servo/Capstan (online)
Step 112	Error Detection Circuitry (online)
Step 113	Write/Backspace/Read test (online)
Step 114	NRZI (800 CPI) Stop/Start Write Tests (online)
Step 115	NRZI (800 CPI) Streaming Write Tests (online)
Step 116	PE (1600 CPI) Stop/Start Write Tests (online)
Step 117	PE (1600 CPI) Streaming Write Tests (online)
Step 118	Power-on Selftest (on/offline)
Step 119	Master Controller Tests (on/offline)
Step 220	Loop Write/Read Test (on/offline)
Section 38	7978A/B Selftests
Step 121	Write/Read PE Data Block Test (online)
Step 122	Write/Read GCR Data Block Test (online)
Step 123	Power-on Selftest (offline)
Step 124	Master Controller Tests (on/offline)
Step 125	Servo Controller Tests (on/offline)
Step 126	HP-IB Internal Loopback Tests (on/offline)
Step 127	Internal Digital Loopback Tests (on/offline)
Step 128	Write Clock Test (on/offline)

Section 40	Firmware Update Utilities
Step 131	Write Firmware Update
Step 132	Display Firmware Header
Step 133	Display Gain Values
Step 134	Display Electronic Set-up Values
Step 135	Firmware Update Dump
Step 136	Firmware Update Reset
Section 45	Download Diagnostics
Step 138	Download Diagnostics
Step 139	Display Downloaded Diagnostics
Section 50	Image Dump Utilities
Step 141	Display Header
Step 142	Read HP-IB Address
Step 143	Read Amount of Tape Across Head
Step 144	Read Master Controller Firmware ID
Step 145	Check EEPROM Test Cells
Step 146	Dump Image
Section 55	Internal Device Logs
Step 151	Display Internal Drive Error Log
Step 152	Display Internal Drive Tape Log
Step 153	Clear Internal Error Logs
Section 60	Interactive Section
Section 62	Do All Tests

Section 2—CLEAR

This section of the diagnostic places the selected device into the following known state:

- Tape drive protocol will be restarted
- Data buffers will be cleared
- Current tape position is retained
- Tape status will be retained
- On/Offline status will remain as is

The device response to this section is not tested. In order to do so, other sections such as Identify, Loopback, and Hardware Status must be executed. If no errors are generated, the diagnostic will output the following message:

```
Section 2 - Clear
End Section 2
```

Error Output Example:

```
Failed Tape Clear Command
```

See error message section for more detailed information.

Section 3—IDENTIFY

This section issues an identify command to the selected tape drive. The device should return a 2-byte identity code. The following ID code and the device mnemonic for the HP 7974A or HP 7978A/B will be output:

ID Codes

```
HP 7974A = 174 hexadecimal
HP 7978A/B= 178 hexadecimal
```

If no errors are generated, the diagnostic will output the following message:

```
Section 3 - Identify
  ID code of nnn hexadecimal returned
  Hardware Status bit id for xxxxxxx is on
  Device is a xxxxxxx
End Section 3
```

Error Output Example:

```
Failed Tape Identify Command
```

See the error message section for more detailed information.

Section 4—LOOPBACK

This section tests the HP-IB Communication Link between the host and HP 7974A/7978A/B by testing the following items: HP-IB (ABI) chip, HP-IB bus transceivers data buffer, handshake logic and buffer memory. This operation involves writing a loopback of 256 bytes of data on the HP-IB channel to the magnetic tape controller. If errors exist the first ten errors will be printed in the following format:

```
Section 4 -Loopback
End Section 4
```

Error Output Example:

```
*** WRITE AND READ DATA LOOPBACK FAILED (MTDERR 5045)

                                                        Bit Positions
                 Hex Value          Hex Value           In Error
Byte #           Transmitted        Received            01234567
 ---------------------------------------------------------------------
 nnn               $nn                $nn              nnnnnnnn
  .                 .                  .                  .
  .                 .                  .                  .
 nnn               $nn                $nn              nnnnnnnn
```

See the error message section for more detailed information.

Section 6—HARDWARE STATUS

This section interprets a 6-byte hardware status message obtained from either a selected HP 7974A/7978A/B or from a calling program if in_decode_stat is set.

Step 65 **Interpret Hardware Status**

This step decodes the 6 hardware status bytes into text output. Each bit corresponds to the DIO line with the same number. A subset of the messages printed below will be interpreted based on the following specifications:

Status Byte	Description
Bytes 1-3	contain the error and status information returned from the DIO lines. Each bit corresponds directly to its DIO line. If a DIO line is on, then the information will be displayed. If the line is off, then no error or status state exists and nothing will be printed for that bit.
Byte 4	contains 2 fields - the retry count for the last read or write operation and the error detail if a command reject error occurred (status byte 2, DIO line 4). If no valid information is contained in byte 4, it should be set to a value of 0.
Bits 0-4	indicate the number of retries performed by the device. If these bits have a value of 00000 then the operation succeeded on the first try. If these bits have a value of 00001 then a correctable error was detected on the first try. If the bits have a greater value than 00001, then the value initiates the number of tries performed to complete that operation.
Bits 5-7	contain the reason for a command reject error. The meanings are as follows:

Decimal	Message
0	Null Code (0)
1	No further detail (1)
2	Device Reject-See byte 5.
3	Protocol Reject-See byte 5.
4	No further detail (4)
5	No further detail (5)
6	No further detail (6)
7	Self-Test Failure

Byte 5 is dependent on the errors reported in previous status information. If the information in previous bytes conflicts with the information in status byte 5, the information from status byte 5 is most likely correct.

Byte 6 is used only for reporting the transparent status of hard or soft errors while in immediate report mode. This byte indicates which command had the error. It contains the number of commands sent and reported since the command in question was issued. For nontransparent status, this byte will always be zero.

Step 66 **Display Hardware Status in Binary**

This step decodes the 6 hardware status bytes into binary, and displays them. If no errors are generated, the diagnostic will output the following message:

```
Section 6 - Hardware Status
```

Table 22-1. Status Byte 1

Bit	Value	Description
0	----	End of file (tape mark)
1	----	BOT (load point)
2	----	EOT (end of tape)
3	----	Recovered error check (see retry count)
4	----	Command rejected (see reject codes A1/BE)
5	----	File write protected (no write ring)
6	----	Unrecovered data/format error (see reject codes 29/49)
7	----	Unit on-line

Table 22-2. Status Byte 2

Bit	Value	Description
0	----	GCR format (6250 BPI) (7978B)
1	----	Unknown tape format/density
2	----	Data parity error (transport electronics)
3	----	Data timing error (shouldn't happen on 7974A/7978B)
4	----	Tape runaway
5	----	Door open
6	----	Long records supported (7978B)
7	----	Immediate response mode enabled

Table 22-3. Status Byte 3

Bit	Value	Description
0	----	PE format (1600 BPI)
1	----	NRZI format (800 BPI) (7974A)
2	----	Power restored or device cleared
3	----	HP-IB command parity error
4	----	Tape position lost/loss of tension (see reject codes 51/5E)
5	----	Formatter error (see reject codes 65/6E)
6	----	Servo error (see reject codes 51/5E)
7	----	Controller error (see reject codes 79/8C)

Table 22-4. Status Byte 4

Bit	Value	Description
0	----	Command error code
1	----	Command error code
2	----	Command error code
3	----	Retry count
4	----	Retry count
5	----	Retry count
6	----	Retry count
7	----	Retry count

Note

The following may appear only if a command reject has occurred (byte 1, bit 5) and a device reject is indicated (byte 4, value 2).

Table 22-5. Status Byte 5

Bit	Value	Description
-	5	Device is write protected but a write type command was initiated.
-	6	Tape not loaded when command received.
-	7	Write density command given but requested density not available.
-	9	The tape to be read had unidentifiable format. Density read may not be available, or the tape may have an unreadable density ID, or may be blank.
-	10	The tape to be written had unidentifiable format; a write record, write file mark, or write gap command was received but cannot be processed without a Write Format command if tape was unidentified at load point.
-	11	Drive is not online.
-	16	A write format command was issued but tape not positioned at Beginning of Tape.
-	19	Backward type command (except Rewind) was initiated with the tape already at BOT.
-	23	Protocol was not synched.
-	24	Unknown tape command.
-	31	Length of write record requested exceeded maximum record size supported by drive.
-	33	Self-test failure. Drive will not accept tape commands.
-	37	Tape positioning failure while removing readaheads.
-	40	Door open reject: door was opened during a long gap while the tape was beyond the end of tape market. This condition is not repeatable; unspooling of the tape may result.

Note

The following may appear if and only if an unrecovered data format error (byte 1, bit 7) has occurred.

Table 22-6. Status Byte 5 (continued)

Bit	Value	Description
-	41	Tape velocity was out of specification.
-	45	Multiple tracks were in error. Two or more tracks were in error for a Read or Write of PE or NRZI density, or two or more tracks were in error.
-	47	Failure to verify a tape mark or density ID just written.
-	48	Noise on detect. Indistinguishable flux transitions were detected while attempting to detect a recorded block.
-	49	Data format error. Flux transitions were found or were missing in the tracks for block detect.
-	50	Failure to identify tape following a rewind command.
-	51	Gap detected before end of data. The read formatter detected a full tape width drop-out within the data portion of a data block.
-	52	Data block drop-out. A full tape width drop-out was detected within the preamble or postamble of a data block.
-	53	Redundancy check error. The read formatter detected either a CRC, ACRC LRC, or residual error while reading or verifying a data block.
-	54	HP 7978 Read parity error. The read formatter detected an unrecovered parity error within a data block. For PE this error could include a
-	55	HP 7974A abnormal command abort, door opened.
-	57	HP 7974A maximum skew exceeded.
-	58	HP 7974A false preamble or postamble detected.
-	59	HP 7974A corrected data error on write.
-	60	Buffer overrun. Record size exceeded the maximum record size supported on a read.
-	61	Data block timeout. Could not detect the gap following a data block. Could be caused by a record length longer than the drive supports.
-	62	Tape mark drop-out. A full tape width drop-out was detected within a tape mark.
-	63	Tape mark unverified. Detected a tape mark which does not meet ANSI specifications in terms of flux transitions and erasure in the appropriate tracks.
-	64	Tape mark timeout. Could not detect the gap following a detected tape mark.

Note

The following may appear only if the position is unrecovered (byte 3, bit 5) or a servo error (byte 3, bit 7) has occurred.

Table 22-7. Status Byte 5 (continued)

Bit	Value	Description
-	41	Tape velocity was out of specification.
-	81	Servo controller unresponsive. The servo will not take data from the master controller.
-	82	Servo failed to reach the desired state requested by the master controller.
-	83	Servo shutdown. The servo system lost tape tension unexpectedly.
-	84	Servo controller hard failure. The servo controller has detected a hard failure within itself.
-	85	Servo protocol error. An invalid byte was received by servo from master controller.
-	86	A run time error was detected by servo.
-	87	In position interrupt not received. Master controller did not get the in position interrupt it expected.
-	88	No gap detected by the servo after reading or writing data block or tape mark.
-	89	Safety shutdown of motor driver.
-	90	No BOT detected on load or rewind.
-	91	Speed out of Specifications.
-	92	The desired state requested by the master controller was invalid for the current context.
-	94	Tape positioning failure.

Note

The following may appear only if a formatter error (byte 3, bit 6) has occurred.

Table 22-8. Status Byte 5 (continued)

Bit	Value	Description
-	101	HP 7978 read formatter unresponsive. The read formatter did not respond with end of record status after a data block was detected.
-	102	HP 7978 Read Formatter hardware error.
-	103	Bad block type detected on write operation.
-	104	Erase failure. Flex transitions were detected in a portion of tape currently being erased.
-	105	No data detected after write.
-	106	Tracks out of sync on write verify.
-	107	HP 7974A formatter hardware error.
-	108	HP 7974A formatter unresponsive.
-	109	No gap timeout. The gap timer did not count down, or was never started.
-	110	Formatter byte count mismatch with data buffer.

Note

The following will appear only if a controller error (byte 3, bit 8) occurs.

Table 22-9. Status Byte 5 (continued)

Bit	Value	Description
-	121	Transaction ID mismatch between command sent to device program and the returned report.
-	122	No pending command found for report received from device program.
-	123	Invalid report message received from device program.
-	124	Report queue overflow.
-	125	Unknown command received by device program.
-	126	Command queue overflow.
-	128	Missing End of Record flag in data buffer.
-	129	Data buffer parity error.
-	131	Byte count mismatch between putting a record into the data buffer and removing it.
-	133	Processor handshake abort between HP-IB interface board and channel program.
-	134	Unknown HP-IB interface exception detected.
-	137	Illegal access to the servo controller registers detected.
-	138	Device program firmware error.
-	139	Hardware utilities firmware error.
-	140	Channel program firmware error.

Note

The following will appear only if a command reject (byte 1, bit 5) and a protocol error (byte 4, value 3) have occurred.

Table 22-10. Status Byte 5 (continued)

Bit	Value	Description
-	161	Command queue not empty; cannot accept self-test, loopback, or diagnostic commands while tape commands are queued.
-	162	Request DSJ expected.
-	163	Request status expected.
-	165	Unknown unit select.
-	166	Tape command secondary expected.
-	167	Tape command data byte expected.
-	168	Missing EOI on tape command data byte, self-test number, or end command data byte.
-	170	Command phase protocol error for write record.
-	173	Report phase protocol error.
-	174	Cold load sequence protocol error.
-	176	End "complete" expected.
-	178	End "data" expected.
-	180	Unknown interface secondary command.
-	181	Misplaced data byte.
-	184	Interface loopback protocol error.
-	185	Run self-test protocol error.
-	188	HP-IB command parity error.
-	189	Reset by operator during a protocol sequence.
-	190	Device clear received.
-	nnn	Non-transparent status.
-	nnn	The number of commands sent since soft error were nnn.
-	nnn	The number of commands which failed since write failure were nnn.

```
End Step 65 - Display Hardware Status With Text

   Status Byte Number: Contents (Base 2):
     1:     nnnnnnnn    (1st Status Byte)
     2:     nnnnnnnn    (2nd Status Byte)
     3:     nnnnnnnn    (3rd Status Byte)
     4:     nnnnnnnn    (4th Status Byte)
     5:     nnnnnnnn    (5th Status Byte)
     6:     nnnnnnnn    (6th Status Byte)

  End Step 66 - Display Hardware Status in Binary
End Section 6
```

Error Output Example:

```
Failed hardware status command
```

See the error message section for more detailed information.

Section 10—SET TAPE DENSITY COMMANDS

This section allows the user to set the tape density to 800, 1600, or 6250 CPI, if the capabilities of the drive permit it. The tape drive must be online to perform this function. Step 70 will set the density to 800 CPI if the tape drive is an HP 7974A or to 6250 CPI if the tape drive is an HP 7978A/B.

Step 70	Set Density 800 CPI (HP 7978A only)
	Set Density 6250 CPI (HP 7978A/B only)
Step 71	Set Density 1600 CPI

If no errors are generated, the diagnostic will output the following message:

For the HP 7974A only:

```
Section 10 - Set Tape Density

   End Step 70 - Set Density 800 CPI

   End Step 71 - Set Density 1600 CPI

End Section 10
```

For the HP 7978A/B only:

```
Section 10 - Set Tape Density

   End Step 70 - Set Density (GCR)

   End Step 71 - Set Density (PE)

End Section 10
```

Error Output Example:

```
Failed set density command
```

See the error message section for more detailed information.

Section 15—WRITE/READ COMPARISON CHECK (NRZI & GCR)

This section outputs a series of files filled with worst-case data at 800 CPI if the device is an HP 7974A; or at 6250 CPI if the device is an HP 7978A/B. The data will be read back and compared against what was written. If discrepancies exist, then the number of bits written, read, in error, and the distance in feet from BOT will be output through the first ten errors. After requested files are processed, the tape will be rewound and left online. If the HP 7974A does not have the 800 CPI option, the diagnostic will continue but will skip all steps which require 800 CPI.

Step 74	**256 1-Byte/Record File:** This step will write a file of one-byte records, spanning the 256 byte character set.
Step 75	**Maximum Buffer File:** This step will write a file the full size of
Step 76	**Streaming Test:** This step will write five files of 16K bytes each to tape in streaming mode, read them back, and check the data read against what was written.
Step 77	**Worst Case Low Frequency Level**
Step 78	**Worst Case High Frequency Level**
Step 79	**Worst Case Tripole File**

Note

The files created by steps 77 - 79 will contain records of 128, 256, and 512 bytes.

If no errors are generated, the diagnostic may output one or more of the following messages:

For the HP 7974A only:

```
Section 15 - Write/Read Comparison Checks (NRZI)

   End Step 74 - 256 1-Byte/Record File (NRZI)

   End Step 75 - Maximum Buffer File (NRZI)

   End Step 76 - Stream Test (NRZI)

   End Step 77 - Worst Case Low Frequency File (NRZI)

   End Step 78 - Worst Case High Frequency File (NRZI)

   End Step 79 - Worst Case Tripole File (NRZI)

End Section 15
```

For the HP 7978A/B only:

```
Section 15 - WRITE/READ COMPARISON CHECKS (GCR)
   End Step 74 - 256 1-BYTE/RECORD FILE (GCR)

   End Step 75 - MAXIMUM BUFFER FILE (GCR)

   End Step 76 - STREAM TEST (GCR)

   End Step 77 - WORST CASE LOW FREQUENCY FILE (GCR)

   End Step 78 - WORST CASE HIGH FREQUENCY FILE (GCR)

   End Step 79 - WORST CASE TRIPOLE FILE (GCR)

End Section 15
```

Error Output Example:

```
Failed Tape Set Density Command
Failed Tape Write Command
Failed Tape Write End of File Command
Failed Tape Read Command
```

Byte #	Hex Value Transmitted	Hex Value Received	Bit Positions In Error 01234567	Ft of Tape Over Head
nnnn	$nn	$nn	nnnnnnnn	nnnnn.nnn
.	.	.	.	.
.	.	.	.	.
nnnn	$nn	$nn	nnnnnnnn	nnnnn.nnn

See the error message section for more detailed information.

Section 16—WRITE/READ COMPARISON CHECK PHASE ENCODED (PE)

This section writes out a series of files filled with worst-case data for the 1600 CPI density. The data will be read back and compared against what was written. If discrepancies exist then the number written, the number read, the bits in error, and the feet from BOT will be output through the first ten errors. After requested files are processed, the tape will be rewound and left online. The following steps are available:

Step 80	**256 1-Byte Record File (PE):** This step will write a file of 256 one-byte records, spanning the 256-byte character set.
Step 81	**Maximum Buffer File (PE):** This step will write a file of the full size of the buffer (16K bytes, and write data to check the tracks).
Step 82	**Streaming Test (PE):** This step writes five files of 16K bytes each to tape in stream mode, reads them back, and checks the data against what was written.
Step 83	**Worst Case Low Frequency File (PE):**
Step 84	**Worst Case High Frequency File (PE):**
Step 85	**Worst Case Tripole File (PE):**

Note

The files created by steps 82 - 85 will contain records of 128, 256, and 512 bytes.

If no errors are generated, the diagnostic may output one or more of the following messages:

```
Section 16 - WRITE/READ COMPARISON CHECKS (PE)

   End Step 80 - 256 1-BYTE RECORD FILE (PE)

   End Step 81 - MAXIMUM BUFFER FILE (PE)

   End Step 82 - STREAMING TEST (PE)

   End Step 83 - WORST CASE LOW FREQUENCY FILE (PE)

   End Step 84 - WORST CASE HIGH FREQUENCY FILE (PE)

   End Step 85 - WORST CASE TRIPOLE FILE (PE)

End Section 16
```

Error Output Example:

```
Failed Tape Set Density Command
Failed Tape Write Command
Failed Tape Write End of File Command
Failed Tape Read Command
```

Byte #	Hex Value Transmitted	Hex Value Received	Bit Positions In Error 01234567	Ft of Tape Over Head
nnnn	$nn	$nn	nnnnnnnn	nnnn
.	.	.	.	.
.	.	.	.	.
nnnn	$nn	$nn	nnnnnnnn	nnnn

See the error message section for more detailed information.

Section 20—SELECTABLE TAPE MOVEMENT COMMANDS

This section allows the user to forward and backspace records and files, test the drive's ability to write a record gap or a file mark, and rewind the tape drive leaving the drive online or offline. The following steps are available:

Step 90	Forward Space One File
Step 92	Back Space One File
Step 93	Back Space One Record
Step 94	Forward Space One Record
Step 95	Write Record Gap
Step 96	Write File Mark
Step 97	Rewind Online
Step 98	Rewind Offline

If no errors are generated, the diagnostic may output one or more of the following messages:

```
Section 20 - SELECTABLE TAPE COMMAND

   End Step 91 - FORWARD SPACE ONE FILE

   End Step 92 - BACK SPACE ONE FILE

   End Step 93 - BACK SPACE ONE RECORD

   End Step 94 - FORWARD SPACE ONE RECORD

   End Step 95 - WRITE RECORD GAP

   End Step 96 - WRITE FILE MARK

   End Step 97 - REWIND TAPE ON-LINE

   End Step 98 - REWIND TAPE OFF-LINE

End Section 20
```

Section 23—SELECTABLE TAPE READ DATA COMMANDS

This section allows data to be read from a pre-written tape. The user can create the data for the pre-written tape on the same HP 7974A/7978A/B by using Sections 15-16, or could simply use data on a customer's previously written tape file. If the file exceeds 16K characters, then after every 16K of data has been processed, the diagnostic will ask the user whether or not to continue reading records and to display records:

```
Read More Records in File ?
Continue ? Enter 'YES' to resume, 'NO' to abort>

Display More Records in File ?
Continue ? Enter 'YES' to resume, 'NO' to abort>
```

Records will be read and displayed until either the user enters NO to the continuation question or the end of file is reached. Once the user indicates that no further records should be displayed, the second question will not be displayed again.

Step 100	Read one file (NRZI for 7974A/GCR for 7978A/B)
Step 101	Read one file (PE)

If no errors are generated, the diagnostic may output one or more of the following messages:

For the HP 7974A only:

```
Section 23 - SELECTABLE TAPE READ DATA

     Record n Read Dump (in Hexadecimal) :
             1   2   3   4   5   6   7   8   9   10
     ===============================================
     nnnn : $nn $nn $nn $nn $nn $nn $nn $nn $nn $nn
      ..     .   .   .   .   .   .   .   .   .   .
     nnnn : $nn $nn $nn $nn $nn $nn $nn $nn $nn $nn
                              .
                              .
     Record n Read Dump (in Hexadecimal) :
             1   2   3   4   5   6   7   8   9   10
     ===============================================
     nnnn : $nn $nn $nn $nn $nn $nn $nn $nn $nn $nn
      ..     .   .   .   .   .   .   .   .   .   .
     nnnn : $nn $nn $nn $nn $nn $nn $nn $nn $nn $nn

     Read n Records

  End Step 100 - READ ONE FILE (NRZI)
```

```
   Record n Read Dump (in Hexadecimal) :
           1   2   3   4   5   6   7   8   9   10
   ============================================
   nnnn : $nn $nn $nn $nn $nn $nn $nn $nn $nn $nn
    ..     .   .   .   .   .   .   .   .   .   .
   nnnn : $nn $nn $nn $nn $nn $nn $nn $nn $nn $nn
                          .
                          .
   Record n Read Dump (in Hexadecimal) :
           1   2   3   4   5   6   7   8   9   10
   ============================================
   nnnn : $nn $nn $nn $nn $nn $nn $nn $nn $nn $nn
    ..     .   .   .   .   .   .   .   .   .   .
   nnnn : $nn $nn $nn $nn $nn $nn $nn $nn $nn $nn

   Read n Records
 End Step 101 - READ ONE FILE (PE)

End Section 23
```

For the HP 7978A/B only:

```
   Record n Read Dump (in Hexadecimal) :
           1   2   3   4   5   6   7   8   9   10
   ============================================
   nnnn : $nn $nn $nn $nn $nn $nn $nn $nn $nn $nn
    ..     .   .   .   .   .   .   .   .   .   .
   nnnn : $nn $nn $nn $nn $nn $nn $nn $nn $nn $nn
                          .
                          .
   Record n Read Dump (in Hexadecimal) :
           1   2   3   4   5   6   7   8   9   10
   ============================================
   nnnn : $nn $nn $nn $nn $nn $nn $nn $nn $nn $nn
    ..     .   .   .   .   .   .   .   .   .   .
   nnnn : $nn $nn $nn $nn $nn $nn $nn $nn $nn $nn

   Read n Records
 End Step 100 - READ ONE FILE (GCR)

   Read  n  bytes from tape
   Read  n  bytes from tape
            .    .    .
            .    .    .
   Read  n  bytes from tape

 End Step 101 - READ ONE FILE (PE)

End Section 23
```

Error Output Example:

See the error message section for more detailed information.

Section 25—PACES

This section implements paces by writing files of pseudo-random worst-case ASCII and binary, reading the files, and performing tape movements on the files. Previous sections and steps which wrote and read files and performed tape movements are designed to do a quick test of the function. This section is designed to push the drive to its limits by forcing it to handle large amounts of random data and random size at maximum speed. The EOT sensor and its associated circuitry must be functioning properly for this test to complete.

Note

It is strongly recommended that a small tape be mounted for this section: execution time is heavily dependent on tape length and system load.

The following steps are available:

Step 105	Write Files (NRZI for 7974A/GCR for 7978A/B) until EOT
Step 106	Read Files (NRZI for 7974A/GCR for 7978A/B) until EOT
Step 107	Write Files (PE) until EOT
Step 108	Read Files (PE) until EOT
Step 109	Tape Movements: 1. Back Space 2 Records 2. Forward Space 1 Record 3. Back Space 2 Files 4. Forward Space 1 File 5. Rewind 6. Forward Space the number of records on tape 7. Back Space the number of records on tape 8. Forward Space the number of files on tape 9. Back Space the number of files on tape

If no errors are generated, the diagnostic may output one or more of the following messages for the HP 7974A only:

```
Section 25 - Paces

     Wrote NNN Files
End Step 105 - Write Files (NRZI) to EOT

     Read NNN Files
End Step 106 - Read Files (NRZI of random size to EOT

     Wrote NNN Files
End Step 107 - Write Files (PE) to EOT
```

```
      Read NNN Files
   End Step 108 - Read Files (PE) of random size to EOT

      Forward Spaced NNN records over NNN files
      Back Spaced NNN records over NNN files
      Forward Spaced NNN files
      Back Spaced NNN files
   End Step 109 - Tape Movements
End Section 25
```

If no errors are generated, the diagnostic may output one or more of the following messages for the HP 7978A/B only:

```
Section 25 - EOT PACES

     Wrote NNN Files
  End Step 105 - WRITE FILES (GCR) to EOT

     Read NNN Files
  End Step 106 - READ FILES (GCR) TO EOT

     Wrote NNN Files
  End Step 107 - WRITE FILES (PE) TO EOT

     Read NNN Files
  End Step 108 - READ FILES (PE) TO EOT

     Forward Spaced NNN records over NNN files
     Back Spaced NNN records over NNN files
     Forward Spaced NNN files
     Back Spaced NNN files
  End Step 109 - TAPE MOVEMENTS

End Section 25
```

Error Output Example:

```
                Failed to write :

File      Record    Bytes       Feet Over
Number    Number    In Record   Tape Head
 ----------------------------------------
nnn       nn        nnnn        nnnnn.nnn
 .         .         .            .
 .         .         .            .
nnn       nn        nnnn        nnnnn.nnn


                Failed to read :

File      Record    Bytes       Feet Over
Number    Number    In Record   Tape Head
 ----------------------------------------
nnn       nn        nnnn        nnnnn.nnn
 .         .         .            .
 .         .         .            .
nnn       nn        nnnn        nnnnn.nnn
```

See the error message section for more detailed information.

Section 34—HP 7974A SELFTESTS

This section tests only the HP 7974A by running the built in selftests. This section is not applicable for the HP 7978A/B. If this section is requested for an HP 7978A/B drive, then the following message will be printed and the applicable selftests will be run:

```
*** ILLEGAL SECTION FOR REQUESTED DEVICE (MTDERR 7774)
    REQUESTED SECTION 34 (STEPS 111-120 APPLIES ONLY TO HP 7974
```

All selftests may be run when the HP 7974A is online; selftests 118-119 may be run on or offline. Selftests which do not require a tape can be run when HP 7974A is offline. When a tape is needed to run a selftest, an operator must be present to mount the tape. A scratch tape should be used on all selftests requiring a tape (i.e., online), even if the selftest does not write or read the tape. The following steps are available:

Step 110	**Transport Test** (online)
	Selftest 101 will be run.
Step 111	**Transport Servo/Capstan** (online)
	Selftests 110, 104, 105, 106, 123, 130, 109, will be run.
Step 112	**Error Detection Circuitry** (online)
	Selftests 107, 110, 124, 130 will be run.
Step 113	**Write /Backspace /Read Test** (online)
	Selftests 109, 117, 110, 130 will be run.
Step 114	**NRZI (800 CPI) Stop/Start Write Tests** (online)
	Selftests 127, 110, 114, 118, 119, 130 will be run.
Step 115	**NRZI (800 CPI) Streaming Write Tests** (online)
	Selftests 127, 110, 114, 120, 11, 109, 114, 120, 121, 130 will be run.
Step 116	**PE (1600 CPI) Start/Start Write Tests** (online)
	Selftests 128, 110, 114, 120, 11, 109, 114, 120, 121, 130 will be run.
Step 117	**PE (1600 CPI)**
	Selftests 128, 110, 114, 120, 11, 109, 121, 130 will be run.
Step 118	**Power-On Self-Test**(on/offline)
	Selftest 5 will be run.
Step 119	**Master Controller Tests** (on/offline)
	Selftest 6, 8, 9, 10, 11, 19 will be run.
Step 120	**Loop Write/Read Test** (on/offline)
	Selftest 108 will be run.

If no errors are generated, the diagnostic may output one or more of the following messages for the HP 7974A only:

```
Section 34 - HP 7974A Self-Tests

      Completed n test(s) successfully of 1 test(s) requested
   End Step 110 - Transport Test

      Completed n test(s) successfully of 7 test(s) requested
   End Step 111 - Transport Servo/Capstan Tests

      Completed n test(s) successfully of 5 test(s) requested
   End Step 112 - Error detection Circuitry Tests

      Completed n test(s) successfully of 5 test(s) requested
   End Step 113 - Write/Backspace/Read Test

      Completed n test(s) successfully of 9 test(s) requested
   End Step 114 - 800 CPI Stop/Start Write Tests

      Completed n test(s) successfully of 10 test(s) requested
   End Step 115 - 800 CPI Streaming Tests

      Completed n test(s) successfully of 9 test(s) requested
   End Step 116 - 1600 CPI Stop/Start Write Tests

      Completed n test(s) successfully of 10 test(s) requested
   End Step 117 - 1600 CPI Streaming Tests

      Completed n test(s) successfully of 1 test(s) requested
   End Step 118 - Power-On Self-Test

      Completed n test(s) successfully of 6 test(s) requested
   End Step 119 - Master Controller Tests

      Completed n test(s) successfully of 1 test(s) requested
   End Step 120 - Loop Write/Read Test

End Section 34
```

Section 38—HP 7978A/B SELF-TESTS

This section will test only the HP 7978A/B by running the built-in selftests. This section is not applicable for the HP 7974A. If this section is requested for an HP 7974A drive, then the following message will be printed and the applicable selftests will be run:

```
*** ILLEGAL SECTION FOR REQUESTED DEVICE (MTDERR 7978)
    REQUESTED SECTION 38 (STEPS 121-128) APPLIES ONLY TO HP 7978A
```

All selftests may be run when HP 7978A/B is online; however, some tests (Power-on Selftest) will set the tape drive offline. Selftests which do not require a tape can be run when HP 7978A/B is offline. When a tape is needed to run a selftest, an operator must be present to mount the tape. A scratch tape should be used on all selftests requiring a tape (i.e., online), even if the selftest does not write or read the tape. The following steps are available:

Step 121	**Write/Read PE Data Block Test** (online)
	Selftests 32, 21, 33, 31 will be run.
Step 122	**Write/Read GCR Data Block Test** (online)
	Selftests 32, 22, 34, 31 will be run.
Step 123	**Power-On Self-Test** (offline)
	Selftest 4 will be run.
Step 124	**Master Controller Tests** (on/offline)
	Selftests 5, 6, 8, 9, 10, 11, 19 will be run.
Step 125	**Servo Controller Tests** (on/offline)
	Selftests 42, 41, 43, 44, 50, 51, 52, 53, 54 will be run.
Step 126	**HP-IB Internal Loopback Tests** (on/offline)
	Selftests 13, 14 will be run.
Step 127	**Internal Digital Loopback Tests** (on/offline)
	Selftests 15, 16 will be run.
Step 128	**Write-Clock Test** (on/offline)
	Selftests 12, 49 will be run.

If no errors are generated, the diagnostic may output one or more of the following messages:

```
Section 38 - HP 7978A/B SELF-TESTS

      Completed n tests successfully of 2 tests requested
   End Step 121 --WRITE/READ PE DATA BLOCK TEST

      Completed n tests successfully of 2 tests requested
   End Step 122 --WRITE/READ GCR DATA BLOCK TEST

      Completed n tests successfully of 1 tests requested
   End Step 123 --POWER-ON SELF-TEST

      Completed n tests successfully of 7 tests requested
   End Step 124 --MASTER CONTROLLER TESTS

      Completed n tests successfully of 10 tests requested
   End Step 125 --SERVO CONTROLLER TESTS

      Completed n tests successfully of 2 tests requested
   End Step 126 --HPIB INTERNAL LOOPBACK TESTS

      Completed n tests successfully of 2 tests requested
   End Step 127 --INTERNAL DIGITAL LOOPBACK TEST

      Completed n tests successfully of 2 tests requested
   End Step 128 --WRITE-CLOCK TEST
```

Section 40—FIRMWARE UPDATE UTILITIES

This section will allow the user to write and/or read the firmware update on the device. If the user chooses to write, then the diagnostic will seek and open a file in the diagnostic system location named FIRMWARE. It will attempt to read this file. The file must be binary, contain only one record, and the first word must contain the length of the data to be downloaded followed by the data to be used as an update. If the length of the file is within the acceptable range, then the file's checksum will be analyzed for accuracy. If the checksum passes, then the file will be passed using update protocol to the device. The device will prompt the user for the update password. If the password is incorrect, then the update will return an incorrect password status and will not execute. For further aid, contact CE Assist at the National Response Center. The following steps are available:

Step 131	Write Firmware Update
Step 132	Display Firmware Header
Step 133	Display Gain Values
Step 134	Display Read/Write Values
Step 135	Firmware Update Dump
Step 136	Firmware Update Reset

If no errors are generated, the diagnostic may output one or more of the following messages:

```
Section 40 - Firmware Updates

   Wrote Firmware Successfully

   Firmware Update Dump (in Hex) :
         1     2     3     4     5     6     7     8     9     10
   ================================================================
     1: $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn
     .    .     .     .     .     .     .     .     .     .     .
     .    .     .     .     .     .     .     .     .     .     .
   203: $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn

End Step 131 - Write Firmware Update

   Header  : $66nn
   Rom ID  : $nn
   Checksum: $nnnn

End Step 132 - Display Firmware Header

   PE Read Electronic Gain Values
     1: $nnnn  2: $nnnn  3: $nnnn  4: $nnnn
     5: $nnnn  6: $nnnn  7: $nnnn  8: $nnnn
     9: $nnnn
```

```
   PE autogain read electronic set-up value : $nnnn
   PE minimum autogain value                : $nnnn
   PE maximum autogain value                : $nnnn


  GCR Read Electronic Gain Values
    1: $nnnn  2: $nnnn  3: $nnnn  4: $nnnn
    5: $nnnn  6: $nnnn  7: $nnnn  8: $nnnn
    9: $nnnn

  GCR autogain read electronic set-up value : $nnnn
  GCR minimum autogain value                : $nnnn
  GCR maximum autogain value                : $nnnn

End Step 133 - Display Gain Values

   PE read electronic setup value   : $nnnn
   PE write electronic setup value  : $nnnn
   PE write clock setup value       : $nnnn
   PE density ID write clock setup  : $nnnn

   GCR read electronic setup value  : $nnnn
   GCR write electronic setup value : $nnnn
   GCR write clock setup value      : $nnnn
   GCR density ID write clock setup : $nnnn

   Density ID read electronic setup : $nnnn
   Density phase locked loop setup  : $nnnn

   Read retry                       : $nnnn
   Read gain boost                  : $nnnn

   Write holdoff (clock counts)     : $nnnn
   Extended gap length              : $nnnn

End Step 134 - Display Read/Write Values

   Firmware Update Dump (in Hex) :
         1     2     3     4     5     6     7     8     9     10
   ================================================================
     1: $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn
     .    .     .     .     .     .     .     .     .     .     .
     .    .     .     .     .     .     .     .     .     .     .
   203: $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn

End Step 135 - Firmware Update Dump

End Step 136 - Firmware Update Reset
```

Section 45—DOWNLOAD DIAGNOSTICS

This section permits the selection of diagnostics which are to be downloaded into the device and executed locally. Following the diagnostic execution, results will be available to the host-based diagnostic. All files to be used must reside in the diagnostic system location. No password is required for downloaded diagnostics.

If the user chooses to do a download diagnostic, then the diagnostic program will search for a file named DOWNLOAD. If the file exists, then the diagnostic will attempt to read it. The file must be binary, contain only one record, and the first word must contain the length of the data to be downloaded, followed by the data to be downloaded. If the length of the data to be downloaded is acceptable, then a checksum analysis will be performed. If the checksum is correct, then the diagnostic will be downloaded. Since a downloaded diagnostic is performed only once and the download area will eventually be overwritten by the tape drive, no clear or reset on the downloaded diagnostic is necessary or possible. The following steps are available:

Step 138	Download Diagnostic
Step 139	Display Downloaded Diagnostic

If no errors are generated, the diagnostic may output one or more of the following messages:

```
Section 45 - DOWNLOADING SELF-TESTS

     Diagnostic results (in Hex) :
           1     2     3     4     5     6     7     8     9     10
     ========================================================================
       1: $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn
       .     .     .     .     .     .     .     .     .     .     .
       .     .     .     .     .     .     .     .     .     .     .
     800: $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn

   End Step 138 - DOWNLOAD DIAGNOSTIC

     Diagnostic results (in Hex) :
           1     2     3     4     5     6     7     8     9     10
     ========================================================================
       1: $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn
       .     .     .     .     .     .     .     .     .     .     .
       .     .     .     .     .     .     .     .     .     .     .
      51: $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn

  End Step 139 - DISPLAY DOWNLOADED DIAGNOSTIC
End Section 45
```

Section 50—IMAGE DUMP UTILITIES

This section displays additional information on the HP 7974A/7978A/B internal status retrieved from an Image Dump request: image header, RAM and EPROM checksums, HP-IB address, amount of tape across the head, master controller firmware revision, check EPROM test cells, dump RAM.

This section is also useful for monitoring service contracts based on duty cycle (head wear via amount of tape across the head). The following steps are available:

Step 141	Display Header
Step 142	Display HP-IB address
Step 143	Display number of feet of tape which have passed across head
Step 144	Display Master Controller Firmware ID
Step 145	Check EPROM Test Cells
Step 146	Dump RAM

If no errors are generated, the diagnostic may output one or more of the following messages:

```
Section 50 - IMAGE UTILITIES

      Ram Header Value: $nnnn
      Ram Checksum    : $nnnn
      Eeprom CheckSum : $nnnn
   End Step 141 --IMAGE HEADER

      HPIB address is n
   End Step 142 --READ HPIB ADDRESS

      Amount of Tape Across Head is  nnnnnn feet
   End Step 143 --READ AMOUNT OF TAPE ACROSS HEAD

      Master Controller/Firmware Update is Revision n
   End Step 144 --READ MASTER CONTROLLER FIRMWARE ID

      Eeprom Test Cells:

        Actual       Correct
        Value        Value
        ==================
        $9999        $9999
        $9999        $9999
        $0000        $0000
        $FFFF        $FFFF
        $AAAA        $AAAA
        $5555        $5555
        $6666        $6666
        $9999        $9999

   End Step 145 - CHECK EEPROM TEST CELLS
```

```
    Image Dump (in Hex) :
          1     2     3     4     5     6     7     8     9     10
    ================================================================
      1: $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn
      .     .     .     .     .     .     .     .     .     .     .
      .     .     .     .     .     .     .     .     .     .     .
    206: $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn $nnnn

  End Step 146 - Image Dump

End Section 50
```

Section 55—INTERNAL DEVICE LOGS

This section requests an image dump of the tape drive's RAM, thus gaining access to the two internal logs (error and tape) from a selected HP 7974A/7978A/B. Steps 151 and 152 may then be used to decode each log. The following steps are available:

Step 151 — Display Internal Drive Error Log: The HP 7974A/7978A/B keeps an internal log from 0 - 10 of the most recently encountered errors. The error log contains:

- 4 bytes — TIME from Power-on that this tape was loaded.
- 2 bytes — ERROR CODE encountered in hexadecimal.

The diagnostic will decode the error code and print all information about that error. For a list of error messages, refer to the back of this section.

Step 152 — Display Internal Drive Tape Log: The HP 7974A/7978A/B keeps an internal log containing a history for each of the last 20 tapes loaded on the HP 7974A/7978A/B. The tape log occupies words 302 through 421. It is a twenty entry circular log which contains:

- 4 bytes — TIME from Power-on that this tape was loaded.
- 2 bytes — HARD-ERROR Number of data blocks that the drive was unable to read or write.
- 2 bytes — SOFT-ERROR Number of data blocks that were successfully retried. If the number of attempts exceeds the number of allowable retries, then a hard error results instead.
- 4 bytes — CMD-COUNT number of commands processed since the tape was loaded.

Section 55 may display one of the following two messages:

```
Section  55 --INTERNAL DEVICE LOGS

     NOTE: PRINTING THIS LOG WILL CAUSE PROTOCOL ERRORS
     $EOBF (Internal reset) AND EOBE (Device clear received)
     TO BE PLACED INTO IT

     Internal Error Log is empty; no data will be displayed

End Step 151 --DISPLAY ERRORLOG
```

```
NOTE: PRINTING THIS LOG WILL CAUSE PROTOCOL ERRORS
$EOBF (Internal reset) AND EOBE (Device clear received)
TO BE PLACED INTO IT

            Time                Hard      Soft      Number
            From                Error     Error     Commands
           Power-on            Count     Count     Processed
=============================================================================
Tape    n   days hours min sec    n         n         nnn
Tape    n   days hours min sec    n         n         nnn
Tape    n   days hours min sec    n         n         nnn
```

Error Output Example:

```
Failed Tape Read Log Command
```

Section 60—INTERACTIVE

This section allows the user to enter commands to be executed, in the order desired, with any number of repetitions. To obtain a list of commands, type `HELP` in response to the MTD7478> prompt. Note that the command numbers correspond to the diagnostic section and step numbers. To repeat the last command, type `REDO` in response to the MTD7478> prompt.

Specifying a section number will cause all default steps in that section to execute in their normal order. The commands are:

Sections:

2	Clear
3	Identify
4	Loopback
6	Hardware Status
10	Set Density
15	Write/Read Comparison Check (NRZI or GCR)
16	Write/Read Comparison Check (PE)
20	Selectable Tape Movement Commands
25	Paces
34	HP 7974A Selftests
38	HP 7978A/B Selftests
40	Firmware Updates
45	Download Diagnostics
50	Image Dump Utilities
55	Internal Device Logs
62	Do All Tests

Steps:

65	Interpret Hardware Status with Text
66	Display Hardware Status in Binary
70	Set Density 800 CPI or 6250 CPI
71	Set Density 1600
74	256 1-Byte/Record File (NRZI) or (GCR)
75	Maximum Buffer File (NRZI) or (GCR)
76	Stream Tests (NRZI) or (GCR)
77	Worst Case Low Frequency File (NRZI) or (GCR)
78	Worst Case High Frequency File (NRZI) or (GCR)
79	Worst Case Tripole File (NRZI) or (GCR)
80	256 1-Byte/Record File (PE)

81 Maximum Buffer File (PE)
82 Stream Tests (PE)
83 Worst Case Low Frequency File (PE)
84 Worst Case High Frequency File (PE)
85 Worst Case Tripole File (PE)
91 Forward Space One File (to end of next EOF mark)
92 Back Space One File (to beginning of previous EOF)
93 Back Space One Record (to start of previous record gap)
94 Forward Space One Record (to end of next record gap)
95 Write Record Gap
96 Write File Mark
97 Rewind online
98 Rewind offline
100 Read one file (NRZI) or (GCR)
101 Read one file (PE)
105 Write Files (NRZI) or (GCR) of random size until EOT
106 Read Files (NRZI) or (GCR) of random size until EOT
107 Write Files (PE) of random size until EOT
108 Read Files (PE) of random size until EOT
109 Tape Movements:
1. Back Space 2 Records
2. Forward Space 1 Record
3. Back Space 2 Files
4. Forward Space 1 File
5. Rewind
6. Forward Space the number of records on tape
7. Back Space the number of records on tape
8. Forward Space the number of files on tape
9. Back Space the number of files on tape

For HP 7974A Only:

110 Transport Test (online)
111 Transport Servo/Capstan (online)
112 Error Detection Circuitry (online)
113 Write/Backspace/Read test (online)
114 NRZI (800 CPI) Stop/Start Write Tests (online)
115 NRZI (800 CPI) Streaming Write Tests (online)
116 PE (1600 CPI) Stop/Start Write Tests (online)
117 PE (1600 CPI) Streaming Write Tests (online)
118 Power-On Self-Test (on/offline)
119 Master Controller Tests (on/offline)
120 Loop Write/Read Test (on/offline)

For HP 7978 A/B Only:

121	Write/Read PE Data Block Test (online)
122	Write/Read GCR Data Block Test (online)
123	Power-On Self-Test (offline)
124	Master Controller Tests (on/offline)
125	Servo Controller Tests (offline)
126	HP-IB Internal Loopback Tests (on/offline)
127	Internal Digital Loopback Tests (on/offline)
128	Write-Clock Test (on/offline)
131	Write Firmware Update
132	Display Firmware Header
133	Display Gain Values
134	Display Electronic Set-up Values
135	Firmware Update Dump
136	Firmware Update Reset
138	Download Diagnostics
139	Display Downloaded Diagnostics
141	Display Image Header
142	Read HP-IB address
143	Read Amount of Tape Across Head
144	Read Master Controller Firmware ID
145	Check EEPROM Test Cell
146	Dump Image
151	Display Internal Drive Error Log
152	Display Internal Drive Tape Log
153	Perform Selftest

For example, if the user requested command number 38, followed by command number 2, then the diagnostic would execute the default steps (123-128) and a clear device (2) in that order.

The diagnostic will display the following prompt: **MTD7478>**. At the prompt, the user may enter any sequence of command numbers, thus setting the order of execution. If the user enters a command which requires a previous command, then the sequence will not execute; the following error message will be printed:

```
*** ERROR. COMMAND N MUST BE PRECEDED BY COMMAND M (MTDERR 6800)
```

Command numbers must be separated by commas. The user may also specify the number of times each command should be repeated by following the command number with a colon and then number of repetitions; the default is one repetition per command. For example, if the user wants to execute commands 4, 25, and 20 in that order, repeating command 4 twice and Section 25, Steps 107 and 108 three times, enter the following:

```
MTD7478>4:2,(107,108):3,20
```

The user may enter as many commands as desired. One layer of parentheses is also allowed to permit cluster repetitions. For example, a user who wants to run steps 107 and 108 in that order 3 times straight can enter:

```
MTD7478> (107,108):3
```

To end the interactive section, the user types **EXIT**.

Example:

```
      Section 60 - Interactive

MTD7478>4:2,(107,108):2,20

      Section 4 - LOOPBACK
      End Section 4

      Section 4 - LOOPBACK
      End Section 4

      Section 25 - PACES
            Wrote N Files
         End Step 107 - WRITE FILES (PE) TO EOT
      End Section 25
      Section 25 - PACES
            Read N Files
         End Step 108 - READ FILES (PE) TO EOT
      End Section 25

      Section 25 - PACES
            Wrote n Files
         End Step 107 - WRITE FILES (PE) TO EOT
      End Section 25

      Section 25 - PACES
            Read N Files
         End Step 108 - READ FILES (PE) TO EOT
```

```
      End Section 25

      Section 20 - SELECTABLE TAPE MOVEMENT

         End Step 91 - FORWARD SPACE ONE FILE

         End Step 92 - BACK SPACE ONE FILE

         End Step 93 - BACK SPACE ONE RECORD

         End Step 94 - FORWARD SPACE ONE RECORD

         End Step 97 - REWIND ON-LINE

      End Section 20

MTD7478>Exit

      End Section 60
```

Section 62—DO ALL TESTS

This section will require the tape drive to be put online initially, and will then run through all tests in the diagnostic, except the write firmware update and the download diagnostic steps.

Caution

The user should note that this step will run all tests including those requiring the device to be online and those tests which will overwrite any tape currently mounted. Therefore, it is important that a scratch tape only be mounted on the drive if this step is to be run.

The output will correspond to the normal output if the user had entered the `RUN DIAG7478` command requesting all sections or steps except write firmware update and download diagnostic.

Error Messages

The following is a list of error messages which may appear when using DIAG7478. Other diagnostic error messages may appear at any time. Error messages without the (MTDERR #) are generated by the Online Diagnostic subsystem or the Operating System. Listed below each error message are a probable cause and recommended action statement. The actual cause and action may differ from this list depending upon the particular circumstances of a given situation.

5000 FAILED TO FIND THE FILE PATH (MTDERR 5000)
CAUSE
ACTION

5001 FAILED FILE READ (MTDERR 5001)
CAUSE
ACTION

5002 FAILED FILE OPEN (MTDERR 5002)
CAUSE
ACTION

5003 FAILED FILE WRITE (MTDERR 5003)
CAUSE
ACTION

5004 FAILED TO READ FULL FILE (MTDERR 5004) READ NNNN BYTES OUT OF NNNN BYTES.
CAUSE
ACTION

5005 FAILED TO WRITE FULL FILE (MTDERR 5005) WROTE NNNN BYTES OUT OF NNNN BYTES.
CAUSE
ACTION

5011 FAILED TO GET BUFFER SPACE FOR DIAGNOSTIC USE (MTDERR 5011)
CAUSE
ACTION

5016 ATTEMPT TO DO MAKE STRING FAILED (MTDERR 5016)
CAUSE
ACTION

5017 ATTEMPT TO DO MAKE NUMBER FAILED (MTDERR 5017)

CAUSE

ACTION

5018 OUTPUT DATA FAILED (MTDERR 5018)

CAUSE

ACTION

5033 IDENTIFY FAILED: (MTDERR 5033)
ILLEGAL IDENTIFY CODE ON NNN HEXADECIMAL RETURNED
ASSUMING THE DEVICE IS AN HP7974A MAGNETIC TAPE DRIVE.

CAUSE

ACTION

5034 DEVICE FAILED TO RESPOND TO IDENTIFY (MTDERR 5034)
NO IDENTIFY CODE WAS RETURNED TO IDENTIFY REQUEST.
7974/7978 TAPE DIAGNOSTIC TERMINATING ABNORMALLY.

CAUSE

ACTION

5043 WRITE DATA LOOPBACK FAILED (MTDERR 5043)
TMEOUT AFTER NNN SECONDS.

CAUSE

ACTION

5044 WRITE DATA LOOPBACK FAILED (MTDERR 5044)

CAUSE

ACTION

5045 WRITE AND READ DATA LOOPBACK FAILED (MTDERR 5045)

Byte #	Hex Value Transmitted	Hex Value Received	Bit Positions In Error 01234567

CAUSE

ACTION

5061	FAILED TO READ RAM (MTDERR 5061)
CAUSE	
ACTION	

5063	TIMEOUT AFTER NNN SECONDS DURING STATUS (MTDERR 5063)
CAUSE	
ACTION	

5100	FILE LOADED DOES NOT MATCH EXPECTED FORMAT (MTDERR 5100)
CAUSE	
ACTION	

5200	FORWARD SPACED NNN FILES TO EOT BUT (MTDERR 5200) HARDWARE DOES NOT INDICATE END OF TAPE STATUS
CAUSE	
ACTION	

5500	UNKNOWN STATUS RETURNED FROM DEVICE (MTDERR 5500)
CAUSE	
ACTION	

5600	STATUS CONFLICT (MTDERR 5600) STATUS REGISTER 5 INDICATES COMMAND REJECT BUT NO COMMAND REJECT IS RECORDED.
CAUSE	
ACTION	

5601	STATUS CONFLICT (MTDERR (5601) STATUS REGISTER 5 INDICATES UNRECOVERED DATA/FORMAT ERROR BUT NONE IS RECORDED.
CAUSE	
ACTION	

5602	STATUS CONFLICT (MTDERR 5602) STATUS REGISTER 5 INDICATES POSITION UNRECOVERED OR SERVO ERROR BUT NEITHER IS RECORDED.
CAUSE	
ACTION	

5603	STATUS CONFLICT (MTDERR 5603) STATUS REGISTER 5 INDICATES FORMATTER ERROR BUT NONE IS RECORDED.
CAUSE	
ACTION	

5604	STATUS CONFLICT (MTDERR 5604) STATUS REGISTER 5 INDICATES CONTROLLER ERROR BUT NONE IS RECORDED.
CAUSE	
ACTION	

5605	STATUS CONFLICT (MTDERR 5605) STATUS REGISTER 5 INDICATES COMMAND REJECT AND PROTOCOL ERROR, BUT NONE IS RECORDED.
CAUSE	
ACTION	

5700	READ FROM TAPE FAILED (MTDERR 5700)
CAUSE	
ACTION	

5720	ERROR OCCURRED IN SCANNER EDIT ROUTINE (MTDERR 5720)
CAUSE	
ACTION	

5722	NOTHING TO REDO (MTDERR 5722)
CAUSE	
ACTION	

5724	WRITE RECORD GAP FAILED (MTDERR 5724)
CAUSE	
ACTION	

5804	FAILED TO OBTAIN DEVICE STATUS (MTDERR 5804) NO STATUS TO INTERPRET.
CAUSE	
ACTION	

5900	BAD CHECKSUM (MTDERR 5900) CKSUM READS : NNNN CHECKSUM SHOULD BE : NNNN FILE WILL NOT BE TRANSFERRED TO DEVICE.
CAUSE	
ACTION	
6000	THE MAXIMUM NUMBER OF ERRORS SPECIFIED HAVE BEEN GENERATED; 7974/78 TAPE DIAGNOSTIC WILL TERMINATE. (MTDERR 6000)
CAUSE	
ACTION	
6008	RECORD NNN DID NOT COMPARE ON RE-READ (MTDERR 6008)
CAUSE	
ACTION	
6009	TAPE DENSITY DOES NOT MATCH (MTDERR 6009) DENSITY REQUESTED: NNN CPI. DENSITY ACTUAL: NNN CPI.
CAUSE	
ACTION	
6010	HARDWARE STATUS INDICATES DEVICE DENSITY UNKNOWN (MTDERR 6010)
CAUSE	
ACTION	
6011	HPIB ADDRESS IS NNN. SHOULD BE BETWEEN 0 AND 7 (MTDERR 6011)
CAUSE	
ACTION	
6066	7974/7978 ENCOUNTERED INTERNAL ERROR. ABNORMAL TERMINATION. (MTDERR 6066)
CAUSE	
ACTION	
6067	TAPE DRIVE INTERNAL TEST NNN FAILED (MTDERR 6067)
CAUSE	
ACTION	

6068	**COULD NOT START INTERNAL SELF-TEST NNN (MTDERR 6068)**
CAUSE	
ACTION	

6070	**BAD FILE FORMAT, DOWNLOAD NOT PERFORMED (MTDERR 6070)**
CAUSE	
ACTION	

6074	**STREAMING FAILED TO COMPLETE FLUSHING REMAINING IO's. (MTDERR 6074)**
CAUSE	
ACTION	

6722	**FAILED TO INITIALIZE STEPS AND OBTAIN DEVICE (MTDERR 6722)**
CAUSE	
ACTION	

7000	**FAILED TO WRITE ONE BYTE RECORD NUMBER NNN. (MTDERR 7000)** **FAILED TO WRITE CHARACTER $NN TO TAPE.**
CAUSE	
ACTION	

7002	**ILLEGAL CHARACTER IN COMMAND STRING (MTDERR 7002)**
CAUSE	
ACTION	

7005	**UNKNOWN COMMAND REQUESTED IN COMMAND STRING (MTDERR 7005)**
CAUSE	
ACTION	

7010	**ILLEGAL SYNTAX IN COMMAND STRING (MTDERR 7010)**
CAUSE	
ACTION	

7015	**FAILED TO RESET SCANNER (MTDERR 7015)**
CAUSE	
ACTION	

7020	FAILED TO EXTRACT BITS (MTDERR 7020)
CAUSE	
ACTION	

7070	INFORMATION TRANSFER TO BUFFER FAILED (MTDERR 7070)
CAUSE	
ACTION	

7075	INFORMATION RECEIPT FROM BUFFER FAILED (MTDERR 7075)
CAUSE	
ACTION	

7080	FAILED TO OBTAIN MESSAGE FROM THE CATALOG (MTDERR 7080)
CAUSE	
ACTION	

7632	ERROR IN RAM HEADER (MTDERR 7632) RAM HEADER READS NNN. RAM HEADER SHOULD BE $0407
CAUSE	
ACTION	

7633	NNN NNN -- INCORRECT EEPROM TEST CELL VALUE (MTDERR 7633)
CAUSE	
ACTION	

7774	ILLEGAL SECTION FOR SELECTED DEVICE (MTDERR 7774) REQUESTED SECTION 34 (STEPS 111-120) APPLIES ONLY TO HP7974. SECTION 38 (STEPS 121-129) RUNS HP7978 SELF-TESTS. DIAGNOSTIC WILL RUN HP7978 DEFAULT SELF-TESTS STEPS.
CAUSE	
ACTION	

7778	ILLEGAL SECTION FOR SELECTED DEVICE (MTDERR 7778) REQUESTED SECTION 38 (STEPS 121-129) APPLIES ONLY TO HP7978. SECTION 34 (STEPS 111-120) RUNS HP7974 SELF-TESTS. DIAGNOSTIC WILL RUN HP7974 DEFAULT STEPS.
CAUSE	
ACTION	

Selftest Error Messages

This section provides a list of error messages which may be returned following the use of one or more selftests for either the HP 7974A or HP 7978A/B magtape drives. The user can refer to either the HP 7974A or the HP 7978A/B selftest error code section depending upon whether the selftests were issued from Section 34 or 38. Once a four digit status code has been displayed, it may be interpreted to show which FRU failed, the subassembly in error, and information on the probable cause or action. The selftest error code sections follow these error messages.

ERROR IN SECTION 34 OR 38.

CAUSE A selftest step in either Section 34 or 38 has failed.

ACTION Examine the next message to determine which step of the selftest has failed.

ERROR IN STEP N.

CAUSE The group of internal selftests corresponding to Step N above has encountered at least one error.

ACTION Carefully examine the following selftest status messages for a selftest status code or further information.

FAILED TAPE SELFTEST COMMAND.

CAUSE A selftest command issued by at least one part of Section 34 or 38 has not completed as specified.

ACTION Determine which selftest has failed and interpret the corresponding error code as specified for either the HP 7974A or HP 7978A/B Tape Drive.

6067 TAPE DRIVE INTERNAL TEST N FAILED. (MTDERR 6067)

CAUSE Selftest number N has failed.

ACTION When the selftest status code is displayed, `record it` and refer to the appropriate selftest code group (HP 7974A or HP 7978A/B) for interpretation.

SELFTEST STATUS EQUALS $NNNN.

CAUSE The selftest which failed has returned status NNNN which may be interpreted to determine the bad FRU.

ACTION If the selftest error message originated from Section 34, then refer to the HP 7974A selftest error code section of this manual for interpretation. If the selftest error message originated from Section 38, then refer to the HP 7978A/B selftest error code section of this manual for interpretation.

6068 COULD NOT START INTERNAL SELFTEST. (MTDERR 6068)

CAUSE One or more conditions necessary for selftest initiation has not been met.

ACTION Examine any other error messages immediately proceeding or following this one for evidence of either a data transaction error or a fault with the tape drive power or cable connections.

Selftest Error Codes for the HP 7974A Tape Drive

The error codes were developed to help trained service personnel identify major component failures, isolate the subassemblies which may be responsible for these failures, and to troubleshoot "mysterious" conditions. Referring to the table below, you can see that the codes are split into four major parts: the FRU in error, the suspected FRU subassembly, the action which caused the failure and the multi-test code. In most cases, these errors indicate a need for adjustment or repair which cannot be performed by the customer.

The Selftest error codes are made up of the four (4) digits in the FRU and CODE sequence. Therefore, to determine the meaning of the code in the example below, you would look up 8702 to find the interpretation.

Table 22-11.

FRU in error.	Subassembly within FRU in error.	The action which caused the failure.	The multi-test code.

Table 22-12. Graphic Illustration of the 7974A Diagnostic Error Messages.

DISPLAY	MEANING
F00	Failed Test 00
FRU	Field Replaceable Unit (FRU) code is next
0087	8: FRU which failed 7: Subassembly in FRU which failed
CODE	Cause of failure next
0002	0: Action during test which caused failure 2: Other FRUs or subassemblies that should be tested (Multi-test code)

1NNN Servo and Tape Motion Assembly FRU

11NN Capstan motor and tachometer subassembly

   111x The low speed ramps were too long.
   112x The low speed ramps were too short.
   113x The high speed ramps were too long.
   114x The high speed ramps were too short.

12NN Tape Motion Mechanical Assembly FRU

   121x Low speed servo failure.
   122x High speed servo failure.

x: multi-test codes

 0 Does not apply.
 1 speed adjustment, capstan assembly, power supply overload,
    mechanical guides and rollers.
 2 mechanical rollers/guides/arms, capstan assembly, Control
    Board servo circuits, power supply overload, speed adjustments.

2NNN NRZI Board FRU

   21yx NRZI parity circuitry failed.
   22yx NRZI LRC circuitry failed.
   23yx NRZI CRC circuitry failed.
   24yx Not Used.
   25yx No head current detected.
   26yx Identify status circuitry failed.
   27yx EOF detection circuitry failed.
   28yx Block valid signal timed out in test.
   29yx Block valid signal too long.
   21yx Failure during selftest.

y: Actions that detected the failure.

 0 Does not apply.
 1 Fixed data pattern.
 2 Random data pattern.
 3 Occurred during a write test only.
 4 Occurred during a read test only.
 5 No board installed or connected disconnected.

```
x:  multi-test codes

 0  Does not apply
 1  NRZI board
 2  NRZI board, head connectors, head
 3  NRZI board, tape, head
 4  Connector missing, board missing, or power failure.

40NN  Master Controller Assembly FRU

41N0  CPU error on Master Controller assembly.

   4110  CPU data register malfunction.  The data value written was
         not the value read while verifying.
   4120  CPU address register malfunction.  Written data not data
         read back.  Value read while verifying.
   4130  CPU condition code malfunction.
   4140  A CPU register had its data fade after a two second wait.
   4160  CPU addressing malfunction.

42N0  Master Controller RAM failure.

   4210  RAM failure found during march test.
   4220  RAM failure found during the selective one walking bit test.
   4230  RAM failure found during the selective zero walking bit test.

43N0  Master Controller Data Buffer subassembly failure.

   4300  Data buffer subassembly is unresponsive.
   4310  Data Buffer RAM failure in marching RAM test.
   4320  Data Buffer register failure in walking '1' bit test.
   4330  Data Buffer register failure in walking  '0' bit test.
   4340  Data Buffer length counter/USM function failure.
   4350  Data Buffer usage counter/USM function failure.
   4360  Data Buffer parity/USM function failure.
   4370  Data transferred not the data received.
   4380  Transferred data missing EOR.
   4390  Data Buffer has incorrect pre-fetch data.
```

44N0 Master Controller timer chip subassembly failure.

4410	Timer interrupt status error.
4420	Timer interrupt status could not be cleared.
4430	Timer 1 didn't count down to zero.
4440	Timer 1 or timer 2 is substantially faster than the other timer.
4450	Timer 1 or timer 2 is substantially slower than the other timer.
4460	Timer 1 or timer 3 is substantially faster than the other timer.
4470	Timer 1 or timer 3 is substantially slower than the other timer.

45N0 Master Controller EEPROM chip subassembly failure.

4510	The read/write ready status was not present.
4520	The computed EEPROM check sum was not the same as the stored check sum.
4530	An EEPROM read value was incorrectly read.
4540	A write value into the EEPROM did not verify after write.
4550	The computed EEPROM check sum did not verify after being written.
4560	EEPROM is write enabled and should not be.
4570	EEPROM is not write enabled and should be.

4600 ROM Checksum error

5NNN Data Formatter Board FRU

51yx	Preamble circuit failure.
52yx	Postamble circuit failure.
53yx	MTE circuit failure.
54yx	Skew circuit failure.
55yx	Vertical parity error circuit failure.
56yx	Corrected error circuit failure.
57yx	Data error.
5802	No head current detected.
5803	No block signal detected.
5Fyx	No data formatter board detected.

y: Actions that detected the failure.

0	Does not apply
1	Fixed data pattern.
2	Random data pattern.
3	Occurred during a write test only.
4	Occurred during a read test only.
5	No board installed or connector disconnected test.

x: multi-test codes

0 Does not apply
1 Data formatter board, Digital read logic board.
2 Data formatter board, Heads.
3 Digital read logic, Data formatter, tape, head.
4 Connectors loose, Boards missing, Power supply problems.

6NN0 HP Interface Bus (HPIB) Assembly FRU

61N0 HP-IB failure.

6100 The HP-IB is unresponsive.
6110 The inbound FIFO was not empty after an attempt to clear.
6120 The internal HP-IB loopback has failed.
6130 The "end" bit in the interface is not functional.

62N0 HPIB/Master Controller interface failure.

6210 The data transferred was not received.
6220 The data transferred was missing an EOI.

7NNN Drive Interface Board FRU

710x Data transfer module assembly.
711x Error found in testing Interface reset circuit.
712x Error detected in write interface initialization.
713x Error detected in read interface initialization.
714x Error detected in sense byte interface initialization.
715x Door opened during test.
716x Sense byte transfer test failed.
717x Sense byte value not returned correctly.
720x Front panel module assembly.
721x Virtual display test failed.
722x Virtual bottom test failed.
730x Command status module assembly.
731x Failure occurred in sending diagnostic command to transport.
732x Sense byte handshake test failure.

x: multi-test codes

1 Cables, Drive Interconnect, Control/Motherboard
2 Cables, Drive Interconnect
3 Cable, Drive Interconnect, or Control/Motherboard
4 Not Used
5 Cables, Drive Interconnect, Data Formatter, Control/Motherboard.
6 Drive Interconnect or Control/Motherboard

8NNN Digital Read Electronics Board FRU

81yx Corrected error circuit failure.
82yx False postamble detection circuit failure.
83yx Multiple track error circuit failure.
84yx Vertical parity error circuit failure.
86yx No identification status during an identify.
87yx No EOF status detected while trying to write a file mark.
88yx Block valid signal timed out during test.
89yx Block valid signal lasted longer than expected.
8A00 Error encountered during selftest.
8Byx No ID mark detected in write from BOT.
8Cyx Gap found in ID.
8F00 The hardware is not present or responsive.

y: Actions that detected the failure.

0 Does not apply
1 Fixed data pattern.
2 Random data pattern.
3 Occurred during a write test only.
4 Occurred during a read test only.
5 No board installed or connector disconnected test.

x: multi-test codes

0 Does not apply
1 Digital read logic board, Data formatter board, Tape, Heads.
2 Digital read logic board, Data formatter board, Heads, Tape.

```
9NNN  Head/Tape Interface Assembly FRU

   91yx  False Preamble detected.
   92yx  False postable detected.
   93yx  Multiple tracks in error were detected.
   94yx  Skew error was detected.
   95yx  Vertical parity error was detected.
   96yx  Corrected error was detected (STE).
   97yx  Data error detected in read test.

y:  Actions that detected the failure.

 0  Does not apply.
 1  Fixed data pattern.
 2  Random data pattern.
 3  Occurred during a write test only.
 4  Occurred during a read test only.
 5  No board installed or connector disconnected test.

x:  Multi-test codes

 0  Multi-test code does not apply.
 1  Tape, Heads, Read logic board, Data formatter board.

ANNN  Drive Control/Motherboard FRU

   A10x  Servo Forward speed slow or reverse speed fast.
   A11x  Servo Forward speed fast or reverse speed slow.
   A12X  Servo High speed ramp too short or low speed ramp too long.
   A13x  Servo High speed ramp too long or low speed ramp too short.
   A14x  Repositions close to limit.  Check speed adjustment.
   A15x  Repositions beyond limit.  Check speed adjustment.
   A20x  The RAM circuits failed RAM tests.
   A30x  The molex connectors are loose.
   A40x  The power supply (not 5V) is failing test.
   A50x  The ROMs are failing checksum test.
   A60x  Data Formatter, NRZI, or Read Logic Board not present.
   A71x  Drive failed to enter NRZI density.
   A72x  Drive failed to enter PE density.
```

```
x:  multi-test codes

 0  Does not apply.
 1  speed adjustment, Control Board circuits, capstan assembly,
    power supply overload, mechanical arms, and guide assemblies.
```

BNNN Unexpected Exceptions

The MC68000 Microprocessor is capable of responding to a number of unexpected conditions which rarely occur in the HP 7974A. If one of these errors is detected, a hardware or firmware error is indicated. The drive will respond by shutting itself down and displaying the error code.

```
B100  Address error.
B200  Illegal instruction.
B300  Divide by zero.
B400  Register bounds violation.
B500  Overflow.
B600  Privilege violation.
B700  Trace exception.
B800  Emulation of future instruction.
B900  Spurious interrupt.
BA00  Unimplemented interrupt.
BB00  Unassigned vector.
```

DNNN Runtime-Detected errors

Runtime errors prevent the execution or completion of a diagnostic program. Errors D310, D330, D370, and D380 can be corrected by the operator and are the most commonly displayed sequences. Codes D340 and D350 apply to the firmware update procedure that is used by HP service personnel. The remaining D-codes indicate that the drive requires servicing. All runtime errors are logged in the error log. If fatal error occurs, test 1 (Error log) and test 5 (Power on selftest) should be run for more detail.

```
D000  Operating System detected failure.
D100  Channel Program detected failure.
D177  Transaction ID mismatch.
D17A  Missing PDN command.
D17B  Report Queue error.
D17C  Report Queue full.
D17D  Unknown command to device program.
D17E  Full command Queue.
D183  Data buffer byte count mismatch.
D184  Bad message type.
D185  Processor handshake abort.
D186  Interface exception.
D187  Outbound data freeze.
D188  Inbound FIFO error.
D189  EEPROM update failure.
D18A  Device firmware error D18B.  Hardware utility firmware error.
D18C  Channel case error.
D200  Device Program detected failure.
D201  Data busy remained asserted when it should have disabled.
D203  A polling loop terminated early.
D204  Unexpected status returned from the transport.
D205  Device write protected or failure to go online.
D206  Formatter busy did not assert upon receipt of a command.
D207  The HP interface board did not initialize correctly.
D208  The rewind command handshake failed.
D209  Load point was not detected when expected.
D20A  Transport failed to be put in the intended density.
D20B  Formatter busy remained asserted when it should have disabled.
D20C  Transport encountered an unrecognized command.
D20D  A reposition took longer than expected.  Speed adjustment required.
D20E  Erase current not detected in head.
D20F  A command was rejected by the transport.
D210  The sense bytes were lost when a sense byte read was attempted.
D211  Power was lost partially or totally during the last operation.
D212  The door was open during a command.
D213  The transport failed to complete a command.
D214  Formatter busy was asserted too long during a sense byte read.
```

D215 Position was lost during retries.
D216 Online failure.
D22D Multiple track error.
D22F Gap in ID.
D231 ID found in read.
D233 Gap in block found.
D237 Door open error.
D239 Skew error.
D23A False preamble/postamble.
D23B Corrected write error.
D253 Servo shutdown error.
D268 Erase failure.
D269 No read after write detected.
D26B Hardware failure.
D26C Timeout error.
D277 Transaction ID mismatch.
D27A Missing PDN command.
D27B Report Queue error.
D27C Report Queue full.
D27D Unknown command to device program.
D27E Full command Queue.
D280 Missing EOR in data buffer.
D283 False EOR in data buffer.
D284 Bad message type.
D285 Processor handshake abort.
D286 Interface exception.
D287 Outbound data freeze.
D288 Inbound FIFO error.
D289 EEPROM update failure.
D28A Device firmware error.
D28B Hardware utility firmware error.
D28C Channel case error.
D300 Diagnostic Program detected failure.
D310 No tape was loaded when a read or write diagnostic test was selected.
D320 Wrong density.
D330 No write ring was installed when a write test selected.
D340 A tape-related error has occurred during a local firmware update.
D350 A valid firmware update record was not found on the loaded tape.
D360 The EEPROM READY signal did not come true during a Tape Usage Odometer update.
D370 Door opened while running test.
D380 BOT/EOT was detected abnormally during a diagnostic operation.
D3F0 An unknown failure code was received from the transport.
D3F1 The user pressed the enter button during a test.
D3FF The selftest was terminated early.

```
Host Protocol Errors

E0A1  Command Queue not empty.
E0A2  Request DSJ expected.
E0A3  Request status expected.
E0A7  Data byte expected.
E0A8  Missing EOI on data byte.
E0AA  Command phase protocol error.
E0AC  Read protocol error.
E0AD  Report phrase protocol error.
E0AE  Cold load protocol error.
E0B0  End complete expected.
E0B2  End data expected.
E0B4  Improper secondary.
E0B8  Loopback protocol error.
E0B9  Selftest protocol error.
E0BC  Command parity error.
E0BD  Reset by operator.
E0BE  Device clear.

Bus Error Exceptions
```

A Bus Error will occur whenever the Master Controller accesses subsystems which do not respond within an allowable amount of time. Since the error can occur during a CPU instruction, the drive is shut down immediately to prevent the Master Controller from executing unpredictably. These Bus Error codes usually indicate a failure of the HPIB, Master Controller, or Drive Interconnect.

```
4300  The Master Controller Data Buffer subassembly is unresponsive.
6100  The HP-IB is unresponsive.
DTAK  Microprocessor did not receive a DTAK.
```

Selftest Error Codes for the HP 7978A/B Tape Drive

The error codes were developed to help trained service personnel identify major component failures, isolate the subassemblies which may be responsible for these failures, and to troubleshoot "mysterious" conditions. Referring to the table below, you can see that the codes are split into four major parts: the FRU in error, the suspected FRU subassembly, the action which caused the failure and the multi-test code. In most cases, these errors indicate a need for adjustment or repair which cannot be performed by the customer.

The Selftest error codes are made up of the four (4) digits in the FRU and CODE sequence. These error codes are presented as 2 digit most and least significant bytes respectively when they appear on the front panel of an HP 7978A/B Magnetic Tape Drive. Therefore, to determine the meaning of the code in the example below, you would look up 8702 to find the interpretation.

Table 22-13.

FRU in error.	Subassembly within FRU in error.	The action which caused the failure.	The multi-test code.

Table 22-14. Graphic Illustration of the 7978A Diagnostic Error Messages.

DISPLAY	MEANING:
F00	Failed Test 00
FRU	Field Replaceable Unit (FRU) code is next
0087	8: FRU which failed 7: Subassembly in FRU which failed
CODE	Cause of failure next
0002	0: Action during test which caused failure 2: Other FRUs or subassemblies that should be tested (Multi-test code)

1NN0 Servo Controller Assembly FRU

10NN A general problem was found with the Servo Controller.

1001 The Servo Controller was unable to perform a soft shutdown during an Unload operation.
1010 The Servo Controller experienced an unexpected loss of tape tension or a safety shutdown has occurred. If a safety shutdown has occurred, please close the door.
1021 The Servo Controller detected that connector J25 is disconnected.
1022 The Servo Controller detected that connector J26 is disconnected.
1023 The Servo Controller detected that connector J27 is disconnected.
1024 The Servo Controller detected a failure on the Buffer Arm assembly.
1025 The Servo Controller was unable to open its relay.
1026 The Servo Controller was unable to close its relay.
1027 The Servo Controller detected a failure in its external counter.
1028 The Servo Controller detected a direction bit failure.
1029 The Servo Controller detected a failure in its internal counter.
102A The Servo Controller detected a failure in its Quadrature circuitry.
102B The Servo Controller detected MOT1_FAIL_NEG.
102C The Servo Controller detected MOT1_FAIL_POS.
102D The Servo Controller detected a sensor test failure.
102F The Servo Controller DAC failed under 0 volts.
1030 The Servo Controller DAC failed over 0 volts.
1031 The Servo Controller DAC failed under -6 volts.
1032 The Servo Controller DAC failed over -6 volts.
1033 An over tension shutdown has occurred during the motor drive diagnostic test.
104N Invalid two-port RAM value.
105N Invalid diagnostic parameter.
1060 The Servo Controller detected an in-position echo failure.
1061 The Servo Controller detected a gap echo failure.
1070 Requested moving fast while not moving at -75 ips.
1080 Reposition overflow.
1081 Not in moving state when an in-position interrupt occurred.
1082 In-position interrupt sign error.
10DN Servo firmware error.
10EN Servo table lookup error.
10F0 This FRU is unresponsive or missing.

12N0 A Servo Controller related error has been detected by the Master Controller.

1210 The Servo Controller found an error in its kernel test.
1220 The Servo Controller failed the interface test with the Master Controller.
1230 The Servo Controller failed the gap interrupt test.
1240 An in-position interrupt was not received.
1250 A gap interrupt was not received.
1260 The write enable signal was not high in the sensor test.
1270 The write enable signal was not low in the sensor test.
12F0 The Servo Controller was not present or responsive.

2NNN Motor Drive Assembly

3NN0 Front Panel Assembly FRU

30F0 This FRU is unresponsive or missing.

4NN0 Master Controller Assembly FRU

41N0 CPU error on Master Controller assembly.

4110 CPU data register malfunction. The data value written was not the value read while verifying.
4120 CPU address register malfunction. The data value written was not the value read while verifying.
4130 CPU condition code malfunction.
4140 A CPU register had its data fade after a two second wait.
4160 CPU addressing malfunction.

42N0 Master Controller RAM failure.

4220 RAM failure found during the selective one walking bit test.
4230 RAM failure found during the selective zero walking bit test.

43N0 Master Controller Data Buffer subassembly failure.

4310 Data Buffer RAM failure in marching RAM test.
4320 Data Buffer register failure in walking '1' bit test.
4330 Data Buffer register failure in walking '0' bit test.
4340 Data Buffer length counter/USM function failure.
4350 Data Buffer usage counter/USM function failure.
4360 Data Buffer parity/USM function failure.
4370 The data transferred was not received. Possible HPIB problem.
4380 The data transferred is missing an EOR. Possible HPIB problem.
4390 The Data Buffer Pop Prefetch status was incorrect during the Data Buffer test.

```
44N0  Master Controller timer chip subassembly failure.

4410  Timer interrupt status error.
4420  Timer interrupt status could not be cleared.
4430  Timer 1 didn't count down to zero.
4440  Timer 1 or timer 2 is substantially faster than the other timer.
4450  Timer 1 or timer 2 is substantially slower than the other timer.
4460  Timer 1 or timer 3 is substantially faster than the other timer.
4470  Timer 1 or timer 3 is substantially slower than the other timer.
45N0  Master Controller EEPROM chip subassembly failure.

4510  The read/write ready status was not present.
4520  The computed EEPROM checksum was not the same as the stored
      checksum.
4530  An EEPROM read value was incorrectly read.
4540  A write value into the EEPROM did not verify after write.
4550  The computed EEPROM checksum did not verify after being written.
4560  The EEPROM is write enabled when it should be disabled.
4570  The EEPROM is not write enabled when it should be enabled.

NNNN  Master Controller timer chip has failed.
NNNN  Master Controller EEPROM failure during a firmware update.
NNNN  Master Controller ROM checksum failure.

5Nyz  Formatter Assembly FRU.

y denotes an event.

y=1  Write ID                 y=2  Write Data
y=3  Verify Data              y=4  Write a Tape Mark
y=5  Force 1 track in error   y=6  Force 2 tracks in error
y=7  Force unrecoverable data y=8  Force a Parity error
y=9  Force data overruns      y=A  Force a data underruns

z denotes a multi-test code.

51yz  Write Formatter failure.
5NNN  Hardware status at time of error detection.

52yz  Data Detect and Deskew failure.
5NNN  Hardware status at time of error detection.
```

53yz Read Formatter failure.
5NNN Hardware status at time of error detection.

5NNN Hardware status at time of error detection.
Bits 1-0 Write Formatter status.
Bits 7-0 Data Detect and Deskew status.
Bit 11 Parity or bad data in buffer status.
Bits 10-0 Read Formatter status bits 14-4.

6NN0 HP Interface Bus (HPIB) Assembly FRU.

61N0 HPIB failure.

6110 The inbound FIFO was not empty after an attempt to clear.
6120 The internal HPIB loopback has failed.
6130 The 'end' bit in the interface is not functional.

62N0 HPIB Master Controller interface failure.

6210 The data transferred was not received. Possible Data Buffer problem.
6220 The data transferred was missing an EOI. Possible Data Buffer problem.

7NN0 Write Electronics Assembly FRU.

71N0 Write Clock failure.

7110 The GCR Density frequency is not working.
7120 The GCR Data frequency is not working.
7130 The PE Density frequency is not working.
7140 The PE Data frequency is not working.

8NN0 Read Electronics Board FRU.

8abc Auto-gain error code. Parameter 0 indicates which tracks are bad by putting a '1' in the track fields. Parameter 1 indicates low or high amplitude by putting a '0' or '1' in the indicated tracks for low or high, respectively. Note: The high order bit is 15, while the low order bit is 0.

a Bit 11 contains the parameter. Bits 10-9 contain the density. (PE=2,GCR=3) Bit 8 contains track 9 data.
b Bits 7-4 contain tracks 8-5.
c Bits 3-0 contain tracks 4-1.

9NN0 Phase Locked Loop (Clock Recovery) Assembly FRU.

y denotes an event.

y=1	Write ID	y=2	Write Data
y=3	Verify Data	y=4	Write a Tape Mark
y=5	Force 1 track in error	y=6	Force 2 tracks in error
y=7	Force unrecoverable data	y=8	Force a Parity error
y=9	Force data overruns	y=A	Force data underruns

z denotes a multi-test code.

91yz An error was detected while accessing the Write Formatter.
92yz An error was detected while accessing the Data Detect and Deskew.
93yz An error was detected while accessing the Read Formatter.

AONN AOFO Read/Write Head is not plugged in or unresponsive.

BN Unexpected exceptions. (Front Panel reportable only.)

B1 Address error exception.
B2 Illegal instruction exception.
B3 Divide by zero exception.
B4 Register bounds violation exception.
B5 Overflow exception.
B6 Privilege violation exception.
B7 Trace exception.
B8 Emulation of future instruction exception.
B9 Spurious interrupt exception.
BA Unimplemented interrupt exception.
BB Unassigned vector exception.

Bus Error Exceptions. (Front Panel reportable only.)

43 The Master Controller Data Buffer subassembly is unresponsive.
51 Write Formatter is unresponsive.
52 Data Detect and Deskew is unresponsive.
53 Read Formatter is unresponsive.
61 The HPIB is unresponsive.
C1 Bus error exception from an unknown source has occurred.

Halted state error codes. (Front Panel reportable only.)

41 MC68000 CPU error.
42 Master Controller RAM failure.
44 Master Controller timer chip failure.
45 The EEPROM failed during a firmware update.
46 Master Controller ROM failure.
D4 Power cycle the tape drive. Firmware update is complete.

DNNN Runtime-Detected errors.

DONN Operating System detected failure.
D1NN Channel Program detected failure.

D179 Transaction ID mismatch.
D17A Missing pending command.
D17B Report Queue error.
D17C Report Queue full.
D17D Unknown command to device program.
D17E Full command Queue.
D17F Unknown non-Host command.
D183 Data buffer-byte count mismatch. (Test MC)
D184 Bad message type.
D185 Process handshake abort. (Test HPIB)
D186 Interface exception. (Test HPIB)
D187 Outbound data freeze. (Test HPIB)
D188 Inbound interface FIFO error. (Test HPIB)
D189 EEPROM update failure. (Test MC)
D18C Channel Program case error.
D1FF Device Program is unresponsive to the Channel Program.

D2NN Device Program detected failure.

D201 A timeout on a Device Program report occurred.
D202 The maximum number of retries have occurred during a tape diagnostic.
D203 A soft error has occurred during a tape diagnostic.
D204 Tape runaway.
D205 The tape is write protected.
D209 The read record/move command returned an unidentifiable tape.
D20A The write gap/tape mark record command returned an unidentifiable tape.
D210 The tape is not at load point.
D213 Backward move command while tape is at load point.
D225 Tape positioning failure. (Test SC)

```
D226  System Reset.
D227  Readahead Reject.
D228  The door was open, so reject the command.
D229  Velocity is out of specification.  (Test SC)
D22D  Multiple tracks were in error.  (Test F)
D22F  Tape mark or ID was not verified.  (Test F)
D230  Gap noise was detected.  (Test F)
D231  Data format error.  (Test F)
D232  Not identifiable on load or rewind commands.  (Test F)
D233  Gap before end of data.  (Test F)
D234  Data block dropout.  (Test F)
D235  Redundancy error.  (Test F)
D236  Read parity errors.  (Test F)
D23C  Data Buffer overrun.  (Test MC)
D23D  Data block timeout.  (Test F)
D23E  Tape mark dropout.  (Test F)
D23F  Tape mark unverified.  (Test F)
D240  Tape mark timeout.  (Test F)
D251  Servo Controller is unresponsive.  (Test SC)
D252  Servo Controller command not complete.
D253  The Servo Controller shutdown.  (Test SC)
D254  Servo Controller hardware failure.  (Test SC)
D255  Servo Controller protocol error.  (Test SC)
D256  Servo Controller runtime error.  (Test SC)
D257  No in-position interrupt.  (Test SC)
D258  No gap position interrupt.  (Test SC)
D259  Safety shutdown.  (Test MDRIVE)
D25A  No BOT marker.
D25B  Speed out of specification.  (Test SC)
D25C  Desired state is invalid.
D25E  Tape position failure.  (Test SC)
D265  Read Formatter unresponsive.  (Test F)
D266  Read Formatter hardware error.  (Test F)
D267  Bad detect on write.  (Test F)
D268  Bad erase.  (Test WE)
D269  No detect on write.  (Test F, WE)
D26A  Track out of synchronization.  (Test F)
D26E  Formatter byte count mismatch.  (Test F)
D27C  Report Queue overflow.
D27D  Unknown command.
D280  No end of record on a write record.  (Test F, MC)
D283  Data Buffer byte count mismatch.  (Test MC)
D28A  Device Program case error.
D28B  Device Program hardware utility case error.
```

D3N0 Diagnostic Program detected failure.

D310 A tape was not loaded when a read or write data block test was called, or the tape was not positioned at BOT.
D320 A tape with the wrong density ID was loaded for a read data block test.
D330 No write ring was installed on the tape loaded for a write date block test
D340 A tape-related error was occurred during a local firmware update.
D345 EEPROM failure was detected during firmware update.
D350 A valid firmware update record was not found on the loaded tape.
D360 The EEPROM READY signal did not come true during a Tape Usage Odometer update.
D364 Download is too large.
D366 Invalid download ID.
D367 Incorrect Download checksum.
D368 The firmware update will not fit into EEPROM. Aborted.
D369 Invalid ID for a firmware update.
D36A Invalid version number for the firmware update. (Not found.)
D36B Bad firmware update checksum.
D36C Insufficient data for the firmware update.
D36D Odd number of bytes for a firmware update.
D36E The requested version number is incorrect for your installed ROM (PROM). No update was performed.
D36F Firmware update has been aborted.
D370 The door was open while attempting to run a servo controller test which requires the door to be closed.
D380 Servo handshake/hardware failure during tests 35 - 40.
D390 A tape is mounted on the drive during motor drive tests.
D400 Power cycle the tape drive. Firmware update has successfully completed.

ENNN Protocol errors.

E079 Command Queue not empty.
E0A2 Request DSJ expected.
E0A3 Request status expected.
E0A5 Unknown unit select.
E0A6 Listen 1 expected.
E0A7 Data byte expected.
E0A8 Missing EOI on data byte.
E0AA Command phase protocol error.
E0AC Read record report phase protocol error.
E0AD Report phase protocol error.

```
E0AE  Cold load protocol error.
E0B0  End "complete" or "Complete - idle" expected.
E0B2  End "Data" expected.
E0B4  Improper secondary.
E0B5  Misplaced data byte.
E0B8  Interface loopback protocol error.
E0B9  Selftest protocol error.
E0BD  Reset by the operator.
E0BE  Device clear received.

FNNN  Remote status.

FCFC  Only local access to diagnostic allowed.
FDFD  Incorrect Online/Offline mode for a diagnostic.
FEFE  Non-existent diagnostic.
FFFF  Diagnostic passed.

Front Panel errors and warnings.

A1  Resetting the Device Program.
A2  Drive is active and is offline.
A3  Dirty tape path warning.
F0  Selftest failure.
F1  The tape is not tensioned.
F2  BOT marker is not present.
F3  Hardware failure.
F4  Firmware error.
F5  Host protocol error.
```

Multi-Test Codes

The multi-test code within the LSB of the diagnostic error message is used to supply additional information about what may really have failed. An FRU and subsystem FRU will be contained in the MSB of the diagnostic error message, but may reflect a symptom rather than error isolation. The multi-test code is used to provide subsequent FRUs which may have caused the failure. The FRUs are listed below from most likely to fail to least likely to fail.

```
NNN1  Digital Loopback w/PLL Test -- PE          PLL, F, MC, WE.
NNN2  Digital Loopback w/PLL Test -- GCR         F, MC, WE.
NNN3  Digital Loopback w/o PLL Test -- PE        F, MC, WE.
NNN4  Digital Loopback w/o PLL Test -- GCR       F, MC, WE.
```

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23

Reel Tape Diagnostic 06/90

Introduction

The reel tape diagnostic (REELDIAG) tests the HP7979A, HP7980A, and/or HP7980XC tape drives which are connected to any HP Precision Architecture RISC computer system which supports the Online Diagnostic Subsystem. REELDIAG is capable of detecting failures of one or more Field Replaceable Units (FRUs). REELDIAG will:

- Set the selected tape drive to a known condition
- Identify the drive as one of the above listed types (and subtype, if necessary)
- Test the HPIB Communication Link between the host and the device
- Request the device to run certain internal selftests
- Obtain and decode hardware status and selftest results
- Obtain and decode device internal logs

Defects and Enhancements

Submit defect reports and enhancement requests concerning this diagnostic through the STARS database referencing product number 30600-10007.

Minimum Configuration

The hardware required to run the diagnostic consists of an HP Precision Architecture RISC computer system with minimum memory, an HPIB interface, a channel adapter and a supported (see above) Magtape Drive connected to it. The drive under test must contain internal selftests that are capable of detecting failed Field Replaceable Units (FRUs) in the drive.

Auto-Diagnostics

The magnetic reel tape diagnostic program can be invoked by the I/O system for auto-diagnostic purposes when an unrecoverable drive error has been detected. In auto-diagnostics mode, this diagnostic program will execute the following sections and steps:

```
Section 2        Clear
Section 3        Identify
Section 4        Loopback
Section 10       I/O path trouble tree
Section 11       Drive electronics trouble tree
```

Operating Instructions

Before attempting to run the diagnostics, ensure that the tape drive to be tested is powered on. If the sections which test tape movement and write/read operations are to be run, ensure that a scratch tape is loaded.

Default Tests

If the user doesn't specify sections and steps to be run, the following default sections and steps will be executed. The default tests do not care whether the drive is on-line or off-line and they will not read from or write to any loaded tape.

```
Section 10       Non-destructive I/O path trouble tree
Section 11       Drive electronics trouble tree
```

RUN Command

To start the Online Diagnostics, enter the following command at the MPE XL system prompt:

```
SYSDIAG
```

To start the Online Diagnostics, enter the following command at the HP-UX system prompt:

```
%/usr/diag/bin/sysdiag
```

The diagnostic subsystem responds with the following prompt indicating that diagnostic system access has been granted to the user:

```
DUI >
```

Typing HELP causes a summary of the DUI function and its commands to appear on the screen.

The program will allow the user to select which testing functions are to be executed, but the default set can also be invoked by not making any section or step specification. In addition, only certain sections/steps will be performed when called as an auto-diagnostic. For security reasons, no auto-diagnostic section will cause any tape reads or writes.

Note

The device to be tested must be powered up and on line. Device physical locations (pdev) shown in the **RUN** commands are those of the devices on the "typical A1002A" system configuration described in the chapter on DUI. The pdev value entered must be correct for the system being tested.

For example, to run the diagnostic in an MPE-XL environment, you might enter:

```
DUI >RUN REELDIAG pdev=4.2.2 <RUN Command Options>
                      |             |
                      |        none required for
                      |        default test suite
                      |
                 insert physical location of
                 device to be tested here;
                 alternatively, for MPE XL,
                 type the ldev number;
                 for HP-UX, type the devfile name
```

Various error options are used by the **RUN** command. A detailed description can be obtained by referring to the DUI chapter of this manual. Enter the desired **RUN** options.

Test Execution

When REELDIAG is executed, the following welcome message will be displayed:

```
****************************************************************
******                                                    ******
******          MAGNETIC REEL TAPE DIAGNOSTIC             ******
******                                                    ******
******    (C) Copyright Hewlett Packard Co. 1987          ******
******            All Rights Reserved.                    ******
******              Version A.00.00                       ******
******                                                    ******
****************************************************************

Welcome, Today is MON, May 22, 1987, 9:00 AM
```

Upon completion of all sections and steps selected by the user or upon a fatal error condition, REELDIAG will exit and control will be returned to the Diagnostic User Interface (DUI).

```
REELDIAG EXITING ...
```

Unless the program is being called simply to decode status, the diagnostic will first request access to the device from the diagnostic subsystem. If access to the drive is not obtained, error messages from the subsystem as well as this diagnostic will appear and the program will terminate.

If access to the device was obtained, the diagnostic will automatically invoke a diagnostic subsystem routine to test the I/O path to the tape drive. This is necessary since REELDIAG has no knowledge of intermediate hardware connecting the host to the drive. If the status returned from this routine is not "successful", a warning message will be displayed but the diagnostic will continue.

If the I/O path tests out okay, the diagnostic will automatically ask the device to identify itself. If the device fails to respond to the request, the program will terminate. If an unexpected identification code is received, an appropriate warning message will be displayed but the execution will continue so as to allow development devices to be diagnosed. In this case if the program is in autodiagnostics mode, an HP7980 will be assumed, otherwise, the user will be prompted for one of the known, valid identification codes to use to diagnose the device:

```
***WARNING:  Device is not diagnosed by this program.
          HPIB code returned = nnnn.

                              {or}

***WARNING: Device is not recognized as a reel tape drive.
          HPIB code returned = nnnn.

Which of the following devices emulates the selected device?
                         HP7979A
                         HP7980A
                         HP7980XC
                         [<cr> = none/exit program]
      Your selection >
```

If the device correctly identifies itself, the sections and steps specified by the user in the DUI **RUN** command will be executed. If the user did not specify sections and steps to be run, the default sections and steps will be executed.

If during the execution of any program section or step the diagnostic request fails, the appropriate error at the end of this chapter will be displayed.

Test Section Description

The following sections and steps are applicable for execution in this diagnostic program:

Section 2	Clear
Section 3	Identify
Section 4	Loopback
Section 5	Selftest
Section 6	Display device status
Section 7	Display Log information
Section 10	Non-destructive trouble tree
Section 11	Drive electronics trouble tree
Section 12	R/W function trouble tree
Section 13	Media trouble tree
Section 50	Interactive external exerciser

Variable output in the output examples is represented by one of the following codes (note the italics font):

n	Refers to a decimal digit (a 4-digit number would be represented as *nnnn*).
c	Refers to an ASCII character.
h	Refers to a hexadecimal digit (0-F).
o	Refers to an octal digit (0-8).
b	Refers to a binary digit (0-1).
text	Is a description of what will appear at that spot.

In addition, an exclamation point (!) in error messages and warnings is normally a symbol representing the point at which certain context sensitive words, phrases, or numbers will be inserted.

Many sections provide generic information displays which cover both the older and newer tape drives. In cases where particular information is not available from the machine, the phrase "NA" (Not Applicable) will be displayed in its place. Similarly, the value of certain states and counters in some drives must be initialized, and until they are, contain all Fs (hex), indicating their unset state. This value will be displayed as "nv" (no value) by REELDIAG. Neither of these are to be considered error conditions, unless other values are definitely expected.

Section 2—CLEAR

This section will place the selected device into a known state:

- Tape drive protocol will be restarted
- Data buffers will be cleared
- Current tape position will be retained
- Current tape status will be retained
- Current On/Off-Line status will be retained

The appropriate commands to selectively clear the device are sent. However, the device response to these commands is not tested. To test the response, use other sections such as Identify, Loopback and Device Status.

```
Section 2 -- CLEAR
End of Section 2 -- CLEAR
```

Section 3—IDENTIFY

This section requests the specified tape drive to identify itself in order to determine whether it is responding. If not, an error message will be displayed and the program aborted. Otherwise, the user will be informed of the device identity. The ID code, the device mnemonic HP*nnn*A, and the current firmware revision number will be displayed.

If the code does not match one of the devices which the program recognizes, a warning will be issued and the user prompted for one of the known, valid identification codes to use to diagnose the device. If none is supplied, the program will terminate. Otherwise, the execution will continue on the selected provisional basis.

```
Section 3 -- IDENTIFY

   =-=-=-=-=-=-=-=-=-= DEVICE IDENTIFICATION =-=-=-=-=-=-=-=-=-=

      HPIB code  = hhhh - Device is recognized as a
                          reel tape drive.
      Product    = HPnnnnc
      Available
        densities:
                   density (e.g. 1600 PE)
                   density (e.g. 1600 PE)
                         :          :
                         :          :
      RAM          :nnn KBytes
      Firmware     :
                   processor name   nn.nn.nn
                   processor name   nn.nn.nn
                         :          :
                         :          :

End of Section 3 -- IDENTIFY
```

Section 4—LOOPBACK

This section will test the HPIB Communication Link between the host and selected tape drive.

```
Section 4 -- LOOPBACK
   Tape Drive data channel checks out OK.
End of Section 4 -- LOOPBACK
```

{*or*}

```
Section 4 -- LOOPBACK

   The following transmission errors were detected during the
   loopback test:

              Hex Value          Hex Value       Erroneous bits
Byte #      Transmitted          Received          01234567
======      ===========        ===========       ==========
 12             56                 54             00000010
 33             7F                 3D             01000010
  .              .                  .                .
  .              .                  .                .
  .              .                  .                .

End of Section 4 -- LOOPBACK
```

Section 5—SELFTEST

This section will attempt to isolate and identify a problem by requesting the device to run one or more of its own built-in selftests.

Error class is a general classification of the type of error according to one of the following:

- Runtime error
- Protocol error
- Diagnostic error
- Multi-processor error
- Read/write hardware status
- Read electronics status

Runtime and protocol errors will not normally detect faulty FRUs, whereas multi-processor errors test the communication between processors and may list more than one FRU if the problem cannot be isolated exactly. In that case, FRUs will be listed in order of probability of failure.

If the unit being tested is not capable of doing a particular selected step, the following message will be displayed and execution will continue with the next selected step.

```
***WARNING - The device selected was not designed to perform this step.
                                                    (REELWARN nnnnn)
```

Tape drive diagnostics are ordered hierarchically, such that some tests call many others. This implies that when a failure is detected, the remaining tests in the checkout may not be run. Secondary and tertiary problems might not be detected until the first problem is fixed, since reporting the first problem cancels the remaining tests. The details of each step within this section follows:

Step 20 **Complete electronics checkout:** This step will request a set of selftests which cause the device to check itself out as thoroughly as possible without requiring any interaction with a mounted tape and without intentionally causing RAM data destruction.

The following selftests will be run:

- HP7979A - Test Sequence #0
- HP7980A - Test Sequence #0
- HP7980XC - Test Sequence #0

```
Section 5 -- SELFTEST

   No faulty Field Replaceable Units (FRUs) were detected
   by device diagnostic #nnn.

                        {or}

   Device diagnostic #nnn detected the following failure:

    Error Class  -       error group according to device ERS
   [Detection    - (nnn) while name of detecting action          ]
   [             - (nnn) name of detecting proc. Processor/Program ]
   [             - (nnn) name of detecting test Test             ]
    Explanation  - (hhh) error explanation as listed in device ERS
    Faulty FRUs  - ( nn) FRU name as listed in device ERS
   [             - ( nn) FRU name as listed in device ERS        ]

                              {or}

   Device diagnostic #nnn was unable to either run to completion
   and/or isolate an FRU.  Error returned:

   Error Class  -      error group according to device ERS
   Explanation  - (hhh) error explanation as listed in device ERS

   End Step nn - {step name}

End of Section 5 -- SELFTEST
```

Note

This is a generalized example and except for the section header/trailer will be repeated for each step selected for execution. Selftest numbers will be displayed in decimal; error and FRU numbers in hexadecimal.

Section 6—DISPLAY DEVICE STATUS

This section will obtain, decode, and display 6 bytes of hardware status from the tape drive. The format of this status is fixed by HP-IB specifications, not the device itself, so that status will be consistent across devices, even though device specific statuses may be returned.

This section will cause the display of both the raw, uninterpreted values of each status register as well as several messages which will reflect, in words, the status of the drive. Registers 1-3 contain 1 bit status flags. Those flags which simply indicate status and not necessarily an error condition will generate a message regardless of their value. Error condition flags will cause message display only when set to true and their messages will be preceded by an asterisk(*). The wording of the messages will conform closely to those which appear in the HP7974/78/79/80 HPIB Interface Specifications.

Finally, the status will be checked for combinations of flag and error number settings which should not occur. An appropriate warning will be issued for each implausible combination.

The phrase "UNRECOGNIZED" will be applied to all items which have a value which is not known (i.e., invalid) to REELDIAG. These values are unexpected and will normally refer to a problem in the device itself or a change in the format of the hardware status.

```
Section 6 -- DISPLAY DEVICE STATUS
   ================================================================
                              DEVICE STATUS
   ================================================================

   RAW FORM:
         Register    Hex       DIO Map     Decimal
                     Value     87654321    Value(s)
            #1        hh       bbbbbbb
            #2        hh       bbbbbbb
            #3        hh       bbbbbbb
            #4        hh                    nn, nn
            #5        hh                    nnn
            #6        hh                    nnn
   ----------------------------------------------------------------

   INTERPRETED DRIVE STATUS:
       Tape drive is [ON-line, OFF-line]
       Immediate Response Mode is [ENABLED, DISABLED]
      *Device has been CLEARED/POWERED-ON since last command
      *Drive door is OPEN
   ----------------------------------------------------------------

   INTERPRETED TAPE STATUS:
       Tape is Write [ENABLED, PROTECTED]
       Tape density is [800cpi, 1600cpi, 6250cpi,
                        UNKNOWN/INVALID, UNRECOGNIZED]
       Tape position is [BOT, EOF, EOT, KNOWN, LOST, UNKNOWN/INVALID]
      *Tape RUNAWAY condition detected
      *Data TIMING error detected
   ----------------------------------------------------------------
```

```
   INTERPRETED I/O STATUS:
       Last command was [REJECTED, ACCEPTED, ACCEPTED but FAILED]
          - Last command was retried nnn times
            *Reject Class: [DEVICE reject, PROTOCOL reject,
                                        SELFTEST failure, #n]
            *Error location : [CONTROLLER, SERVO, FORMATTER, UNRECOGNIZED]
            *Error #hhh - error explanation
         *HPIB Command Parity Error detected
         *Unrecovered Data PARITY error detected
         *Unrecovered Data/Format Error (MTE)
         *RECOVERED error detected (STE)
***WARNING: The above status contains the following inconsistencies:

    (one or more of the following as appropriate:)

    - Conflicting tape density indicators
    - Conflicting tape position indicators

    - Conflicting error location indicators
    - Conflicting retry count and/or error recovery flags
    - Conflicting command status, reject reason, and/or
         error explanation
    - A problem was indicated, but no explanation
         was provided in Register 5
    - Register 5 implies a(n) [DEVICE reject,
                               FORMATTER,
                               CONTROLLER,
                               SERVO/tape position,
                               PROTOCOL reject,
                               unrecovered data/format]
         error but this is not fully indicated.

End of Section 6 -- DISPLAY DEVICE STATUS
```

Section 7—DISPLAY DEVICE LOG

This section will obtain, decode, and display pertinent information from the logs maintained by the tape drive itself. The information will be broken into logical groupings which are activated by separate steps. Also available is a step which displays the log dump in uninterpreted form.

Device memory organization is product dependent, but will be translated to fit the common display interface specified below. Display items which do not apply to a particular device will display the value "NA" for "not applicable". If an entire step does not apply to the selected device, a special message indicating so will be displayed and the remainder of the display ignored. The phrase "UNRECOGNIZED" will be applied to all items which have a value which is not known to REELDIAG. These values are unexpected and will normally refer to a problem in the device itself. Other details of memory organization can be found in the diagnostic ERS for each tape drive product.

Step 60 **Maintenance info:** This step will display the contents of normal operation counters and other information not contained in the error logs. This will include tape odometer, RAM odometer, current clock setting, number of power cycles, battery date, and version numbers. The string "NA" will be displayed for any information item which, by design, is not available from a particular device.

Step 61 **Configuration:** This step will indicate how the device is currently configured; i.e. selected gap size, write retrycount, whether or not archival rewind is enabled, etc.

The string "NA" will be displayed for any information item which, by design, is not available from a particular device. If the value of a particular configuration item has not been set (value = FF), the string "nv" will be displayed.

A warning will be issued for any configuration item which contains a value outside the documented range for that value for the selected device. A number will be supplied in the message which refers to the corresponding configuration value as documented in the ERS for the device. Also, in this case, coded values will be displayed as "UNRECOGNIZED" or "**"; whereas uncoded numeric values will be displayed despite the apparent error.

Step 62 **Fault log:** Each error recorded in the device's hard error log will be displayed in succession. Information from other drives will be adjusted to fit this format to provide a uniform interface. The interpreted displays will include error class/subclass, error explanation text, the name of the offending FRU, and lapsed time since last error.

Error class is a general classification of the type of error according to one of the following:

Runtime error
Protocol error
Diagnostic error
Multi-processor error
Read/write hardware status
Read electronics status

Different types of log entries will often require different interpretations and/or different display formats. Runtime and protocol errors will not normally detect faulty FRUs, whereas multi-processor errors test the communication between processors and may list more than one FRU since the problem cannot be isolated exactly. In that case, FRUs will be listed in order of probability of failure (if known). Read/write hardware status and read electronics status are reserved for later planned incorporation of 7974 and 7978 devices.

The items delimited with square brackets ([]) in the output below are displayed only if there is a pertinent value to be shown.

The actual number of entries which will be displayed will vary according to the number actually logged and the device itself. The maximum number of entries which should be displayed is as follows:

HP7974 - 10 entries
HP7978 - 10 entries
HP7979 - 30 entries
HP7980 - 30 entries

Step 63 **Error rates**: In addition to the error log, which records serious, usually fatal errors, the error rate log keeps track of the number of errors from which the device was able to recover on its own. Each loading of a tape generates a new entry. These entries will be shown in an interpreted format by the program.

The display will consist of 3 major sections. The first lists cumulative error rates for the device; the second lists error rates for the current loaded tape (if any); and the third displays the contents of the rest of the log (error rates for previous tapes).

The actual number of entries which will be displayed will vary according to the number actually logged and the device itself. The maximum number of entries which should be displayed is as follows:

HP7979 - 20 entries
HP7980 - 20 entries

Step 64 **Device Controller Statistics**: Finally, there are a number of useful information items found in the device controller log. These are the drive repositioning statistics (info item #20 on newer drives), tape auto load statistics (auto load drives only - info item #21) and gap gains.

Step 69 **Raw Dump**: This section will display the entire memory dump as a table of paired hex values. No attempt will be made to group the characters according to the logical units from the drive's point of view (the other steps effectively do most of that). Rather, the display is to be entirely device independent except for the number of bytes returned by the device, as follows:

HP7979 - 1509 bytes (variable)
HP7980 - 1509 bytes (variable)

Section 7 -- DISPLAY DEVICE LOGS

```
==========================================================================
                        MAINTENANCE INFO
==========================================================================

                Clock          : nnnnn:nn:nn
                Tape odometer  : nnnnnnnnnnnnnn.n feet
                RAM  odometer  : nnnnnnnnnn
                Power cycles   : nnnnn
                Battery date   : nn
                Versions:
                    processor   nn.nn.nn
                      :          :
                      :          :
End Step 60 - Maintenance Info

==========================================================================
                    POWER-ON CONFIGURATION VALUES
==========================================================================

   FRONT PANEL
         Allow FP configuration change     ENABLED/DISABLED
         Front panel media removal         ENABLED/DISABLED

         Prompt for archival rewind        ENABLED/DISABLED
         Prompt for data compression       ENABLED/DISABLED
         Operator selection timeout        ENABLED/nn

         Front panel language              ENGLISH/GERMAN/FRENCH/SPANISH
         Activity indicator symbol         "-"/"--"/"*"
         Gauge usage                       "BOT ..... EOT"/
                                           "Data in buffer ....."/
                                          "Queued commands/reports....."
     GENERAL CONTROL
         Allow FP configuration change     ENABLED/DISABLED
         Allow host configuration change   ENABLED/DISABLED

         Default write density             NONE/800/1600/6250/COMPRESSED
         FP density control lock           ENABLED/DISABLED
                                                 [HOST override]
         Auto online                       ENABLED/DISABLED
         Archival rewind                   ENABLED/DISABLED
                                                 [OVERRIDE prompt]
         Stop on failure                   ENABLED/DISABLED
         Report Recovered Errors           ENABLED/DISABLED
```

```
WRITE
    Immediate response mode          ENABLED/DISABLED
    Tape mark count to terminate
       immediate response mode       DISABLED/nn
    Retry count                      nn
    Gap size

      800cpi (NRZI)              MIN = n.nn MAX = n.nn
      1600cpi (PE)               MIN = n.nn MAX = n.nn
      6250cpi (GCR)              MIN = n.nn MAX = n.nn
  EOT stop                          ENABLED/DISABLED
    Holdoff timeout                 nn
    Startup point (8ths of memory)  n

DATA COMPRESSION
    Default                         COMPRESSED/UNCOMPRESSED
                                              [OVERRIDE prompt]
    Front panel request             COMPRESSED/UNCOMPRESSED
    Host request                    COMPRESSED/UNCOMPRESSED
    Host override of front panel    ENABLED/DISABLED
    Resulting request               COMPRESSED/UNCOMPRESSED

    Expansion protection            ENABLED/DISABLED

    Max record size                 nnn   Kbytes
    Max record tape marks           nnn
    Max record bytes                nnnn  Kbytes

    Max access tape marks           nn
    Max access bytes                nnnn  Kbytes

    Record optimization threshold   nn:1
    DC optimization threshold       nn:1
    DC optimization sample period   n     Bytes

READ
    Readahead mode                  ENABLED/DISABLED
    Tape mark count to terminate
       readahead mode               DISABLED/nn
    Retry count                     nn
    Trailing buffer                 n records (nn Kbytes)
    Startup point (8ths of memory)  n

INTERFACE
    Unload after rewind offline     ENABLED/DISABLED
    Device emulation                HP7974/HP7978/HP7979/HP7980

End Step 61 - Power-on Configuration Values
```

```
================================================================
                          ERROR LOG
================================================================
---------- 01 ----------------------------------------------------

      Error Class   -   error group according to device ERS
      [Detection    -   (nnn) while name of detecting action        ]
      [             -   (nnn) name of detecting test                ]
      [             -   (nnn) by name of detecting processor/program]
      [Explanation  -   (hhh) error explanation as listed in device ERS ]
      [Faulty FRUs  -   ( nn) FRU name as listed in device ERS      ]
                    -   ( nn) FRU name as listed in device ERS      ]
       Cumltv Time  -   nnnnn:nn:nn
       Lapsed Time  -   nnnnn:nn:nn
                    {or} Clock reset since last error
                         NOTE: Error occurred during power-on selftest.

---------- 02 ----------------------------------------------------
                                :
                                :
---------- nn ----------------------------------------------------

End Step 62 - Fault Log
```

CUMULATIVE SOFT ERROR RATES

800cpi (NRZI)	READ	WRITE	TOTAL
Density	*nnnncpi (ccc)*	*nnnncpi (ccc)*	
Hard Errors	*nnn*	*nnn*	*nnn*
Soft Errors	*nnnnn*	*nnnnn*	*nnnnn*
Bytes Processed	*n* X 10**nn	*n* X 10**nn	
Bytes/Soft Error	*n* X 10**nn {*and/or*}	*n* X 10**nn	

1600cpi (PE)	READ	WRITE	TOTAL
Density	*nnnncpi (ccc)*	*nnnncpi (ccc)*	
Hard Errors	*nnn*	*nnn*	*nnn*
Soft Errors	*nnnnn*	*nnnnn*	*nnnnn*
Bytes Processed	*n* X 10**nn	*n* X 10**nn	
Bytes/Soft Error	*n* X 10**nn {*and/or*}	*n* X 10**nn	

6250cpi (GCR)	READ	WRITE	TOTAL
Density	*nnnncpi (ccc)*	*nnnncpi (ccc)*	
Hard Errors	*nnn*	*nnn*	*nnn*
Soft Errors	*nnnnn*	*nnnnn*	*nnnnn*
Bytes Processed	*n* X 10**nn	*n* X 10**nn	
Bytes/Soft Error	*n* X 10**nn	*n* X 10**nn	

```
==========================================================================
                        CURRENT TAPE ERROR RATE
==========================================================================

          nnnncpi (ccc)    READ          WRITE         TOTAL
                           ------------  ------------  ----------
          Hard Errors       nnnnn         nnnnn         nnnnn
          Soft Errors       nnnnn         nnnnn         nnnnn
          Bytes Processed   n X 10**nn     n X 10**nn
          Bytes/Soft Error  n X 10**nn     n X 10**nn


==========================================================================
                          ERROR RATE LOG
==========================================================================
---------- 01 ------------------------------------------------------------

          nnnncpi (ccc)    READ          WRITE         TOTAL
                           ------------  ------------  ----------
          Hard Errors       nnnnn         nnnnn         nnnnn
          Soft Errors       nnnnn         nnnnn         nnnnn
          Bytes Processed   n X 10**nn     n X I0**nn
          Bytes/Soft Error  n X 10**nn     n X 10**nn

          Load Time         - nnnnn:nn:nn


---------- 02 ------------------------------------------------------------
                              :
                              :
---------- nn ------------------------------------------------------------

End Step 63 - Error Rates
```

```
==========================================================================
                    DRIVE CONTROLLER STATISTICS
==========================================================================

Drive Repositioning:

      Forward reposition error - mean          nn mils
      Forward reposition error - variance      nn mils squared

      Reverse reposition error - mean          nn mils
      Reverse reposition error - variance      nn mils squared

Tape Auto Load:

      Loads attempted                          nnnnn
      Successful loads                         nnn%
      Successful loads requiring retries       nnn%

Gap Gains:

                      800 (NRZI)   1600 (PE)    6250 (GCR)
                      ----------   ---------    ----------
            Track  1     hhhh         hhhh         hhhh
                   2     hhhh         hhhh         hhhh
                   3     hhhh         hhhh         hhhh
                   4     hhhh         hhhh         hhhh
                   5     hhhh         hhhh         hhhh
                   6     hhhh         hhhh         hhhh
                   7     hhhh         hhhh         hhhh
                   8     hhhh         hhhh         hhhh
                   9     hhhh         hhhh         hhhh

                Average  hhhh         hhhh         hhhh

End Step 64 - Drive Controller Statistics
```

```
================================================================
                          RAW DUMP
================================================================

          0    1    2    3    4    5    6    7    8    9
WORDS ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
    0| hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh
   10| hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh
   20| hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh
     :    :    :    :    :    :    :    :    :    :
     :    :    :    :    :    :    :    :    :    :
```

End Step 69 - Raw Dump
End of Section 7 -- DISPLAY DEVICE LOGS

Section 10—I/O PATH TROUBLE TREE

This section will check out the device as thoroughly as possible without requiring exclusive level access to the device. The trouble tree will determine whether the device is up and responding, and whether the HPIB channel appears to be free of problems.

This section is nondestructive since the tests will not clear data buffers or otherwise reset the device.

Note

This trouble tree is NOT destructive, nor does it require on-site manual assistance.

The user will be informed of the status (PASSED, FAILED, or REJECTED) of each node of the trouble tree as it is executed, until a terminus is reached. At that point, a list of suspected problems and/or a list of follow-up suggestions will be displayed.

The output listed below for this section refers to, and is representative of anticipated conditions, but may not be fully inclusive of all possible situations.

OUTPUT

```
Section 10 -- IO PATH TROUBLE TREE
```

{Scenario 1:}

```
    TIME-OUT : Device identification

    SUSPECT:  (in descending order of probability)
        1. Device powerfail
        2. Device not at specified address
        3. HPIB cable/cable connections
        4. HPIB interface
        5. HPIB adapter
        6. Bad channel
```

{Scenario 2a:}

```
    REJECTED: Device identification
    SUSPECT:  (in descending order of probability)
        1. HPIB interface
        2. HPIB adapter
        3. Bad channel
```

{Scenario 2b:}

```
    FAILED    : Device identification
       HPIB code  = hhhh - WARNING: Device is not recognized
                                          as a reel tape drive.

    SUSPECT:  (in descending order of probability)
        1. HPIB interface
        2. HPIB adapter
        3. Bad channel
```

{Scenario 3}

```
    PASSED    : Device identification
    REJECTED  : HPIB Loopback test

    SUSPECT:  (in descending order of probability)
        1. HPIB cable
        2. HPIB interface
        3. HPIB adapter
        4. Channel adapter
```

{Scenario 4:}

```
    PASSED    : Device identification
    FAILED    : HPIB Loopback test

    SUSPECT:  (in descending order of probability)
        1. HPIB cable
        2. HPIB interface
        3. Data buffer
        4. HPIB adapter
        5. Channel adapter
```

{Scenario 5:}

```
    PASSED    : Device identification
    PASSED    : HPIB Loopback test

    NO PROBLEMS DETECTED.
       Suggestions for further action:

          1. Run electronics checkout trouble tree.

End of Section 10 -- IO PATH TROUBLE TREE
```

Section 11—DRIVE ELECTRONICS TROUBLE TREE

This section will check out the device as thoroughly as possible without on-site assistance (tape handling), and without taking excessively long to complete. The trouble tree will determine whether the device is up and responding, whether the HPIB channel appears to be free of problems, and whether the basic data processing hardware of the device reports that it is functioning correctly.

This section is destructive, since the tests may clear data buffers and otherwise reset the device or even declare it unuseable by processes other than diagnostics. The tree is not designed to read to or write from tape.

Note

This trouble tree is DESTRUCTIVE and does NOT require on-site manual assistance.

The user will be informed of the status (PASSED, FAILED, or REJECTED) of each node of the trouble tree as it is executed, until a terminus is reached. At that point, a list of suspected problems and/or a list of follow-up suggestions will be displayed.

OUTPUT

```
Section 11 -- DRIVE ELECTRONICS TROUBLE TREE

{Scenario 1:}

   TIME-OUT: Device identification

   SUSPECT:   (in descending order of probability)
          1. Device powerfail
          2. Device not at specified address
          3. HPIB cable/cable connection
          4. HPIB interface
          5. HPIB adapter
          6. Bad channel


{Scenario 2a:}

    REJECTED  : Device identification

    SUSPECT:   (in descending order of probability)
          1. HPIB interface
          2. HPIB adapter
          3. Bad channel
```

{Scenario 2b:}

```
PASSED    : Device identification
     HPIB code  = hhhh - WARNING: Device is not recognized
                                        as a reel tape drive.

  SUSPECT:  (in descending order of probability)
      1. HPIB interface
      2. HPIB adapter
      3. Bad channel
```

{Scenario 3}

```
  PASSED   : Device identification
  REJECTED : HPIB Loopback test

  SUSPECT:  (in descending order of probability)
      1. HPIB cable
      2. HPIB interface
      3. HPIB adapter
      4. Channel adapter
```

{Scenario 4:}

```
  PASSED   : Device identification
  FAILED   : HPIB Loopback test

  SUSPECT:  (in descending order of probability)
       1. HPIB cable
       2. HPIB interface
       3. Data buffer
       4. HPIB adapter
       5. Channel adapter
```

{Scenario 5:}

```
  PASSED   : Device identification
  PASSED   : HPIB Loopback test
  REJECTED : Power-on selftest sequence

  SUSPECT:  (in descending order of probability)
      1. Drive controller
```

{*Scenario 6:*}

```
PASSED   : Device identification
PASSED   : HPIB Loopback test
FAILED   : Power-on selftest sequence

SUSPECT:  (in descending order of probability)
    1. FRU - name of suspected failing component/FRU
    1. FRU - name of suspected failing component/FRU
```

{*Scenario 7:*}

```
PASSED   : Device identification
PASSED   : HPIB Loopback test
FAILED   : Power-on selftest sequence

NO PROBLEMS DETECTED.
   Suggestions for further action:

      1. Read logs; use exerciser to run specific
          tests for log problems.
      2. RUN R/W trouble tree

End of Section 11 -- DRIVE ELECTRONICS TROUBLE TREE
```

Section 12—R/W FUNCTION TROUBLE TREE

This tree is intended to diagnose major tape transport and read/write problems in a short period of time. Normally, the electronics trouble tree (section 11) should have been already run with a "pass" status. Any failures will be isolated as far as possible without an undue expenditure of time. If an intermittent and/or media problem is suspected after running this tree, the media check trouble tree, which can take a substantial amount of time to complete, may be run.

Since this tree may cause data to be written to or read from tape, **REELDIAG** will prompt the user for confirmation before reading or writing tape, if a tape is found already loaded, prior to the first r/w operation.

Note

This trouble tree is DESTRUCTIVE, and it requires on-site MANUAL ASSISTANCE.

The user will be informed of the status (PASSED, FAILED, or REJECTED) of each node of the trouble tree as it is executed, until a terminus is reached. At that point, a list of suspected problems and/or a list of follow-up suggestions will be displayed.

OUTPUT

```
Section 12 -- R/W FUNCTION TROUBLE TREE

{Scenario 1:}

    REJECTED : Power-on selftest sequence

    SUSPECT:   (in descending order of probability)
        1. Data path
        2. Drive controller

       Suggestions for further action:
          1. Run electronics trouble tree

{Scenario 2:}

    FAILED   : Power-on selftest sequence

    SUSPECT:   (in descending order of probability)
        1. FRU - name of suspected failing component/FRU
        2. FRU - name of suspected failing component/FRU
```

{*Scenario 3:*}

```
PASSED   : Power-on selftest sequence
FAILED   : Servo test

SUSPECT:   (in descending order of probability)
 {if FRUs given}
    1. FRU - name of suspected failing component/FRU
    2. FRU - name of suspected failing component/FRU
 {or otherwise}
    1. Drive controller
    2. Encoder/capstan
    3. Motor
    4. Power supply
```

{*Scenario 4:*}

```
PASSED   : Power-on selftest sequence
PASSED   : Servo test
FAILED   : Data buffer test

SUSPECT:   (in descending order of probability)
 {if FRUs given}
    1. FRU - name of suspected failing component/FRU
    2. FRU - name of suspected failing component/FRU
 {or otherwise}
    1. Data Buffer
```

{Scenario 5:}

```
PASSED   : Power-on selftest sequence
PASSED   : Servo test
PASSED   : Data buffer test
FAILED   : R/W formatter test


SUSPECT:   (in descending order of probability)
 {if FRUs given}
    1. FRU - name of suspected failing component/FRU
    2. FRU - name of suspected failing component/FRU
 {or otherwise}
    1. R/W FRU
    2. Formatter
```

{Scenario 6:}

```
PASSED   : Power-on selftest sequence
PASSED   : Servo test
PASSED   : Data buffer test
PASSED   : R/W formatter test
FAILED   : Actual R/W test - general
FAILED   : Actual R/W test - detailed

SUSPECT:   (in descending order of probability)
 {if FRUs given}
    1. FRU - name of suspected failing component/FRU
    2. FRU - name of suspected failing component/FRU
 {or otherwise}
    1. Heads/head connectors
    2. R/W board

  Suggestions for further action:
     1. Clean heads and run this trouble tree again
```

{*Scenario 7:*}

```
PASSED   : Power-on selftest sequence
PASSED   : Servo test
PASSED   : Data buffer test
PASSED   : R/W formatter test
FAILED   : Actual R/W test - general
PASSED   : Actual R/W test - detailed

SUSPECT:   (in descending order of probability)
 {if FRUs given}
    1. FRU - name of suspected failing component/FRU
    2. FRU - name of suspected failing component/FRU
 {or otherwise}
    1. Media
    2. Heads

  Suggestions for further action:
    1. Run media trouble tree
    2. Clean heads and run this trouble tree again
```

{*Scenario 8:*}

```
PASSED   : Power-on selftest sequence
PASSED   : Servo test
PASSED   : Data buffer test
PASSED   : R/W formatter test
PASSED   : Actual R/W test - general
PASSED   : Actual R/W test - detailed

NO PROBLEMS DETECTED
  Suggestions for further action:
    1. Run media trouble tree
```

End of Section 12 -- R/W FUNCTION TROUBLE TREE

Section 13—MEDIA TROUBLE TREE

This trouble tree will attempt to distinguish defective media from drive read/write hardware problems. It may also serve to identify and isolate intermittent hardware problems.

Large amounts of data must be written, read, and verified, making execution time only a minor constraining factor. It is expected that the electronics and read/write hardware trouble trees will have already passed before running this section.

If a branch in the tree is reached which requires an extensive period of time to complete (e.g., verifying the medium, erasing the tape, etc.), the user will be informed of how to break and abort that process.

Since this tree may cause data to be written to or read from tape, **REELDIAG** will prompt the user for confirmation before reading or writing tape, if a tape is found already loaded, prior to the first R/W operation.

Note

This trouble tree is DESTRUCTIVE and requires on-site MANUAL ASSISTANCE.

The user will be informed of the status (PASSED, FAILED, or REJECTED) of each node of the trouble tree as it is executed, until a terminus is reached. At that point, a list of suspected problems and/or a list of follow-up suggestions will be displayed.

The output listed below for this section refers to, and is representative of, anticipated conditions, but may not be fully inclusive of all possible situations.

OUTPUT

```
Section 13 -- MEDIA TROUBLE TREE


{Scenario 1:}

    FAILED   : Tape load

    SUSPECT:  (in descending order of probability)
        1. Human error
        2. Servo
        3. BOT sensor
        4. Medium
        5. Drive controller
        6. Door sensor

      Suggestions for further action:
         1. Manually correct tape load
         2. Run manual selftests 84-87, 90-93
         3. Run manual selftest 94
         4. Run manual selftest 88
```

{*Scenario 2:*}

```
PASSED    : Tape load
FAILED    : Write test

SUSPECT:  (in descending order of probability)
 {otherwise error code implicates hardware}
    1. Medium
    2. Heads

   Suggestions for further action:
      1. Rerun test & compare locations of failures
         If same suspect medium, otherwise heads.
```

{*Scenario 3:*}

```
PASSED    : Tape load
PASSED    : Write test
FAILED    : Read/verify

SUSPECT:  (in descending order of probability)
    1. Heads
```

{*Scenario 4:*}

```
PASSED    : Tape load
PASSED    : Write test
PASSED    : Read/verify

NO PROBLEMS DETECTED
   {If soft error count <= 2}
      A total of nnnnnnn soft errors indicates a GOOD tape.
   {If 2 < soft error count <= 10}
      A total of nnnnnnn soft errors indicates an OK tape.
   {If 10 < soft error count <= 50}
      A total of nnnnnnn soft errors indicates a MARGINAL tape.
   {If soft error count > 50}
      A total of nnnnnnn soft errors indicates a BAD tape.
```

End of Section 13 -- EXTENDED R/W FUNCTION TROUBLE TREE

Section 50—INTERACTIVE EXTERNAL EXERCISER

The REELDIAG External Exerciser is an interactive program which provides the user with access to a set of internal diagnostics and utilities within an HP7979 or HP7980 tape drive. The purpose of this exerciser is to aid service-trained personnel in troubleshooting tape drives to a replaceable assembly level.

This exerciser is, for the most part, an implementation of the MPE-V diagnostic TPUTIL with certain enhancements, and some renaming and reorganizing of commands to facilitate the objectives of REELDIAG. The following commands will be implemented:

```
Displays:          HWSTATUS
                   IDENTIFY
                   LOGS
                      ALL
                      CONFIGURATION
                      CONTROLLER
                      CUMULATIVE
                      FAULT
                      MAINTENANCE
                      RAW
                      TAPE

Diagnostics:       LOOPBACK (hpib)
                   MOTIONCHECK
                   SELFTEST
                   TREES
                      IOPATH
                      ELECTRONICS
                      READWRITE
                      MEDIA
                   WORKOUT

Tape commands:     IRM
                   LOADTAPE
                   REWIND
                   UNLOADTAPE

Utilities:         CLEARDEV
                   CLEARLOG
                     ALL
                     CUMULATIVE
                     FAULT
                     AUTOLOAD
                     REPOSITION
                     TAPE
                   CONFIGS
                   DECODE
```

Exerciser
control:

CANCEL
EXIT
HELP
REFRESH
SUSPEND

Commands For Interactive External Exerciser

When the external exerciser is invoked, the following prompt will be displayed to the user:

```
REELDIAG>
```

The prompt indicates that the exerciser is waiting for a command from the user. When the user enters a command that is recognized by the external exerciser, that command will then be processed according to the corresponding command description given below.

Some commands may not be available if the requested device could not be locked for exclusive access. Exit from the exerciser will be accomplished via the EXIT command. Syntax and usage help will be available via the HELP command.

If the user enters an unrecognized command the following error message with one or more of the applicable additional explanations will be displayed. The user will then be reprompted:

```
*** YOUR RESPONSE IS INVALID.  (REELERR 05008)

    -- ! is an unrecognized command;
       check spelling or type help for assistance.

    -- expected a numeric response.

    -- numeric response must fall between ! and !.

    -- response is not a valid integer number

    -- parameter "!" is unknown, is out of order,
       or is invalid for the command !.


REELDIAG>
```

Some commands will require some additional information from the user. In many cases, this information can be supplied in parameters to the command. If an invalid parameter is supplied, the following error message will be displayed. The user will then be prompted for remaining information as described in the following paragraphs.

```
*** UNEXPECTED PARAMETER (!) ENCOUNTERED.
```

If an unexpected parameter is encountered or the command does not accept parameters, additional prompts for the needed information will be displayed. These data prompts will be displayed in mixed case and will end with the prompt symbol ">". They will also include a range or selection of choices enclosed in parentheses and, where appropriate, a default selection, enclosed by square brackets, supplied by the program upon entry of a simple carriage return (<CR>). For example:

```
Enter the configuration value. (off|1..99) [OFF]>
```

The text enclosed in the parentheses indicates that the user is to type either "off" or an integer value between 1 and 99 inclusive. Each option is separated by a "|". The default response "off", as indicated by [OFF], would be assumed if the user simply entered a carriage return. For items like configuration values, the current value will normally be displayed as the default. If a default is not shown, the user will not be allowed to "default" the input by only entering a <CR>.

Keyword responses (e.g., command names) may be abbreviated but not below the minimum number of characters necessary to distinguish them from all other valid responses. Responses will not be case sensitive. In addition, some commands will have special 2 or 3 character abbreviations which will also be recognized. These abbreviations are listed next to the command name in help messages. Where possible, command names, abbreviations, and other characteristics will conform to similar commands in the proposed Support User Interface Standard.

The HELP keyword will be recognized at all prompts.

If an error is encountered as a result of issuing a command to the device, appropriate error messages as well as the hardware status that is returned by the device will be displayed. Status display will conform to that in in Section 6—Display Device Status. Note that some exerciser commands may issue several different device commands to the tape drive. Therefore, error messages may refer to command names other than those which are part of the exerciser.

Each command description below is in the following format:

COMMAND NAME:	The unabbreviated form of the command name.
USAGE:	Explanation of what the command does and when it should be used.
SYNTAX:	Listing of command syntax (including any special abbreviation) and any parameter descriptions.
DATA PROMPTS:	Prompts to be displayed for needed information not available from the command parameter list.
OUTPUT FORMAT:	Information printed as a result of this command being executed.
ERROR MESSAGES:	Any error messages worth noting that may be generated as a result of this command. Note that this does not imply that all possible error messages that may be generated are listed here, but rather, only those that are especially worth mentioning in relation to the command.

There are several conventions used throughout the command output descriptions. They are as follows:

n - refers to a decimal digit
(a 4-digit number would be represented as *nnnn*).

c - refers to an ASCII character.

h - refers to a hexadecimal digit (0-F).

o - refers to an octal digit (0-8).

b - refers to a binary digit (0-1).

text - is a description of what will appear at that spot.

Comments in the input and output sequences are enclosed in curly brackets. These comments are only part of this document and are not output by the program. For example, a command description may contain the following:

```
Do you wish to continue? (Y|N)[N]>

          {if response is "N" this command will terminate}
```

However, the actual output of the program would be only:

```
Do you wish to continue? (Y|N)[N]>
```

CLEARDEV

USAGE:

This command clears the selected device in a manner independent of the channel to which it is connected. This command causes the drive to be placed in a known condition as follows:

- Tape drive protocol will be restarted
- Data buffers will be cleared
- Current tape position will be retained
- Current tape status will be retained
- Current On/Off-Line status will be retained

SYNTAX:

```
CLEARDEV
CDEV
```

DATA PROMPTS:

```
None
```

OUTPUT FORMAT:

```
Device has been cleared.
```

CLEARLOG

USAGE:

This command is used to initialize (clear) various logs internal to the device. The user is given a choice of which log to clear or to clear all logs. This command can destroy valuable information and should be used with care.

SYNTAX:

```
CLEARLOG [log specifier]
CLOG
```

log specifier:

```
ALL        - All of the following clears will be done
CUMULATIVE - Cumulative rate logs for all densities
FAULT      - Hard error log
AUTOLOAD   - Tape auto load statistics
REPOSITION - Drive repositioning statistics
TAPE       - Soft error rate log
```

DATA PROMPTS:

```
Which log is to be initialized?
    ALL
    CUMULATIVE
    FAULT
    AUTOLOAD
    REPOSITION
    TAPE

Your selection [<cr> = none]>
```

OUTPUT FORMAT:

```
The specified log has been initialized.
```

CONFIGS

USAGE:

This command allows the user to read and/or set any standard device configuration value. The user will need access to and understanding of the documentation for the configurations which can be set (this can be found in the diagnostic ES for the device). Furthermore, many configuration items require passwords which are intended for restricted service personnel only.

The default value supplied for each configuration value prompt is the value as it currently exists in the device. If this default is taken, no change is even attempted so that power-on settings cannot be accidentally changed if power-on configuration by the host happens to be enabled. Thus, values for any configuration can safely be read without change by simply defaulting the new value (by entering <cr>) for the item selected.

SYNTAX:

```
CONFIGS [start# [/ end#]]
CNF
      Where start# and end# are both valid
            configuration item numbers (>=40,<=207)
            and start# <= end#.
      Note that end# is optional.  Note also that some values
      may not be valid for the device.  In this case, the next
      highest valid value will be used.
```

DATA PROMPTS:

```
      NOTE:  Default values = current setting. Configuration values
             will NOT be changed if the response is defaulted.
      {This note is issued only once at the beginning of each session}


      {The following is issued for each configuration item.}

      Configuration item #nn = nn.
      Enter the new value       (0..255)  [nnn]       >


      {The following is issued if no range or an invalid range is given}

      Enter configuration to set        (0..101) [<cr> = quit]>
      Configuration item #nn = nn.
      Enter the new value       (0..255) [nnn]       >
```

OUTPUT FORMAT:

```
      Configuration item ! remains at !.

      {or}

      Configuration item ! is now at !.
```

DECODE

USAGE:

This command enables the user to interactively decode front panel error codes and FRU codes.

SYNTAX:

```
DECODE
DC
```

DATA PROMPTS:

```
{For HP7979/80}
   Specify codes:
                    ERROR#  ($0..$fff) [$0]>
                    FRU 1#    (0..255)  [0]>
                    FRU 2#    (0..255)  [0]>
                    TEST #    (0..255)  [0]>
```

OUTPUT FORMAT:

```
 Error Class  - error group according to device ERS
[Detection    - while name of detecting action                ]
[             - by name of detecting processor/program        ]
[             - (nnn) name of detecting test                  ]
 Explanation  - (hhh) error explanation as listed in device ERS
 Faulty FRUs  - ( nn) FRU name as listed in device ERS
[             - ( nn) FRU name as listed in device ERS        ]
```

EXIT

USAGE:

This command terminates execution of the External Exerciser. It may be entered any time the REELDIAG> prompt appears.

SYNTAX:

```
EXIT
```

DATA PROMPTS:

```
None
```

OUTPUT FORMAT:

```
End of Section 50 -- INTERACTIVE EXTERNAL EXERCISER
```

HELP

USAGE:

This command provides the user with access to information concerning the commands that are available in the external exerciser. The user may request a list of all available commands accompanied by a brief description of each, or individual command descriptions. Individual command help contains a brief explanation of usage and describes command syntax.

SYNTAX:

```
HELP [command name|ALL]
?
```

OUTPUT FORMAT:

```
{If no parameter is specified, the following table of available
 commands will be displayed:}

DISPLAYS      TESTS         UTILITIES     COMMANDS      OTHER
------------- ------------- ------------- ------------- -------------

HWSTATUS      LOOPBACK      CLEARDEV      IRM           CANCEL
IDENTIFY      MOTIONCHECK   CLEARLOG      LOADTAPE      EXIT
LOGS          SELFTEST      CONFIGS       REWIND        HELP
              TREES         DECODE        UNLOADTAPE    REFRESH
              WORKOUT                                   SUSPEND
```

```
{If ALL is specified, the following alphabetical list with brief
 explanations will be displayed: }

   CLEARDEV      - Resets device to known state.
   CANCEL        - Aborts the function for which the user is
                     currently being prompted for data. (May be
                     used at any prompt.)
   CLEARLOG      - Resets user specified device internal log.
   CONFIGS       - Allows internal reconfiguration of drive.
   DECODE        - Decodes error messages as displayed on the
                   front panel of the drive.
   EXIT          - Terminates Interactive External Exerciser.
   HELP          - Displays descriptions of exerciser commands.
   HWSTATUS      - Obtains and displays device hardware status.
   IDENTIFY      - Displays device identification information,
                     including product code, firmware revs, etc.
   IRM           - Enables/disables Immediate Response Mode.
   LOGS          - Displays various device internal logs.
   LOADTAPE      - Loads a tape (on auto-loading drives) and places
                     drive on-line.
   LOOPBACK      - Tests HPIB link to device.
   MOTIONCHECK   - Exercises drive's ability to skip files & records.
   REWIND        - Rewinds the loaded tape to BOT.
   REFRESH       - Redisplays the current prompt (and associated menu).
   SELFTEST      - Executes of user specified sequence of
                     device selftests.
   SUSPEND       - Suspends execution of REELDIAG so that other
                     DUI commands can be executed.
   TREES         - Executes user specified REELDIAG diagnostic
                     trouble tree.
   UNLOADTAPE    - Rewinds and unloads a tape (auto-loading drives).
   WORKOUT       - Checks drive's basic ability to write & read data.

   {If a command name is specified, a message similar in form to
    the following for HELP (i.e., REELDIAG> help help) will be
    displayed:}

   HELP [command name|ALL]

     This command provides the user with access to information
     concerning the commands that are available in the external
     exerciser. The user may request a list of all available commands
     accompanied by a brief description of each, or individual
     command descriptions. Individual command help contains a brief
     explanation of usage and describes command syntax.
```

HWSTATUS

USAGE:

This command will obtain the current hardware status from the device and display it in readable text form.

On-line diagnostic utilities **LOGTOOL** and **IOTT** should be consulted for decoding status which has been obtained by other means.

SYNTAX:

```
HWSTATUS
HS
```

DATA PROMPTS:

```
None
```

OUTPUT FORMAT:

```
=================================================================
                          DEVICE STATUS
=================================================================

RAW FORM:
       Register   Hex       DIO Map     Decimal
                  Value     87654321    Value(s)
          #1       hh       bbbbbbbb
          #2       hh       bbbbbbbb
          #3       hh       bbbbbbbb
          #4       hh                    nn, nn
          #5       hh                    nnn
          #6       hh                    nnn
-----------------------------------------------------------------

INTERPRETED DRIVE STATUS:
    Tape drive is [ON-line, OFF-line]
    Immediate Response Mode is [ENABLED, DISABLED]
  * Device has been CLEARED/POWERED-ON since last command
  * Drive door is OPEN
-----------------------------------------------------------------

INTERPRETED TAPE STATUS:
    Tape is Write [ENABLED, PROTECTED]
    Tape density is [800cpi, 1600cpi, 6250cpi, 6250-COMPRESSED,
                     UNKNOWN/INVALID, UNRECOGNIZED]
    Tape position is [BOT, EOF, past EOT], UNKNOWN, UNRECOGNIZED]
  * Tape RUNAWAY condition detected
  * Data TIMING error detected
```

```
INTERPRETED I/O STATUS:
    Last command was [REJECTED, ACCEPTED, ACCEPTED but FAILED]
       - Last command was retried nnn times
       * Reject Class    : [DEVICE reject, PROTOCOL reject,
                           SELFTEST failure, #n]
       * Error location : [CONTROLLER, SERVO, FORMATTER, UNRECOGNIZED]
       * Error #hhh - error explanation
  * HPIB Command Parity Error detected
  * Unrecovered Data PARITY error detected
  * Unrecovered Data/Format Error (MTE)
  * RECOVERED error detected (STE)

  * WARNING: The above status contains the following inconsistencies:

         (one or more of the following as appropriate:)
             - Conflicting tape density indicators
             - Conflicting tape position indicators
             - Conflicting error location indicators
             - Conflicting retry count and/or error recovery flags
             - Conflicting command status, reject reason, and/or
                 error explanation
             - A problem was indicated, but no explanation
                 was provided in Register 5
             - Register 5 implies a(n) [DEVICE reject,
                                        FORMATTER,
                                        CONTROLLER,
                                        SERVO/tape position,
                                        PROTOCOL reject,
                                        unrecovered data/format]
                 error but this is not fully indicated.
```

IDENTIFY

USAGE:

This command requests device identification information from the drive. The HPIB code returned by the device as well as the product number (if determined) will be displayed. Note that since newer drives can masquerade as older drives with respect to HPIB, these two numbers may not necessarily be in agreement.

SYNTAX:

```
IDENTIFY
ID
```

DATA PROMPTS:

```
None
```

OUTPUT FORMAT:

```
=-=-=-=-=-=-=-=-=-= DEVICE IDENTIFICATION =-=-=-=-=-=-=-=-=-=

     HPIB code      = hhhh - Device is recognized as a
                             reel tape drive.
     Product        = HPnnnnc
     Available
       densities    :
                      density (e.g. 1600 PE)
          density (e.g. 1600 PE)
                                  :                 :
                                  :                 :
     RAM            : nnn KBytes
     Firmware       :
                      processor name   nn.nn.nn
                      processor name   nn.nn.nn
                               :               :
                               :               :

   {NOTE that this is identical to section 3 of REELDIAG}
```

ERROR MESSAGES:

The user will be informed if the device is either not a tape drive or is a tape drive but not diagnosed by REELDIAG.

Since complete identification involves several different tape commands, the failure of one command may make the determination of remaining items impossible.

IRM

USAGE:

This command is used to enable or disable immediate response mode on the drive. Drives will require this to be enabled in order to stream.

SYNTAX:

```
IRM
```

DATA PROMPTS:

```
Immediate Response Mode? (on|off) [!]>
```

OUTPUT FORMAT:

```
Immediate Response Mode is now !.  {! = enabled|disabled}
```

LOADTAPE

USAGE:

This command causes the automatic loading to be initiated. The drive will also be placed on-line if not already so. The command makes sense only for those drives which automatically load tapes (i.e., command is not available for HP7974s or HP7978s).

SYNTAX:

```
LOADTAPE
LT
```

DATA PROMPTS:

```
None
```

OUTPUT FORMAT:

```
Tape was successfully LOADed.
```

LOGS

USAGE:

This command displays the contents of a portion of the device logs. The user must specify which portion or form is to be displayed. The displays will be identical to those obtained by running section 7 of REELDIAG.

SYNTAX:

```
LOGS [log specifier]

    log specifier:
        ALL          - All of the following logs will be displayed
        CONFIGS      - Device power-on configuration values
        CONTROLLER   - Device controller log (e.g. gains,
                           drive repositioning stats, etc.)
        CUMULATIVE   - Cumulative soft error rates
        FAULT        - Hard errors
        MAINTENANCE  - Maintenance info (e.g. tape odometer,
                           device clock, battery date, etc.)
        RAW          - The entire log in hex
        TAPE         - Soft error rates for last 20 tapes
```

DATA PROMPTS:

```
Which log is to be displayed?
    ALL
    CONFIGS
    CONTROLLER
    CUMULATIVE
    FAULT
    MAINTENANCE
    RAW
    TAPE

Your selection [<cr> = none]>
```

OUTPUT FORMAT:

```
{For CONFIGS:}

------------------------------------------------------------------------
                    POWER-ON CONFIGURATION VALUES
------------------------------------------------------------------------

FRONT PANEL
    Allow FP configuration change     ENABLED|DISABLED
    Front panel media removal         ENABLED|DISABLED

    Prompt for archival rewind        ENABLED|DISABLED
    Prompt for data compression       ENABLED|DISABLED
    Operator selection time-out       DISABLED|nn

    Front panel language              ENGLISH|GERMAN|FRENCH|SPANISH
    Activity indicator symbol         "-"|"--"|"*"
    Gauge usage                       "BOT ..... EOT"|
                                      "Data in buffer ........"|
                                      "Queued commands/reports........"
GENERAL CONTROL
    Allow FP configuration change     ENABLED|DISABLED
    Allow host configuration change   ENABLED|DISABLED

    Default write density             HOST|NONE|800|1600|
                                             6250|COMPRESSED
    FP density control lock           ENABLED|DISABLED
                                             [HOST override]
    Auto on-line                      ENABLED|DISABLED
    Archival rewind                   ENABLED|DISABLED
                                             [OVERRIDE prompt]
    Stop on failure                   ENABLED|DISABLED
    Report recovered errors           ENABLED|DISABLED

WRITE
    Immediate response mode           ENABLED|DISABLED
    Tape mark count to terminate
       immediate response mode        DISABLED|nn
    Retry count                       nn
    Gap size
        800cpi (NRZI)                 MIN = n.nn" MAX = n.nn"
       1600cpi (PE)                   MIN = n.nn" MAX = n.nn"
       6250cpi (GCR)                  MIN = n.nn" MAX = n.nn"
    EOT stop                          ENABLED|DISABLED
    Holdoff time-out                  nn
    Startup point (8ths of memory)    n
```

```
DATA COMPRESSION
    Default                          COMPRESSED|UNCOMPRESSED
                                             [OVERRIDE prompt]
    Front panel request              COMPRESSED|UNCOMPRESSED
    Host request                     COMPRESSED|UNCOMPRESSED
    Host override of front panel     ENABLED|DISABLED
    Resulting request                COMPRESSED|UNCOMPRESSED

    Expansion Protection             ENABLED|DISABLED

    Max record size                  nnn  Kbytes
    Max record tape marks            nnn
    Max record bytes                 nnnn Kbytes

    Max access tape marks            nn
    Max access bytes                 nnnn Kbytes

    Record optimization threshold    nn:1
    DC optimization threshhold       nn:1
    DC optimization sample period    nnnn Bytes

READ
    Readahead mode                   ENABLED|DISABLED
    Tape mark count to terminate
       readahead mode                DISABLED|nn
    Retry count                      nn
    Trailing buffer                  n records (nn Kbytes)
    Startup point (8ths of memory)   n

INTERFACE
    Unload after rewind off-line     ENABLED|DISABLED
    Device Emulation                 HP7974|HP7978|HP7979|HP7980|
                                     HP7981
```

{For CONTROLLER:}

```
==========================================================================
                        CONTROLLER STATISTICS
==========================================================================

Drive Repositioning:

      Forward reposition error - mean          nn mils
      Forward reposition error - variance      nn mils squared

      Reverse reposition error - mean          nn mils
      Reverse reposition error - variance      nn mils squared

Tape Auto Load:

      Loads attempted                          nnnnn
      Successful loads                         nnn%
      Successful loads requiring retries       nnn%

Gap Gains:
                          800 (NRZI)   1600 (PE)    6250 (GCR)
                          ----------   ----------   ----------
              Track  1       hhhh         hhhh         hhhh
                     2       hhhh         hhhh         hhhh
                     3       hhhh         hhhh         hhhh
                     4       hhhh         hhhh         hhhh
                     5       hhhh         hhhh         hhhh
                     6       hhhh         hhhh         hhhh
                     7       hhhh         hhhh         hhhh
                     8       hhhh         hhhh         hhhh
                     9       hhhh         hhhh         hhhh

                  Average    hhhh         hhhh         hhhh
```

{For CUMULATIVE:}

CUMULATIVE SOFT ERROR RATES

800cpi (NRZI)	READ	WRITE	TOTAL
Hard Errors	*nnnnn*	*nnnnn*	*nnnnn*
Soft Errors	*nnnnn*	*nnnnn*	*nnnnn*
Bytes Processed	*n* X 10**nn	*n* X 10**nn	
Bytes/Soft Error	*n* X 10**nn	*n* X 10**nn	
	{*and/or*}		

1600cpi (PE)	READ	WRITE	TOTAL
Hard Errors	*nnnnn*	*nnnnn*	*nnnnn*
Soft Errors	*nnnnn*	*nnnnn*	*nnnnn*
Bytes Processed	*n* X 10**nn	*n* X 10**nn	
Bytes/Soft Error	*n* X 10**nn	*n* X 10**nn	
	{*and/or*}		

6250cpi (GCR)	READ	WRITE	TOTAL
Hard Errors	*nnnnn*	*nnnnn*	*nnnnn*
Soft Errors	*nnnnn*	*nnnnn*	*nnnnn*
Bytes Processed	*n* X 10**nn	*n* X 10**nn	
Bytes/Soft Error	*n* X 10**nn	*n* X 10**nn	

{For FAULT:}

```
=============================================================================
                              ERROR LOG
=============================================================================
---------- 01 -----------------------------------------------------------

     Error Class    -    error group according to device ERS
    [Detection      -    while name of detecting action                  ]
    [               -    by name of detecting processor/program          ]
    [               -    (nnn) name of detecting test                    ]
     Explanation    -    (hhh) error explanation as listed in device ERS
    [Faulty FRUs    -    ( nn) FRU name as listed in device ERS          ]
    [               -    ( nn) FRU name as listed in device ERS          ]
     Cumltv Time    -    nnnnn:nn:nn
     Lapsed Time    -    nnnnn:nn:nn
                    {or} Clock reset since last error
                         NOTE: Error occurred during power-on selftest.


---------- 02 -----------------------------------------------------------
                                  :
                                  :
---------- nn -----------------------------------------------------------
```

{For MAINTENANCE:}

```
======================================================================
                          MAINTENANCE INFO
======================================================================

               Clock         : nnnnn:nn:nn
               Tape odometer : nnnnnnnnnnnnnn.n feet
               RAM  odometer : nnnnnnnnnn
               Power cycles  : nnnnn
               Battery date  : 'nn
               Versions:
                  processor   nn.nn.nn
                       :             :
                       :             :
```

{For RAW}

```
======================================================================
                              RAW DUMP
======================================================================

                0    1    2    3    4    5    6    7    8    9
   WORDS      ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
          0| hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh
         10| hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh
         20| hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh hhhh
         :     :    :    :    :    :    :    :    :    :    :
         :     :    :    :    :    :    :    :    :    :    :
```

{For TAPE:}

```
======================================================================
                      CURRENT TAPE ERROR RATE
======================================================================
```

nnnncpi (ccc)	READ	WRITE	TOTAL
Hard Errors	nnnnn	nnnnn	nnnnn
Soft Errors	nnnnn	nnnnn	nnnnn
Bytes Processed	n X 10**nn	n X 10**nn	
Bytes/Soft Error	n X 10**nn	n X 10**nn	

```
================================================================
                      ERROR RATE LOG
================================================================
---------- 01 ----------------------------------------------------

nnnncpi (ccc)          READ          WRITE          TOTAL
                    ------------   ------------     ------
Hard Errors           nnnnn          nnnnn          nnnnn
Soft Errors           nnnnn          nnnnn          nnnnn
Bytes Processed     n X 10**nn     n X 10**nn
Bytes/Soft Error    n X 10**nn     n X 10**nn

Load Time     - nnnnn:nn:nn


---------- 02 ----------------------------------------------------
                               :
                               :
---------- nn ----------------------------------------------------
```

LOOPBACK

USAGE:

This command tests the HPIB Communication Link between the host and the selected tape drive. A 256 byte pattern is sent on the HPIB channel to the mag tape controller. The same number of bytes is read back out and the resulting pattern compared with the original.

SYNTAX:

```
LOOPBACK
LB
```

DATA PROMPTS:

None

OUTPUT FORMAT:

```
Tape Drive data channel checks out OK.

{OR}

The following transmission errors were detected during the
channel loopback test:
```

Byte #	Hex Value Transmitted	Hex Value Received	Erroneous bits 01234567
nn	*hh*	*hh*	*bbbbbbbb*
{EXAMPLE:}			
12	56	54	00000010
33	7F	3D	01000010
.	.	.	.
.	.	.	.
.	.	.	.

MOTIONCHECK

USAGE:

This command checks out basic tape movement functions of the drive. The tape will be partially erased and rewound. A set of 5 files (20 records each) will be written to tape and the tape rewound. The following sequence will then be executed:

```
+ = forward space
- = backward space

     + 1 files
          read record (to verify position : 2,1)
     - 2 file
          read record (to verify position : 1,1)
     + 1 record
          read record (to verify position : 1,3)
     - 2 records
          read record (to verify position : 1,2)
     + 3 files
     - 4 files
     + 2 files
     - 1 files
          read record (to verify position : 3,1)
     +11 records
     - 4 records
     +11 records
     -19 records
     + 2 records
          read record (to verify position : 3,4)
     + 4 files
          verify tape runaway
          rewind
     - 2 records
          verify past BOT
     - 2 files
          verify past BOT
```

Since this function may cause data to be written to or read from tape, **REELDIAG** will prompt the user for confirmation before reading or writing tape if a tape is found already loaded prior to the first R/W operation.

SYNTAX:

```
MOTIONCHECK
MC
```

DATA PROMPTS:

None

OUTPUT FORMAT:

```
No unexpected errors were encountered on Motion check.
{or}

   Expected position   : record #nn of file nn
   Detected position   : record #nn of file nn

*** MOTIONCHECK FAILED.  (REELDIAG 05054)
```

REWIND

USAGE:

This command causes the tape mounted on the drive to be rewound to BOT. The user has the option of leaving the tape on-line or off-line at the end of the operation.

SYNTAX:

```
REWIND [OFFLINE|ONLINE]
RW
     where:
         OFFLINE   - puts the drive off-line at the end of the rewind.
         ONLINE    - leaves the drive on-line at the end of the rewind.
```

DATA PROMPTS:

```
{If the user does not provide a parameter, the following will
 be issued: }

How should drive be left? (ONLINE|OFFLINE)  [ONLINE]>
```

OUTPUT FORMAT:

```
REWIND of tape was successful.
```

SELFTEST

USAGE:

This command will initiate internal diagnostic tests which reside in the tape drive. The tests which can be selected are device dependent and are fully described in the support documentation for each type of tape drive. The user will be prompted for all needed information but will require the aforementioned support documentation to select correct selftest numbers and parameter values.

The selftest may be automatically repeated up to 10,000 times. The execution count used is implemented at the diagnostic level and NOT within the device. The selftest request will be issued until the specified execution count is reached or until the selftest fails. The user can abort the selftest request by entering a loop count of 0. Once the selftest sequence has been started, the user may abort via the program interrupt which is conventional on the local system (CNTL-Y on MPEXL, CNTL-C on HPUX).

SYNTAX:

```
SELFTEST
ST
```

DATA PROMPTS:

```
Selftest number.      (0..255) [<cr>=quit]>
{                                          }
{parameter prompts are conditional depending on the}
{selftest number}                          }
Parm A                      (0..255) [0]>
Parm B                      (0..255) [0]>
Parm C                      (0..255) [0]>
Specify loop count (0..10000)|infinite)[1]>
```

```
{If the selected selftest is valid but requires manual interaction at }
{the device (other than loading a tape), the following will be issued:}

* Warning - Selftest (nnn) requires manual interaction at the device.

  Do you wish to continue anyway? (yes|no) [NO]>

{If "yes" is selected}
  This test will terminate in 7 minutes if you do not terminate it
  sooner from the front panel of the device.
```

OUTPUT FORMAT:

nnnnnnnnn out of *nnnnnnnnn* iterations were completed.

{The following conforms to section 3.4.4 of this document.}
No faulty Field Replaceable Units (FRUs) were detected
by device diagnostic #*nnn*.

{or}
Device diagnostic #*nnn* detected the following failure:

```
 Error Class  - error group according to device ERS
[Detection    - while name of detecting action                    ]
[             - by name of detecting processor/program            ]
[             - (nnn) name of detecting test                      ]
 Explanation  - (hhh) error explanation as listed in device ERS
 Faulty FRUs  - ( nn) FRU name as listed in device ERS
[             - ( nn) FRU name as listed in device ERS            ]
```

{or}
Device diagnostic #*nnn* was unable to either run to completion
and/or isolate an FRU. Error returned:

```
Error Class  -        error group according to device ERS
Explanation  - (hhh)  error explanation as listed in device ERS
```

ERROR MESSAGES:

Special warnings will be given the user upon selection of an invalid selftest code, depending on the code selected. In most cases the user will be prompted for a valid selftest.

```
***SELFTEST ! IS NOT IMPLEMENTED BY THE SELECTED DEVICE.

{or}

* Warning - Selftest (!) requires manual interaction at the device
            and/or returns results only to the front panel.

  Do you wish to continue anyway? (yes|no) [NO]>

 {or}

 *** SELFTEST ! IS NOT APPROPRIATE FROM A REMOTE TERMINAL.

     -- Use CONFIGS instead.
     -- Use SHOW LOGS instead.
     -- Use IDENTIFY  instead.
     -- Remote command sequences are unimplemented.
```

SUSPEND

USAGE:

This command temporarily suspends running of the diagnostic, allowing the user to issue other DUI commands. This feature should be handy for retaining any default values accumulated by WORKOUT or other REELDIAG functions. To return to REELDIAG, the user simply enters "resume" at the DUI prompt.

SYNTAX:

```
SUSPEND
```

DATA PROMPTS:

```
None
```

OUTPUT FORMAT:

```
DUI>
```

TREES

USAGE:

This command causes one of REELDIAG's diagnostic trouble trees to be executed.

SYNTAX:

TREES [*tree specifier*]

tree specifiers:

```
ALL                 - All of the following
IOPATH              - Does not require restrictive access to device.
ELECTRONICS         - Requires exclusive access to device.
READWRITE           - Requires exclusive access & operator assistance.
MEDIA               - Requires exclusive access & operator assistance.
```

DATA PROMPTS:

```
Which tree is to be executed?
    ALL
    IOPATH
    ELECTRONICS
    READWRITE
    MEDIA
Your selection [<cr> = none]>
```

UNLOADTAPE

USAGE:

This command causes the automatic unloading to be initiated. The request will be honored even if the tape has not been rewound. The command makes sense only for those drives which automatically load tapes (i.e., command is not available for HP7974s or HP7978s).

SYNTAX:

```
UNLOADTAPE
ULT
```

DATA PROMPTS:

```
None
```

OUTPUT FORMAT:

```
Tape was successfully UNLOADed.
```

WORKOUT

USAGE:

Introduction

This command provides the user with a way to read and write to tape in a variety of ways. This function should be useful in isolating medium vs. drive problems, verifying media, isolating certain classes of read/write problems, and simulating system use of the tape drive.

This command will cause records to be written to tape, the tape rewound, and those same records read back off the tape. The user will have the option of whether or not to verify that the records read match those written earlier. The user will be able to vary the write density record sizes (file size will be a constant 20 records per file), record content, number of files per tape, and number of tapes. In addition, the command has certain built-in error count limits, but these can be overridden.

This command will always clear the drive's internal error log prior to writing to the tape. The user will be warned of this and may thenback out of the command to look at and/or record the log by typing **CANCEL** at any prompt.

Since this function may cause data to be written to or read from tape, **REELDIAG** will prompt the user for confirmation before reading or writing tape if a tape is found already loaded prior to the first R/W operation. The tape will be rewound and left on-line at the end of this command.

Data Selection

Data will be written as constant 20 record files. However, file size can be varied indirectly by manipulating record size. The record size choice will be limited by the minimum and maximum record size for the selected device, selected write density, and interface (60K for HPIB0). Selection of the "MIXTURE" option will vary record sizes between different files. In this case, the following pattern will be repeated until the specified number of files (see below) is reached:

```
1 file MAX  byte records
  :   :     :      :       (in 16 Kbyte increments)
1 file  16 kbyte records
1 file   4 kbyte records
1 file 256  byte records
1 file MIN  byte records
1 file 256  byte records
1 file   4 kbyte records
1 file  16 kbyte records
  :   :     :      :       (in 16 kbyte increments)
1 file MAX  byte records
  :   :     :      :       (in 16 kbyte increments)
1 file MIN  byte records
```

There will be a choice of byte patterns to be written to the tape. Each record will consist of repetitions of the pattern up to the record size limit specified. The "SEQUENTIAL" pattern writes the pattern 0,1, ... 254,255 (00..ff hex). The "ALTERNATING" pattern alternates between 00 and ff (all 0s and all 1s). The "BUTTERFLY" pattern attempts to change as many bits as possible in each successive non-repeating character - 0,255,1,254,3, ... (00,ff,01,fe,03, ...). If "SINGLE CHARACTER" is selected, the user will be prompted for a character (in hexadecimal representation). Each record is then filled with repetitions of that single character. "WORST CASE "data varies according to density format (i.e., NRZI, PE, GCR). Patterns to be sent in each of these cases are as follows:

```
NRZI (800 bpi) - 00,00,...
PE   (1600 bpi) - ff,ff,ff,f0,0f,00,00,00
GCR (1600 bpi) - 04,20,98,bc,20,04,bc,00
```

The number of files to be written per tape must be specified. The EOT option will allow continuous writes to the end of tape, however many records that turns out to be. In addition the number of tapes to be written is specified. Any number between 1 and 10000 is valid. Note that in this context, a tape to be written does not refer to an actual medium change, but rather to the cycle of "write records, rewind, read records, and rewind".

Data Verification

The ultimate success of the write/read operation can be determined by specifying record verification. This option will compare each record read to what this program originally sent, displaying any discrepancies. The user should note that this option may have a substantial effect on streaming since it slows the rate at which REELDIAG can read and accept new records. Normally, the first 10 character mismatches for any given record will be sufficient to identify a problem. However, the user will be allowed to specify any mismatch display limit.

The user will be notified if verification is prematurely disabled for any reason. Verification will be disabled for the current tape when any of the following conditions occur:

- A hard read/write error occurs.
- The specified record write/read mismatch limit is reached.

Error Processing

REELDIAG sorts hard errors into three major categories - fatal, ignorable, and recoverable. Fatal errors are serious enough to cause the remainder of processing for a particular tape to be aborted. In such a case, the appropriate error message(s) will be issued and the user will be returned to the REELDIAG> prompt.

Recoverable hard errors are those which may be corrected by REELDIAG. These include:

HPIB error	REELDIAG action
5 -write protection	Correct or prompt user to do so
11 -drive not on-line	Correct or prompt user to do so
-tape runaway	Rewind & start next tape

Ignorable errors are read/write hard errors for which the drive has already performed retries and tape repositioning. The user will be able to specify the number of ignorable errors to tolerate for each tape before that tape is aborted. If the user specifies a limit greater than one, no recovery will be attempted, but the processing will continue, despite the fact that the drive may have purged many records from its buffer. In addition, record verification will be disabled for that tape. The following HPIB error codes are considered ignorable:

READ	WRITE
41	41
45	45
47	
48..49	48..49
50..54	50..54
57..64	57..64
103..106	103..106

The user should note that even a failure due to exceeding the retry limit is considered ignorable, even though this may result in a tape runaway condition on a subsequent read.

If any of the following conditions is met, execution of the defined sequence for the current tape will cease, the tape will be rewound and processing of the next tape will be initiated.

- The number of files specified by the user has successfully been processed.
- The specified limit of ignorable read/write hard errors has been reached.
- The specified limit of record write/read mismatches has been reached.

Normally, execution of this command will cease when any of the following conditions is met:

- The number of tapes specified by the user has been processed.
- A fatal hard error occurs (e.g., loss of tension, rewind failure, etc.).
- The user stops processing with the program interrupt which is conventional on the local system (CNTL-Y on MPEXL, CNTL-C on HPUX). The user will be returned to the REELDIAG> prompt.
- The specified number of fatal hard errors has been reached.

The device internal log is a circular queue, so that if the specified error limit has been reached, the most recent errors will be available when the command finally terminates.

Sequences

The user will select one of several different read/write sequences. The user-defined sequence allows the user to select all of the pertinent parameters. The others run the workout with preselected values.

SHORT Sequence

The short sequence is intended to provide a brief checkout of basic functionality of the drive. Normally, the user will not suspect anything is wrong with the drive and will use this to verify that assumption.

For each of the content patterns listed below enough files will be written to tape to accommodate all of the record sizes in the mixture option. This will then be repeated for all densities available on the selected drive. The user will be able to select a loopcount for the entire sequence. The following values will be selected:

```
Write density              = (all available)
Record size                = mixture
Content pattern            = all 0s
                             then all 1s
                             then alternating
                             then worst case
Number of files/tape       = 15
Number of tapes            = (user specified)
Soft error display         = no
Record verification        = yes
Mismatch display limit     = 10
Mismatch record limit      = 10
Ignorable hard error limit = 1
Fatal hard error limit     = 1
```

LONG Sequence

The long sequence is also intended to check out a drive which is not suspected of failing (i.e., new or just repaired). Since this sequence writes to end of tape several times, users should select a length of tape appropriate to their time constraints.

For each of the content patterns listed below, 16KByte records will be written to the end of tape (EOT). This will then be repeated for all densities available on the selected drive. The user will be able to select a loopcount for the entire sequence. The following values will be selected:

```
Write density              = (all available)
Record size                =   16KBytes
Content pattern            =   all 0s
                             then sequential
                             then worst case
Number of files/tape       = EOT
Number of tapes            = (user specified)
Soft error display         = no
Record verification        = yes
Mismatch display limit     = 10
Mismatch record limit      = 10
Ignorable hard error limit = 10
Fatal hard error limit     = 1
```

MEDIACHECK Sequence

The mediacheck sequence checks an entire tape to determine if it is good. The user will select the density to be written to the tape. The number of any record which has been retried will be displayed along with the number of retries. Soft errors are tallied and displayed at the end as an indication of overall tape condition. The following values will be selected:

```
Write density              = (user specified)
Record size                = max
Content pattern            = all 1s
Number of files/tape       = EOT
Number of tapes            = 1
Soft error display         = yes
Record verification        = yes
Mismatch display limit     = 10
Mismatch record limit      = 10
Ignorable hard error limit = 100
Fatal hard error limit     = 1
```

SYNTAX:

```
WORKOUT [workout specifier]
WO
      workout specifier
            SHORT          - Quick check of read/write capabilities ( <5min.)
            LONG           - Extended check of read/write capabilities
            MEDIACHECK     - Checks condition of loaded tape (destructive)
            USERDEFINED    - User is prompted for read/write parameters
```

DATA PROMPTS:

```
        {The defaults shown for all prompts are the initial values for the}
        {first call to workout after entering the interactive section.}
        {Thereafter, the values from the previous call will be default.   }

        {If the workout type is not specified as a command qualifier, the}
        {user will be prompted for that information.                      }

            Specify workout:
                            (short
                             long
                             mediacheck
                             userdefined)
                                    Your selection [USERDEFINED] >
```

```
{For all options, the following will be issued}

WARNING - This command clears the drive's internal hard error log.
          If this is not desired, type "cancel" at any prompt.

{If "userdefined" is selected, the following prompts will obtain  }
{the required parameters.  The other media sequence options may  }
{use one or more of these prompts as well.                       }
    Specify write density:
          (NRZI800|PE1600|GCR6250|COMPRESSED)     [PE1600]>
    Specify record size in bytes:
                         (min..max|mixture)  [MIXTURE]>

    Specify content pattern:
        (sequential       [ff,00,01,02,..fe]
         alternating      [00,ff,00,ff,..]
         butterfly        [00,ff,01,fe,..]
         single           [you will be prompted]
         worst            [density dependent]  )

                                Your selection [SEQUENTIAL]>
   [Specify the desired character:
                                            ($$00..$$ff) [$$ff]>]
    Specify number of 20 record files per tape:
                                       (1..10000|EOT) [10]>
    Specify number of tapes (sequence repeats):
                                       (1..10000|infinite)  [1]>
    Should soft error counts be displayed?
                                                    (yes|no) [NO]>
    Do you wish to verify records?
                                                    (yes|no) [NO]>
   [Specify verification display limit?
               (mismatches per record):
                                                    (1..10000) [10]>]
    Specify maximum error limits:
          [Mismatched records/tape:                 (1..10000) [10]>]
           Ignorable r/w errors/tape:               (1..10000)  [1]>
           Total fatal hard errors (max log size = nn):
                                                    (1..10000)  [1]>
```

OUTPUT FORMAT:

```
{The user will be warned of any hard errors even if nonfatal}

*WARNING - A FATAL hard error occured while attempting to
           write record !.                          (REELWARN 07035)
*WARNING - An IGNORABLE hard error occured while attempting to
           write record ! of file !.          (REELWARN 07036)
*WARNING - A FATAL hard error occured while attempting to
           read record !.                           (REELWARN 07037)
*WARNING - An IGNORABLE hard error occured while attempting to
           read record !.                           (REELWARN 07038)
{If soft error display is selected, the following display will occur:}
     Record nnnnnnnnn of file nnn was retried nn times
     Record nnnnnnnnn of file nnn was retried nn times
       :         :         :     :       :     :
       :         :         :     :       :     :

     A total of nnnnnnnn retries were made on nnnnnnn records.

{If verification mode was selected, any mismatches found during the
 read phase will be shown as follows:}

*** RECORD READ DOES NOT MATCH THE DATA ORIGINALLY SENT. (REELERR 50xx)

          File   : nnnnnnnnn     Bytes written : nnnnn
          Record :         nn    Bytes read    : nnnnn

                     Hex Value     Hex Value    Erroneous bits
          Byte #      Written       Read          01234567
          ======   =========     =========    ==============
          nnnnnn       hh            hh          bbbbbbbb

         {EXAMPLE:}
              12       56            54           00000010
              33       7F            3D           01000010
               .        .             .              .
               .        .             .              .
               .        .             .              .

{If the specified mismatch  display limit is exceeded, the      }
{following message will be displayed:                           }

        Verification display has been SUPPRESSED for the rest of this record.

{Any time verification has been disabled, one or more of the
 following messages will be displayed as appropriate:}


* WARNING - Data verification has been DISABLED for the rest of
            this tape.                                  (REELWARN 7034)
```

```
            - nnnnn records failed verification.
            - fatal hard error encountered.
            - write operation produced ignorable hard errors.

{One of the following summary messages will be displayed as appropriate:}
    WORKOUT complete - nnnnn fatal hard errors were detected.
                     - nnnnn ignorable hard errors were detected.
                     - nnnnn records failed verification.
                     - nnnnn records were retried.
{OR}
*** WORKOUT ABORTED -- HARD ERROR LIMIT REACHED.  (REELERR 5047)
                     - nnnnn fatal hard errors were detected.
                     - nnnnn ignorable hard errors were detected.
                     - nnnnn records failed verification.
                     - nnnnn records were retried.
```

Error and Warning Messages

The following are general error/warning messages which may be encountered during the execution of REELDIAG. The system dependent error messages may be displayed by the subsystem along with any error message generated by this diagnostic. All error messages without the (REELERR #) trailer are generated by the subsystem. Errors which have explanatory notes (preceded by --) will normally display only one of the notes listed here. The "!" indicates the point at which context-dependent information is to be placed.

05000	***** THE SUPPLIED BUFFER IS TOO SMALL FOR REQUESTED TRANSFER OF ! BYTES. (REELERR 05000)**
CAUSE	The device attempted to return more data than the program was capable of receiving. Normally, the program should know how many bytes to expect for each message, so this is indicative of either 1) a device problem, or 2) a device update which has not yet been incorporated into the diagnostic program.
ACTION	Isolate which of the above causes applies. If 2, then notify your support engineer.

05001	***** TAPE DRIVE FAILED TO COMPLY WITH REQUEST. (REELERR 05001) RESULTING HARDWARE STATUS:**
CAUSE	The tape drive has acknowledged a request but refuses to comply. Normally the reason for the refusal is contained in the I/O status block which is displayed following this message.
ACTION	Correct any problems indicated by the status display (e.g. remove write ring from tape, place drive on-line, etc.) and then retry the diagnostic.

05002	***** REELDIAG ABORTING DUE TO FATAL ERROR. (REELERR 05002)**
CAUSE	This diagnostic has detected an error from which it cannot or should not recover.
ACTION	Correct problems indicated by previous error messages and then rerun the diagnostic if appropriate.

05003	***** UNABLE TO OBTAIN COMPLETE IDENTIFICATION OF DEVICE. (REELERR 05003)**
CAUSE	**REELDIAG** was unable to obtain device logs from the drive. Therefore, some identification information could not be determined. However, the device did respond to an identify command (supplied **HPIB** code).
ACTION	The program will attempt to do all functions possible with the information it does have. If this is not satisfactory, take further action based on I/O status returned.

05004	***** UNEXPECTED ERROR RETURNED BY THE DIAGNOSTIC SYSTEM. (REELERR 05004)**
CAUSE	An unexpected condition arose which is indicative of a problem outside this program.
ACTION	Report any immediately preceding errors to your support engineer.

05005 ***** UNEXPECTED ERROR ENCOUNTERED - LIKELY REELDIAG PROGRAM ERROR. REELDIAG ERROR LOCATION CODE = !. (REELERR 05005)**

CAUSE An unexpected condition arose which is indicative of an internal problem in this program. The error location code has meaning only to a support engineer in the context of the program source code.

ACTION Notify your support engineer.

05006 ***** RECEIVED INVALID RESPONSE FROM DRIVE. A DATA PATH OR DEVICE ERROR IS INDICATED. (REELERR 05006)**

CAUSE A response was received from the device but is not recognized by this diagnostic.

ACTION Further diagnosis of the drive is necessary. Run the loopback test (Section 4) to attempt to isolate the problem to the data path. If the device being tested is new and returns previously unused codes, modification of this program may eventually be necessary. In this case, notify your support engineer.

05007 ***** YOUR RESPONSE IS NOT A VALID INTEGER NUMBER. (REELERR 05007)**

CAUSE **REELDIAG** expected but did not receive an integer number as a response to a prompt for information.

ACTION You should be reprompted for the same information. Check your previous entry for non-numeric characters and/or an invalid base indicator and enter numeric digits only.

05008 ***** YOUR RESPONSE IS INVALID. (REELERR 05008)**

CAUSE A response was entered by the user which was in some way inappropriate for the prompt given. One of the following submessages will be provided as a detailed explanation:

```
-- ! is an unrecognized command;
   check spelling or type help for assistance.

-- expected a numeric response.

-- numeric response must fall between ! and !.

-- response is not a valid integer number

-- parameter "!" is unknown, is out of order,
   or is invalid for the command !.
```

ACTION Re-enter requested data or type "HELP" for prompt specific information. Data prompts often contain a range of valid responses enclosed in parentheses.

05009 ***** AN HPIB CODE OF ! WAS RETURNED WHICH IS DIFFERENT FROM THE PREVIOUS CODE. (REELERR 05009)**

CAUSE The HPIB identification of the accessed device has changed in the middle of the diagnosis. This would be expected if a different device is physically substituted (via cable connections) for the original device. Otherwise a problem in the device, driver, or HPIB interface is indicated.

ACTION **REELDIAG** considers this problem to be the same as being unable to identify the device at all and aborts further diagnosis. Cable connections should be checked for correctness.

05010	***** DEVICE HARDWARE STATUS COULD NOT BE OBTAINED. (REELERR 05010)**
CAUSE	**REELDIAG** is unable to obtain the device hardware status in either a response to a request or as an explanation of a failed request. Additional messages which further isolate the problem should precede this.
ACTION	Action is dependent on preceding error message(s). NOTE: This is an expected response for a loopback write failure. That is, when the device receives a faulty pattern from **REELDIAG**, it simply returns a failure status - neither a reply pattern nor an explanatory hardware status is returned.

05011	***** UNABLE TO SATISFY REQUEST TO !. (REELERR 05011)**
CAUSE	Some program request (substituted for !) could not be executed. Other explanatory messages should precede this. If the root cause was drive failure (REELERR 05001), this message will be preceded by a listing of the current hardware status for the drive. Note: Some sections make several different requests to the drive so that requests seemingly unrelated to the users actual request may be may fail. For example, section 3 (Identify) involves both an "identification" request and a "read log" request. In these cases, an additional error message will specify the actual failed request, made by the program on behalf of the user.
ACTION	Action is dependent on preceding error message(s) and device state as indicated in hardware status.

05012	***** IMPRACTICAL OR IMPOSSIBLE TO COMPLETE REMAINDER OF SECTION !. (REELERR 05012)**
CAUSE	The previous error was fatal to successful completion of the current section.
ACTION	Fix cause of previous error(s) and rerun this section of the diagnostic, if desired.

05013	***** IMPRACTICAL OR IMPOSSIBLE TO COMPLETE REMAINDER OF STEP !. (REELERR 05013)**
CAUSE	The previous error was fatal to successful completion of the current step.
ACTION	Fix cause of previous error(s) and rerun this step of the diagnostic, if desired.

05014	***** UNABLE TO RETRIEVE REQUESTED INFORMATION FROM DATA BUFFER. (REELERR 05014)**
CAUSE	The drive complied with the current request, but **REELDIAG** was unable to access information returned by the drive.
ACTION	Advisory only. Action dependent on preceding error message(s).

05015	***** UNABLE TO OBTAIN DATA BUFFERS FOR TALKING WITH THE TAPE DRIVE. (REELERR 05015)**
CAUSE	An area for data transfer between the device and **REELDIAG** could not be established in memory. Additional details should precede this message. The most likely cause is insufficient system resources (memory).
ACTION	Action dependent on preceding error message(s).

05016 ***** UNABLE TO CONTINUE EXECUTION OF REQUESTED DIAGNOSTICS. (REELERR 05016)**

CAUSE Either access to the device could not be obtained, and/or fatal error internal to the diagnostic system occurred while trying to establish access to the device.

ACTION Correct any immediately preceding error conditions and rerun the diagnostic if desired.

05017 ***** UNABLE TO RETRIEVE ONE OR MORE COMMANDS FROM THE MESSAGE CATALOG. EXECUTION WILL PROCEED USING NUMBER CODED INPUT ONLY:**

NO : 20003
YES : 20004
Numbered panel commands are entered as usual. (REELERR 05017)

CAUSE Either the message catalog is incorrect/corrupted or one or more commands are missing from the catalog.

ACTION You will be given the choice to continue on a number code basis or not (you must answer in the numeric codes for yes/no). In any case, your support engineer should ensure that all commands and keywords are properly listed in the system catalog.

05018 ***** UNABLE TO COMPLETELY DECODE HARDWARE STATUS. (REELERR 05018)**

CAUSE Some diagnostic program service unexpectedly failed, preventing complete decoding of device hardware status.

ACTION The hardware status displayed should be consulted but with the understanding that some information may be misleading or missing. This is normally not expected so your support engineer should be notified.

05019 ***** FAILED TO RECEIVE REPLY FROM THE DEVICE AFTER ! SECONDS. (REELERR 05019)**

CAUSE A reply from the selected device was not received within the specified time-out interval. Although this could result from extremely heavy system usage, the device or some intermediate hardware/software is probably not functioning properly.

ACTION If you selected the "ERRPAUSE" parameter in the **RUN** command, you be will given the opportunity to retry the function by answering "YES" to the continuation prompt. More than one retry will probably be fruitless.

05020 ***** SPECIFIED ERROR COUNT LIMIT HAS BEEN REACHED. (REELERR 05020)**

CAUSE The error limit specified in the "ERRCOUNT" parameter of **RUN** command has been reached, causing the diagnostic to abort further processing.

ACTION If this is not desired, either omit the ERRCOUNT parameter or set it to a higher value.

05022 ***** THE REQUESTED FUNCTION IS NOT CURRENTLY AVAILABLE ON THE SELECTED DRIVE. (REELERR 05022)**

CAUSE The requested function is not currently implemented by the diagnostic system for the device being tested.

ACTION If this is unexpected, notify your support engineer.

05023	***** THE REQUESTED COMMAND REQUIRES ! MODE. (REELERR 05023)**
CAUSE	The user either did not or was not able to request a restrictive enough operation mode (exclusive) to execute the requested function.
ACTION	Consult the Diagnostic Program Development Guide for information on operation modes and how to request them. You may need to obtain additional security clearance from your system manager.

05024	***** UNABLE TO RUN A DEVICE INTERNAL DIAGNOSTIC TEST. (REELERR 05024)**
CAUSE	A selftest/diagnostic which **REELDIAG** requested the device to execute was either invalid or did not run to completion.
ACTION	Action is dependent on accompanying error messages and returned hardware status. If the requested test was not recognized by the device, an adjustment to **REELDIAG** may be necessary and your support engineer should be notified.

05025	***** THE TIME STAMP RETURNED BY THE DEVICE WAS LARGER THAN EXPECTED BY REELDIAG AND THEREFORE COULD NOT BE DECODED. (REELERR 05025)**
CAUSE	A time stamp greater than 6.8 years was found. Time stamps this large are not expected from any device.
ACTION	If this is not an error for the device being diagnosed, consult your support engineer.

05026	***** UNABLE TO VERIFY DEVICE ID FOR DEVICE DEPENDENT OPERATION. (REELERR 05026)**
CAUSE	**REELDIAG** was attempting to perform a function which requires knowledge of specific device identification information. That information could not be obtained, and therefore, **REELDIAG** could not take the appropriate action(s).
ACTION	Correct problems described by preceding messages and rerun diagnostic if desired.

05027	***** REELDIAG WAS ASKED TO EXECUTE AN UNRECOGNIZED SECTION (!). (REELERR 05027)**
CAUSE	This is strictly an internal error for REELDIAG or for the diagnostic subsystem.
ACTION	Non-fatal advisory. Notify your support engineer.

05028	***** THE DRIVE REFERENCED A LOG ENTRY (!) WHICH IS LARGER THAN THE TOTAL NUMBER OF ENTRIES IN THE LOG (!). (REELERR 05028)**
CAUSE	The log header in the drive's memory specifies both the total number of entries in the log and the number of the most recent entry. These two numbers were found to conflict with one another. No entries will be displayed.
ACTION	This is indicative of a problem internal to the device. Execution of the selftest section of the diagnostic and/or specific RAM device selftests is recommended. Also, the raw dump of the controller memory (section 7, step 69) may be of use in determining the exact source of the problem.

05029	***** THE DEVICE DIRECTLY OR INDIRECTLY SPECIFIED A LOCATION (!) WHICH IS LARGER THAN THE TOTAL NUMBER OF BYTES IN THE LOG (!). THE LOG IS PROBABLY CORRUPTED AND SOME OR ALL OF THE FOLLOWING DATA MAY BE INVALID. (REELERR 05029)**
CAUSE	The drive returns a limited number of bytes of information for a log dump request. A pointer was found which directly or indirectly refers to a location past the last byte returned.
ACTION	This is indicative of a problem internal to the device. Execution of the selftest section of the diagnostic and/or specific RAM device selftests is recommended. Also, the raw dump of the controller memory (section 7, step 69) may be of use in determining the exact source of the problem.
05030	***** THE NUMBER OF BYTES IN THE LOG ARE LESS THAN THE MINIMUM LOG SIZE FOR THIS DEVICE. (REELERR 05030)**
CAUSE	A certain portion of any log dump contains a fixed size portion (in later devices this is the index to the variable portion of the log). Not all of this fixed size portion was returned.
ACTION	This is indicative of a problem internal to the device. Execution of the selftest section of the diagnostic and/or specific RAM device selftests is recommended. Also, the raw dump of the controller memory (section 7, step 69) may be of use in determining the exact source of the problem.
05031	***** REELDIAG CANNOT PROPERLY COMMUNICATE WITH THE USER. (REELERR 05031)**
CAUSE	The diagnostic subsystem could not obtain and/or return the the user's reply to REELDIAG.
ACTION	This error is unexpected and probably indicates an error in the diagnostic subsystem itself. A support engineer should be consulted.
05032	***** A SERIOUS LOG CORRUPTION HAS PRECLUDED DISPLAY OF THIS LOG. (REELERR 05032)**
CAUSE	A invalid log internal pointer or other value has been detected which precludes display of this particular portion of the log.
ACTION	This is indicative of a problem internal to the device. Execution of the selftest section of the diagnostic and/or specific RAM device selftests is recommended. Also, the raw dump of the controller memory (section 7, step 69) may be of use in determining the exact source of the problem.
05033	***** REELDIAG HAS DETECTED AN INCONSISTENCY BETWEEN THE PRODUCT CODE (!) AND THE HPIB CODE (!) RETURNED BY THE DEVICE. (REELERR 05033)**—This particular combination is known but is not supported.
CAUSE	The device is masquerading as some other device by returning the hpib code of that other device. This particular combination is recognized as a valid possibility for the drive but is not supported on this system.
ACTION	REELDIAG will prompt you for continuation permission. Further attempts to diagnose the device will result in unpredicted results. This configuration can be changed by your support engineer.

05034	***** REELDIAG HAS DETECTED AN INCONSISTENCY BETWEEN THE PRODUCT CODE (!) AND THE HPIB CODE (!) RETURNED BY THE DEVICE. (REELERR 05034)**—This particular combination indicates a device hardware problem.
CAUSE	The device is masquerading as some other device by returning the hpib code of that other device. This particular combination is invalid for any device known to REELDIAG and is not supported.
ACTION	REELDIAG will prompt you for continuation permission. Further attempts to diagnose the device will result in unpredicted results. This configuration can be changed by your support engineer.

05035	***** THIS DEVICE IS NOT YET DIAGNOSED BY REELDIAG. USE DIAGNOSTIC "DIAG7478" INSTEAD. (REELERR 05035)**
CAUSE	REELDIAG has not yet been enhanced to cover HP7974s & HP7978s. This enhancement is scheduled.
ACTION	Run the proper diagnostic for the device selected.

05036	*****YOU CURRENTLY HAVE ! ACCESS TO THE DEVICE. ! ACCESS IS REQUIRED TO EXECUTE THIS FUNCTION. (REELERR 05036)**
CAUSE	Normally, this will result from an attempt to execute a function which requires exclusive access to the device when that access mode has not been granted. It is probable that either you do not have sufficient security clearance or that someone else was probably using the device when you activated **REELDIAG**.
ACTION	Exit **REELDIAG**, attempt to prevent other processes from using the device, and rerun **REELDIAG**. If you need a higher security level, contact your system administrator. If you do not feel either of these is the problem, consult your support engineer.

05037	***** THE SPECIFIED DENSITY IS NOT AVAILABLE ON THE CURRENTLY SELECTED DEVICE. (REELERR 05037)**
CAUSE	A valid density was specified, but is not implemented by the device currently being diagnosed.
ACTION	The **IDENTIFY** command should provide you with a list of available densities.

05038	***** REELDIAG IS UNABLE TO POINT TO THE EXACT LOCATION OF THE FOLLOWING ERROR. (REELERR 05038)**
CAUSE	REELDIAG failed to obtain a pointer to the last parsed location in the users reply.
ACTION	This error is unexpected and probably indicates an error in REELDIAG or the diagnostic subsystem itself. A support engineer should be consulted.

05039	***** CONFIGURATIONS ACCESS IS NOT AVAILABLE ON THE SELECTED DEVICE. (REELERR 05039)**
CAUSE	Accessible device configurations are only available on some tape drives. REELDIAG has detected that the selected drive is not one of those.
ACTION	If you feel certain this should have been issued, it is possible REELDIAG does not have current device identification data. In this case request device identify (section 3 or identify command) and retry.

05040	***** TAPE COULD NOT BE LOADED. (REELERR 05040)**
CAUSE	An attempt to load a tape on the selected device failed. Probable causes include the user not making a tape available to the device to load or requesting a load on a device which does not have autoload capability.
ACTION	If the device has autoload capability and a tape is available, take action based on other messages displayed.

05041	***** TAPE COULD NOT BE UNLOADED. (REELERR 05041)**
CAUSE	An attempt unload a tape on the selected device failed. Probable causes include a tape not currently loaded or requesting an unload on a device which does not have autoload capability.
ACTION	If the device has autoload capability and a tape is loaded, take action based on other messages displayed.

05042	***** TAPE DRIVE COULD NOT BE PLACED ONLINE. (REELERR 05042)**
CAUSE	An attempt to place the tape on-line failed. This is expected if a tape is not loaded.
ACTION	Ensure that a tape is loaded on the drive. Take other action as suggested by other messages displayed.

05043	***** ! LOG(S) COULD NOT BE CLEARED. (REELERR 05043)**
CAUSE	An attempt to initialize an internal device log failed. Usually, this will result from trying to clear a log which is not maintained on the device or trying to clear a log on a device which does not support log clears.
ACTION	Retry with a valid log for the device. If the device and your selection are verified, this may indicate a device problem.

05044	***** CONFIGURATION ITEM ! COULD NOT BE SET. (REELERR 05044)**
CAUSE	The request to set a configuration item was rejected by the device.
ACTION	Take action based on other error messages displayed.

05045	***** TAPE WAS FOUND IN AN UNEXPECTED, ERRONEOUS POSITION (!). (REELERR 05045)**
CAUSE	The tape was found in an unexpected position, e.g. BOT after successfully writing a record to tape or at EOT after a successful rewind.
ACTION	This indicates a device problem.

05046	***** TAPE IS UNEXPECTEDLY AT THE EOT MARK. (REELERR 05046)**
CAUSE	The EOT marker was encountered when not expected. This may be the result of a device read error but will also happen if the user has not loaded a tape large enough to satisfy the requested number of record reads or writes.
ACTION	If this occurs on the read cycle of a workout command or trouble tree, a device problem should be suspected. Otherwise, if the user has specified a number of files other than "EOT", a larger tape is probably needed.

05047 ***** WORKOUT ABORTED -- HARD ERROR LIMIT REACHED. (REELERR 05047)**

CAUSE A workout sequence was prematurely aborted. This normally occurs when the specified limit of fatal errors has been exceeded.

ACTION Correct device problem based on accompanying messages.

05048 ***** MOTION CHECK COULD NOT BE PERFORMED - UNABLE TO WRITE MOTION CHECK SEQUENCE TO TAPE. (REELERR 05048)**

CAUSE The motioncheck function requires that a set of files be written to tape. It is this set of files on which the tape movement functions are tested. REELDIAG was unable to complete the write and therefore aborted the remainder of the check.

ACTION Take action based on the cause displayed for the write error.

05049 ***** RECORD READ DOES NOT MATCH THE DATA ORIGINALLY SENT. (REELERR 05049)**

```
Record : !          Bytes written : !
File   : !          Bytes read    : !
```

CAUSE A record read from the tape drive was expected to match the record written in a previous operation but did not. The mismatched bytes are listed following this message.

ACTION Fix tape drive.

05050 ***** FILE 2! CONTAINED FEWER THAN THE EXPECTED 1! RECORDS. (REELERR 05050)**

CAUSE An end of file mark was found before expected.

ACTION Fix tape drive.

05051 ***** FILE ! CONTAINED MORE THAN THE EXPECTED ! RECORDS. (REELERR 05051)**

CAUSE A data record was found where an end of file marker was expected.

ACTION Fix tape drive.

05052 ***** UNABLE TO VERIFY TAPE POSITION DOWN TO RECORD NUMBER. (REELERR 05052)**

CAUSE REELDIAG attempted to determine the exact position of the tape by reading a record with the file and record number in the header of the record. This read in some way failed.

ACTION The problem is probably in the device hardware. Take action based on the messages previous to this one.

05053 ***** AN END OF FILE WAS EXPECTED BUT NOT DETECTED. (REELERR 05053)**

CAUSE REELDIAG was expecting to he at the end of file on the tape, but some other tape position (e.g. valid data record or end of tape) was found. This is indicative of a drive problem.

ACTION Service tape drive as appropriate.

05054	***** MOTIONCHECK FAILED. (REELERR 05054)**
CAUSE	The sequence of motioncheck commands did not proceed as expected.
ACTION	Service tape drive as appropriate.

05055	***** THIS SECTION REQUIRES A WRITABLE (WRITE RING INSTALLED) TAPE TO BE LOADED ON THE DRIVE AT BOT AND THE DRIVE TO BE ON-LINE. (REELERR 05055)**
CAUSE	A section of REELDIAG was requested which requires writing to tape. It is not considered appropriate here to prompt for corrections, so the section is aborted.
ACTION	Load a tape with write ring installed, place the drive on-line, and retry the section. If all this is done correctly, suspect drive hardware problem.

07001	***WARNING - The I/O path to the drive may be faulty. Any results (good or bad) shown below might not originate at the drive. (REELWARN 07001)**
CAUSE	The I/O path between memory and the drive was not verified. This can result from a system internal error, an unimplemented test program, or an actual failure of the test, in which case a faulty field replaceable unit (FRU) should be displayed.
ACTION	If the test failed, further testing of the I/O path should be done. In any case, communication with the drive should be considered unreliable from this point on.

07002	***WARNING - The selected device was not designed to perform this step. (REELWARN 07002)**
CAUSE	A step was selected (perhaps as a default) which does not apply to the selected device.
ACTION	Advisory only. If this turns out to be unexpected or incorrect, a program adjustment may be needed - consult your support engineer.

07003	***WARNING - Conversions of very large numbers are done in base 10 only. (REELWARN 07003)**
CAUSE	REELDIAG attempted to display a number greater than 214783647 or less than -2147483648 in a base other than base 10.
ACTION	Advisory only. The number will be displayed in base 10. If this is unsatisfactory, notify your support engineer.

07004	***WARNING - An HPIB code of ! was returned. However, the device will continue to be diagnosed as though "!" had been returned. (REELWARN 07004)**
CAUSE	When the user directs the program to treat an unrecognized device as a known one, the device is labeled as experimental. This message will be issued upon each retry of the diagnostic when either the LOOPCOUNT or AUTORESTART parameters were specified in the DUI's **RUN** command.
ACTION	None, advisory only.

07005	***WARNING - Unable to mark tape drive as defective. (REELWARN 07005)**
CAUSE	**REELDIAG** detected a serious problem with the selected device and attempted to block further use of it by the system. This attempt failed.
ACTION	The device should be electronically or physically removed from the system until it is repaired or deemed operational again by this diagnostic.

07006	***WARNING - Unable to convert number to readable form. (REELWARN 07006)**
CAUSE	A numeric quantity could not be converted to its corresponding character string form for display purposes. The most likely cause is that the number was too bit to fit into the designated space. In any case, asterisks will be substituted for the number.
ACTION	This problem is not fatal to execution of the program, but a displayed message may lack part of its informational content as a result. This is normally unexpected and your support engineer should be notified.

07007	***WARNING - The selected device is not diagnosed by this program. HPIB code returned = !. (REELWARN 07007)**
CAUSE	The identification information returned by the device indicates that it is recognized as a reel type tape drive, but that **REELDIAG** was not designed to diagnose it.
ACTION	If in auto-diagnostic mode, the device will be treated as an HP7980 and diagnosis will continue on that basis. Otherwise, upon the original issue of this warning, the user will be given the opportunity to either exit or select a known device which **REELDIAG** will then pretend it is diagnosing.

07008	***WARNING - The selected device is not recognized as a reel tape drive. HPIB code returned = !. (REELWARN 07008)**
CAUSE	The identification information returned by the device indicates that it is not a magnetic reel type tape drive and, therefore, it is not diagnosed by REELDIAG.
ACTION	If in auto-diagnostic mode, the device will be treated as an HP7980 and diagnosis will run on that basis. Otherwise, upon the original issue of this warning, the user will be given the opportunity to either exit or select a known device which REELDIAG will then pretend it is diagnosing.

07009	***WARNING - The tape drive referenced an error log which is larger than this program is capable of handling. The log will be truncated to ! entries. (REELWARN 07009)**
CAUSE	Either the drive has errored in maintaining its non-volatile memory or the specification for the maximum size of logs has changed. In either case, as many entries as indicated will be decoded.
ACTION	If drive error is suspected, execution of the selftest section of the diagnostic and/or specific RAM device selftests is recommended. If the log is expected to be longer than the value given in the message, notify your support engineer.

07010	***WARNING - Data buffers granted this program by the diagnostic system were not as large as requested. One or more diagnostic functions may fail at a later time. (REELWARN 07010)**
CAUSE	**REELDIAG** did not receive as much data transfer memory as was requested.
ACTION	This is normally a system restriction which you may not be able to overcome. Some diagnostic functions may work just fine with a less than maximum needed area and **REELDIAG** will attempt to limp along on that basis. Other or all functions may fail for this reason. You may wish to notify your support engineer.

07011	***WARNING - The density of this mounted tape remains incompatible. Analysis requiring this density will be skipped. (REELWARN 07011)**
CAUSE	The user failed or refused to rectify a density conflict after being given a reasonable number of opportunities to do so.
ACTION	Advisory only. If this was not intentional on the part of the user, **REELDIAG** should be rerun with a tape of the requested density loaded on the drive.

07012	***WARNING - The drive remains in incorrect mode. Analysis requiring on-line status will be skipped. (REELWARN 07012)**
CAUSE	The user failed or refused, after a reasonable number of opportunities, to place the drive on-line or off-line as requested by **REELDIAG**.
ACTION	Advisory only. If this was not intentional on the part of the user, **REELDIAG** should be rerun and the drive placed in the requested mode as directed.

07013	***WARNING - The mounted tape remains write protected. Analysis requiring write enable will be skipped. (REELWARN 07013)**
CAUSE	The user failed or refused to place a write ring on the mounted tape.
ACTION	Advisory only. If this was not intentional on the part of the user, the tape should be dismounted, a write ring inserted, and **REELDIAG** rerun.

07014	***WARNING - Only the first ! bytes returned by the drive will be processed. (REELWARN 07014)**
CAUSE	The drive returned more data than **REELDIAG** expected. In this case the smaller, expected number of bytes will be processed. This will yield incomplete and/or erroneous information, but is given as a partial aid to the user.
ACTION	Your support engineer needs to informed of this problem. The diagnostic will continue, processing the smaller, expected number of bytes. However, this will yield incomplete and/or erroneous information, but is given as a partial aid to the user.

07015	***WARNING - Expected ! bytes of response from the tape drive. Received ! bytes instead. (REELWARN 07015)**
CAUSE	The amount of data returned by the device was not what **REELDIAG** expected. This might be reasonable for a new device under development. However, it can also result from a problem with the drive or any intervening hardware/software.
ACTION	Either error message 05018 or warning message 7014 is normally issued depending on the nature of the discrepancy. If this is unexpected, your support engineer should be notified.

07016	***WARNING - The number of entries in the log is greater than expected for this drive. (REELWARN 07016)**
CAUSE	Either the drive has errored in maintaining its nonvolatile memory or the specification for the maximum size of logs has changed. In either case, REELDIAG will attempt to display as many entries as indicated, even if some do not make sense.
ACTION	If drive error is suspected, execution of the selftest section of the diagnostic and/or specific RAM device selftests is recommended. If the log is expected to be longer than the value given in the message, notify your support engineer.

07017	***WARNING - The value (!) of configuration item #! is outside the expected range of ! - !. (REELWARN 07017)**
CAUSE	REELDIAG checks configuration values returned by the device against specified ranges for the device. If the value returned is less than the lower range value or greater than the higher range value, this warning is issued. REELDIAG will attempt to process the value in any case. The item number can be found in maintenance documents for the device.
ACTION	Check the specified range against device documentation. If the range is valid, a device error is indicated; otherwise, REELDIAG may need to be updated to new specifications. In either case, notify your support engineer.

07018	***WARNING - Density ! is not considered valid for the selected device. (REELWARN 07018)**
CAUSE	REELDIAG checks density requests against product capabilities. If the value requested density is not implemented on the device, this message will be displayed. REELDIAG will normally have forwarded the request to the device anyway. This message may also be displayed when decoding hardware status.
ACTION	Verify device identification and capabilities. If these are correct, a device hardware problem may be assumed. If associated with hardware status display, REELDIAG may need to be updated.

07019	***WARNING - An unexpected change in device identification was detected. (REELWARN 07019)**
CAUSE	The device returned and hpib identification code which is different that the previous one returned.
ACTION	None. If REELDIAG recognizes the new code, exectution will continue on the basis of that new identity, otherwise, the user will be prompted for a substitute ID.

07020	***WARNING - REELDIAG was not able to determine if the drive is equipped DATA COMPRESSION. The default is NOT EQUIPPED. (REELWARN 07020)**
CAUSE	The buffer board of the drive could not be determined.
ACTION	None. REELDIAG will continue as though the data compression option is not present.

07021	***WARNING - REELDIAG was not able to determine if the drive is equipped to handle 800bpi(NRZI) tapes. The default is NOT EQUIPPED. (REELWARN 07021)**
CAUSE	The read/write board of the drive could not be determined.
ACTION	None. REELDIAG will continue as though this option is not present.

07022	***WARNING - REELDIAG was not able to determine if the drive is equipped with an 8 or 16 bit processor. The default is 16 BIT. (REELWARN 07022)**
CAUSE	The buffer board of the drive could not be determined.
ACTION	None. REELDIAG will continue as though the drive is equipped with a 16 bit processor.

07023	***WARNING - Hardware identification was not obtained from the device . Diagnosis will continue on the basis of the HPIB code returned by the device. (REELWARN 07023)**
CAUSE	The device either did not recognize or could not comply with the request for hardware identification. The former condition is expected for HP7974s & HP7978s.
ACTION	None. Diagnosis will continue as far as possible based on the hardware normally associated with the HPIB code returned.

07024	***WARNING - Full identity of the physical device could not be obtained. Default values have been supplied as follows: (REELWARN 07024)**
CAUSE	The describe command (or some portion of the describe command simulation for earlier devices) failed. Rather than abort at this point, REELDIAG has chosen to continue with certain default information. Those default values are included in the identification information following this message.
ACTION	Diagnosis will continue as far as possible based on any other information available. If this is not desired, you may interrupt via the interrupt combination for the current operating system (e.g. CNTL-Y for MPE-XL, CNTL-B for HPUX).

07025	***WARNING - The log contained an unrecognized buffer controller ID code (!) Log decoding will proceed assuming an ID code of !. (REELWARN 07025)**
CAUSE	The first byte of the log did not contain a value recognized as valid by REELDIAG. This could be the result of a change in the device for which REELDIAG has not yet been updated.
ACTION	Diagnosis will continue as far as possible based on the latest version of the hardware known to REELDIAG. If this is an expected code for the device, contact your support engineer for correction of the diagnostic.

07026	***WARNING - The allocated io buffer is too small to handle the requested data transfer. (REELWARN 07026)**
CAUSE	This should only occur when the system was not able to grant an io buffer as large as requested by REELDIAG.
ACTION	Since this involves system allocation of memory resources, no specific action can be recommended here other than to rerun the diagnostic. If necessary, consult your support engineer.

07027	***WARNING - The data sent to the device has been truncated. (REELWARN 07027)**
CAUSE	This warning will always be preceded by REELWARN 07027. In this case, REELDIAG has determined that it is reasonable to attempt to continue.
ACTION	The user should be wary of results of the operation.

07028	***WARNING - Extra and/or invalid command parameters were encountered. These items will be ignored. (REELWARN 07028)**
CAUSE	The user has either incorrectly specified parameters in a command or supplied more parameters than expected. If an incorrect parameter was specified, all others, even correct ones will be ignored.
ACTION	This is non fatal. Extra parameters will be ignored and you will be prompted for any needed data.

07029	***WARNING - REELDIAG was unable to return data buffer resources to the system. (REELWARN 07029)**
CAUSE	REELDIAG did not succeed in releasing its hold on system memory resoureces.
ACTION	None - Advisory only. This is of no major consequence if you are exiting REELDIAG, but should be reported to your support engineer. If you are not exiting, REELDIAG will attempt to use that buffer if needed rather than requesting new resources.

07030	***WARNING - This command clears the drive's internal hard error log. If this is not desired, type "cancel" at any prompt. REELWARN 07030)**
CAUSE	The user has requested an operation which clears (initializes) the selected tape drive's internal error logs so that data may data may be accumulated from scratch.
ACTION	None - Advisory only. If the user has not already examined the error logs via REELDIAG's section 7 or 'displaylogs' command, typing 'cancel' at the next subsequent prompt will abort the clear and its associated task.

07031	***WARNING - Selftest ! does not return valid results to REELDIAG. The result of this test must be read at the front panel of the device. (REELWARN 07031)**
CAUSE	Certain selftest (especially interactive ones) always return a successful status when called remotely. REELDIAG believes the specified test is one of those.
ACTION	The results of this selftest must be read at the front panel of the device.

07032	***WARNING - Selftest ! requires manual interaction at the device. (REELWARN 07032)**
CAUSE	The specified selftest is interactive and requires physical manipulation of the tape drive. Furthermore, the reset button on the device front panel must be pressed before the device will return control to REELDIAG.
ACTION	Cause the required mechanical manipulation to be performed to the device. When done, press the reset button on the front panel of the device to cause it to return control to REELDIAG. If nothing is done, REELDIAG will time out after a reasonable period of time (usually about 5 minutes);

07033	***WARNING - An end of file was passed on a record skip request. (REELWARN 07033)**
CAUSE	A skip of the specified number of records resulted in the skip crossing over into the next file.
ACTION	Advisory only.

07034	***WARNING - Data verification has been DISABLED for the rest of this tape. (REELWARN 07034)**
CAUSE	Data verification is disabled for a tape whenever write or read operation creates a complex recovery situation or when the user specified limit of record mismatches for the tape has been reached.
ACTION	Correct causes of fatal/ignorable hard errors or specify a higher mismatched records limit, as appropriate.

07035	***WARNING - A FATAL hard error occured while attempting to write record !. (REELWARN 07035)**
CAUSE	The requested tape write operation failed in such a way that continuing to write to tape is sensless.
ACTION	Advisory only.

07036	***WARNING - An IGNORABLE hard error occured while attempting to write record ! of file !. (REELWARN 07036)**
CAUSE	The requested tape write operation failed but the failure is no considered to serious enough to stop writing. Record verification for this tape, however, will be turned off.
ACTION	Advisory only.

07037	***WARNING - A FATAL hard error occured while attempting to read record !. (REELWARN 07037)**
CAUSE	The requested tape read operation failed in such a way that continuing to reead the tape is sensless.
ACTION	Advisory only.

07038	***WARNING - An IGNORABLE hard error occured while attempting to read record !. (REELWARN 07038)**
CAUSE	The requested tape read operation failed but the failure is no considered to serious enough to stop reading. Record verification for this tape, however, will be turned off.
ACTION	Advisory only.

07039	***WARNING - Invalid command parameter encountered. (REELWARN 07039)**
CAUSE	User has supplied a parameter along with a valid command. Either the command does not take parameters, the parameter was invalid in the specified context, or the parameter was not recognized.]
ACTION	Follow correct syntax for specified command. If you do not supply any parameter, you will be prompted for the needed information.

07040	***WARNING - Selftest with parameters not yet supported. (REELWARN 07040)**
CAUSE	
ACTION	

07041	***WARNING - Current access to device does not allow selftest ! to be executed. (REELWARN 07041)**
CAUSE	The user was not granted a high enough diagnostic security clearance upon entering REELDIAG. This can be due either to the user's capabilities or the access mode to the device which was granted. Program initialization messages should have clarified this.
ACTION	If after insuring that the device is not being used by another process and after attempting to rerun REELDIAG does not solve the problem, consult your system administrator for sufficient capabilities or consult your support engineer to determine how to get needed access to the device.

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23a

1/4-Inch Cartridge Tape Drives and Autochanger Diagnostic 06/90

Introduction

The CARTDIAG diagnostic program will test 1/4-inch cartridge tape drives and autochangers which use the CS/80 protocol. This diagnostic, which is only available on operating systems which support the online diagnostics subsystem, will detect failures down to a field replaceable unit (FRU).

Defects and Enhancements

Submit defect reports and enhancement requests concerning this diagnostic through the STARS database referencing product number 30600-10017.

Auto-Diagnostics

If CARTDIAG is run as an auto-diagnostic by the system, the default set of sections and steps will be run, as listed in the "Default Sections" section, below.

Minimum Configuration

This product will be usable on any HP Precision Architecture RISC system supporting the online diagnostics subsystem.

In order to execute the CARTDIAG diagnostic program, a 1/4-inch cartridge tape drive and intermediate hardware necessary to communicate with the tape drive must exist on the host system.

In order to run this diagnostic, the online diagnostics subsystem must be supported.

Operating Instructions

The following subsections list the CARTDIAG default tests, tell how to invoke the diagnostic using the RUN command, and describe test execution.

Default Tests

The default sections for CARTDIAG are:

Section 2	Clear
Section 3	Identify
Section 4	Loopback
Section 5	Selftest
Section 6	Request and Decode Status
Section 7	Error Logs
Section 8	Common System Operations
Section 9	Status Tests
Section 10	Verification Trouble Tree
Section 11	Hardware Trouble Tree

The default steps are all steps within these sections. These defaults are dependent on the test mode that has been granted by the system. Therefore, a smaller set of the defaults may be run due to the limitations of the test mode that was obtained.

RUN Command

The CARTDIAG diagnostic can be accessed by the user via the Diagnostic User Interface. It is initiated using the RUN CARTDIAG command. All parameters associated with the DUI's RUN command will be accepted by this diagnostic. Please refer to the DUI chapter for details concerning this command and its parameters. All parameters available in the RUN command are acceptable as parameters when running this diagnostic. Note that if the ERRONLY parameter is set "on", only error messages will be output by this diagnostic. Error messages can be distinguished from other messages by three "*"'s preceding the text of the message (i.e., '*** MESSAGE' is an error message whereas 'Message' is not). Also note that error messages are in all capital letters and other messages use some lower case. This diagnostic can also be run as an auto-diagnostic by the diagnostic system. As noted in the previous section, certain modes are required in order to do certain tests. The mode needed to execute each command will be noted in the description of that command.

Test Execution

When CARTDIAG is executed, the following header and welcome message will be displayed:

```
**********************************************************************
******                                                          ******
******                CARTRIDGE TAPE DIAGNOSTIC                 ******
******                                                          ******
******         (C) Copyright Hewlett Packard Co.  1987          ******
******                   All Rights Reserved                    ******
******                     Version  n.nn.nn                     ******
******                                                          ******
**********************************************************************

Welcome, Today is MON, OCT 5, 1987  7:39 AM
```

At this point, the diagnostic calls IO_Path_Test, which is a diagnostic procedure that tests the I/O path to the device. If the status returned from this procedure call is "fail", the following message will be output:

```
*** WARNING -- THE I/O PATH TO THE TAPE DRIVE MAY NOT BE FUNCTIONING
    PROPERLY (CARTERR 100)
```

The diagnostic then issues an identify to the specified device to determine whether or not it is a cartridge tape drive. If the device does not respond to the identify command, the following message will be output:

```
*** DEVICE FAILED TO RESPOND TO IDENTIFY COMMAND (CARTERR 101)
```

The diagnostic will terminate immediately after outputting this message.

If a response was obtained, then the returned status is examined to determine if the device is a cartridge tape drive. If not, the following messages will be displayed:

```
*** THE SPECIFIED DEVICE IS NOT A CARTRIDGE TAPE DRIVE --
    RETURNED ID CODE WAS XXXX (CARTERR 102)

Do you wish to continue (Y/N)[N]?
```

If the response is Y then the diagnostic will continue, and if the response is N, the diagnostic will terminate. The [N] indicates that N will be the default response if the user simply hits <CR> in response to the prompt.

At this point, the sections and steps specified by the user will be executed and the results output. If the user did not specify sections and steps to be run, the default section and steps will be executed. If at any time, the number of errors generated reaches the limit specified by the user in the ERRCOUNT parameter of the run command, the following message will be output:

```
*** THE MAXIMUM NUMBER OF ERROR HAS BEEN REACHED (CARTERR 110)
```

The diagnostic will then terminate execution. If the ERRPAUSE parameter of the RUN command was assigned a value of "on", then this diagnostic will stop after each error is generated and ask the user if the test should continue:

```
Do you wish to continue (Y/N)[Y]?
```

If the response is `Y`, then the test will be resumed (if possible), and if the response is `N`, this diagnostic will terminate. The `[Y]` indicates that `Y` will be the default response if the user simply hits <CR> in response to the prompt. If the sections and steps specified by the user were executed the number of times specified in the LOOP parameter of the run command without the number of errors exceeding the ERRCOUNT value, the diagnostic will terminate normally and the following message output:

```
CARTRIDGE TAPE Diagnostic Exiting . . .
```

Upon termination of this diagnostic, control will return to the online diagnostics subsystem.

Detailed Test Descriptions

This section is devoted to explaining each section of **CARTDIAG**, as well as each step within a section. For each section/step, this explanation will consist of a description of the section/step, including the actions performed therein, the expected output from that section/step, and any error messages that may be generated that are worth noting. Please note in regard to the error messages, that not all possible error messages that may be generated are listed. The only error messages that are listed are those that are considered to be of special significance. For a complete list of error messages that may be generated while running **CARTDIAG**, please refer to the "Error Messages" section, below.

Section 2—CLEAR

This section performs a CLEAR operation on the tape drive. This command basically resets the tape drive to its power-on state. The command that will be sent to clear the tape drive will be a CS/80 'SELECTED DEVICE CLEAR". The following actions are taken as a result of executing this section:

- Flush any unwritten data to tape.
- Abort any command that is in progress.
- Reset all complementary parameters to their power-on values.

Note that no data will be lost due to a CLEAR and no unnecessary tape movement will occur.

OUTPUT:

```
Section 2 -- CLEAR

End of Section 2 -- Clear
```

Section 3—IDENTIFY

This section issues an IDENTIFY command to the selected tape drive to determine whether it is responding to commands and whether it is a CS/80 tape drive.

OUTPUT:

```
Section 3 -- IDENTIFY

   The selected device has been identified as an HPXXXX tape drive.

End of Section 3 -- Identify
```

Section 4—LOOPBACK

This section will perform a write loopback of 256 bytes of data to the device using the pattern—255,0,1, ... ,254. This operation will be followed by a read loopback of 256 bytes which will be compared with to the expected pattern to verify correct transmission.

This section has two steps:

- Step 6 - Write data loopback.
- Step 7 - Read data loopback.

OUTPUT:

```
Section 4 -- LOOPBACK

   Step 6 - Write Loopback Completed

   Step 7 - Read Loopback Completed

End of Section 4 -- Loopback
```

ERROR MESSAGES:

```
*** ERROR IN TRANSMISSION DETECTED DURING READ
    LOOPBACK TEST: (CARTERR 115)
```

Byte #	Octal Value Transmitted	Octal Value Received	Bit Positions In Error 01234567
12	56	54	00000010
33	127	63	01100100
.			
.			
.			
241	74	72	00000110

```
   Note -- entries in the preceding table will be printed
           for as many errors as were detected, unless the
           ERRCOUNT value is exceeded.
```

Section 5—SELFTEST

This section initiates the internal power-on selftest on the tape drive and reports the status of the test to the user. The test will be initiated by issuing an INITIATE DIAGNOSTIC command specifying diagnostic 0 as the test to be performed, which is the power-on selftest used by the device.

OUTPUT:

```
Section 5 -- SELFTEST

End of Section 5 -- Selftest
```

POSSIBLE ERROR MESSAGES:

```
*** DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE
    CS/80 INITIATE DIAGNOSTIC COMMAND (CARTERR 109)

    STATUS = { status }

NOTE -- This status printout will include the failing field
        replaceable unit(s) as specified by the device.
```

Section 6—REQUEST and DECODE STATUS

This section will request status from the tape drive and subsequently output the status to the user.

OUTPUT:

```
Section 6 -- STATUS

    Status =

    Unit = nnnn      Volume = nnnn

    No units with pending status
              or
    Unit nnnn has status pending

    {One or more of the following status messages may be printed}

    >>>>>>>>>> REJECT ERRORS <<<<<<<<<<
    Received a command without odd parity
    Received an unrecognized opcode
    Received an illegal volume or unit address
    Received an address which exceeds device bounds
    Received an illegal parameter
    Received a parameter of the wrong length
    Received a message out of sequence
    Received a message of the wrong length

    >>>>>>>>>> FAULT ERRORS <<<<<<<<<<
    Unit hardware fault
    Hardware failed diagnostic --
       Failed part numbers are : nnnn, nnnn
       Test error numbers = nnnn, nnnn
    Operator release required before command can be executed
    maintenance release required before command can be executed
    Power failed or drive just powered on
    Auto Release has been completed -- Retransmit last command

    >>>>>>>>>> ACCESS ERRORS <<<<<<<<<<
    Media has not been initialized or is unusable
    Spare Block cannot be executed -- No spare media available
    Drive is not ready for access
    The selected volume is write protected
    A block accessed during a read has not been written
    Unrecoverable data has been detected
    End of file encountered
    End of volume encountered

    >>>>>>>>>> INFORMATION ERRORS <<<<<<<<<<
    Device is requesting operator release
    Device is requesting diagnostic release
```

```
     A defective block has been automatically spared
     Early warning of EOV (End Of Volume)
     Recoverable data

End of section 6 -- Status
```

Section 7—ERROR LOGS

This section obtains data from the run-time error log and drive fault log(fault log only exists on HP9145), then decodes the error messages, and displays them to the user. The run-time error log contains an accumulation of the run-time data errors which have been logged by the tape drive automatically during normal operation. The drive fault log contains an accumulation of faults that have occurred on the drive which have been logged by the tape drive automatically. Both logs contain all errors that have occurred since the last time the logs were cleared. This section is divided into two steps, one step for each log.

OUTPUT:

```
Section 7 -- ERROR LOGS

Step 10 - Run Time Data Error Log :


   Number of uncorrectable read errors          = nnnn
   Number of key errors                         = nnnn
   Number of blocks spared on write             = nnnn
   Number of correctable errors with retries    = nnnn
   Number of correctable errors without retries = nnnn
   Type of certification is NOT CERTIFIED
              or
   Type of certification is 3M CERTIFIED
              or
   Type of certification is HP FACTORY CERTIFIED
              or
   Type of certification is 7914 DRIVES CERTIFIED
              or
   Type of certification is HP35401A/HP9144A/T CERTIFIED
              or
   Type of certification is HP9145A CERTIFIED


Step 11 - Drive Fault Log :

For HP9145:
   There are nnnn entries in this log


Fault Code    Fault Type   Time (milliseconds)
==========    ==========   ===================
 DERR nnnn       nnnn         nnnnnnnnnnnnnnnnn
.
.  Repeat for each entry in the log
.
 DERR nnnn       nnnn         nnnnnnnnnnnnnnnnn

Note: Decoding of Fault Code and Fault Type will be provided
      when information becomes available.
```

```
For HP9144 and HP35401
   Fault Log does not exist on this drive.

End of section 7 -- Error Logs
```

Section 8—COMMON SYSTEM OPERATIONS

This section will execute all CS/80 commands applicable to tape drives with the exception of Initialize Media and Spare Block. The intent of this section is to verify that these commands are functioning properly. A tape has to be mounted in order for this section to operate. The tests will be as thorough as possible while still allowing them to be automated. There are several steps to choose from in this section as described below.

Step 15 - Sends a CS/80 **WRITE FILE MARK** command to the tape drive to write a file mark at the current position of the tape. To the host, the file mark will appear as a complete 1 KByte logical block which contains no data. Destructive mode will be required to run this step.

Step 16 - Reads data on the tape twice and compares them. If there is any mis-matches, the user will be informed that the CS/80 **LOCATE AND READ** command is not working properly.

Step 17 - Writes random data blocks to the tape, reads them back and compares them. If there are any mis-matches, the user will be informed that the CS/80 **LOCATE AND WRITE** command is not working properly. Destructive mode will be required to run this step.

Step 18 - Sends a CS/80 **SET UNIT** command to the tape drive to set unit 0 or unit 15, requests a hardware status from the device, and verifies that the unit set is either 0 or 15. If not, the user will be informed that the CS/80 **SET UNIT** command is not working properly. Destructive mode will be required to run this step.

Step 19 - Sends a CS/80 **SET ADDRESS** command to the tape drive to set the current address to some random value, requests a hardware status from the device, and verifies that the current address is the same as the address that was set. If not, the user will be informed that the CS/80 **SET ADDRESS** command is not working properly. Only single vector addressing is supported.

Step 20 - Sends a CS/80 **SET BLOCK DISPLACEMENT** command to the tape drive. This will result in a new target address by adding the parameter to the current address. It will then request a hardware status from the tape drive, and verify that the current address is the address that was set. If not, the user will be informed that the CS/80 **SET BLOCK DISPLACEMENT** command is not working properly. Destructive mode will be required to run this step.

Step 21 - Sends a CS/80 **LOCATE AND READ** command to the tape drive to read 256 bytes of data at the current address. This is to ensure that the CS/80 **SET LENGTH** complementary command is working properly. If the drive does not return exactly 256 bytes of data, the user will be informed that the CS/80 **SET LENGTH** command is not working properly.

Step 22 - Sends a CS/80 **SET VOLUME** command to the tape drive to specify the desired storage volume. The only valid parameter for this command is 0. Any attempt to set the volume other than 0 will result in a module addressing error. Requests a hardware status from the device, and verifies that the volume is set to 0. If not, the user will be informed that the CS/80 **SET VOLUME** command is not working properly.

Step 23 - Sends a CS/80 **SET STATUS MASK** command to mask out the error conditions reported by the **REQUEST STATUS** message. Each bit position in the eight parameter bytes corresponds to an error bit position in the **REQUEST STATUS** message. All error conditions except fault errors may be masked by setting the appropriate bit position to 'one'. An address bounds error bit will then be forced to occur by sending a CS/80 **SET ADDRESS** command to the tape drive to set an address that is greater than the maximum allowed. If an error is generated as a result, the user will be informed that the CS/80 **SET STATUS MASK** command is not working properly.

Step 25 - Sends a CS/80 **SET RETRY TIME** command to set the retry time value to some random number. A read will then be performed at the current address. If an error is generated by this read, the user will be informed that the CS/80 **SET RETRY TIME** command is not working properly.

Step 26 - Sends a CS/80 **SET RELEASE** command to the tape drive. If any error is generated, the user will be informed that the CS/80 **RELEASE** command is not working properly.

Step 27 - Sends a CS/80 **SET OPTION** command to the tape drive to set tape specific options. If any error is generated, the user will be informed that the CS/80 **SET OPTION** command is not working properly. The option opcode is *M000IASC*, where

```
M = 0 :  Cartridge unload mode (Sequential)
M = 1 :  Media unload Mode (Sequential Mode)

I = 0 :  Disable immediate report/command queueing
I = 1 :  Enable immediate report/command queueing

A = 0 :  Auto sparing disabled
A = 1 :  Auto sparing enabled

S = 0 :  Auto spare invokes Jump Sparing
S = 1 :  Auto spare invokes Skip Sparing

C = 0 :  Disable character count capability
C = 1 :  Enable character count capability
```

Note: M option is only valid for HP35401A.

Step 28 - Sends a CS/80 **COLD LOAD READ** command to the tape drive, reads data on the tape twice, and compares them. If there is any mis-matches, the user will be informed that the CS/80 **COLD LOAD READ** command is not working properly. This step has same sequence as **LOCATE AND READ**.

OUTPUT:

```
Section 8 -- Common System Operations

End of Section 8 -- Common System Operations
```

Section 9—STATUS TESTS

This section will force several errors to occur on the tape drive and then verify that the correct error bit was set in the hardware status returned from the drive. As many status bits as possible are checked by this section, although for many of the bits, it is not possible to force the errors that correspond to them. Thus, 7 status bits can be checked and one step will be provided per bit.

Step 40 - Sends an invalid command opcode to the tape drive and then verifies that the Invalid Opcode bit was set in the hardware status that was returned from the device. If this bit was not set, the user will be informed that the status is not being set properly.

Step 41 - Sends a CS/80 **SET UNIT** command to the tape drive, setting the unit to an illegal number and then verifies that the Module Addressing error bit was set in the hardware status that was returned from the device. If this bit is not set, the user will be informed that the status is not being set properly.

Step 42 - Sends a CS/80 **SET ADDRESS** command to the tape drive, setting the address to a value greater than the maximum allowed, and then verifies that the Address Bounds error bit was set in the hardware status that was returned from the device. If this bit was not set, the user will be informed that the status is not being set properly.

Step 43 - Sends a CS/80 **SET STATUS MASK** command to the tape drive, setting the status mask to all unmaskable bits, and then verifies that the Parameter Bounds error bit was set in the hardware status that was returned from the device. If this bit is not set, the user will be informed that the status is not being set properly.

Step 44 - Sends a CS/80 **SET LENGTH** command to the tape drive, giving it only one byte for the length value instead of the 4 bytes that the drive expects, and verifies that the Illegal Parameter error bit was set in the hardware status that was returned from the device. If this bit is not set, the user will be informed that the status is not being set properly.

Step 45 - Sends a CS/80 **LOCATE AND WRITE** command while requesting that it return an execution message instead of providing it with an execution message as it expects, and verifies that the Message Sequence error bit is set in the hardware status that is returned from the device. If this bit is not set, the user will be informed that the status is not being set properly.

Step 46 - Sends a CS/80 **LOCATE AND WRITE** command to the tape drive, giving it fewer bytes in the execution message than were specified in the length that was set in the write command, and then verifies that the Message Length error bit was set in the hardware status that was returned from the device. If this bit is not set, the user will be informed that the status is not being set properly.

OUTPUT:

```
Section 9 -- Status Tests

End of Section 9 -- Status Tests
```

Section 10—Verification Trouble Tree

This section will perform a series of non-destructive tests to an HP9144, HP9145, or HP35401 to detect and isolate the MSFRU (Most Suspect FRU). The algorithm is yet to be defined.

Section 11—Hardware Trouble Tree

This section will perform a series of tests, some of which are destructive, to an HP9144, HP9145, or HP35401 to detect and isolate the MSFRU (Most Suspect FRU). Several possible output scenarios from this section are given below. Note that this is not an exhaustive set of possibilities, but is provided to give the user an idea of the type of output this section will produce.

OUTPUT:

```
Section 11 -- Hardware Trouble Tree


Scenario 1:

   Device loopback test failed.

      Suspected failing FRU(s) are (in order of probability):
         Device Controller
         HPIB channel



Scenario 2:

   Device loopback test passed.
   HDC-DDC interface test failed.

      Suspected failing FRU(s) are (in order of probability):
         Device Controller



Scenario 3:

   Device loopback test passed.
   HDC-DDC interface test passed.
   DDC board test passed.
   Microcontroller test passed.
   Read/Write loopback test passed.
   HDC-DDC Read/Write loopback test passed.
   HDC-DDC-Servo interface test failed.

      Suspected failing FRU(s) are (in order of probability):
         Servo Mechanism Electronics


End of Section 11 -- Hardware Trouble Tree
```

Section 12—Media Trouble Tree (Non-Destructive)

This section will perform a series of non-destructive tests to the media of an HP9144, HP9145, or HP35401 to verify the integrity of the media. Several possible output scenarios from this section are given below. Note that this is not an exhaustive set of possibilities but is provided to give the user an idea of the type of output this section will produce.

OUTPUT:

```
Section 12 -- Media Trouble Tree (Non-Destructive)


Scenario 1:

   Read Use Log passed.
   Read Spares Table failed.

      Suspected failure(s) are (in order of probability):
         For 600 ft tape, the media has more than 110 spared blocks.
         For 150 ft tape, the media has more than 27 spared blocks.
      MEDIA SHOULD BE REPLACED.



Scenario 2:

   Read use log passed.
   Read spares table passed.
   Read run log failed.

      Suspected failure(s) are (in order of probability):
         The media has more than 1 uncorrectable errors.
      MEDIA SHOULD BE REPLACED.


End of Section 12 -- Media Trouble Tree (Non-Destructive)
```

Section 13—Media Trouble Tree (Destructive)

This section will perform a series of destructive tests to the media of an HP9144, HP9145, or HP35401 to verify the integrity of the media. Several possible output scenarios from this section are given below. Note that this is not an exhaustive set of possibilities but is provided to give the user an idea of the type of output this section will produce.

OUTPUT:

```
Section 13 -- Media Trouble Tree (Destructive)


Scenario 1:

   Read Use Log passed.
   Read Spares Table passed.
   Read run log passed.
   Clear run log passed.
   Write ERT log passed.
   Read ERT log failed.

      Suspected failure(s) are (in order of probability):
         For 600 ft tape, the media has more than 80 permanent errors
             or 400 transient errors.
         For 150 ft tape, the media has more than 20 permanent errors
             or 100 transient errors.
      MEDIA SHOULD BE REPLACED.


Scenario 2:

   Read use log passed.
   Read spares table passed.
   Read run log failed.

      Suspected failure(s) are (in order of probability):
         The media has more than 1 uncorrectable errors.
      MEDIA SHOULD BE REPLACED.


End of Section 13 -- Media Trouble Tree (Destructive)
```

Section 17—EXTERNAL EXERCISER

The CS/80 EXTERNAL EXERCISER is an interactive program which provides the user with access to the set of internal diagnostics and utilities within a CS/80 tape drive. The purpose of the exerciser is to aid service-trained personnel in troubleshooting CS/80 tape drives to a replaceable assembly level.

The EXTERNAL EXERCISER is an interactive program that provides the user with access to the set of internal diagnostics and utilities within a CS/80 tape drive.

ERROR-RATE TESTING

Error-rate tests are used to determine media integrity within a CS/80 device. These tests can find correctable and uncorrectable read errors. They also provide information on each error, such as the address where the error occurred, the type of error, and the number of times it has occurred. This information can be displayed to the user and/or logged in the error rate test log. This log file resides in the drive's RAM and can be accessed through the Read_Error_Rate_Test_Log utility.

All error rate tests allow the user to input a loop count when requesting the test. Each time an error is detected during the test, the test will stop, report the error, and then resume testing until the loop count has been satisfied. Note that the loop count is not a count of the number of errors, but rather the number of passes the device will execute during the error-rate test. The following information will be reported for each error that occurs:

- An error information byte.
- The loop count when the error occurred.
- The current physical address.
- The current logical address.
- The byte number at which the error begins.
- A bit map of the bits that were in error.

When requesting the error-rate test, the user may specify whether the errors are to be logged as opposed to displaying them on the user's terminal.

There are two general types of error rate tests that can be performed. The first type, called a read only error rate test, is a non-destructive test which reads data from the tape drive and attempts to detect any read errors that occur. There are two tests available in this category:

1. Read Only Error-Rate Test—Sequentially reads the current data on the tape drive in a specified area of the media.
2. Random Read Only Error-Rate Test—Reads 256 random blocks of random length data. This allows read errors to be detected on a large portion of the media in a minimum amount of time.

The second type of error-rate test, called a write-then-read error-rate test, is a destructive test which writes data onto the media and subsequently reads it back, attempting to detect sensitive bit patterns, read errors, and media defects. When requesting an error-rate test in this category, the user is allowed to specify a pattern to be used in the test. A user input pattern can be defined and edited via the Set Pattern command. If the user chooses not to enter a pattern, he/she will be given a choice to use internal patterns or random data

generated by the tape drive. There are several types of write-then-read error rate tests available to the user:

1. Pattern Write-Then-Read Error-Rate Test—Sequentially writes a specified data pattern over a specified area of the media and then reads the data back.
2. Random Write-Then-Read Error-Rate Test—Write-then-read 256 randomly generated data patterns of random length at random locations on the media. This test locates errors that occur over a large area of the media in a minimum amount of time.
3. Certification Write-Then_Read Error-Rate Test—Executes a Write-then-read Error-Rate Test with bad blocks spared after test is done.

ERROR LOGGING

During run-time, the error correction circuitry of the drive is enabled. If an error is detected that cannot be corrected by this circuitry, it will be logged to an area of random access memory (RAM) on the drive. If this area becomes full during run-time, which is defined to be any time in which a test, diagnostic, or utility is not being performed, the device requests a release so that it can log the error information in the run-time data error log on the maintenance tracks. All error logging is done automatically by the drive.

When error-rate tests are run, the error correction circuitry is disabled, allowing correctable and uncorrectable errors to be logged.

The tape use log keeps a record of tape use on the tape. This log is never cleared and cannot be updated if the tape is write protected. Thus, not all the sessions will be reflected in this log. Device use log gives an indication of the amount of usage of the device has sustained. Both use logs are specific to HP35401A and HP9145A.

The transient error log records all read/write errors HP9145A encounters and overcomes by retries.

The fault log is used to store all drive and controller faults which have occurred since the last time the logs were cleared.

SPARING

All CS/80 tape drives provide the means to replace defective blocks with good ones. This operation is refered to as "sparing". Sparing includes updating the sparing table near BOT; thus, tape motion is involved. There are two types of sparing: skip sparing and jump sparing. Skip sparing deletes bad blocks by replacing the address of the next unused spare with that of the defective block. This action causes the bad block to be skipped in the conversion of logical to physical addresses and returns the spare to the pool of user blocks. It alters the address mapping of blocks after the target address which results in the effective loss of data beyond this point. For this reason, skip sparing can only be used during certification and sequential write operations.

Jump sparing places the defective block address in the spares table and links it to the closest available spare block. Subsequent references to the bad block will result in a seek to its spare. Although this method is slower in recovering spared blocks, all user data beyond the spared block is preserved.

EXERCISER COMMAND DESCRIPTIONS

When the external exerciser is invoked, the following prompt will be displayed to the user:

```
CARTDIAG>
```

When the prompt appears, the exerciser is waiting for a command from the user. The available commands are listed in this section in alphabetical order accompanied by descriptions. Each command description is in the following format:

```
COMMAND NAME

SHORT DEFINITION
```

Explanation of what the command does and when it should be used.

```
INPUT FORMAT:

CARTDIAG> [COMMAND NAME]
```

Note that the prompt for this exerciser is **CARTDIAG>**. The appearance of this prompt indicates that the exerciser is waiting for the user to input a command.

```
OUTPUT FORMAT:
```

Information printed as a result of this command being executed

```
ERROR MESSAGES:
```

Any error messages worth noting that may be generated as a result of this command. Note that this does not imply that all possible error messages that may be generated are listed here, but rather, only those that are especially worth mentioning in relation to the command.

There are several conventions used throughout this section in the command formats. They are as follows:

nnnn	- refers to a decimal number of any magnitude that is output by the diagnostic.
vvvv	- refers to a decimal number of variable magnitude that must be input by the user.
H	- refers to a hexadecimal digit (0-F).
O	- refers to an octal digit (0-8).
B	- refers to a binary digit (0-1).

Any text enclosed in parenthesis indicates that the user is expected to input that text in response to a query from the diagnostic. Text enclosed in square brackets indicates the default response that will be assumed if the user simply hits <CR> in response to the query. For example, the user may be asked if the program should continue by the following question:

```
Do you wish to continue (Y/N)[N]?
```

The text enclosed in the parenthesis (i.e., **Y / N**) indicates that the user is to type either a **Y** or an **N** in response to the question. Each option is separated by a **/**. The default response in this case would be **N**, as indicated by the **[N]** prior to the question mark. If there is no default response listed (enclosed in square brackets), the user will not be allowed to "default" the input by only entering a <CR>.

Comments in the input and output sequences are enclosed in curly brackets and are not output by the program. For example, following the question in the previous example, the input sequence would probably look something like the following:

```
{if response was N this command will terminate}
```

Error messages will be preceded by three asterisks (***) and will be in all upper case letters. Other messages will not be all upper case and will not be preceded by the astericks.

If the user enters a command in response to a prompt and that command is not recognized as an exerciser command, the following message will be displayed:

```
*** YOUR RESPONSE WAS INVALID

CARTDIAG>
```

This message simply means that the command entered is not part of the command set for the external exerciser.

When the user enters a command that is recognized by the external exerciser, that command will then be processed as according to the corresponding command description given in one of the following sections of this document. If an error is encountered as a result of issuing a CS/80 command to the device, the hardware status that is returned by the device will be displayed to the user. The status display will consist of some device identification information followed by several categorized error messages. The categories are reject errors, fault errors, access errors, and information errors. Reject errors indicate illegal interaction with the device such as an opcode error. These errors result when commands are sent to the device but not recognized by it. Fault errors indicate hardware failures. Access errors indicate media absence, formatting problems, or operator intervention. Information errors indicate potential problems or performance irregularities in the device. The format of the output status message follows:

```
Status =

Unit = nnnn       Volume = nnnn

No units with pending status
          or
Unit nnnn has status pending

{One or more of the following status messages may be printed}

>>>>>>>>>> REJECT ERRORS <<<<<<<<<<
Received a command without odd parity
Received an unrecognized opcode
Received an illegal volume or unit address
Received an address which exceeds device bounds
Received an illegal parameter
Received a parameter of the wrong length
Received a message out of sequence
Received a message of the wrong length

>>>>>>>>>> FAULT ERRORS <<<<<<<<<<
```

```
Error occurred during copy data transaction --
   Units experiencing errors are :
      nnnn, nnnn, nnnn, nnnn
Hardware failed diagnostic --
   Failed part numbers are : nnnn, nnnn
   Test error numbers = nnnn, nnnn
Operator release required before command can be executed
Maintenance release required before command can be executed
Power failed or drive just powered on
Auto Release has been completed -- Retransmit last command

>>>>>>>>>> ACCESS ERRORS <<<<<<<<<<
Media has not been initialized or is unusable
Spare Block cannot be executed -- No spare media available
Drive is not ready for access
The selected volume is write protected
A block accessed during a read has not been written
Unrecoverable data has been detected
End of file encountered
End of volume encountered

>>>>>>>>>> INFORMATION ERRORS <<<<<<<<<<
Device is requesting operator release
Device is requesting diagnostic release
A defective block has been automatically spared
Early warning of EOV (End Of Volume)
Recoverable data
```

Note that only the portions of the above status display that correspond to errors indicated by the hardware status will be displayed. This means, for example, that if no Access Errors were indicated by the status, none of the messages listed under that heading would be output.

In order to exit the exerciser, the **EXIT** command should be entered (see **EXIT** command description).

This exerciser only covers the CS/80 utilities that are considered to be the most useful to the field. This diagnostic does not include **Extended Describe, Release, Release Denied, Return Amplifier Gain, Return DDC Status, Return Servo Status, Return Trip Point, Set Front Panel Lights, Blind Load Cartridge, Control Infra_Red LEDs, Enable/Disable Auto Load, Enable/Disable Decompression, Enable/Disable Request Status Buffer Flushing, Enable/Disable XOR Correction, Enable/Disable Fault Recovery, Force R/W Gap, Send DDC Command, Send Servo Command, Set Amplifier Gain, Set DABS Extend, Set EWEOV Extend, Set Retry Mode, Set R/W Threshold, Set Trip Point, and Write Memory.**

CART INFO

This command allows the user to read the information about cartridges that are loaded and their write-protect status (gathered with last Preload) without performing a Preload. This command is specific to HP35401A.

INPUT FORMAT:

```
CARTDIAG> CART INFO
```

OUTPUT FORMAT:

```
The following cartridges are present:
    nn nn ... nn

The following cartridges are write protected:
    nn nn ... nn
```

CART STATUS

This command allows the user to read the status of loaded cartridges and is specific to HP35401A.

INPUT FORMAT:

```
CARTDIAG> CART STATUS
```

OUTPUT FORMAT:

```
The following cartridge have failed during a load operation:
    nn nn ... nn

The following cartridges have exceeded their normal use limit:
    nn nn ... nn
```

CLEAR LOGS

This command is used to clear the Run-Time Data Error Log, the Error-Rate Test Data Error Log, the Transient Test Log and the Drive Fault Log. The user will be given the option of clearing all of the logs or just the Error-Rate Test Data Error Log, which would allow the logging of multiple executions of error-rate tests.

INPUT FORMAT:

```
CARTDIAG> CLEAR LOGS

For HP9144A/T and HP35401A:
Clear logs:
  0 - Clear both the Error Rate AND the Runtime Error Log
  1 - Clear ONLY the Error Rate Log


For HP9145A:
Clear logs:
  0 - Clear the Error Rate, Transient Test AND the Runtime Error Logs
  1 - Clear ONLY the Error Rate and Transient Test Logs
  2 - Clear ONLY the Fault Log
Which log?
```

OUTPUT FORMAT:

```
For HP9144A/T and HP35401A:
   All logs cleared
         or
   ERT logs cleared

For HP9145A:
   All logs cleared
         or
   ERT and Transient Test logs cleared
         or
   Fault Log cleared
```

COUNTERS

This command will obtain the vertical motor count and horizontal motor count of HP35401A.

INPUT FORMAT:

```
CARTDIAG> COUNTERS
```

OUTPUT FORMAT:

```
Vertical motor count   = nnnn
Horizontal motor count = nnnn
```

DESCRIBE

This command will obtain a CS/80 describe message from the device and will display the contents to the user in text form. The information in the describe message includes device parameters that are used by system drivers.

INPUT FORMAT:

```
CARTDIAG> DESCRIBE
```

OUTPUT FORMAT:

```
Describe Information

The following unit(s) are installed:
    nn  nn  . . . nn
Maximum transfer rate = nnnn Kbytes per second
Device is a nnnn tape drive
Block size = nnnn bytes
Buffer size = nnnn blocks
Burst mode is not recommended
Block transfer time = nnnn microseconds
Average transfer rate = nnnn Kbytes per second
Optimal retry time = nnnn 10's of milliseconds
Maximum access time to data = nnnn 10's of milliseconds
Maximum interleave = nnnn
There are no fixed volumes
There is one removable volume -- vol. 0

Maximum block address = nnnn
Current interleave = 0
```

DEVICE USELOG

This command allows the user to access the device use logs which contain the amount of usage the device has sustained since the logs were last cleared. This command is specific to HP35401A and HP9145A.

INPUT FORMAT:

```
CARTDIAG> DEVICE USELOG
```

OUTPUT FORMAT:

```
For HP35401A:

    Total Movement time                 = nnnn milli-seconds
    Total operations                    = nnnn
    Total unit faults                   = nnnn
    Total recovery calls                = nnnn
    Total nested faults                 = nnnn
    Total cleaning cycles               = nnnn
    Total power cycles                  = nnnn
    Overflow value                      = BBBBB
        where BBBBB are

          01234
          =====
          00001       Movement time overflow
          00010       Operations overflow
          00100       Unit faults overflow
          01000       Recovery calls overflow
          10000       Nested faults overflow


For HP9145A:
    Total Power Cycle                   = nnnn
    Total Power on time                 = nnnn seconds
    Number of times tape was loaded     = nnnn
    Total Cartridge Cleaning cycle      = nnnn
    Total Unit Faults                   = nnnn
    Last Diagnostic To Fail             = nnnn
    Total Number of Diagnostic Failures = nnnn
    Overflow value                      = BBB

        where BBB are

          012
          ===
          001     Unit Faults overflow
          010     Tape Loads overflow
          100     Diagnostic Failures overflow
```

DIAG

This command will initiate internal diagnostic tests which reside in the tape drive. The tests which can be selected are device dependent and are fully described in the support documentation for each type of drive.

INPUT FORMAT:

```
CARTDIAG> DIAG

   Input the diag # (nnnn <= diag <= nnnn)[0]?
   Input the loop count to be used (1<=loop<=65535)[1]?
```

OUTPUT FORMAT:

```
   Internal diagnostic nnnn has completed successfully
```

POSSIBLE ERROR MESSAGES:

```
*** DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE
    CS/80 INITIATE DIAGNOSTIC COMMAND
    {status - including failing FRU if any}
```

ERT LOG

This command allows the user to access the Error-Rate Test Data Error Log which contains an accumulation of all read errors which were detected during error-rate tests. These errors accumulate until the CLEAR LOGS command is used to clear them.

INPUT FORMAT:

```
CARTDIAG> ERT LOG
```

OUTPUT FORMAT:

```
Error Rate Test Log Values
==========================

Number of blocks accessed = nnnn
Permanent errors = nnnn
Transient errors = nnnn
Uncorrectable errors = nnnn
permanent key errors = nnnn
There are no log entries
                or

        Logical
        Address       Error
        =======       =====
         nnnn        BBBBBBBB
         nnnn        BBBBBBBB
         .
         .   Repeat for each entry in the log
         .
         nnnn        BBBBBBBB

      {if any entries were printed}
Do you wish to see error byte decoding information(Y/N)[N]?


      {if yes}

The Error values are :

   76543210
   ========
   00000001  Frame 1 has a CRC error
   00000010  Frame 2 has a CRC error
   00000100  Frame 3 has a CRC error
   00001000  Frame 4 has a CRC error
   00010000  Frame 5 has a CRC error
   00100000  Frame 6 has a CRC error
   01000000  Data was unrecoverable
   10000000  Key error
```

EXIT

This command terminates execution of the EXTERNAL EXERCISER. It may be entered any time the CARTDIAG> prompt appears.

INPUT FORMAT:

```
CARTDIAG> EXIT
```

OUTPUT FORMAT:

```
End of Section 17 - External Exerciser
```

EXTENDED STATUS

This command returns status information concerning mechanism faults and diagnostics. EXTENDED STATUS is specific to HP35401A.

INPUT FORMAT:

```
CARTDIAG> EXTENDED STATUS
```

OUTPUT FORMAT:

```
The value loaded into the counter is nnnn and is a vertical counter.
                    or
The value loaded into the counter is nnnn and is a horizontal counter.


The previous vertical counter value is nnnn.
The previous horizontal counter value is nnnn.
The Read_Movement_Sensor's value is nnnn.
The Status value returned by Make_Primitive_Movement is nnnn.
Faulty H/V counter value is nnnn.
The current sensor state is nnnn.
The ideal state of the sensor is nnnn.
The distance measured by the Vertical Travel diagnostic, the
    Horizontal Travel diagnostic and the first part of the
    Horizontal sensors diagnostic is nnnn.
The distance measured by the Horizontal Sensors diagnostic from
    the state HB(Horizontal sensor B)=1, HC(Horizontal sensor
    C)=0 to Horizontal Home is nnnn.
The distance measured by the Horizontal Sensors diagnostic from
    Horizontal Home to the state HB=0, HC=1 is nnnn.
The Movement Primtive address which failed the primitive movement
    in Fault_Recovery is BBBBBBBB.
The status of the most recent Fault_Recovery is nnnn.
```

FAULT LOG

This command allows the user to access the Drive Fault Log which contain an accumulation of all faults that have occurred on the drive since the last CLEAR LOGS command was executed or power on. This log is not maintained during power failure and is cleared every time the drive is switched on. The timer used to derive the time stamp will be reset after 25 days of continuous power. The drive uses the fault log as a circular list, once the log is full, it will begin overwriting the oldest entries automatically without host intervention. This command is specific to HP9145A.

INPUT FORMAT:

```
CARTDIAG> FAULT LOG
```

OUTPUT FORMAT:

```
   There are nnnn entries in this log

   Fault log values:

 Fault Code    Fault Type   Time (milliseconds)
 ==========    ==========   ===================
  DERR nnnn       nnnn        nnnnnnnnnnnnnnnn
 .
 .  Repeat for each entry in the log
 .
  DERR nnnn       nnnn        nnnnnnnnnnnnnnnn

Note: Decoding of Fault Code and Fault Type will be provided
      when information becomes available.
```

HELP

This command provides the user with access to information concerning the commands that are available in the external exerciser. The user may request a list of the available commands accompanied by a brief description of each, or individual command descriptions. For individual commands, the user can request a description and syntax or just the syntax.

INPUT FORMAT:

```
CARTDIAG> HELP [command name or <cr>]
```

OUTPUT FORMAT:

```
     {If no command name was given (i.e. <cr>)}
The following commands are available:

CLEAR LOGS - Clears the various error logs on the device
   .
   .
   .
WTR ERT - performs a write-then-read error rate test on
          the device

     {If a command was given}
Do you want a description or just syntax (D/S)[D]?

     {If response was D}
COMMAND DESCRIPTION:
Description of the command
Syntax of the command

     {If response was S}
COMMAND SYNTAX:
Syntax of the command
```

INIT MEDIA

This command allows the user to certify the tape. For HP9145A, this command will also allows a cartridge to be marked for uncompressed or compressed operation. The user will also be given the option to allocate spares. All data on the tape may be destroyed by this command. It is essential that extensive error-rate testing be performed and all questionable sectors spared after executing this command.

INPUT FORMAT:

```
CARTDIAG> INIT MEDIA

  For HP9144A/T:
   This command will take the action based on the option and
   the state of the tape

                | option
tape status     | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
-------------------------------------------------
Certified       | 0 | C | X | X | 0 | B | X | X |
                |   |   |   |   |   |   |   |   |
-------------------------------------------------
Not certified   | C | C | X | X | B | B | X | X |
No spares       |   |   |   |   |   |   |   |   |
-------------------------------------------------
Not certified   | C | C | X | X | 0 | B | X | X |
Spares          |   |   |   |   |   |   |   |   |
-------------------------------------------------

    C = Certify the tape.
        Allocate 32 spares for a short tape or 128 for
        a long tape.
    0 = Optimize the spares table.
        Convert any jump spares on the tape to skip spares.
    B = Build a new spare table.
        Allocate initial spares on the tape but do not
        test for any bad blocks.
    X = Clear spares.

   Input the option --

   For HP35401A:
      the option code is 00000CWZ(binary) where

          C = 0: Run certification if necessary.
          C = 1: Do not force a certify test.

          W = 0: Initial spares are every 512 block plus
                 a track offset.
          W = 1: Initial spares to no spares.

          Z = 0: Rewrite sparing table with no jump spares.
```

```
        Z = 1: Reset sparing table to initial spares.

    For HP9145A:
       the option code is 0000MCWZ(binary) where

        M = 0: Mark cartridge uncompressed.
        M = 1: Mark cartridge compressed.

        The W bit -- Spares allocation is ignored
                     by HP9145A.

        C and Z bits together with the tape status produce
        the actions in the following table:

                                C | 0 | 0 | 1 | 1 |
        tape status             Z | 0 | 1 | 0 | 1 |
        ----------------------------------------
        No spares table           | CT| CT| U | B |
        Formatted, not certified  |   |   |   |   |
        ----------------------------------------
        16 Track Format Tape      | B | CT| B | B |
        ----------------------------------------
        32 Track Format Tape      | 0 | CT| 0 | B |
        ----------------------------------------

      where  CT -- Certify the tape and mark according
                   to M bit.
             0  -- Optimize the spare table and mark
                   using M bit.
             B  -- Build a new spare table and mark using
                   M bit.
             U  -- Return uninitialized media error status
                   to host.

    Input the option --


    This test will destroy current data on the tape
    Do you wish continue (Y/N)[N]?
         {responding N will terminate this command}
```

OUTPUT FORMAT:

```
    format - retain all spares

    Media is being initialized -- may take several minutes

    Media has been successfully initialized
```

LAST RUNLOG

This command is specific to HP9145A and allows the user to access the Last Run-Time Data Error Log which contains an accumulation of all run-time data errors that have been logged by the drive during the operation following the previous tape load (not the current load). If this log has never been written or cannot be read or a 9144A tape is loaded, all 0's will be returned.

INPUT FORMAT:

```
CARTDIAG> LAST RUNLOG
```

OUTPUT FORMAT:

```
Number of uncorrectable read errors          = nnnn
Number of blocks spared out                  = nnnn
Number of key errors                         = nnnn
Number of correctable errors with retries    = nnnn
Number of correctable errors without retries = nnnn
```

LOAD

This command will perform a full load of the cartridge in the drive. If a cartridge is unloading when the utility is issued, a load will be performed after the unload completed. This command is specific to HP35401A and HP9145A.

INPUT FORMAT:

```
CARTDIAG> LOAD

For HP35401A:
    Enter the cartridge number to be loaded (1-8)[1] --
```

LOCATE VERIFY

This command allows the users to instruct the device to perform an internal verification of a section of data to ensure that it can be read. Verification will terminate immediately on an unrecoverable data error but will not terminate on a file mark.

INPUT FORMAT:

```
CARTDIAG> LOCATE VERIFY

Enter block address (<cr> to use current address) --
Enter the length --
```

MOVE

This command moves the axis into the direction specified by the user. **MOVE** is specific to HP35401A.

INPUT FORMAT:

```
CARTDIAG> MOVE

Do you want to move to   00 -- Vertical home
                         01 -- horizontal home
                         02 -- Home position (H/V)
                         03 -- Vertical cartridge position
                         04 -- into Carrier
                         05 -- into HP9144A/T

Enter direction -->
```

OPEN DOOR

This command is used to release and re-engage the door lock, and therefore is used to open the door. `OPEN DOOR` is specific to HP35401A.

INPUT FORMAT:

```
CARTDIAG> OPEN DOOR
```

PANEL LIGHTS

This command is used to set the front panel lights and is specific to HP9145A.

INPUT FORMAT:

```
CARTDIAG> PANEL LIGHTS

Do you want to set Busy Light (Y/N)[Y]?
Do you want to set Write Protect Light (Y/N)[Y]?
Do you want to set Fault Light (Y/N)[Y]?
Do you want to set Loaded Light (Y/N)[Y]?
Do you want to set Clean Head Light (Y/N)[Y]?
```

PATTERN ERT

This command is used to initiate a pattern error-rate test. Four options are available to the user. The test will destroy data on the tape. Thus, the user must be running in destructive mode in order to execute this command. The four options are loop count, test type, test area, and data source. They are defined as follow:

```
Loop count  :  0 - 255

Test type   :  00 = Read only ERT.
               01 = Write then Read ERT.
               02 = Certification (Write then read with bad
                    blocks spared after test done).

Test area   :   C = Use current address and current length.
                S = Use specific track.
                E = Entire tape.

Data source :
     For HP9144A/T and HP35401A:
               00 = Internal patterns.
                    For first loop, pattern #1 is used, for second
                    loop, pattern #2 is used, etc.  If more than
                    eight loops of the test are requested, then
                    the pattern numbers will be cycled through
                    again from the beginning.  The patterns, in
                    order, are:

                    Pattern         Function
                    =======         ========
                    B6 6D DB        MFM DC offset
                    7F              Standing wave
                    77              Standing wave
                    55 49 3F        Frequency sweep
                    FF              Produces 2F in one phase
                    00              Produces 2F in other phase
                    55              Produces 1F in one phase
                    AA              Produces 1F in other phase

               01 = User defined pattern.
                    This is the 64 byte pattern that is sent to
                    the unit via the Receive user pattern utility.
                    This pattern will be used on all loops.

               02 = Random pattern.

     For HP9145A:
               00 = Use internal pattern 6D B6 DB.
               01 = User defined pattern.
                    Patterns received via the Receive User Pattern
                    Utility.  Use internal pattern if Receive User
```

```
                    pattern is not sent immediately prior to this
                    command.
                02 = Use random data.
                03 = Use FF.
                04 = Use 55.
                05 = Use F5.
                06 = Use FFFFF5.
```

Note: The test area is ignored if Certification is selected because this option will test the entire tape.

INPUT FORMAT:

```
CARTDIAG> PATTERN ERT

   Do you wish to clear the ERT log (Y/N)[N]?

   Which type would you like: 00 -- Read only ERT
                              01 -- Write then Read ERT
                              02 -- Certification ERT
        type --

     {if type <> 02}

   Available test area:

For HP9144A/T or HP35401A:
     C - Current address and length
     S - Use specific track
     E - Entire tape


   What test area would you like:

      {if S is chosen}
Enter track number --

For HP9145A:
     C - Current address and length
     S - Use specific track X and X+1
     E - Entire tape


   What test area would you like:

      {if S is chosen}
Do you want to use 1st or 2nd set of 16 tracks(1/2)[1]?
Enter track number --

   What loop count would you like (0<= count <= 255)[1]?

      {if Pattern test was selected}
```

```
For HP9144A/T or HP35401A:
   The sources for the data pattern to be used are:
     I - Internal pattern
     R - Random pattern
     U - User input pattern
   Which pattern source would you like (I/R/U)[I]?

For HP9145A:
   The sources for the data pattern to be used are:
     00 - Internal pattern
     01 - User defined pattern
     02 - Random pattern
     03 - Use FF
     04 - Use 55
     05 - Use F5
     06 - Use FFFFF5


   This test will destroy data on the tape
   Do you wish to continue (Y/N)[N]?
         {Responding N will terminate this command}

   Do you wish to read the ERT log (Y/N)[N]?
```

OUTPUT FORMAT:

```
         {if user wants to read the ERT log}
   No errors were detected in the ERT

         {if errors were detected}


   Error Rate Test Log Values
   ==========================

   Number of blocks accessed = nnnn
   Permanent errors = nnnn
   Transient errors = nnnn
   Uncorrectable errors = nnnn
   Permanent key errors = nnnn
   There are no log entries
                  or

          Logical
          Address      Error
          =======      =====
           nnnn       BBBBBBBB
           nnnn       BBBBBBBB
           .
           .   Repeat for each entry in the log
           .
```

```
        nnnn        BBBBBBBB

     {if any entries were printed}
Do you wish to see error byte decoding information(Y/N)[N]?


     {if yes}

The Error values are :

   76543210
   ========
   00000001  Frame 1 has a CRC error
   00000010  Frame 2 has a CRC error
   00000100  Frame 3 has a CRC error
   00001000  Frame 4 has a CRC error
   00010000  Frame 5 has a CRC error
   00100000  Frame 6 has a CRC error
   01000000  Data was unrecoverable
   10000000  Key error
```

POWERFAIL STATUS

This command returns information due to power failure since the current cartridge was inserted or the last **POWERFAIL STATUS** was issued. This command is specific to HP9145A.

INPUT FORMAT:

```
CARTDIAG> POWERFAIL STATUS
```

OUTPUT FORMAT:

```
Power fail has occurred.
          or
Power fail has occurred but no tape was loaded.
          or
Power fail occurred and a tape was loading or loaded and the
tape was successfully loaded during powerfail.
          or
Power fail occurred and a tape was loaded but the power fail
load FAILED.

          AND

No data was lost during last power down/fail.
          or
Host data in the buffer was not written to tape due to the last
power down/fail.  The logical host block address of the first block
not written to tape due to the power failure is nnnnnnnn
          or
Spares table was not able to be updated on tape after the last
power down/fail.
```

PRESET DRIVE

This command will update all logs on the tape if they require an update. This includes the spares table, run time logs, and use log. This utility enables the user to force the logs to be flushed to tape.

INPUT FORMAT:

```
CARTDIAG> PRESET DRIVE

Note:  If a 9144A 16 track tape or a compressed tape is being
       used in HP9145A, then there will be an error message.
```

READ

This command allows the user to access any data block from the tape on the selected device. The user will be prompted for the block address to be read at. This command requires Level 0 security.

INPUT FORMAT:

```
CARTDIAG> READ

   Enter block address  --
```

OUTPUT FORMAT:

```
   The data in hex follows:

        0   1   2   3   4   5   6   7   8   9

   0:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH   . . . . . .
  10:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH   . . . . . .
     .
     .
     .
 250:  HH  HH  HH  HH  HH  HH                   . . . . . .

{NOTE -- the dots in the preceding table represent non-alpha-numeric
 ASCII characters.  Alpha-numeric characters will be printed.}
```

READ MEMORY

This command allows the user to access any data block from the global data memory area on the selected device. For HP9144A/T and HP35401A, 1024 bytes of data will be returned starting at the address user specified. For HP9145A, user will be prompted for number of bytes of data. This command requires Level 0 security.

INPUT FORMAT:

```
CARTDIAG> READ MEMORY

  Enter block address  --

For HP9145:

  Enter number of block to be read --
```

OUTPUT FORMAT:

```
  The data in hex follows:

       0   1   2   3   4   5   6   7   8   9

  0:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH   . . . . . .
 10:  HH  HH  HH  HH  HH  HH  HH  HH  HH  HH   . . . . . .
    .
    .
    .
250:  HH  HH  HH  HH  HH  HH                  . . . . . .

{NOTE -- the dots in the preceding table represent non-alpha-numeric
 ASCII characters.  Alpha-numeric characters will be printed.}
```

READ NOVRAM

This command allows the user to access all the 32 bytes data in the Non-volatile RAM and is specific to HP35401A.

INPUT FORMAT:

```
CARTDIAG> READ NOVRAM
```

OUTPUT FORMAT:

```
The drive is in Sequential mode.
                or
The drive is in Selective mode.

There are currently nnnn installed cartridges.

The drive is currently IDLE.
              or
The drive is currently LOADING.
              or
The drive is currently UNLOADING.
              or
The drive is currently has a drive FAULT.

Cartridge nnnn is currently Loading/Unloading.

Cartridge nnnn is selected for the next load.

The following cartridges are present in the drive:
    nnnn  nnnn ... nnnn

The following cartridges are write protected:
    nnnn  nnnn ... nnnn

The carrier is initialized.
            or
The carrier is not initialized.

The following cartridges have faults:
    nnnn  nnnn ... nnnn

The following cartridges have exceeded the media life limit:
    nnnn  nnnn ... nnnn

The nested faults field is overflowed.

The recovery calls field is overflowed.

The unit faults field is overflowed.

The operations field is overflowed.
```

```
The movement time field is overflowed.

The mechanism movement time is nnnn milli seconds.

Total operations = nnnn.

Total unit faults = nnnn.

Total recovery calls = nnnn.

Total nested faults = nnnn.

Total cleaning cycles = nnnn.

Total power cycles = nnnn.
```

RELOAD

This command will initiate the load sequence if the cartridge is inserted. `RELOAD` is specific to HP9144A/T.

INPUT FORMAT:

```
CARTDIAG> RELOAD
```

REV

This command allows the user to read the revision numbers of the ROM's that contain the firmware installed in the device.

INPUT FORMAT:

```
CARTDIAG> REV
```

OUTPUT FORMAT:

For HP9144A/T:

```
Firmware Revision Values:
                  Revision Number
                  ===============
 Unit Code Rom    nnnn - R
 Executive Rom    nnnn - R
```

For HP35401A:

```
Firmware Revision Values:
                              Revision Number
                              ===============
 Executibe Rom                nnnn - R
 HP35401A Unit Code Rom       nnnn - R
 HP9144A/T Unit Code Rom      nnnn - R
```

For HP9145A:

```
Firmware Revision Values:
                    Revision Number
                    ===============
 Controller Code    nnnn - R
 DDC Code           nnnn - R
 Servo Code         nnnn - R
```

RUN LOG

This command allows the user to access the Run-Time Data Error Log which contains an accumulation of all run-time data errors detected by the drive since the last CLEAR LOGS command. HP9145A will not roll over any of the error counts during operation. If the number of correctable without retries becomes "65535", for instance, then it will remain at "65535" and not roll to "0" on the next error until the log is cleared.

INPUT FORMAT:

```
CARTDIAG> RUN LOG
```

OUTPUT FORMAT:

```
For HP9144A/T and HP35401:

  Run-Time Error Log Values
  =========================

  Number of uncorrectable read errors          = nnnn
  Number of key errors                         = nnnn
  Type of certification                        = nnnn

For HP9145A:

  Run-Time Error Log Values
  =========================

  Number of uncorrectable read errors          = nnnn
  Number of key errors                         = nnnn
  Type of certification                        = nnnn
  Number of blocks spared on write             = nnnn
  Number of correctable errors with retries    = nnnn
  Number of correctable errors without retries = nnnn

  Values for type of certification:
      0 -- Not certified
      1 -- 3M certified
      2 -- HP factory certified
      4 -- 7914 drives certified
      8 -- HP35401A/HP9144A/T certified
     16 -- HP9145A certified

  There are no log entries
                  or

          Logical
          Address      Error
          =======      =====
           nnnn       BBBBBBBB
           nnnn       BBBBBBBB
           .
           .   Repeat for each entry in the log
```

```
        nnnn        BBBBBBBB

     {if any entries were printed}
Do you wish to see error byte decoding information(Y/N)[N]?


     {if yes}

The Error values are :

   76543210
   ========
   00000001  Frame 1 has a CRC error
   00000010  Frame 2 has a CRC error
   00000100  Frame 3 has a CRC error
   00001000  Frame 4 has a CRC error
   00010000  Frame 5 has a CRC error
   00100000  Frame 6 has a CRC error
   01000000  Data was unrecoverable
   10000000  Key error
```

SENSE

This command allows the user to read the values of the state of the sensors/switches and is specific to HP35401A and HP9145A.

INPUT FORMAT:

```
CARTDIAG> SENSE
```

OUTPUT FORMAT:

```
For HP35401A:

  The Quarry ID = 110100 (Binary)
  The Mode is Field mode
          or
  The Mode is Factory mode
          or
  The Eject button has been pressed
          or
  Horizontal movement sensor is on HP9144A/T side
          or
  Horizontal movement sensor is on Magazine side
          or
  Vertical home sensor
          or
  Cartridge under arm detector
          or
  Cartridge write-protect indicator
          or
  Magazine is loaded and door is closed
          or
  Selective mode (0=Sequential mode)
          or
  Vertical movement sensor


For HP9145A:

  Cartridge Present Switch is on
          or
  Write Protect Switch is on
          or
  Unload Button is on
          or
  Self Test Button is on
          or
  Display Self Test Results Button is on
```

SERVICE MODE

This command will allow the user to enable or disable service mode on the HP35401A or HP9145A. Service mode is required for some of the utilities to be performed.

INPUT FORMAT:

```
CARTDIAG> SERVICE MODE

Do you want to Enable or Disable service mode (E/D)[D]?
```

SET PATTERN

This command will allow the user to define and edit a pattern to be used in Pattern Error Rate Test. The pattern must be input in hex and is restricted to 64 digits in length. If less than 64 digits are input, the pattern that was input will be duplicated as many times as necessary to produce 64 digits. If no pattern has yet been defined, the pattern that is input will be stored for use in a Pattern ERT. If a pattern has been previously defined, via this command, that pattern will be displayed and the user can then edit that string. Valid edit characters are: R - for replace, I - for insert, and D for delete. R will replace the characters in the pattern with the characters following the R, starting at the pattern character under which the R is typed. I will insert the characters following the I into the pattern following the character in the pattern under which the I is typed. D will delete the pattern character under which the D is typed. Multiple D's may be typed to delete multiple pattern characters and other editing characters may follow a D (i.e., "DIab" will delete one character and insert the string "ab" at that point in the pattern). Following each edit string typed in, the resulting edited pattern will be re-displayed and the user will be given another opportunity to edit it. This process may be terminated by simply inputing a <cr> for the edit string.

INPUT FORMAT:

```
CARTDIAG> SET  PATTERN

   {if no previous pattern has been defined}
   Input the pattern in hex:

   {if pattern contains all valid hex characters this
    command will terminate}


   {if a previous pattern has been defined or the initial pattern
    input contained invalid characters}

   Input the changes (<cr> to stop):
       {previous pattern is displayed here}
>

   {if the input edit pattern is not valid then the pattern will
    again be displayed and a new edit string will be requested}


    {this process will be repeated until user inputs a <cr>
     only for the edit string}
```

SPARE

This command will allow the user to spare the current target block. The user is also given a choice of method to use for sparing. This command is specific to HP9144A/T and HP35401A. The user must be running in Destructive mode in order to execute this command.

INPUT FORMAT:

```
CARTDIAG> SPARE

   Enter the method of sparing:
          0 -- skip spare
          1 -- jump spare

   Method you want to perform sparing --
```

OUTPUT FORMAT:

```
         {If spare was performed}
   {status -- including address of track affected by spare}
```

TABLES

This command provides access to the various information tables which reside in the drive. This includes the Manufacturer's block and Spares tables. The manufacturer's block table is written by 3M when the tape is formatted. It contains manufacturer's information about the tape and is written in the same direction on all tracks (moving towards EOT). The Spares table contains a list of all blocks which have been spared either by certification or auto-sparing.

INPUT FORMAT:

```
CARTDIAG> TABLES

   The available drive tables are:
      Manufacturer's Table
      Spares Table

   Which table do you want (M/S)[S]?

    {other drives output the spare track table}
```

OUTPUT FORMAT:

```
   Manufacturer's block Table:

   Cartridge type              = DC6xxHC
   Number of user blocks       = bbbb
   Copyright notice            =
   Cartridge ID code           = xxxxxxnnnnnnnnnn for HP9144A/T and
                                                      HP35401A
                               = ZABBBCDDEEFFGGHH for HP9145A

   where xx          = 00 for the long tape
         xx          = 15 for the short tape
         bbbb        = 1024 for HP9144A/T and HP35401A
         bbbb        = 1024 or 4096 for HP9145A
         xxxxxx      = manufacturer's control code
         nnnnnnnnnn  = the date code
         Z           = cartridge mechanical configuration
                        0 - DC600HC or 1 - DC600XTDHC
         A           = location of formatter
                        1 - St. Paul or 2 - Camarillo
         BBB         = machine number
         C           = revision number
         DD          = year
         EE          = month
         FF          = day
         GG          = hour
         HH          = minute

    Note: The cartridge ID code contains both numeric and
          alphanumeric characters and is unique for each
          cartridge.
```

Spares Table:

KEY #	TRACK #
nnnn	nnnn
.	
. For each entry in the table	
.	
nnnn	nnnn

TAPE INFO

This command allows the user to obtain information that is specific to tapes loaded in HP9145A.

INPUT FORMAT:

```
CARTDIAG> TAPE INFO
```

OUTPUT FORMAT:

```
A tape is loaded
      or
There is no tape loaded

The tape is write protected
        or
The tape is not write protected

Cartridge code is HC
        or
Cartridge code is XTD


Cartridge format of the tape is HP9145A format (32 tracks)
                                or
Cartridge format of the tape is 9144A/LINUS format (16 tracks)

             or
The tape is an uninitialized tape

The tape contains uncompressed data
            or
The tape contains compressed data


The tape is Greeley MAGIC compression algorithm
The tape has a known EORD(End Of Record Data) with a host
address of nnnn and actual EORD block address of nnnn
                       or
The tape has an unknown EORD(End Of Record Data)

The tape has nnnn DABS(Direct Access Blocks) Extent
```

TAPE USELOG

This command allows the user to access the tape use log which contain the record of tape usage. This log is never cleared and it is not possible to update this log if the tape is Write Protected.

INPUT FORMAT:

```
CARTDIAG> TAPE USELOG
```

OUTPUT FORMAT:

```
Number of times tape was loaded      = nnnn

For HP9144A/T and HP35401A, the following information also return:

Number of blocks accessed            = nnnn
```

TRANSIENT LOG

This command returns all the read/write errors the drive encountered and overcomes by retries. This command is specific to HP9145A.

INPUT FORMAT:

```
CARTDIAG> TRANSIENT LOG
```

OUTPUT FORMAT:

```
   Transient Log Values
==========================

Number of transient errors = nnnn
                or

       Logical
       Address      Error
       =======      =====
        nnnn        BBBBBB
        nnnn        BBBBBB
        .
        .   Repeat for each entry in the log
        .
        nnnn        BBBBBB

     {if any entries were printed}
Do you wish to see error byte decoding information(Y/N)[N]?


     {if yes}

The Error values are :

   543210
   ======
   000001  Frame 1 has an error
   000010  Frame 2 has an error
   000100  Frame 3 has an error
   001000  Frame 4 has an error
   010000  Frame 5 has an error
   100000  Frame 6 has an error
```

UNLOAD

This command will perform a full unload of the cartridge. If a cartridge is loading when the utility is issued, the load will be aborted and the unload will be performed. For HP35401A, the user can specify the slot where the tape should be loaded. This command is specific to HP35401A and HP9145A.

INPUT FORMAT:

```
CARTDIAG> UNLOAD

For HP35401A:

Enter slot number for the tape to be loaded (1-8)[1] --
```

Error Messages

This section gives a partial list of the error messages that may be generated by CARTDIAG along with brief explanations of the meaning of the messages. The messages will be listed in numerical order and are exactly as they appear in the message catalog. Thus, a "!" indicates that a parameter of some sort will be placed in the location marked by the exclamation point. A "&" indicates that the line below will be concatenated onto the end of the line with the ampersand. Finally, a "%" means that the line below is a continuation of the message, but not to be concatenated as with the ampersand.

100	***** WARNING -- THE I/O PATH MAY NOT& BE FUNCTIONING PROPERLY (CARTERR 100)%**
CAUSE	An error was detected by the Io_Path_Test service while testing the modules on the i/o path preceding the selected device.
ACTION	Execute the appropriate diagnostics on the modules preceding the selected device on the i/o path, especially on those that may have been reported as faulty in error messages immediately preceding this message. Note that the results of the execution of this instance of CARTDIAG may be invalid.

101	***** DEVICE FAILED TO RESPOND TO ! COMMAND (CARTERR 101)%**
CAUSE	No response to an i/o was received prior to the expiration of the allotted time.
ACTION	Verify that the selected tape drive is actually connected to the system. Run SYSMAP, if available, to confirm the presence of the device.

102	***** THE SPECIFIED DEVICE IS NOT A CARTRIDGE TAPE DRIVE & -- RETURNED ID CODE WAS ! (CARTERR 102)%**
CAUSE	The selected device identified itself as something other than a CS/80 drive.
ACTION	Determine type of selected device and run the appropriate diagnostic on it.

103	***** CARTRIDGE TAPE DIAGNOSTIC TERMINATING (CARTERR 103)%**
CAUSE	A fatal error has been encountered.
ACTION	The specific error that was encountered should have been reported immediately prior to this message. Follow the action instructions for that error message.

104	***** A RESERVE AREA IS NOT AVAILABLE ON THIS DRIVE -- NO % OPERATION WAS PERFORMED. (CARTWARN 104)%**
CAUSE	There is no available area on the tape drive that can be written to without corrupting user data. This can happen if no such area is provided by the system, or if the diagnostic is running in destructive mode, in which the location of the reserve area is unknown to the system since the drive is locked for diagnostics.
ACTION	For systems which do not support a reserve area (e.g. HP-UX), reserve area operations are not supported. Otherwise, execute the diagnostic selecting only section 8.

106	*** ! MODE REQUIRED TO EXECUTE THIS COMMAND (CARTERR 106)%
CAUSE	The diagnostic does not have access to the drive in the mode necessary to execute the selected command.
ACTION	The mode granted to a diagnostic for a selected device is system dependent.

108	*** ! COMMAND IS NOT IMPLEMENTED & ON THIS DRIVE/SYSTEM (CARTERR 108)%
CAUSE	The selected operation is either not implemented on the selected drive or the system does not provide access to it.
ACTION	This operation is unavailable.

109	*** DEVICE ENCOUNTERED AN ERROR WHILE EXECUTING THE% CS/80 ! COMMAND (CARTERR 109)%
CAUSE	The drive reported an error as a result of executing the selected operation.
ACTION	The hardware status that is displayed immediately following this message should indicate what sort of problem occurred, including a failing FRU if one is reported. If an FRU is reported, replace it and re-execute this diagnostic.

110	*** THE MAXIMUM NUMBER OF ERRORS HAS BEEN REACHED (CARTERR 110)%
CAUSE	The user specified error limit has been reached.
ACTION	If more errors are desired, re-run the diagnostic assigning a larger value to the ERRCOUNT parameter of the run command.

111	*** UNRECOGNIZED COMMAND -- % TYPE "HELP" FOR A LIST OF VALID COMMANDS (CARTERR 111)%
CAUSE	The specified command is not a valid command.
ACTION	Use the help facility to obtain a list of the commands that are valid and enter the desired command.

112	*** UNRECOGNIZED REPLY WAS FOUND (CARTERR 112)%
CAUSE	The reply that was entered in response to a prompt by the diagnostic is not valid.
ACTION	Refer to the prompt that was displayed and enter a response that is within the specified list of valid responses.

113 *** A NUMERICAL INPUT WAS EXPECTED BUT NOT RECEIVED (CARTERR 113)%

CAUSE The reply that was entered in response to a prompt by the diagnostic is not a valid number.

ACTION Re-enter number using only numeric characters and valid special characters (e.g. +, -, , etc.).

---

114 *** AN UNEXPECTED ERROR OCCURRED IN THE IO_CS80 DAR (CARTERR 114)%

CAUSE A call to the CS/80 device access routine resulted in an unexpected status return.

ACTION The specific status generated by Io_Cs80 should have been displayed immediately prior to this error message. Report this set of error messages to support personnel.

---

115 *** ERROR IN TRANSMISSION DETECTED DURING&
READ LOOPBACK TEST: (CARTERR 115)%

Byte #	Octal Value Transmitted	Octal Value Received	Bit Positions% In Error% 01234567%
======	==========	==========	==========

CAUSE One or more bytes of data that were received from the tape drive as a result of a loopback operation did not contain the expected value(s).

ACTION Data is most likely being corrupted along the data path between the host and the drive. Check all cable connections along the path and re-execute the diagnostic. If errors persist, execute appropriate diagnostics against the modules that lay in the path between the host and the device.

---

116 ! ! ! !

---

118 *** ERROR -- EXPECTED ! BYTES FROM THE DEVICE AND %
RECEIVED ! BYTES (CARTERR 117)%

CAUSE The number of bytes in the reply from the device was not what was expected. This is most likely a result of executing the diagnostic on a drive which is not supported by it.

ACTION Verify that the selected device is in the list of supported devices for the diagnostic (LIST ALL from the DUI). If it is, report the problem to support personnel.

119	*** THIS COMMAND IS NOT SUPPORTED ON THIS DEVICE (CARTERR 119)%
CAUSE	The specified operation is not supported by the selected device.
ACTION	While other devices supported by the diagnostic may support the specified command, the selected device does not.

120	*** FILE SYSTEM ERROR ENCOUNTERED WHILE& RETRIEVING A MESSAGE (CARTERR 120)%
CAUSE	An error was returned while attempting to obtain a message from the catalog. The actual error will have been displayed prior to this message.
ACTION	This is a software error. Report to support personnel.

121	*** IDENTICAL READS FROM TAPE& RETURNED NON-IDENTICAL DATA (CARTERR 121)%
CAUSE	A read operation was performed on the same sector twice and the data from both reads did not match exactly.
ACTION	This is most likely a hardware problem with the drive. If loopback executes correctly, the read/write board in the drive is the probable cause of the error.

122	*** DATA READ FROM TAPE DID NOT& MATCH DATA PREVIOUSLY WRITTEN (CARTERR 122)%
CAUSE	A block was written to the tape and immediately read back. The data read did not match exactly the data written.
ACTION	This is most likely a hardware problem with the drive. If loopback executes correctly, the read/write board in the drive is the probable cause of the error.

123	*** UNIT WAS SET TO 15 BUT STATUS DOES NOT INDICATE THE CURRENT% UNIT AS 15 (CARTERR 122)%
CAUSE	A set unit command was sent to the tape drive specifying unit 15 and hardware status was immediately requested. The unit field of the status was not 15.
ACTION	This is definitely a drive problem—probably firmware.

124	*** THE ADDRESS THAT WAS SET ON THE TAPE DRIVE IS NOT EQUIVALENT TO% THE ADDRESS RETURNED IN STATUS (CARTERR 124)%
CAUSE	A set address command was sent to the tape drive immediately followed by a status request. The address reported in the hardware status did not match the address that was set.
ACTION	This is definitely a drive problem—probably firmware.

125	*** BLOCK DISPLACEMENT WAS SET TO 1 BUT THE% ADDRESS RETURNED IN STATUS DOES NOT INDICATE% THAT THE DISPLACEMENT IS BEING USED (CARTERR 125)%
CAUSE	A set block displacement command was sent to the tape drive immediately followed by a status request. The current block displacement did not match that which was set.
ACTION	This is definitely a drive problem—probably firmware.

127	*** THE ADDRESS BOUNDS BIT IN STATUS WAS MASKED, BUT THE% DEVICE SET IT WHEN AN ADDRESS BOUNDS& ERROR WAS FORCED (CARTERR 127)%
CAUSE	The set status mask command was used to mask address bounds errors and then a set address command was issued with an address that exceeded the maximum. The drive reported the error even though the status was masked.
ACTION	This is definitely a drive problem—probably firmware.

128	*** THE ADDRESS RETURNED IN STATUS INDICATES % THAT THE DEVICE ERRONEOUSLY CONVERTED THE ADDRESS % WHEN CHANGING ADDRESSING MODE (CARTERR 128)%
CAUSE	A set address command was issued to the drive followed by a set return address mode to the opposite of the current mode. Status was then requested and the current target address did not match the address that was set, implying that the address conversion performed by the drive was incorrect.
ACTION	This is definitely a drive problem—probably firmware.

129	*** AN ERROR WAS ENCOUNTERED WHEN READING AFTER RETRY TIME WAS% SET TO A RANDOM VALUE (CARTERR 129)%
CAUSE	A set retry time was issued to the drive with a random time value followed by a read command. The drive reported an error.
ACTION	This is definitely a drive problem—probably firmware.

130	*** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO SEND A SET RELEASE% COMMAND TO THE DEVICE (CARTERR 130)%
CAUSE	A release command was sent to the drive and the drive returned an error.
ACTION	This is definitely a drive problem—probably firmware.

133	*** AN INVALID OPCODE WAS SENT TO THE DEVICE, BUT THE ILLEGAL% OPCODE BIT OF THE STATUS MESSAGE WAS NOT SET (CARTERR 133)%
CAUSE	A command was sent to the drive with an invalid op code and the drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.

134	*** A SET UNIT COMMAND WAS ISSUED WITH A UNIT% NUMBER OF 1, BUT THE MODULE ADDRESSING BIT OF % THE STATUS MESSAGE WAS NOT SET (CARTERR 134)%
CAUSE	A set unit command was sent to the drive with a unit number of 1, which is an invalid unit number. The drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.

135	*** A SET ADDRESS COMMAND WAS ISSUED TO AN ADDRESS GREATER THAN% THE MAXIMUM FOR THE DEVICE, BUT THE ADDRESS BOUNDS BIT OF THE% STATUS MESSAGE WAS NOT SET (CARTERR 135)%
CAUSE	A set address command was sent to the drive with an address greater than the maximum allowable. The drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.

136	*** THE STATUS MASK WAS SET TO MASK ALL UNMASKABLE % BITS, BUT THE PARAMETER BOUNDS BIT OF THE STATUS % MESSAGE WAS NOT SET (CARTERR 136)%
CAUSE	A set status mask command was sent to the drive specifying that all bits be masked that are not allowable (unmaskable). The drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.

137	***** A SET LENGTH COMMAND WAS ISSUED WITH ONLY 1 PARAMETER BYTE% INSTEAD OF THE 4 EXPECTED BY THE DEVICE, BUT THE ILLEGAL% PARAMETER BIT OF THE STATUS MESSAGE WAS NOT SET (CARTERR 137)%**
CAUSE	A set length command was sent to the drive with fewer bytes than are expected by the drive for that command. The drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.

138	***** A WRITE COMMAND WAS ISSUED TO THE DEVICE FOLLOWED % BY A REQUEST FOR AN EXECUTION MESSAGE INSTEAD OF % SENDING ONE, BUT THE MESSAGE SEQUENCE BIT OF THE % STATUS MESSAGE WAS NOT SET (CARTERR 138)%**
CAUSE	The CS/80 protocol was violated by sending a write command and specifying the wrong type of execution message. The drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.

139	***** A WRITE COMMAND WAS ISSUED WITH THE LENGTH SET TO 10,% FOLLOWED BY AN EXECUTION MESSAGE OF ONLY 6 BYTES, BUT THE% MESSAGE LENGTH BIT OF THE STATUS& MESSAGE WAS NOT SET (CARTERR 139)%**
CAUSE	The CS/80 protocol was violated by sending a write command which specified that more bytes be written than were actually provided in the execution message. The drive did not report the expected error.
ACTION	This is definitely a drive problem—probably firmware.

140	***** NO OPERATION WAS PERFORMED (CARTERR 140) %**
CAUSE	Due to a previous error, which has already been reported, no operation was performed.
ACTION	Refer to action instructions for previously reported error.

200	***** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO SEND/RECEIVE% INFORMATION FROM THE USER (CARTERR 200)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to communicate with the user interface process.
ACTION	Refer to action instructions for previously reported error.

201	*** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO RETRIEVE A% MESSAGE FROM THE CATALOG (CARTERR 201)%
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to extract a message from its message catalog.
ACTION	Refer to action instructions for previously reported error.

202	*** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO CONVERT A% NUMBER TO A STRING (CARTERR 202)%
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to convert a number to a string.
ACTION	Refer to action instructions for previously reported error.

203	*** AN ERROR WAS ENCOUNTERED IN ATTEMPTING A BIT EXTRACTION% OPERATION (CARTERR 203)%
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to extract one or more bits from a number.
ACTION	Refer to action instructions for previously reported error.

204	*** THE SELECTED DEVICE COULD NOT BE OBTAINED% FOR TESTING (CARTERR 204)%
CAUSE	
ACTION	

205	*** DUE TO PROBLEMS WITH RETURN ADDRESSING MODE, ADDRESSES% REPORTED WITH STATUS INFORMATION MAY BE INACCURATE (CARTERR 205)%
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to set the return address mode on the drive.
ACTION	Refer to action instructions for previously reported error. Also, if hardware status is displayed later in the diagnostic run, the address portion of the status could be displayed in both block and 3-vector formats since the diagnostic cannot determine the mode that the tape drive is currently in.

206	***** DUE TO PROBLEMS WITH SET BLOCK DISPLACEMENT, CARTDIAG%** **WILL TERMINATE TO AVOID POTENTIAL DESTRUCTION OF %** **USER DATA (CARTERR 206)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully set the block displacement value on the drive. Since the diagnostic no longer knows what the displacement value is, it must terminate to avoid destroying data.
ACTION	Refer to action instructions for previously reported error.

207	***** DUE TO PROBLEMS WITH DESCRIBE, CARTDIAG CANNOT FUNCTION%** **PROPERLY AND WILL THEREFORE TERMINATE (CARTERR 207)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully obtain describe data from the drive. Since the diagnostic needs this information to function correctly, it must terminate.
ACTION	Refer to action instructions for previously reported error.

208	***** AN ERROR WAS ENCOUNTERED IN ATTEMPTING TO COMMUNICATE%** **WITH THE DIAGNOSTIC SYSTEM (CARTERR 208)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to successfully perform a function which requires communication with the diagnostic system.
ACTION	Refer to action instructions for previously reported error.

209	***** YOUR RESPONSE WAS INVALID (CARTERR 209)%**
CAUSE	The data entered in response to a prompt was not valid.
ACTION	Refer to the prompt to determine the valid responses for the particular situation and enter one of the specified valid responses.

210	***** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO OBTAIN DATA%** **FROM AN I/O BUFFER (CARTERR 210)%**
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable to get data from its i/o buffer and, therefore cannot obtain data from the device.
ACTION	Refer to action instructions for previously reported error.

211	*** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO PLACE DATA% INTO AN I/O BUFFER (CARTERR 211)%
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable place data into its i/o buffer and, therefore, cannot send data to the device.
ACTION	Refer to action instructions for previously reported error.

212	*** AN ERROR WAS ENCOUNTERED WHILE ATTEMPTING TO OBTAIN AN% I/O BUFFER (CARTERR 212)%
CAUSE	Due to a previous error, which has already been reported, the diagnostic was unable obtain an i/o buffer and therefore, cannot send/receive data to/from the device.
ACTION	Refer to action instructions for previously reported error.

215	*** HIGHER SECURITY IS NEEDED TO PERFORM THIS OPERATION & (CARTERR 215) %
CAUSE	The user requested an operation which is restricted to users with higher security than the user possesses.
ACTION	Contact system administrator if higher security level is desired.

216	*** ! BYTES WERE EXPECTED TO HAVE BEEN SENT FROM THE TAPE DRIVE, % BUT ONLY ! WERE RECEIVED (CARTERR 216) %
CAUSE	Data returned from the device in response to a command consisted of a different number of bytes than were expected.
ACTION	This is probably a firmware problem in the drive.

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HPIB Digital Data Storage Tape Drive Diagnostic

Introduction

The HPIB Digital Data Storage Tape Drive (HPIBDDS) diagnostic tests the DDS (Digital Data Storage) drive with the HPIB interface. This diagnostic detects failures down to a field replaceable unit (FRU) and is only available on operating systems which support the online diagnostic subsystem.

Defects and Enhancements

Submit defect reports and enhancement requests concerning this diagnostic through the STARS database referencing product number 30600-10033.

Auto-Diagnostics

The HPIBDDS diagnostic program can be initiated by the I/O system to perform auto-diagnostics when an unrecoverable drive error has been detected. In auto-diagnostics mode, this diagnostic program will execute the following sections:

```
Section  2: Clear
Section  3: Identify
Section  4: Loopback
Section  5: Selftest
Section  6: Hardware Status
Section  7: Logs
Section 10: Verification trouble tree
Section 11: Hardware trouble tree
```

Minimum Configuration

This product is available on any Precision Architecture RISC system which supports the online diagnostic subsystem.

Intermediate hardware for communication with the DDS drive must be available on the host system.

The online diagnostic system must be supported with DAR to access DDS. I/O driver with access to diagnostic functions for DDS through the host operating system.

Operating Instructions

Diagnostic subsystem security level 3 is required to initiate this diagnostic. However, some diagnostic tasks which are exclusive or destructive to tape data will require a higher clearance.

Default Tests

If the user does not specify sections and steps, the default sections and steps will be executed. These default sections and steps will be performed whether the drive is either on-line or off-line:

```
Section  2 : Clear
Section  3 : Identify
Section  4 : Loopback
Section  6 : Obtain and display device status
Section 10 : Non-destructive verificiation trouble tree
Section 11 : Destructive hardware trouble tree
```

RUN Command

To bring up the Online Diagnostic subsystem, enter the following command to the MPE XL system prompt:

```
SYSDIAG
```

To bring up the Online Diagnostic subsystem, enter the following command to the HP-UX system prompt:

```
%/usr/diag/bin/sysdiag
```

The system responds with the following prompt indicating that access has been gained to the Online Diagnostic User Interface (DUI).

```
DUI >
```

Typing HELP causes a summary of the DUI and its commands to be printed. Refer to the DUI Section of this manual for details.

Note

The device to be tested must be powered up. Device physical locations (pdev) shown in the RUN commands are those of the devices on the "typical A1002A" system configuration described in the chapter on DUI. The pdev value entered must be correct for the system being tested.

For example, to run the diagnostic, you might enter:

```
DUI&>RUN HPIBDDS pdev=4.6.1 <RUN Command Options>
                            |             |
                            |   none required for
                            |   default test suite
                            |
                  insert physical location of
                  device to be tested here;
                  alternatively, for MPE XL,
                  type the ldev number;
                  or for HP-UX, type the devfile name
```

A description of HPIBDDS and all the sections are available through the DUI's Help facility.

Upon completion of all sections and steps or when a fatal error condition is encountered, control will be returned to the Diagnostic User Interface (DUI).

Test Execution

In executing HPIBDDS, the following welcome message will be displayed:

```
**********************************************************************
******                                                          ******
******                HPIB DDS DIAGNOSTIC                       ******
******                                                          ******
******       (C) Copyright Hewlett Packard Co. 1987             ******
******                 All Rights Reserved.                     ******
******                   Version  n.nn.nn                       ******
******                                                          ******
**********************************************************************

Welcome, Today is TUE, Jul 12, 1988 at 9:00 AM

        {Output from sections and steps executed}

HPIBDDS EXITING ...
```

The diagnostic will request access to the device from the diagnostic subsystem unless the program is being called to decode status. If access is denied, error messages from the subsystem as well as this diagnostic will be displayed upon program termination. If access is successful, the diagnostic will automatically invoke a diagnostic subsystem routine to test the I/O path between the intermediate hardware and the drive. If the status returned from this routine is "unsuccessful", a warning message will be displayed and the diagnostic will continue. For "successful" status, the diagnostic will interrogate the device to identify itself. If the device fails to respond, the program will clear the device and re-interrogate the device to identify itself.

```
The HPIBDDS is CLEARing the drive and DESCRIBE will be performed
again after clear.
```

If the device still fails to respond, the program will terminate.

```
*** DUE TO PROBLEMS WITH DESCRIBE, HPIBDDS CANNOT FUNCTION
    PROPERLY AND WILL THEREFORE TERMINATE (DDSERR 207)
```

If an unexpected identification code is received, an appropriate warning message will be displayed and the execution will continue to allow development devices to be diagnosed. In this case, the user will be asked whether to continue or not, for example:

```
*** HPIBDDS IS UNABLE TO DIAGNOSE THE SELECTED DEVICE(DDSERR 102)

              Do you wish to continue (Y/N)[N]?
```

If the device identifies itself as a valid candidate, the sections and steps specified by the user in the DUI run command will be executed. If the user did not specify sections and steps, the default sections and steps will be executed. These default sections and steps will be performed whether the drive is either on-line or off-line.

If the diagnostic request fails during the execution of any program section or step, the appropriate error will be displayed. When the number of errors generated reaches the limit specified by the user in the ERRCOUNT parameter of the RUN command, an error will be displayed and the diagnostic will terminate.

If the ERRPAUSE parameter of the RUN command was assigned a value of "on", the diagnostic will pause after each error and will ask the user whether or not to continue the test.

Detailed Test Descriptions

The following test sections and steps are available to the user with HPIBDDS:

```
Section 2     Clear

Section 3     Identify

Section 4     Loopback

Section 5     Selftest

Section 6     Display Device Status

Section 7     Display Device Log
  Step 62       Fault Log
  Step 63       Error Rate Log
  Step 64       Tape Log


Section 10    Verification Trouble Tree

Section 11    Hardware Trouble Tree

Section 12    Media Trouble Tree (Non-Destructive)

Section 13    Media Trouble Tree (Destructive)

Section 50    Interactive External Exercisera
```

Section 2—CLEAR

This section will place the device in the following state:

- Tape drive protocol will be restarted
- Internal command and report queues will be purged
- Data buffers will be cleared
- Current tape position will be retained
- Current tape status will be retained
- Current On/Off-Line status will be retained

However, the device response to these commands will not be tested. To test the response, use other sections such as Identify, Loopback and Device Status.

OUTPUT :

```
Section 2 -- CLEAR

End of Section 2 -- CLEAR
```

Section 3—IDENTIFY

This section requests the tape drive to identify itself in order to determine whether it is responding. If not, an error message will be displayed and the program aborts. Otherwise, the user will be informed of the device identity. The ID code and the device mnemonic (HP*nnnn*) will be displayed.

If the code does not match the device, a warning will be issued and the user will be prompted for one of the valid identification codes to use to diagnose the device. If none is supplied, the program will terminate.

OUTPUT :

```
Section 3 -- IDENTIFY

      The selected device has been identified as an HPC15X1
                        Digital Audio Tape Drive.

End of Section 3 -- IDENTIFY
```

Section 4—LOOPBACK

This section will test the HPIB Communication Link between the host and selected tape drive.

The Loopback operation tests the HPIB (ABI) chip, HPIB transceivers, data buffer, handshake logic and buffer memory. This operation performs a write loopback of 256 bytes of data to the device using the pattern—255, 0, 1, ... , 254, follows by a read loopback of 256 bytes. The results will be checked against the expected pattern.

OUTPUT:

```
Section 4 -- LOOPBACK

   Tape Drive data channel checks out OK.

End of Section 4 -- LOOPBACK
```

{OR}

```
Section 4 -- LOOPBACK

   The following transmission errors were detected during the
   loopback test:

                Hex Value        Hex Value       Erroneous bits
Byte #          Transmitted      Received          01234567
======          ===========      ===========     ============
 nn               hh               hh             bbbbbbbb
 12               56               54             00000010
 33               7F               3D             01000010

  .                .                .                .
  .                .                .                .

End of Section 4 -- LOOPBACK
```

Note

Entries in the preceding table will be displayed for as many errors as were detected, unless the ERRCOUNT parameter of the RUN command has been exceeded.

Section 5—Selftest

This section will attempt to isolate and identify a problem by initiating the internal power-on selftest on the tape drive and reports the status of the test to the user. The test will be initiated by issuing an INITIATE DIAGNOSTIC command specifying diagnostic 0.

OUTPUT:

```
Section 5 -- SELFTEST

      No faulty Field Replaceable Units (FRUs) were detected
         by device diagnostic #nnn.
 {or}
      Device diagnostic #nnn detected the following failure:

      Error Class  -       error group according to device ERS
     [Detection    -       while name of detecting action          ]
     [             -       by name of detecting processor/program  ]
     [             - (nnn) name of detecting test                  ]
      Explanation  - (hhh) error explanation as listed in device ERS
      Faulty FRUs  - (nn) FRU name as listed in device ERS
     [             - (nn) FRU name as listed in device ERS         ]
 {or}
      Device diagnostic #nnn was unable to either run to completion
      and/or isolate an FRU.  Error returned:

      Error Class  -       error group according to device ERS
      Explanation  - (hhh) error explanation as listed in device ERS

End of Section 5 -- SELFTEST
```

Note

This is a generalized example and selftest numbers will be displayed in decimal; error and FRU numbers in hex except for the section which the header/trailer will be repeated for execution.

Section 6—DISPLAY DEVICE STATUS

This section decodes the 6 bytes of hardware status from the tape drive and displays the status to the user. It will display both the raw and interpreted values of each status register which will reflect the status of the drive.

OUTPUT:

```
Section 6 -- DISPLAY DEVICE STATUS
    ================================================================================
                                  DEVICE STATUS
    ================================================================================

    RAW FORM:
          Register   Hex       DIO Map     Decimal
                     Value     87654321    Value(s)
             #1        hh       bbbbbbbb
             #2        hh       bbbbbbbb
             #3        hh       bbbbbbbb
             #4        hh                   nn, nn
             #5        hh                   nnn
             #6        hh                   nnn
    --------------------------------------------------------------------------------

    INTERPRETED DRIVE STATUS:
        Tape drive is [ON-line, OFF-line]
        Immediate Response Mode is [ENABLED, DISABLED]
        Device has been CLEARED since last command or power has
            been just restored
    --------------------------------------------------------------------------------

    INTERPRETED TAPE STATUS:
        Tape is Write [ENABLED, PROTECTED]
        Tape density is UNKNOWN
        Tape position is [BOT, EOF, past EOT, UNKNOWN]
        Tape RUNAWAY condition detected
        Data TIMING error detected
    --------------------------------------------------------------------------------
```

```
    INTERPRETED I/O STATUS:
        Last command was [REJECTED, ACCEPTED]
           - Last command was retried nnn times
             Reject Class    : [DEVICE reject, PROTOCOL reject,
                                SELFTEST failure, #n]
             Error location : [CONTROLLER, SERVO, FORMATTER]
             Error #hhh - error explanations
        HPIB Command Parity Error detected
        Unrecovered Data PARITY error detected
        Unrecovered Data/Format Error
        RECOVERED error detected


End of Section 6 -- DISPLAY DEVICE STATUS
```

Section 7—DISPLAY DEVICE LOG

This section obtains data from the fault log, error rate log, and tape log, and decodes and displays the error messages to the user.

Step 62 - Fault Log	Contains selftest failures along with all problems encountered during normal operation.
Step 63 - Error Rate Log	Used to monitor the condition of a tape during normal operation and may also be used to monitor tape errors while executing error rate tests.
Step 64 - Tape Log	Contains tape-related information generated during the current tape load.

OUTPUT:

```
    Section 7 -- DISPLAY DEVICE LOGS

  Step 62 - Fault Log
       ========================================================================
                                    FAULT LOG
       ========================================================================
       ---------- 01 ------------------------------------------------------------
       Device diagnostic #nnn detected the following failure:

       Error Class  -        Runtime errors
                                    OR
                             Drive controller diagnostic errors
                                    OR
                             Buffer controller diagnostic errors
                                    OR
                             Interface controller diagnostic errors
                                    OR
                             Multi-processor errors
                                    OR
                             Operational status
       Error Code   - (hhh)  error explanation as listed in device ERS
      [Faulty FRUs  - ( nn)  FRU name as listed in device ERS          ]
      [             - ( nn)  FRU name as listed in device ERS          ]


       ---------- 02 ------------------------------------------------------------
                                    :
                                    :
       ---------- nn ------------------------------------------------------------

  End Step 62 - Fault Log
```

```
Step 63 - Error Rate Log

  ========================================================================
                          ERROR RATE LOG
  ========================================================================
  Number of groups written          = nnnn
  Number of groups has RAW rewrites = nnnn
  Number of write hard errors       = nnnn
  Number of groups read             = nnnn
  Number of groups retried          = nnnn
  Number of read hard errors        = nnnn

 End Step 63 - Error Rates


 Step 64 - Tape Log

     ========================================================================
                                  TAPE LOG
     ========================================================================
            Total tape load        = nnnnn

            Current groups written = nnnnnnnn
            Current RAW retries    = nnnnn
            Current groups read    = nnnnnnnn
            Current ECC-3 retries  = nnnnn

            Previous groups written = nnnnnnnn
            Previous RAW retries    = nnnnn
            Previous groups read    = nnnnnnnn
            Previous ECC-3 retries  = nnnnn

            Total groups written = nnnnnnnn
            Total RAW retries    = nnnnn
            Total groups read    = nnnnnnnn
            Total ECC-3 retries  = nnnnn

 End Step 64 - Tape Log

 End of Section 7 -- DISPLAY DEVICE LOGS
```

Section 10—VERIFICATION TROUBLE TREE

This section will perform a series of non-destructive tests to a DDS drive to detect and isolate the FRU. This diagnostic trouble tree will determine that the device is up and responding and that the HPIB channel appears to be free of problems.

OUTPUT:

```
Section 10 -- VERIFICATION TROUBLE TREE
```

{Scenario 1:}

```
    REJECTED - Device identification
       Explanation: (nnn) hardware status error if available.

    SUSPECT:  (in descending order of probability)
        1. FRU    : HPIB cable
        2. Device powerfail
```

{Scenario 2:}

```
    FAILED   - Device identification
       HPIB code  = hhhh - WARNING: Device is not recognized
                                    as a DDS tape drive.
    REJECTED - HPIB Loopback test
       Explanation: (nnn) hardware status error if available.

    SUSPECT:  (in descending order of probability)
        1. FRU    : HPIB cable
        2. FRU nn: Hp - HPIB Interface
```

{Scenario 3:}

```
    FAILED   - Device identification
       HPIB code  = hhhh - WARNING: Device is not recognized
                                    as a DDS tape drive.
    FAILED   - HPIB Loopback test

                  Hex Value          Hex Value       Erroneous bits
       Byte #     Transmitted        Received           01234567
       ======     ===========        ==========      =============
        nn            hh               hh             bbbbbbbb
        12            56               54             00000010
        33            7F               3D             01000010

        .             .                .                 .
        .             .                .                 .

    SUSPECT:  (in descending order of probability)
        1. FRU    : HPIB cable
```

```
    2. More than 1 device answering to the same address
    3. FRU nn: Hp - HPIB Interface
```

{Scenario 4:}

```
FAILED   - Device identification
   HPIB code  = hhhh - WARNING: Device is not recognized
                               as a DDS tape drive.
PASSED   - HPIB Loopback test

SUSPECT:  (in descending order of probability)
    1. Invalid configuration
    2. Wrong device at specified address
    3. More than 1 device answering to the same address
    4. FRU nn: Hp - HPIB Interface
    5. FRU   : HPIB cable
```

{Scenario 5:}

```
PASSED   - Device identification
REJECTED - HPIB Loopback test
   Explanation: (nnn) hardware status error if available.

SUSPECT:  (in descending order of probability)
    1. FRU   : HPIB cable
    2. FRU nn: Hp - HPIB Interface
```

{Scenario 6:}

```
PASSED   - Device identification
FAILED   - HPIB Loopback test
```

Byte #	Hex Value Transmitted	Hex Value Received	Erroneous bits 01234567
nn	*hh*	*hh*	*bbbbbbbb*
12	56	54	00000010
33	7F	3D	01000010
.	.	.	.
.	.	.	.

```
SUSPECT:  (in descending order of probability)
    1. FRU   : HPIB cable
    2. More than 1 device answering to the same address
    3. FRU nn: Hp - HPIB Interface
```

{Scenario 7:}

```
    PASSED   - Device identification
    PASSED   - HPIB Loopback test

    NO PROBLEMS DETECTED.
       Suggestions for further action:
          1. Run destructive trouble tree (section 11)
          2. Run operator assisted trouble tree (section 12)

End of Section 10 -- VERIFICATION TROUBLE TREE
```

Section 11—HARDWARE TROUBLE TREE

This section will check out the device as thoroughly as possible without on-site assistance (tape handling) and without taking excessively long to complete. This section is destructive since the tests may clear data buffers and otherwise reset the device or even declare it unuseable by processes other than diagnostics. This section will attempt to clear the device to a known state and cause a series of device internal selftests to be run.

OUTPUT:

```
Section 11 -- HARDWARE TROUBLE TREE

{Scenario x:}
   [PASSED    - test description]
   [PASSED    - test description]
   [FAILED    - test description]
   [REJECTED - test description
       Explanation: (nnn) hardware status error if available.]

    SUSPECT:  (in descending order of probability)
        1. name of suspected failing component/FRU
        2. name of suspected failing component/FRU


{Scenario 2:}

    PASSED    - Device clear
    PASSED    - Device identification
    PASSED    - HPIB Loopback test
    PASSED    - Selftest nnn

    NO PROBLEMS DETECTED.
       Suggestions for further action:
          1. Run operator assisted trouble tree (section 12)

End of Section 11 -- HARDWARE TROUBLE TREE
```

Section 12—MEDIA TROUBLE TREE (Non-Destructive)

This section will perform a series of non-destructive tests to the media of the DDS tape drive to verify the integrity of the media. Several possible output scenarios from this section are given below. Note that this is not an exhaustive set of possibilities but is provided to give the user an idea of the type of output this section will produce.

OUTPUT:

```
Section 12 -- MEDIA TROUBLE TREE (Non-Destructive)

{Scenario 1:}


{Scenario 2:}


End of Section 12 -- MEDIA TROUBLE TREE (Non-Destructive)
```

Section 13—MEDIA TROUBLE TREE (Destructive)

This section will perform a series of destructive tests to the media of the DDS tape drive to verify the integrity of the media. Several possible output scenarios from this section are given below. Note that this is not an exhaustive set of possibilities but is provided to give the user an idea of the type of output this section will produce.

OUTPUT:

```
Section 13 -- MEDIA TROUBLE TREE (Destructive)

{Scenario 1:}


{Scenario 2:}


End of Section 13 -- MEDIA TROUBLE TREE (Destructive)
```

Section 50—INTERACTIVE EXTERNAL EXERCISER

The HPIBDDS External Exerciser is an interactive section which allows the user to access to a set of internal diagnostics and utilities within the DDS tape drive. The purpose of the exerciser is to aid service-trained personnel in troubleshooting DDS tape drives to a replaceable assembly level.

The following commands will be implemented:

```
Displays:          HWSTATUS
                   IDENTIFY
                   LOGS
                      ALL
                      FAULT LOG
                      ERROR RATE
                      TAPE

Diagnostics:       LOOPBACK (hpib)
                   MOTIONCHECK
                   SELFTEST
                   TROUBLE TREES
                      VERIFICATION
                      HARDWARE
                      MEDIA (NON-DESTRUCTIVE)
                      MEDIA (DESTRUCTIVE)
                   WORKOUT

Tape commands:     IRM
                   LOADTAPE
                   REWIND
                   UNLOADTAPE

Utilities:         CLEARDEV
                   CLEARLOG
                     ALL
                     FAULT
                     ERROR RATE
                     TAPE
                   REV

Exerciser
 control:          EXIT
                   HELP
                   SUSPEND
```

When the external exerciser is executed, the user will enter command upon the following prompt:

```
HPIBDDS>
```

Some commands may not be available if the requested device could not be obtained with exclusive access. The Exit command will terminate the program. Syntax and usage help will be available via the HELP command.

If the user enters an unrecognized command the following error message with one or more of the applicable additional explanations will be displayed. For unrecognized command the user will be reprompted, e.g.

```
*** YOUR RESPONSE IS INVALID.  (DDSERR 05008)

    {explanation of error.}

HPIBDDS>
```

Some commands require additional information from the user. In many cases, this information can be supplied as parameters to the command. If an invalid parameter is supplied, the following error message will be displayed.

```
*** UNEXPECTED PARAMETER (!) ENCOUNTERED.
```

The user will then be prompted for remaining information. The data prompts will be displayed in mixed case and will end with the prompt symbol ">". They will also include a range or selection of choices enclosed in parentheses and, where appropriate, a default selection, enclosed by square brackets, supplied by the program upon entry of a carriage return (<CR>). For example:

```
Enter the value. (off|1..99) [OFF]>
```

The text enclosed in the parentheses indicates that the user is to type either "off" or an integer value between 1 and 99 inclusive. Each option is separated by a "|". The default response "off", as indicated by [OFF], would be used if the user simply entered a carriage return. For items like configuration values, the current value will normally be displayed as the default.

Keyword responses (e.g., command names) may be abbreviated but not below the minimum number of characters necessary to distinguish them from all other valid responses. Responses will not be case sensitive. In addition, some commands will have special 2 or 3 character abbreviations which will also be recognized. These abbreviations are listed next to the command name in help messages. Where possible, command names, abbreviations, and other characteristics will conform to similar commands in the proposed Support User Interface Standard.

The **HELP** keyword will be recognized at all prompts.

If an error is encountered as a result of issuing a command to the device, error messages and the hardware status will be displayed. Status display will conform to that of *Section 6 -- Display Device Status.* Note that some exerciser commands may issue several different device commands to the tape drive. Therefore, error messages may refer to command names other than those which are part of the exerciser.

Each command description below is in the following format:

Command Name

USAGE:
Explanation of what the command does and when it should be used.

SYNTAX:
Listing of command syntax (including any special abbreviation) and any parameter descriptions.

DATA PROMPTS:
Prompts to be displayed for needed information not available from the command parameter list.

OUTPUT FORMAT:
Information printed as a result of this command being executed.

ERROR MESSAGES:
Any error messages worth noting that may be generated as a result of this command. Note that this does not imply that all possible error messages that may be generated are listed here, but rather, only those that are especially worth mentioning in relation to the command.

There are several conventions used throughout the command output descriptions. They are as follows:

```
in    - a decimal digit
              (a 4 digit number would be represented as nnnn).
c     - an ASCII character.
h     - a hexadecimal digit (0-F).
o     - an octal digit (0-7).
b     - a binary digit (0-1).
text  - a description of what will appear at that spot.
```

Comments in the input and output sequences are enclosed in curly brackets "{}". These comments are only part of this document and are not output by the program. For example, a command description may contain the following:

```
Do you wish to continue? (Y|N)[N]>

                {if response is "N" this command will terminate}
```

However, the actual output of the program is:

```
Do you wish to continue? (Y|N)[N]>
```

CLEARDEV

USAGE:

This command performs a CLEAR operation on the DDS tape drive. It basically resets the drive to a given known state. This command causes the drive to be placed in a known condition as follows:

- Tape drive protocol will be restarted
- Internal command and report queues will be purged
- Data buffers will be cleared
- Current tape position will be retained
- Current tape status will be retained
- Current On/Off-Line status will be retained

SYNTAX:

```
CLEARDEV
```

DATA PROMPTS: None

OUTPUT FORMAT:

```
Device has been cleared.
```

CLEARLOG

USAGE:

This command is used to initialize (clear) various logs internal to the device. The user is given a choice of log to be cleared or to clear all logs. This command can destroy valuable information and should be used with caution.

SYNTAX:

```
CLEARLOG

     where:
          ALL              - All of the following clears will be done.
          FAULT            - Selftest failures and all problems
                             encountered during normal operation.
          ERROR RATE       - Tape condition during normal operation.
```

DATA PROMPTS:

```
Which log is to be initialized?
     0 -- ALL
     1 -- FAULT
     2 -- ERROR RATE

Your selection [<cr>=none]>
```

OUTPUT FORMAT:

```
The specified log has been initialized.
```

DESCRIBE

USAGE:

This command will obtain a message describing the device and display the contents to the user in text form.

SYNTAX:

```
DESCRIBE
```

DATA PROMPTS: None

OUTPUT FORMAT:

```
The product is an HPC15X1 Digital Audio Tape Drive.
RAM size is 512 KBytes.
The interface ID is HPIB.
```

EXIT

USAGE:

This command terminates execution of the External Exerciser. It may be entered any time at the HPIBDDS> prompt.

SYNTAX:

```
EXIT
```

DATA PROMPTS: None

OUTPUT FORMAT:

```
End of Section 50 -- INTERACTIVE EXTERNAL EXERCISER
```

HELP

USAGE:

This command provides the user information about the commands that are available in the external exerciser. The user may request a list of all available commands accompanied by a brief description of each, or individual command descriptions. Individual command help contains a brief explanation of usage and describes command syntax.

SYNTAX:

```
HELP
```

OUTPUT FORMAT:

```
CLEARDEV     - Resets device to known state.
CLEARLOG     - Resets user specified device internal log.
DESCRIBE     - Obtains describe information from the device.
EXIT         - Terminates Interactive External Exerciser.
HELP         - Displays descriptions of exerciser commands.
HWSTATUS     - Obtains and displays device hardware status.
IDENTIFY     - Displays device identification information,
                 including product code, firmware revs, etc.
IRM          - Enables/disables Immediate Response Mode.
LOGS         - Displays various device internal logs.
LOADTAPE     - Loads a tape (on auto-loading drives) and places
                 drive on-line.
LOOPBACK     - Tests HPIB link to device.
MOTIONCHECK  - Exercises drive's ability to skip files & records.
REV          - Displays the firmware revision number.
REWIND       - Rewinds the loaded tape to BOT.
SELFTEST     - Executes of user specified sequence of
                 device selftests.
SUSPEND      - Suspends execution of HPIBDDS so that other
                 DUI commands can be executed.
TREES        - Executes user specified HPIBDDS diagnostic
                 trouble tree.
UNLOADTAPE   - Rewinds and unloads a tape (auto-loading drives).
WORKOUT      - Checks drive's basic ability to write & read data.
```

HWSTATUS

USAGE:

This command will obtain the current hardware status from the device and display it in readable text form.

SYNTAX:

```
HWSTATUS
HS
```

DATA PROMPTS: None

OUTPUT FORMAT:

```
=====================================================================
                          DEVICE STATUS
=====================================================================

RAW FORM:
      Register   Hex       DIO Map     Decimal
                 Value     87654321    Value(s)
         #1        hh      bbbbbbbb
         #2        hh      bbbbbbbb
         #3        hh      bbbbbbbb
         #4        hh              nn, nn
         #5        hh              nnn
         #6        hh              nnn
---------------------------------------------------------------------

INTERPRETED DRIVE STATUS:
    Tape drive is [ON-line, OFF-line]
    Immediate Response Mode is [ENABLED, DISABLED]
    Device has been CLEARED since last command or power has
        been just restored
---------------------------------------------------------------------

INTERPRETED TAPE STATUS:
    Tape is Write [ENABLED, PROTECTED]
    Tape density is UNKNOWN
    Tape position is [BOT, EOF, past EOT, UNKNOWN, UNRECOGNIZED]
    Tape RUNAWAY condition detected
    Data TIMING error detected
---------------------------------------------------------------------
```

```
INTERPRETED I/O STATUS:
    Last command was [REJECTED, ACCEPTED, ACCEPTED but FAILED]
       - Last command was retried nnn times
         Reject Class    : [DEVICE reject, PROTOCOL reject,
                              SELFTEST failure, #n]
         Error location : [CONTROLLER, SERVO, FORMATTER, UNRECOGNIZED]
    HPIB Command Parity Error detected
    Unrecovered Data PARITY error detected
    Unrecovered Data/Format Error
    RECOVERED error detected
```

IDENTIFY

USAGE:

This command requests device identification information from the drive. The HPIB code and the product number returned by the device will be displayed.

SYNTAX:

```
IDENTIFY
```

DATA PROMPTS: None

OUTPUT FORMAT:

```
The selected device has been identified as an HPC15X1
                    Digital Audio Tape Drive.
```

IRM

USAGE:

This command is used to enable or disable immediate response mode on the drive. Drives will require this command to turn on streaming.

SYNTAX:

```
IRM
```

DATA PROMPTS:

```
Immediate Response Mode? (Enable/Disable)[E]>
```

OUTPUT FORMAT:

```
Immediate Response Mode is now !.  {! = enabled|disabled}
```

LOADTAPE

USAGE:

This command causes automatic loading to be initiated. The drive will also be placed on-line if it is not. The tape needs to be in the drive when the command is issued.

SYNTAX:

```
LOADTAPE
```

DATA PROMPTS: None

OUTPUT FORMAT:

```
Load completed successfully.
```

LOGS

USAGE:

This command displays the contents of a portion of the device logs. The user must specify which portion or form to be displayed. The displays will be identical to those obtained by running section 7 of HPIBDDS.

SYNTAX:

```
LOGS

    where
        ALL                 - All of the following logs will be displayed.
        FAULT               - Selftest failures and all problems
                              encountered during normal operation.
        ERROR RATE          - Tape condition during normal operation.
        TAPE                - Tape information during current tape load.
```

DATA PROMPTS:

```
Which log is to be displayed?
    0 -- ALL
    1 -- FAULT
    2 -- ERROR RATE
    3 -- TAPE

Your selection [ALL]>
```

OUTPUT FORMAT:

```
{For Fault Log:}
 ================================================================================
                                  FAULT LOG
 ================================================================================
 ---------- 01 ----------------------------------------------------------------
 Device diagnostic #nnn detected the following failure:

 Error Class  -        Runtime errors
                              OR
                       Drive controller diagnostic errors
                              OR
                       Buffer controller diagnostic errors
                              OR
                       Interface controller diagnostic errors
                              OR
                       Multi- processor errors
                              OR
                       Operational status
 Error Code   - (hhh) error explanation as listed in device ERS
[Faulty FRUs  - ( nn) FRU name as listed in device ERS          ]
[             - ( nn) FRU name as listed in device ERS          ]


  ---------- 02 ----------------------------------------------------------------
                                :
                                :
  ---------- nn ----------------------------------------------------------------

  {For Error Rate Log:}

================================================================================
                          ERROR RATE LOG
================================================================================
Number of groups written          = nnnn
Number of groups has RAW rewrites = nnnn
Number of write hard errors       = nnnn
Number of groups read             = nnnn
Number of groups retried          = nnnn
Number of read hard errors        = nnnn
```

{For Tape Log:}

```
=============================================================================
                              TAPE LOG
=============================================================================
       Total tape load         = nnnnn

       Current groups written = nnnnnnnn
       Current RAW retries    = nnnnn
       Current groups read    = nnnnnnnn
       Current ECC-3 retries  = nnnnn

       Previous groups written = nnnnnnnn
       Previous RAW retries    = nnnnn
       Previous groups read    = nnnnnnnn
       Previous ECC-3 retries  = nnnnn

       Total groups written = nnnnnnnn
       Total RAW retries    = nnnnn
       Total groups read    = nnnnnnnn
       Total ECC-3 retries  = nnnnn
```

LOOPBACK

USAGE:

This command tests the HPIB Communication Link between the host and the tape drive. This operation performs a write loopback of 256 bytes of data to the device using the pattern—255, 0, 1, ... , 254, follows by a read loopback of 256 bytes. The results will be checked against the expected pattern.

SYNTAX:

```
LOOPBACK
```

DATA PROMPTS: None

OUTPUT FORMAT:

```
Tape Drive data channel checks out OK.

{OR}

The following transmission errors were detected during the
channel loopback test:

            Hex Value          Hex Value       Erroneous bits
Byte #      Transmitted        Received           01234567
======      ===========        ===========     =============
   nn        hh                 hh              bbbbbbbb
{EXAMPLE:}
    12          56                 54              00000010
    33          7F                 3D              01000010

     .           .                  .                .
     .           .                  .                .
     .           .                  .                .
```

MOTIONCHECK

USAGE:

This command checks out basic tape movement functions of the drive. The tape will be erased and rewound. A set of 5 files (20 records each) will be written to tape and the tape rewound. The following sequence will then be executed:

```
+ = forward space
- = backward space

     + 2 files
          read record (to verify position)
     - 1 file
          read record (to verify position)
     + 1 record
          read record (to verify position)
     - 1 record
          read record (to verify position)
     + 3 files
     - 4 files
     + 2 files
     - 1 files
          read record (to verify position)
     +11 records
     - 3 records
     +11 records
     -19 records
     + 2 records
          read record (to verify position)
     - 4 records
          verify past EOF
     +20 records
          verify past EOF
     + 4 files
          verify tape runaway
          rewind
     - 1 record
          verify past BOT
     - 1 file
          verify past BOT
```

SYNTAX:

```
MOTIONCHECK
```

DATA PROMPTS:

```
This command takes approximately 15 minutes to complete ...
Do you wish to continue (Y/N)[N]?
```

OUTPUT FORMAT:

```
This command takes approximately 15 minutes to complete ...
Do you wish to continue (Y/N)[N]?

Motion check has completed successfully.
```

REV

USAGE:

This command displays the current firmware revision numbers in the drive.

SYNTAX:

```
REV
```

DATA PROMPTS: None

OUTPUT FORMAT:

```
Firmware Revision Values:

                              Version.Revision Number
                              =======================

  Drive Controller                      n.n
  Buffer Controller                     n.n
  Interface Controller                  n.n
```

REWIND

USAGE:

This command causes the tape mounted on the drive to be rewound to BOT. The user will be asked for the option of leaving the tape off-line before the operation.

SYNTAX:

```
REWIND
```

DATA PROMPTS:

```
Do you want to just rewind or rewind offline?(REWIND|OFFLINE) [RREWIND>

  where:
      OFFLINE   - puts the drive off-line at the end of the rewind.
      REWIND    - rewind to BOT.
```

OUTPUT FORMAT:

```
REWIND of tape was successful.
```

SELFTEST

USAGE:

This command will initiate internal diagnostic tests. The tests which can be selected are device dependent and are fully described in the support documentation of the tape drive. The user will be prompted for all required information.

The selftest may be automatically repeated up to 1,000 times. The execution count used is implemented at the diagnostic level and NOT within the device. The selftest request will be issued until the specified execution count is reached or until the selftest fails. Once the selftest sequence has been started, the user may abort via the program interrupt (CNTL-Y on MPE XL, CNTL-C on HP-UX).

SYNTAX:

```
SELFTEST
```

DATA PROMPTS:

```
Selftest number.            (0..255) [0]>
Number of times to execute:
          0 - continuous
          1 - run once
          2 - run 10 times
          3 - run 100 times
          4 - run 1000 times
Your selection (0..4) [1]>
Do you want to break on first error?
               0 - break on first error
               1 - no break on error
Your selection (0..1) [0]>
{                                                  }
{parameter prompts are conditional depending on the}
{selftest number}                                  }
Parm A (mnemonic).              (0..nn) [0]>
Parm B (mnemonic).              (0..nn) [0]>
```

OUTPUT FORMAT:

```
        No faulty Field Replaceable Units (FRUs) were detected
           by device diagnostic #nnn.
    {or}
        Device diagnostic #nnn detected the following failure:

        Error Class  -       error group according to device ERS
       [Detection    -       while name of detecting action          ]
       [             -       by name of detecting processor/program  ]
       [             - (nnn) name of detecting test                  ]
        Explanation  - (hhh) error explanation as listed in device ERS
        Faulty FRUs  - ( nn) FRU name as listed in device ERS
       [             - ( nn) FRU name as listed in device ERS        ]
    {or}
        Device diagnostic #nnn was unable to either run to completion
        and/or isolate an FRU.  Error returned:

        Error Class  -       error group according to device ERS
        Explanation  - (hhh) error explanation as listed in device ERS
```

ERROR MESSAGES:

Special warnings will be given the user upon selection of an invalid selftest code, depending on the code selected. In most cases the user will be prompted for a valid selftest.

```
*** SELFTEST ! IS NOT IMPLEMENTED BY THE SELECTED DEVICE.
```

SUSPEND

USAGE:

This command temporarily suspends execution of the diagnostic, allowing the user to issue other DUI commands. To return to HPIBDDS, the user enters **resume** at the DUI prompt.

SYNTAX:

```
SUSPEND
```

DATA PROMPTS: None

OUTPUT FORMAT:

```
DUI>
```

TREES

USAGE:

This command causes one of HPIBDDS's diagnostic trouble trees to be executed.

SYNTAX:

```
TREES
```

DATA PROMPTS:

```
Which tree is to be executed?
    0 -- ALL
    1 -- VERIFICATION
    2 -- HARDWARE
    3 -- NON-DESTRUCTIVE MEDIA
    4 -- DESTRUCTIVE MEDIA

Your selection [<cr> = none]>
```

where

ALL	- All of the following
VERIFICATION	- Non-destructive trouble tree.
HARDWARE	- Destructive trouble tree.
NON-DESTRUCTIVE MEDIA	- Non-destructive media trouble tree.
DESTRUCTIVE MEDIA	- Destructive media trouble tree.

UNLOADTAPE

USAGE:

This command causes the automatic unloading to be initiated. The request will be honored even if the tape has not been rewound. The tape will be unloaded and ejected.

SYNTAX:

```
UNLOADTAPE
```

DATA PROMPTS: None

OUTPUT FORMAT:

```
Unload completed successfully.
```

WORKOUT

USAGE:

This command provides the user with different ways of reading and writing tape. It is useful in isolating medium vs drive problems, verifying media, isolating certain classes of read/write problems, and simulating system use of the tape drive.

This command will cause records to be written to tape, the tape rewound, and those same records read back off the tape. The user will also be able to vary the density record lengths, record content, number of files per tape, and loop count.

The user will have an option to clear the drive's internal error log prior to writing to the tape. The user will be warned and given an opportunity to back out of the command to look at and/or record the log before reissuing this command. This will also serve as the mechanism for correcting invalid entries.

There will be a choice of byte patterns to be written to the tape. Each record will consist of repetitions of the pattern up to the record size limit specified.

Data Verification This command will compare each record read to what this program originally sent, displaying any discrepancies.

SYNTAX:

```
WORKOUT
```

DATA PROMPTS:

```
WORKOUT

*******************************************
*                 WARNING                 *
*   This command may destroy user data    *
*******************************************

Do you wish to continue (Y/N)[N]?

Reset in progress ...

Reset completed successfully


Clear the drive logs (Y/N)[N]?

 Types of WTR ERTs
   P = selected area pattern WTR ERT
   R = random area WTR ERT
 Enter the test type [P]?

Is the media a Short(0.5 GBytes) or a Long(1.3 Gbytes) media? (S/L)[S]>
Do you want to write to the end of the media? (Y/N)[N]>

Do you want:
  R = random transfer length
```

```
  U = user input transfer length

 Which option would you like (R/U)[U]?

 Input transfer length (1 <= bytes <= nnnn)[1]?

 Input number of records to write to media(1 <= records <= !)[1]?

  The sources of the data pattern to be used are:
    I - Internal pattern
    R - Random pattern
    U - User input pattern
  Which pattern source would you like(I/R/U)[I]?
  {if user chooses U}
 Input the pattern in hex:

  Input loop count (1 <= count <= 254)[1]?
 Writing to media is in progress ...

 Reading from media and comparing data are in progress ...
```

OUTPUT FORMAT:

```
  No errors were detected in the media test
                  or
*** ERROR IN TRANSMISSION DETECTED DURING READ/WRITE MEDIA TEST:

                              Bit
                  Hex   Hex   Positions
                  Value Value In Error
      BYTES #     TRNS  RECD  01234567     Time Error Occurred
================= ====  ====  ========  ==========================
        50          FF    60  11000011   Fri, Mar 17, 1989  3:30 PM
         .           .     .      .                    .
         .           .     .      .                    .
         .           .     .      .                    .

WORKOUT COMPLETED.
```

Error and Warning Messages

The following are general error/warning messages which may be encountered during the execution of HPIBDDS. Note, however, that system dependent error messages may be displayed by the subsystem along with any error message generated by this diagnostic. All error message without the (DDSERR #) trailer are generated by the subsystem.

Errors which have explanatory notes (preceded by "—") will normally display only one of the notes listed here. The exclamation point (!) is a symbol used to indicate the point at which context dependent information is to be placed.

```
TO BE SUPPLIED
```

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25

Ciper Line Printer Diagnostic

Introduction

The CIPER Diagnostic will test an HP 2563A/64B/65A/66A,66B or HP2567B Line Printer to detect failures of a Field Replaceable Unit. The diagnostic will run on any HP Precision Architecture Computer system which supports the Online Diagnostic subsystem. CIPER (which stands for Control messages for Intelligent PERipherals) was developed to control intelligent peripherals. The user can:

- specify which sections and steps are to be run
- set test parameters to control the handling of error messages
- select the number of test executions and the particular CIPER Line Printer unit to be tested. Only MPE XL-based systems have auto-diagnostic capability.

Defects and Enhancements

Submit defect reports and enhancement requests for this diagnostic through the STARS database referencing product number 30600-10002.

Minimum Configuration

The hardware required to run the diagnostic consists of an HP Precision Architecture RISC computer system with a supported (see above) Ciper Line Printer connected and configured to it. The Ciper Device under test must contain internal selftests that are capable of detecting failed Field Replaceable Units (FRU's).

Auto-Diagnostics

The Ciper Line Printer diagnostic program can be invoked by the I/O system for auto-diagnostic purposes when a nonrecoverable printer error has been detected. In auto-diagnostics mode, this diagnostic program will execute the following sections and steps:

Section 2	Reset
Section 3	Clear/Identify
Section 5	Selftest
Section 6	Request Device Status (all steps)

Operating Instructions

The diagnostic is accessible by all users who have obtained diagnostic security 1 or 0. Refer to the Security Section on DUI for a detailed description of user capabilities. The diagnostic program will execute only after all current printer activity has completed. During testing, the printer will be unable to output system user data but will resume spooling upon completion of the current diagnostic section and step. Before attempting to run the diagnostic, ensure that the line printer to be tested is powered up and put online.

Default Tests

If the user does not specify the sections and steps to be run, the following default sections and steps will be executed:

Section 2	Reset
Section 3	Clear/Identify
Section 5	Selftest
Section 6	Request Device Status (all steps)

RUN Command

To bring up the Online Diagnostic subsystem, enter the following command to the MPE XL system prompt:

```
SYSDIAG
```

To bring up the Online Diagnostic subsystem, enter the following command to the HP-UX system prompt:

```
%/usr/diag/bin/sysdiag
```

The system responds with the following prompt indicating that access has been gained to the Online Diagnostic User Interface (DUI).

```
DUI >
```

Typing **HELP** causes a summary of the DUI and its commands to be printed. Refer to the DUI chapter of this manual for details.

Note

The device to be tested must be powered up and on line. Device physical locations (pdev) shown in the **RUN** commands are those of the devices on the "typical A1002A" system configuration described in the chapter on DUI. The pdev value entered must be correct for the system being tested.

For example, to run the diagnostic in an MPE XL environment, you might enter:

```
DUI >RUN CIPERLPD pdev=4.2.1 <RUN Command Options>
                       |              |
                       |       none required for
                       |       default test suite
                       |
        insert physical location of
        device to be tested here;
        alternatively, for MPE XL,
        type the ldev number;
        for HP-UX, type the devfile name
```

Test Execution

The diagnostic will display the following header and welcome message:

```
***********************************************************
*****                                                   ***
*****       CIPER LINE PRINTER DIAGNOSTIC               ***
*****                                                   ***
*****     (C) Copyright Hewlett Packard Co. 1987        ***
*****                All Rights Reserved.               ***
*****                    Version A.00.00                ***
*****                                                   ***
***********************************************************

Welcome, Today is MON, May 22, 1987, 9:00 AM
```

Following the header, CIPERLPD will try to obtain access to the device from the Online Diagnostic subsystem. If access to the printer is not given, error messages originating from the Diagnostic subsystem as well as the following message will appear and the diagnostic will terminate:

```
*** DEVICE COULD NOT BE OBTAINED FROM DIAGNOSTIC SYSTEM (CPRERR 21)
```

System dependent information concerning the error encountered will be displayed by the Diagnostic subsystem. All errors without (CPRERR #) trailer are generated by either the Online Diagnostic subsystem or the operating system.

The diagnostic continues operation by attempting to open the communication link to the printer through the transport-level establish link command. If the device does not respond to the establish link command, the following message will be displayed:

```
*** COULD NOT ESTABLISH COMMUNICATION LINK TO PRINTER (CPRERR 15)
```

The CIPER printer diagnostic will terminate execution immediately upon displaying the above message.

If establish link executes successfully, a device clear is performed to synchronize this diagnostic with the printer and to obtain printer configuration information, such as record buffer size, which is required by this diagnostic. The device clear causes the printer to discard all internally buffered data and advance the paper to physical top of page (if not currently at top of form). Replies received before the clear response request are discarded. If any unexpected

device status messages are received, they are immediately displayed to the user. If the device clear is unsuccessful, the CIPER line printer diagnostic will terminate immediately.

Upon completion of synchronization, the section and steps specified by the user are executed, and the results output. The test sections and steps are described in the "Detailed Test Descriptions Section". If the user did not specify sections or steps to be run, the default sections and steps will be run by CIPERLPD. The default sections are 2, 3, 5, and 6 (Reset Clear/Identify, Selftest and Request Device Status).

If at any time, the number of errors generated reaches the limit specified by the user in the ERRCOUNT parameter of the **RUN** command, the following message will be displayed:

```
*** SPECIFIED ERROR COUNT HAS BEEN EXCEEDED (CPRERR 16)
```

The diagnostic will then terminate execution. If the ERRPAUSE parameter of the **RUN** command was assigned a value of "on", then the diagnostic will stop after each error is generated and ask the user whether the test should continue:

```
Continue (Y/N) [Y]?
```

If the response is "Y" then the test will be resumed, and if the response is "N", the diagnostic will terminate. If the user enters a carriage return, the diagnostic defaults to a "Y". Upon completion of all sections and steps selected by the user or CIPERLPD default, the following message will signal the termination of CIPERLPD. The diagnostic will terminate normally and the following message will be output:

```
CIPERLPD Exiting ...
```

If the diagnostic terminated prematurely due to ERRPAUSE or exceeding ERRCOUNT, the above message will not be displayed. Control will return to the DUI:

```
DUI >
```

To exit CIPERLPD, the user simply types **EXIT**. Control will return to the DUI upon completion of the current section and step.

Test Section Descriptions

The seven diagnostic program sections listed below are available for user selection. The user may also select individual steps to be run for Section 6. A description of each section and step will be given, along with the expected output from that section and step.

Section 2	Reset
Section 3	Clear/Identify
Section 5	Selftest
Section 6	Request Device Status
Step 10	Obtain Device Status
Step 11	Decode Device Status
Section 10	Ripple Print
Section 12	Request and Decode Environmental Status
Section 14	Request and Decode Job Status

Section 2—RESET

This section issues a (ESC E) programmatic reset to the CIPER line printer. This will cause the device to be placed into one of the following known states:

- Primary and secondary symbol sets as configured from the Operator Control Panel
- Vertical line spacing (6/8 LPI) as selected from the Operator Control Panel
- Paper moves to the next top of form position (if not currently at top of form)
- Print buffer cleared
- Standard VFC Channel assignments selected
- Left margin set at first column
- Form length remains at the save value as before power loss

If no errors are generated the diagnostic will output the following message:

```
Section 2 - RESET
End of Section 2 - RESET
```

Section 3—CLEAR/IDENTIFY

This section issues a device clear to the printer and will display the information contained in the Device Clear Response to the user. This includes the record size in bytes, the maximum environmental status size in bytes, and the HP product code. If no errors are generated the diagnostic will output the following message:

```
Section 3 - CLEAR/IDENTIFY

   The selected device has been identified as an nnnn printer.
   Record Buffer size (bytes): nnn
   Max Env Status Block size (Bytes): nnn

End of Section 3 - CLEAR/IDENTIFY
```

Section 5—SELFTEST

This section issues an (ESC Z) to the CIPER line printer, which will execute the printer selftest. The selftest will print one or more pages of test patterns onto the paper. If the selftest failed, the hardware status information will be displayed to the user. Refer to Section 6, Step 11 of this section for decoding format. Some printers will go offline if the selftest fails. This section may execute up to 90 seconds. If no errors are generated the diagnostic will output the following message:

```
Section 5 - SELFTEST
End of Section 5 - SELFTEST
```

Section 6—DEVICE STATUS

This section obtains and decodes the device status from the printer. The following steps are available:

Step 10	**Request Hardware Status:** This step will obtain the device hardware status. Only the status of the I/O request will be displayed if the request failed.
Step 11	**Decode Hardware Status:** This step displays the device hardware status in text format to the user. The SELFTEST FAIL CODE BYTE fields of the device status will identify the failing Field Replaceable Unit (FRU). If Step 10 was selected and did not complete successfully, then

If no errors are generated the diagnostic will output the following message:

```
Section 6 -- DEVICE STATUS

   Step 10 - Request Hardware Status Completed

      ------------------------------------------------------
      Peripheral Status:
          [any of:  On Line
                    Off Line
                    Paper Out
                    Paper Jam
                    Platen/Gate Open
                    Ribbon Malfunction
                    Self Test Fail]

      Error Conditions:
          [any of:  Data Loss
                    Power Fail]

      Selftest Fail Code Byte 1 : nn
      Selftest Fail Code Byte 2 : nn

          < Description of selftest fail code >
```

Note

The possible error descriptions are specific to each CIPER printer, so listing the possible message is not possible. If this program does not recognize the printer model as returned in the Clear/Identify section, or does not have a language localized message for the particular failure, the user must refer to the printer manual to decode the selftest fail code themselves.

```
CIPER Protocol Errors:
    [any of:  Illegal Record Header Length
              Incorrect Host-to-peripheral record number
              Illegal Host/Peripheral field
              Undefined Record Code
              Undefined Data Type
              Illegal Device-Dependent Format Number
              Illegal Block Label
              Transport Service Error
              Data Overrun]
-----------------------------------------------------------

   Step 11 - Decode Hardware Status Completed

End of Section 6 -- DEVICE STATUS
```

Section 10—RIPPLE PRINT

This section causes the line printer to perform a ripple print for the number of lines specified by the user. Upon entering this section, the user will be asked to enter the number of lines to be printed. If a carriage return is entered, one page of output will be printed. Any input except a line number count is illegal, and this section will ask for input again. When printing has completed the job status will be displayed to the user. If no errors are generated the diagnostic will output the following message:

```
Section 10 - RIPPLE PRINT

   Enter number of lines to be printed (page = 60) >>
       ---------------------------
       Silent Run Mode:  <ON/OFF>
       Job Sheet Count:   nnn
       ---------------------------

End of Section 10 - RIPPLE PRINT
```

Error Messages

The following is a list of error messages which may appear when using CIPERLPD. Other diagnostic error messages may appear at any time. Error messages without the (CPLERR #) trailer are generated by the Online Diagnostic subsystem or the Operating system. Listed below each error message are a probable cause and recommended action statement. The actual cause and action may differ from this list depending upon the particular circumstances of a given situation. The "!" indicates that a parameter of some sort replaces the exclamation point when the message is displayed.

10	*** SECTION ! DOES NOT EXIST. (CPRERR 10)
CAUSE	The user has specified a section which does not exist in this diagnostic.
ACTION	Please use the diagnostic user interface HELP command to determine the correct section number.

11	*** STEP ! DOES NOT EXIST. (CPRERR 11)
CAUSE	The user has specified a step which does not exist in this diagnostic.
ACTION	Please use the diagnostic user interface HELP command to determine the correct step number.

12	*** WARNING -- THE I/O PATH TO THE LINE PRINTER MAY NOT BE FUNCTIONING PROPERLY. (CPRERR 12)
CAUSE	This diagnostic program issued a request to have the diagnostic system test the I/O path to the line printer. The results of those tests indicate that a problem may exist in the path to the line printer.
ACTION	A message indicating the hardware problem encountered will be displayed before this message. It may be advisable to run the appropriate diagnostic program for the suspected I/O hardware indicated by that message.

13	*** RECEIVED UNKNOWN RESPONSE MESSAGE FROM THE PRINTER. (CPRERR 13)
CAUSE	This diagnostic received an unknown reply message from the line printer during an I/O transaction.
ACTION	Verify that the printer being tested is supported by this diagnostic. The diagnostic user interface LIST command will give a list of printers which are appropriate for this diagnostic. Otherwise, report the set of error messages and product number of printer to support personnel.

15	*** COULD NOT ESTABLISH COMMUNICATION LINK TO THE PRINTER. (CPRERR 15)
CAUSE	This diagnostic was not able to open communications with the line printer.
ACTION	Verify that the printer is properly cabled to the system. Also, the printer must be on line.

16	***** SPECIFIED ERROR COUNT HAS BEEN EXCEEDED. (CPRERR 16)**
CAUSE	The number of errors specified by the user has been reached. As requested the diagnostic will terminate after this message is displayed.
ACTION	Please execute this diagnostic with a higher error count in the ERRCOUNT option if you wish to see more error message. If the ERRCOUNT option is not given, all the error messages will be displayed.

17	***** STEP WAS SELECTED WITHOUT SECTION. (CPRERR 17)**
CAUSE	The user selected a step but did not specify the corresponding section in the RUN parameters.
ACTION	Please consult the diagnostic user interface **HELP** command to determine the appropriate section to select with the desired step.

18	***** ENVIRONMENTAL STATUS BLOCK TOO LARGE FOR I/O BUFFER ALLOCATED. (CPRERR 18)**
CAUSE	The environmental status block returned by the line printer is too large for the I/O buffer specified by the diagnostic program.
ACTION	Please submit a service request indicating the following: a) Identify the printer being tested by product number. Also include any special printer options installs if applicable. b) Any other error messages displayed with this error message. c) The CIPERLPD sections and steps executed to produce this error.

19	***** EXPECTED RECEIVE READY RESPONSE NOT OBTAINED. (CPRERR 19)**
CAUSE	This diagnostic is expecting a receive ready message from the printer and did not receive it. This diagnostic cannot issue any requests to the printer until a receive read message is obtained.
ACTION	Verify that the printer is on line. If the printer is not on line, the fault encountered will be displayed on the LED's. Otherwise we have a communication protocol error. Re-execute the diagnostic, and if problem persists report error to support personnel.

20	***** COULD NOT CLOSE COMMUNICATION LINK TO THE PRINTER. (CPRERR 20)**
CAUSE	This diagnostic was not able to terminate communications with the line printer.
ACTION	Enable error tracing by rerunning the program with the TRACE=ERROR parameter at the DUI command line, and a file service request with the trace information generated by executing CIPERLPD again with the same sections and steps.

21	***** DEVICE COULD NOT BE OBTAINED FROM DIAGNOSTIC SYSTEM. (CPRERR 21)**
CAUSE	The diagnostic program did not obtain permission to access the line printer. Detailed information will be displayed with this message.
ACTION	The reason for being denied access to the printer will be displayed before this message. Please refer to the action clause for that error message.

22	***** RECORD RECEIVED OUT OF SEQUENCE. (CPRERR 22)**
CAUSE	The reply message received from the line printer did not have the correct sequence number.
ACTION	This may be a communication protocol error. Re-execute the diagnostic, and if problem persists report error to support personnel.

23	***** UNABLE TO ISSUE REQUEST: RECEIVE READY COUNT IS ZERO. (CPRERR23)**
CAUSE	The diagnostic is unable to issue a request to the line printer because the receive ready count is zero.
ACTION	This may be a communication protocol error. Re-execute the diagnostic, and if problem persists report error to support personnel.

24	***** INVALID LINE COUNT WAS GIVEN. (CPRERR 24)**
CAUSE	User gave a zero or negative number of lines to be printed.
ACTION	User must give a positive number of lines to be printed. If the user enters <cr>, default of 80 lines will be printed.

25	***** INITIALIZATION FAILURE: DEVICE CLEAR REQUEST FAILED (CPRERR 25)**
CAUSE	During initialization of this diagnostic, it issues a write request to initiate a device clear. In this case, that write request failed.
ACTION	Error messages indicating the cause of the write error will be displayed before this message. Please refer to action clause for those error messages. Also, verify that the printer is properly cabled to the system, and is on line.

26	***** INITIALIZATION FAILURE: READ CLEAR RESPONSE FAILED (CPRERR 26)**
CAUSE	During initialization of this diagnostic, it issues a read request to obtain the device clear response message. In this case, that read request was not successful.
ACTION	Error messages indicating the cause of the read error will be displayed before this message. Please refer to action clause for those error messages. Also, verify that the printer is properly cabled to the system, and is on line.

27	***** WRITE REQUEST FOR JOB STATUS FAILED (CPRERR 27)**
CAUSE	This diagnostic tried to issue a write request to initiate a **READ JOB STATUS** command. That write request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should he displayed on the LED's.

28	***** READ REQUEST FOR JOB STATUS FAILED (CPRERR 28)**
CAUSE	This diagnostic tried to issue a read request to obtain job status from the printer. That read request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

29	*** WRITE REQUEST FOR ENVIRONMENTAL STATUS FAILED (CPRERR 29)
CAUSE	This diagnostic tried to issue a write request to initiate a **READ ENVIRONMENTAL STATUS** command. That write request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

30	*** READ REQUEST FOR ENVIRONMENTAL STATUS FAILED (CPRERR 30)
CAUSE	This diagnostic tried to issue a read request to obtain environmental status information. That read request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

31	*** WRITE REQUEST FOR JOB START FAILED (CPRERR 31)
CAUSE	This diagnostic tried to issue a write request to initiate a **JOB START** command. That write request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

32	*** WRITE REQUEST FOR ONE LINE OF RIPPLE PRINT FAILED (CPRERR 32)
CAUSE	This diagnostic tried to issue a write request to write a data pattern to the printer. That write request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

33	*** WRITE REQUEST FOR JOB END FAILED (CPRERR 33)
CAUSE	This diagnostic tried to issue a write request to initiate a **JOB END** command. That write request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

34	***** WRITE REQUEST FOR DEVICE STATUS FAILED (CPRERR 34)**
CAUSE	This diagnostic tried to issue a write request to initiate a device status. That write request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

35	***** READ REQUEST FOR DEVICE STATUS FAILED (CPRERR 35)**
CAUSE	This diagnostic tried to issue a read request to obtain a reply from a **DEVICE STATUS** command. That read request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

36	***** WRITE REQUEST FOR SELFTEST FAILED (CPRERR 36)**
CAUSE	This diagnostic tried to issue a write request to initiate a selftest. That write request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

37	***** READ REQUEST FOR SELFTEST FAILED (CPRERR 37)**
CAUSE	This diagnostic tried to issue a read request to obtain a reply from a **SELFTEST** command. That read request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

38	***** WRITE REQUEST FOR DEVICE CLEAR FAILED (CPRERR 38)**
CAUSE	This diagnostic tried to issue a write request to initiate a device clear. That write request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

39	***** READ REQUEST FOR DEVICE CLEAR FAILED (CPRERR 39)**
CAUSE	This diagnostic tried to issue a read request to obtain reply from a **DEVICE CLEAR** command. That read request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

40	***** WRITE REQUEST FOR RESET FAILED (CPRERR 40)**
CAUSE	This diagnostic tried to issue a write request to initiate a reset. That write request was not successful.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages. Also, verify that the printer is on line. If the printer is not on line, the fault encountered should be displayed on the LED's.

41	***** UNABLE TO RELEASE READ I/O BUFFER TO HOST (CPRERR 41)**
CAUSE	This diagnostic was not able to return data space to the host system.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages.

42	***** UNABLE TO RELEASE WRITE I/O BUFFER TO HOST (CPRERR 42)**
CAUSE	This diagnostic was not able to return data space to the host system.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages.

43	***** UNABLE TO OBTAIN READ I/O BUFFER FROM HOST (CPRERR 43)**
CAUSE	This diagnostic program was not able to obtain data space to use as an I/O buffer for READ transactions.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages.

44	***** UNABLE TO OBTAIN WRITE I/O BUFFER FROM HOST (CPRERR 44)**
CAUSE	This diagnostic program was not able to obtain data space to use as an I/O buffer for WRITE transactions.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages.

45	*** UNABLE TO INITIALIZE READ I/O BUFFER TO ZERO (CPRERR 45)
CAUSE	This diagnostic was not able to initialize the contents of the read I/O buffer to zero.
ACTION	Enable error tracing by rerunning the program with the TRACE=ERROR parameter at the DUI command line, and a file service request with the trace information generated by executing CIPERLPD again with the same sections and steps.

46	*** UNABLE TO INITIALIZE WRITE I/O BUFFER TO ZERO (CPRERR 46)
CAUSE	This diagnostic was not able to initialize the contents of the write I/O buffer to zero.
ACTION	Enable error tracing by rerunning the program with the TRACE=ERROR parameter at the DUI command line, and a file service request with the trace information generated by executing CIPERLPD again with the same sections and steps.

47	*** INTERNAL ERROR: CASE OVERFLOW --- FILL RECORD (CPRERR 47)
CAUSE	This diagnostic has hit the default clause of a CASE statement. This is a software error.
ACTION	Please submit a service request indicating the following: a) The sections and steps being requested of the diagnostic. b) The section and step that produced this error message. c) Any other error messages displayed with this message. d) Identify the printer being tested by product number.

48	*** EXCEEDED MAXIMUM READ RE-TRY COUNT OF 5. (CPRERR 48)
CAUSE	This diagnostic has received 5 reply messages from the printer, but the expected message was not obtained.
ACTION	Verify that the printer is on line. If the printer is not on line, the fault encountered will be displayed on the LED's. Otherwise, re-execute the diagnostic and if problem persists report error to support personnel.

49	*** UNABLE TO CONVERT BUFFER INDEX TO BE DISPLAYED (CPRERR 49)
CAUSE	This diagnostic was not able to convert an integer value, which is the buffer index, into a string representation.
ACTION	Enable error tracing by rerunning the program with the TRACE=ERROR parameter at the DUI command line, and a file service request with the trace information generated by executing CIPERLPD again with the same sections and steps.

50	*** UNABLE TO OBTAIN BUFFER TEXT FROM CATALOG (CPRERR 50)
CAUSE	This diagnostic was not able to obtain the environmental status label from the message catalog. Detailed error information will be displayed with this error message.
ACTION	Enable error tracing by rerunning the program with the TRACE=ERROR parameter at the DUI command line, and a file service request with the trace information generated by executing CIPERLPD again with the same sections and steps.

51	*** UNABLE TO CONVERT DATA TO BE DISPLAYED (CPRERR 51)
CAUSE	This diagnostic was not able to convert an integer value into a string representation.
ACTION	Enable error tracing by rerunning the program with the TRACE=ERROR parameter at the DUI command line, and a file service request with the trace information generated by executing CIPERLPD again with the same sections and steps.

52	*** UNABLE TO MARK PRINTER AS DEFECTIVE (CPRERR 52)
CAUSE	This diagnostic encountered an error while trying to inform the diagnostic system that the printer is defective.
ACTION	Error messages containing more detailed information will be displayed before this message. Please refer to the action clause for those error messages.

53	*** INITIALIZATION FAILURE: DEVICE STATUS WRITE REQUEST FAILED (CPRERR 53)
CAUSE	During initialization of this diagnostic, it issues a write command to request hardware status. In this case, that write request failed.
ACTION	Error messages indicating the cause of the write error will be displayed before this message. Please refer to action clause for those error messages. Also, verify that the printer is properly cabled to the system, and is on line.

54	*** INITIALIZATION FAILURE: DEVICE STATUS READ REQUEST FAILED (CPRERR 54)
CAUSE	During initialization of this diagnostic, it issues a read request to obtain hardware status. In this case, that read request was not successful.
ACTION	Error messages indicating the cause of the read error will be displayed before this message. Please refer to action clause for those error messages. Also, verify that the printer is properly cabled to the system, and is on line.

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26

Page Printer Diagnostic

Introduction

The Page Printer Diagnostic will test an HP 2680A or 2688A Page Printer to detect failures of Field Replaceable Units (FRU's). This function may be supplemented and enhanced by display of other status information. The diagnostic will run on any HP Precision Architecture Computer system which supports the Online Diagnostic Subsystem. The user can specify which sections and steps are to be run, set test parameters to control the handling of error messages, and select the number of test executions and the particular Page Printer unit to be tested.

Defects and Enhancements

Submit defect reports and enhancement requests for this diagnostic through the STARS database referencing product number 30600-10004.

Minimum Configuration

The hardware required to run the diagnostic consists of an HP Precision Architecture RISC computer system with a supported (see above) Page Printer connected and configured to it. The Device under test must contain internal selftests that are capable of detecting failed Field Replaceable Units (FRU's).

Auto-Diagnostics

The Page Printer diagnostic program can be invoked by the I/O system for auto-diagnostic purposes when a nonrecoverable printer error has been detected. Only MPE XL-based systems have auto-diagnostic capability.

In auto-diagnostics mode, this diagnostic program will execute the following sections and steps:

Section 2	Clear
Step 6	Hard Clear
Section 3	Identify
Section 4	Loopback
Section 5	Selftest

Operating Instructions

The diagnostic is accessible by all users who have obtained diagnostic security 1 or 0. Refer to the Online Diagnostics Overview section for a detailed description of system security. The diagnostic program will execute only after all current printer activity has completed. During testing, the printer will be unable to output system user data but will resume spooling upon completion of the diagnostic.

Before attempting to run the diagnostic, ensure that the page printer to be tested is powered up and put online.

Default Tests

If the user does not specify the sections and steps to be run, the following default sections and steps will be executed:

Section 2	Clear
Step 6	Hard Clear
Section 3	Identify
Section 4	Loopback
Section 5	Selftest
Section 20	Pattern Print

RUN Command

To bring up the Online Diagnostic subsystem, enter the following command to the MPE XL system prompt:

```
SYSDIAG
```

The system responds with the following prompt indicating that access has been gained to the Online Diagnostic User Interface (DUI).

```
DUI >
```

Typing **HELP** causes a summary of the DUI and its commands to be printed. Refer to the DUI Section of this manual for details.

Note

The device to be tested must be powered up and on line. Device physical locations (pdev) shown in the **RUN** commands are those of the devices on the "typical A1002A" system configuration described in the chapter on DUI. The pdev value entered must be correct for the system being tested.

For example, to run the diagnostic in an MPE XL environment, you might enter:

```
DUI >RUN PPDIAG pdev=4.6.2 <RUN Command Options>
                        |          |
                        |      none required for
                        |      default test suite
                        |
            insert physical location of
            device to be tested here;
            alternatively, for MPE XL,
            type the ldev number;
            for HP-UX, type the devfile name
```

All parameters associated with the DUI's **RUN** command are accepted by the Page Printer diagnostic. More detailed information can be obtained by referring to the section on DUI.

Test Execution

When PPDIAG is executed, the following welcome message will be displayed:

```
*********************************************************
*****                                                ***
*****             PAGE PRINTER DIAGNOSTIC            ***
*****                                                ***
*****     (C) Copyright Hewlett Packard Co. 1987     ***
*****                  All Rights Reserved.          ***
*****                      Version A.00.00           ***
*****                                                ***
*********************************************************

Welcome, Today is MON, May 22, 1987, 9:00 AM
```

Following the header, PPDIAG will try to obtain access to the requested device from the Online Diagnostic subsystem. If access to the printer is not obtained, the following PPDIAG error message appears and the program terminates. Other messages from either the operating system or the diagnostic subsystem may also appear:

```
*** UNABLE TO CONTINUE EXECUTION OF REQUESTED DIAGNOSTICS. (PPERR 05010)
```

If access to the device was obtained, the diagnostic will automatically invoke a diagnostic subsystem routine to test the I/O path to the printer. This is necessary since PPDIAG has no knowledge of intermediate hardware connecting the host to the printer. If the status returned from this routine is "fail", a warning message will be displayed but the diagnostic will continue:

```
*** The I/O path to the printer may be faulty.  Any results
    (good or bad) shown below might not originate in the printer.
    (PPWARN 07005)
```

If the I/O path tests out okay, the diagnostic will automatically ask the device to identify itself. If the device fails to respond to the request the program will terminate displaying an appropriate error message(s). If an unexpected identification code is received, the following warning message will be displayed and PPDIAG will continue to treat the selected device as though it were a page printer:

```
*** Device not recognized as a page printer.  HP-IB code
    returned = !. (PPWARN 07006)
```

If the device correctly identifies itself, the sections and steps specified by the user in the DUI **RUN** command will be executed. If the user did not specify sections and steps to be run, the default sections and steps will be executed (See Mini Operating Instructions).

If at any time, the number of errors generated reaches the limit specified by the user in the ERRCOUNT parameter of the **RUN** command, the following error message will be displayed and the diagnostic will terminate:

```
*** SPECIFIED ERROR COUNT LIMIT HAS BEEN EXCEEDED. (PPERR 05015)
```

If the ERRPAUSE parameter of the **RUN** command was assigned a value of "on", then PPDIAG will stop after each error is generated and ask the user whether the test should continue. If the response is "Yes" (default) then the test will be resumed and if the response is "No", the program will terminate.

```
Continue Execution ? (YES/NO) [YES] >
```

To exit **PPDIAG**, the user simply types **EXIT**. Control will return to the DUI upon completion of the current section and step. A description of PPDIAG and all the sections contained within are available through the DUI Help facility.

Test Section Descriptions

There are eight diagnostic program sections which are available for user selection. The user may also select individual steps to be run for Section 2. A description of each section and step is given, along with the expected output from that section and step along with any error messages of note.

Section 2	Clear
Step 5	Soft Clear (flush buffers)
Step 6	Hard Clear (complete reset)
Section 3	Identify
Section 4	Loopback
Section 5	Selftest
Section 6	Display I/O Status
Section 8	Display Environmental Status
Section 20	Pattern Print
Section 50	Simulate Panel (2680 only)

Section 2—CLEAR

This section performs a Hard and/or Soft Clear on the page printer specified when the diagnostic was invoked. This causes the device to be placed into a known state as follows:

Step 5 **Soft Clear** (Close Job)
Print buffer emptied by printing
All character sets, forms & VFCs remain unchanged

Step 6 **Hard Clear** (Clear to power on state)
Print buffer cleared (data lost)
Default character set loaded, all other sets cleared
Default vertical format control loaded, all other VFCs cleared
All forms cleared
Default logical page table (LPT) loaded
Paper moves to the next blank physical page

If no errors are generated the diagnostic will output the following:

```
Section 2 -- CLEAR
  Step  5 - Soft Clear (Close job - print buffers)
  Step  6 - Hard Clear (Reset to power on state)
End of Section 2 -- CLEAR
```

Section 3—IDENTIFY

This section requests the specified page printer to identify itself in order to determine whether it is responding. If not, an error message is displayed and the program aborted. Otherwise, the user will be informed of the device identity or, if not a page printer, will be issued a warning and execution will continue. If no errors are generated the diagnostic will output the following:

```
Section 3 -- IDENTIFY

  =-=-=-=-=-=-=-=-= DEVICE IDENTIFICATION =-=-=-=-=-=-=-=-=-=

     HPIB code    = 2004  Device is recognized as a page printer.
     Product      = HP2680A (EPOC)
                    {or HP2680A (EPOC -- Graphics option)}
                    {or HP2688A (BONSAI)}
                    {or HP2688A (BONSAI -- Graphics option)}
     MCS date code = -info not available-
     DCS date code = 4121

End of Section 3 -- IDENTIFY
```

Section 4—LOOPBACK

This section tests the accuracy of transmission over the data channel between the host and the selected device by sending a bit pattern (as a 256-byte string) to the printer, reading the pattern back out of the printer, and comparing the resulting pattern with the original. Because the printer does not generate a predictable sequence of its own, some types of transmission errors may not be detected. PPDIAG will output one of the following messages:

```
Section 4 -- LOOPBACK

   Page Printer data channel checks out OK.
```

or:

```
   The following transmission errors were detected during the
   loopback test:

              Hex Value          Hex Value        Erroneous bits
   Byte #    Transmitted         Received            01234567
   ======    ===========        ===========       =============
    12           56                 54               00000010
    33           7F                 3D               01000010


    .            .                  .                .
    .            .                  .                .
    .            .                  .                .

End of Section 4 -- LOOPBACK
```

Entries in the preceding table will be printed for as many errors as were detected, unless the ERRCOUNT parameter of the RUN command has been exceeded.

Section 5—SELFTEST

This section causes execution of the internal power-up selftest of the page printer circuitry. The name and/or number of any field replaceable unit (FRU) which this test identifies as being faulty is displayed. Both environmental and I/O status are cleared and reset to the power-up state. Unlike a selftest resulting from an actual power-up, the printer is immediately available to receive data at the end of a remote selftest. In addition, the remote selftest does not cause any printout. The user should be aware that selftest identifies problems in the DCS (Data Control System) only. Limited information on the MCS (Machine Control System) can be found by requesting a display of I/O status. PPDIAG will output one of the following messages:

```
Section 5 -- SELFTEST

   No faulty Field Replaceable Units (FRUs) were detected.

                    or

   Selftest detected failures in the following FRUs:

      o Data Processor
      o External Register
      o Main Memory
      o Character Block Processor

End of Section 5 -- SELFTEST
```

Section 6—DISPLAY I/O STATUS

This section will obtain and decode the device status as contained in the I/O Status Block of the printer. Status will be displayed in readable text format.

Page Printer protocol is such that a request for the I/O status block is considered erroneous when the status block is clean. When this happens the I/O status returned indicates a transmission error. If this condition occurs, PPDIAG issues the following message after the status display:

```
NOTE: The above status can also result from an unexpected
      request to read clean (no problems) I/O status;
      i.e., a transmission error in this situation is
      probably not indicative of a problem.
```

If no errors are generated the diagnostic will output the following:

```
Section 6 -- DISPLAY I/O STATUS


============================================================
                        I/O STATUS
============================================================

  =-=-=-=-=-=-=-=-=-=-= MACHINE STATUS =-=-=-=-=-=-=-=-=-=-=-

  o The printer is ON-line
  o The printer is OFF-line
  o Power fail/Power on detected since last I/O status read
      The printer was in the process of printing sheet # x.
      Last successfully transferred page was on  sheet # x.
  o A message is being displayed on the printer panel
  o The Machine Control System (MCS) has detected the
    following error:

      200   A/O modulator failure
      201   Beam detect failure
            First order power (FOP) < 50, may be result of
              low RF target.
      202   Laser failure
      203   RF driver failure
            ON/OFF RF output differential too low.
      204   Scanner failure
            Scanner frequency <> 75Hz +- 1%
      205   Phtr area 0
            No pad warm-up in area 0.
            Check fuses, AC power, other power path.
      206   Preheat fail
      207   Relay failure
            Either current detected with all relays open
              or current < 32 in one or more relays.
      208   Triac/fuse
            Current < 32 in one of the pads and it will
              not warm up.
      209   Fuser circuit open
            current < 32
      210   ADC hung up
            time-out on request for A/D converter.
      211   Purge pump, fan fail
            Current < 21
      212   No response from DCS
            Data Control System failed to reply to a
              status or loopback request.
      213   MCS/DCS loopback
            Data Control System replied to loopback request,
            but test failed.
```

```
214   Dev supply fail
      Developer voltage < 100 or 2"setting-287
      AND/OR door bias voltage < 20.
215   Scanner start fail
220   ES loop fail 1
      Primary Corona limited,
        Simultaneous Corona locked.
      Probable failure - Primary Corona.
221   ES loop fail 2
      Simultaneous Corona limited,
        Primary Corona locked.
      Probable failure - Simultaneous Corona.
222   ES loop fail 3
      Both Primary and Simultaneous Coronae limited.
      Probable failure - both Coronae.
223   Low sim corona fail
      Simultaneous Corona current < (expected - 32)
224   Low primary V fail
      Primary Corona voltage < 128
225   Low primary I fail
      Primary corona current < 40
        OR < (desired screen voltage - 32)
226   Low screen V fail
      Screen voltage < (expected - 32)
227   High transfer I fail
      Transfer current > (expected + 32)
228   Low transfer I failure
      Transfer current < (expected - 32)
229   ESM shut door test F
      Electrostatic monitor voltage
        <> (door bias voltage +- 15)
230   ESM supply failure
      Electrostatic monitor not receiving power.
231   ESM open door test F
      Electrostatic monitor voltage < 50
232   Noisy signal ground
      Signal ground > 10
233   DCS power on
      Data Control System has performed a power on
        sequence but there was not corresponding
        power on sequence done in the MCS.
234   High sim corona fail
235   Drum top switch err
      Drum top switch is giving false top of drum
        indication.
240   A/D data invalid
      A/D converter +5V ref. > 138 or < 118
241   Cardcage overtemp (failure)
      A/D count > 205
242   Densitometer failure 1
      Clean drum reflectance < 600.
```

```
243   Developer short cct
      Short circuit indicated by developer voltage
          < 2"setting-287
        OR < 100 AND door bias >= 20
244   Drum not in sync
      Top of drum not being indicated every 2.64 sec.
245   Low reflectance
      Average reflectance < (target - 100)
247   +28V supply failure
      28V power supply < 149 (26V)
249   Illegal MCS command
      Data Control System received illegal
         command from Machine Control System.
250   Fuser/PAMM fan fail
      Current < 81.
251   No top of drum
      Either drum not up to speed or faulty
         drum top switch.
252   High reflectance
      Average reflectance > (target + 60)
        AND toner hopper empty bit not set.
253   Densitometer failure 2
      LED current <128 OR > 230.
254   Developer overfull
      Average developer volume >= 210
255   Illegal DCS command
      Machine Control System received illegal
         command from Data Control System.
260   Prim cor supply 2
      Primary Corona current > 32.
261   Trfr cor supply 2
      Transfer current > 32
262   Phtr temp sensor
      Preheater temperature sensor registers < 10
        while at least one pad registers > 25.
263   Simul cor supply 2
      Simultaneous corona current > 32
264   Fuser switch short
      current > 32
265   Phtr overtemp
      Hardware overtemp bit set (190 C)
        OR one or more pads too hot (>250 (185 C))
266   RF driver stuck on
      RF power >= 16 when RF driver should be off.
267   AC triac short
      Current > 20
```

268 No drum
Drum has been removed from printer.
270 Encoder edge error
Encoder level did not change as stepper advanced.
Look for faulty encoder disc or faulty level
detection circuit.
271 Encoder res error
Encoder disc resolution <> 20+-1
272 Step phase error
Step phase does not advance along with stepper.
Due either to stepper motor not operation
properly or faulty drive circuit.
273 Stepper init error
Stepper initialization value found in non-
volatile memory is out of bounds.
274 High ZOP, laser off
275 Stack safety switch
Stack safety switches have been set for 1050ms.
(AC contactor is now open.)
276 NVR failure
Nonvolatile RAM selftest has failed.
277 Invalid stepper position
Desired stepper position is too close to an
encoder edge.
Select another stepper position or adjust
encode disc position.
278 Illegal NVR #xx
One or more of the parameters in the Machine
Control System's RAM is not within limits.
280 High screen V fail
Screen voltage > (expected + 32)
281 Low transfer V fail
Transfer voltage < 100.
282 DCS mem parity err
DCS memory controller has issued a parity
interrupt.
Printer should be taken off-line and Data
Control System error log should be displayed.
283 Wiper blade is up
300 A/O modulator warning
301 Beam detect warning
First order power (FOP) < 50, may be result of
low RF target. Electrostatic loop is limited
or running in Service Command Mode.
302 Laser warning
303 RF driver warning
ON/OFF RF output differential too low.
Electrostatic loop is limited or running in
Service Command Mode.
305 Cardcage Overtemp (warning)
196 < A/D count < 205

306 ESM shut door test W
Electrostatic monitor voltage <> bias voltage +-6.

307 Pad area fail
Current < 32 in one or more areas in one or more pads.

308 Phtr I Sensor
Current < 32 in one of the pads, however pad warms up.

309 Erase lamp warn
Current to erase lamp < 33.

310 Overall illum warn
Current < 33.

311 Hopper motor warn
Current < 21

312 Paper width sensor
Faulty paper width sensor (45 < voltage < 245).

313 Invalid phtr target
Target temperature form A/D converter < 50.

314 Relay warning
Current detected with all relays open. This is similar to relay failure except that wide paper is being used. Inability to open a relay is not harmful to the printer.

315 Developer full
189 > average developer volume count < 210.

320 ES loop warn 1
Electrostatic loop limited (within range).
Primary Corona limited,
Simultaneous Corona locked.
Probable failure - Primary Corona.

321 ES loop warn 2
Electrostatic loop limited (within range).
Simultaneous Corona limited,
Primary Corona locked.
Probable failure - Simultaneous Corona.

322 ES loop warn 3
Electrostatic loop limited (within range).
Both Primary and Simultaneous Coronae limited.
Probable failure - both Coronae.

323 ES loop warn 4
Process potentials did not reach acceptable levels during printer warm-up.

324 Low primary V warn
Electrostatic loop limited (within range).
Primary Corona voltage < 128

```
325   Low primary I warn
      Electrostatic loop limited (within range).
      Primary corona current < 40
        OR < (desired screen voltage - 32)
326   DCS ROM read err
      Data Control System detected a read error
        as it was trying to load default Logical
        Page Table (LPT), Vertical Format Control,
        and/or character set from ROMs on the
        DCS PCA.
327   Spur DCS ack intrpt
      Machine Control Processor received an
        unexpected acknowledgment (no message
        was sent which required acknowledgment)
        from the Data Control System.
328   Can't turn off +28V
      28 volt power supply was detected as being
      on when it shouldn't be.
329   Vacuum bag full
      Vacuum bag sensor switch detected full bag.
330   Low screen V warn
      Electrostatic loop limited (within range).
      Screen voltage < (expected - 32)
331   High screen V warn
      Electrostatic loop limited (within range).
      Screen voltage > (expected + 32)
332   Low sim corona fail
      Electrostatic loop limited (within range).
      Simultaneous Corona current < (expected - 32)
333   Volume sensor warn
      Instantaneous developer volume < 40.
335   Densitometer warn 1
      Clean drum reflectance = 765.
        A/D converter is held latched at max count.
340   Mem controller fail
      Selftest on Data Control System's
      memory controller indicates failure.
341   Char processor fail
      Selftest on Data Control System's
      character processor indicates failure.
342   DMA failure
      Selftest on Data Control System's
      direct memory access indicates failure.
343   DCS main memory fail
      Selftest on Data Control System's
      main memory arrays indicates failure.
344   External reg fail
      Selftest on Data Control System's
      external register indicates failure.
```

```
345   Data processor fail
      Selftest on Data Control System's
      data processor indicates failure.
346   High sim corona warn
      Electrostatic loop limited (within range).
      Simultaneous Corona current > (expected + 32)
347   ESM door reference
      100 < door bias voltage < 40

NOTE: Detailed information on this status can be found
      in the "HP2680 Service Manual".
```

=-=-=-=-=-=-=-=-=-=-= DATA STREAM STATUS =-=-=-=-=-=-=-=-=-=-=

o OK
o The following errors were encountered while processing
  Sheet !
  Record !
o The following errors were encountered while processing
  the environment file for this job.
o Data was lost
o No data loss was detected
o Parity error detected during HPIB activity
o Transmission error detected by printer,
  Possible causes:
    erroneous channel command
    undefined channel command
    erroneous data length

o other problems:

  o No memory is available to load the character set
    currently being sent.
  o No memory is available to load the form set
    currently being sent.
  o No memory is available to load the Vertical Format
    Control currently being sent.
  o An attempt was made to print data and no character
    set was selected.
  o An attempt was made to select an undefined form.
  o An attempt was made to print data and no Vertical
    Format Control is currently selected.
  o An attempt was made to print data and no Logical
    Page Table is currently selected.
  o An attempt was made to move the logical pen beyond
    the limits of the currently defined logical page.
  o The printer could not process all the data before
    it was due to be transferred to the
    drum/photoconductor/paper.
    WARNING: Data was lost.
  o The spooler block contains a format error. The
    error could be an invalid function code, an
    incorrect record, or an incorrect block size.
  o Missing Multi-Copy Form table. An attempt was made
    to use the Multi-Copy Forms table, but the table was
    not loaded.
  o The maximum number of copies per physical page, as
    as defined by the spooler with function code 132,
    has been exceeded. The printer has reset the requested
    number of copies to equal that maximum.

- o A command or function was received when no job was in progress.
- o No memory. Printer's dynamic memory (User & Bucket) is so occupied with character sets, VFCs, and forms that an inadequate amount of memory remains to process the current input data.
  WARNING - Data was lost.
- o The VFC selected, word 10 of the Logical Page Table (line spacing on page), is <= 0.
- o Attempt made to skip to a nonexistent VFC channel.
- o The logical page was truncated to fit on the physical page.
- o The page size requested by the programmer did not match the paper length set on the printer. The length indicated on the printer prevails.
- o No character set was selected when processing print record. The record will be skipped.
- o Not enough memory is available for picture download
- o An attempt was made to print more than 64 pictures on physical page.
- o An attempt was made to print a picture which is not present.

End of Section 6 -- DISPLAY I/O STATUS

Section 8—DISPLAY ENVIRONMENT STATUS

This section obtains and then display in text form, the information contained in the ENVIRONMENTAL STATUS BLOCK of the printer. If no errors are generated the diagnostic will output the following:

```
Section 8 -- DISPLAY ENVIRONMENTAL STATUS


=============================================================
                    ENVIRONMENTAL STATUS
=============================================================


-=-=-=-=-=-=-=-=-=-= MEMORY UTILIZATION =-=-=-=-=-=-=-=-=-=-=-

Capacity
   Printer:                      !k words
   DCS:                          !k words
   Incoming data buffer:         !  blocks

Available
   DCS Main Memory:              ! buckets (20 words/bucket)

Utilization
   Max used this job:            ! buckets
   Incoming data buffer:         ! blocks (512 words/block)
   User area                     ! words/16

       Character sets
         Descriptor blocks:          ! words
         Images:                     ! words/16

       Vertical Format Control:      ! words

       Forms
         Descriptor blocks:          ! words
         Images & triplet words:     ! words/16

       Pictures
         Images & triplet words:     ! words/16


-=-=-=-=-=-=-=-=-=-=-= JOB STATUS =-=-=-=-=-=-=-=-=-=-=-=-=-

# of VFCs loaded:               !
# of character sets loaded:     !
# of forms loaded:              !
# of pictures loaded:           !
```

```
# active logical pages:          !
# blanks not printed (clipped)
  this job:                      !
currently processing page #      !
Page length                      ! in.
Page width                       ! in.

Print error explanations:

   o Picture(s) not printed because of start before the 1/4
     inch margin at top of page.  Either programming error or
     operator inadvertently positioned the picture off the
     page via the ADJUST PRINT POSITION keys.

   o End of Job encountered while printer was silent running.

   o Form(s) not printed because of start before the 1/4 inch
     margin at top of page.  Either programming error or
     operator inadvertently positioned the picture off the
     page via the ADJUST PRINT POSITION keys.

   o Data truncated from either the top or bottom of page.
     Either programming error or operator inadvertently
     positioned the picture off the page via the ADJUST
     PRINT POSITION keys.

End of Section 8 -- DISPLAY ENVIRONMENTAL STATUS
```

Section 20—PATTERN PRINT

This section causes the device to print a test pattern to verify the overall operation of the page printer. This section also causes the printer to set up the environment to the default state and then to print the following 131 character line 119 times. Default spacing and page ejection should cause 60 lines to be printed on the first page and 59 on the second.

The following will be printed all on one line:

```
 !"#$%&'()"+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ \ ]^_ `
abcdefghijklmnopqrstuvwxyz{|}~ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
```

If no errors are generated the diagnostic will output the following:

```
Section 20 -- PATTERN PRINT

End of Section 20 -- PATTERN PRINT
```

Section 50—SIMULATE PANEL (2680 only)

This section is included for Customer Engineers (CEs) who want to run the remote diagnostic as they would the printer by entering printer commands at a simulated printer panel. This panel will accept numbers, and the word **EXIT**. **RUN** and **HALT** are not executable remotely. Any resulting messages and/or "printouts" are displayed on the screen.

The current hardware and firmware configuration of 2680s severely limits the practical functionality of this section. Rather, it is included as a framework to accommodate any future firmware changes and to provide a model for diagnostic writers of new printers. If the user enters a valid panel code which is not accessible remotely, a list of available commands is displayed. If no errors are generated the diagnostic will output the following:

```
Section 50 -- SIMULATE PANEL

                                  ------------------------
   Current panel msg:             |                      |
                                  ------------------------

   Explanation :

                                  ------------------------
   Next command ("EXIT" to stop) > |
                                  ------------------------
```

The above is repeated until EXIT is entered.

```
End of Section 50 -- SIMULATE PANEL
```

Error and Warning Messages

The following are general error/warning messages which may be encountered during the execution of PPDIAG. Note, however, that system dependent error messages may be displayed by the subsystem along with any error message generated by this diagnostic. All error message without the (PPERR #) trailer are generated by the subsystem. Errors which have explanatory notes (preceded by "—") will normally display only one of the notes listed here.

05001	***** PRINTER FAILURE (PPERR 05001)** **RESULTING HARDWARE STATUS:**
CAUSE	The printer has acknowledged a request but refuses to comply. The reason for the refusal is contained in the I/O status block which is returned and displayed following this message.
ACTION	Dependent on device and status returned.

05002	***** UNEXPECTED ERROR INTERNAL TO DIAGNOSTIC SYSTEM.**
CAUSE	An unexpected condition arose which is indicative of a problem outside this program.
ACTION	Submit an SR against ppdiag. Report any immediately preceding errors in the SR.

05003	***** UNEXPECTED ERROR ENCOUNTERED - LIKELY PPDIAG PROGRAM ERROR.**
CAUSE	An unexpected condition arose which is indicative of a programming problem in this program.
ACTION	Submit an SR against ppdiag. Report any immediately preceding errors in the SR.

05004	***** RECEIVED INVALID RESPONSE FROM PRINTER. DATA PATH OR PRINTER ERROR INDICATED. (PPERR 05004)**
CAUSE	A response was received from the printer that could not be decoded according to current specifications.
ACTION	Further diagnosis of printer necessary. If the device being tested is new and uses previously unused codes, modification of this program may be necessary.

05005	***** UNABLE TO SATISFY REQUEST TO !. (PPERR 05005)**
CAUSE	Some printer request (substituted for !) could not be executed. Other explanatory messages should precede this. If the root cause was printer failure (PPERR 05001), this message will be preceded by a listing of the current I/O status for the printer (if available). NOTE: Some sections make several different requests to the printer so that seemingly unrelated requests may fail. For example, section 3 (Identify) involves both an "identification" request and a "read env status" request. In these cases, an additional error message will specify the actual user request that failed.
ACTION	See actions associated with explanatory messages.

05006 ***** CURRENT PAGE SIZE COULD NOT BE OBTAINED. (PPERR 05006)**

CAUSE Some failure to read environmental status occurred.

ACTION Further diagnosis of printer based on I/O status returned is necessary.

05007 ***** IMPRACTICAL OR IMPOSSIBLE TO COMPLETE REMAINDER OF SECTION. (PPERR 05007)**

CAUSE Previous fatal error in execution of requested section.

ACTION Fix cause of previous error(s).

05008 ***** IMPRACTICAL OR IMPOSSIBLE TO COMPLETE REMAINDER OF STEP. (PPERR 05008)**

CAUSE Previous fatal error in execution of requested step.

ACTION Fix cause of previous error(s).

05009 ***** UNABLE TO OBTAIN DATA BUFFERS FOR TALKING WITH PRINTER. (PPERR 05009)**

CAUSE Memory space for data transfers could not be set aside.

ACTION Action based on previous explanatory errors.

05010 ***** UNABLE TO CONTINUE EXECUTION OF REQUESTED DIAGNOSTICS. (PPERR 05010)**

CAUSE Either access to the device could not be obtained, or an error internal to the system occurred.

ACTION Correct any immediately preceding error conditions.

05012 ***** ONLY THE FOLLOWING PANEL COMMANDS ARE AVAILABLE REMOTELY:**

0 - Reset
1 - Selftest (NOTE: Same as 610, i.e. this remote version does not cause any printout)
101 - Display DCS date code
610 - DCS selftest (Tests for individual components (612-618) cannot be activated remotely)

(PPERR 05012)

CAUSE The state of page printer firmware currently restricts use of the panel to the above commands.

ACTION Select only from the above list of commands.

05013 ***** UNABLE TO RETRIEVE ONE OR MORE COMMANDS FROM THE MESSAGE CATALOG. EXECUTION WILL PROCEED USING NUMBER CODED INPUT ONLY:**

EXIT : 20001
NO : 20002
YES : 20003

Numbered panel commands are entered as usual.

(PPERR 13)

CAUSE Either the message catalog is incorrect/corrupted or one or more commands are missing from the catalog.

ACTION You will be given the choice to continue on a number code basis or not (you must answer in the numeric codes for yes/no). In any case, your support engineer should ensure that all commands and keywords are properly listed in the system catalog.

05014	***** FAILED TO RECEIVE REPLY FROM THE DEVICE AFTER ! SECONDS. (PPERR 05014)**
CAUSE	A reply from the selected device was not received within the specified time-out interval. The device or some intermediate hardware/software is probably not functioning properly.
ACTION	If you selected the "errpause" parameter in the run command, you be will given the opportunity to retry the function by answering "YES" to the continuation prompt. More than one retry is probably fruitless.

05015	***** SPECIFIED ERROR COUNT LIMIT HAS BEEN EXCEEDED. (PPERR 05015)**
CAUSE	The error limit specified in the "ERRCOUNT" parameter of "RUN" command has been exceeded.
ACTION	If this is not desired, either omit the ERRCOUNT parameter or set a higher limit.

05016	***** FUNCTION IS NOT CURRENTLY AVAILABLE ON THE SELECTED PRINTER. (PPERR 05016)**
CAUSE	The requested function is not currently implemented by the diagnostic system for the device being tested.
ACTION	If this is unexpected, submit an SR against ppdiag.

05017	***** INDIVIDUAL TESTS ARE NOT AVAILABLE REMOTELY. USE COMPLETE SELFTEST(610) INSTEAD. (PPERR 05017)**
CAUSE	A request for a selftest of 612-618 (selftest of a single, particular field replaceable unit). Only the complete selftest (covers all FRUs within the DCS) is available remotely.
ACTION	Select 610 if that selftest will suffice.

05018	***** THE ! BYTE BUFFER PROVIDED IS TOO SMALL FOR REQUESTED DATA. (PPERR 05018)**
CAUSE	The device and/or diagnostic subsystem attempted to return more data than could be placed into the transfer buffer provided by this program.
ACTION	If this is unexpected, submit an SR against ppdiag.

05019	***** INVALID USER RESPONSE. (PPERR 05019)**
CAUSE	A response was entered by the user which was in some way inappropriate for the prompt given. One of the following listed submessages will be provided as a detailed explanation:—expected numeric response—unrecognized command, type help for assistance—numeric response must fall between ! and !.
ACTION	Re-enter requested data or type "HELP" for prompt specific information.

05020	***** UNRECOGNIZED MCS ERROR. MCS ERROR CODE = ! (PPERR 05020)**
CAUSE	An unexpected Machine Control System printer error code was received. It is probably a new code and not yet included in this program's message set.
ACTION	The code will have to be looked up in the latest version of the service manual. Notify the maintenance engineer for this diagnostic program.

05021	***** PPDIAG ABORTING DUE TO FATAL ERROR. (PPERR 05021)**
CAUSE	The reason for abort is always listed in one or more preceding errors.
ACTION	Fix preceding error(s), if desired.

05023	***** UNABLE TO OBTAIN COMPLETE IDENTIFICATION. (PPERR 05023)**
CAUSE	PPDIAG was unable to obtain environmental status from the printer. Therefore, the product name/number and DCS date code could not be determined. However, the device did respond to an identify command (supplied HPIB code).
ACTION	Take action based on I/O status returned.

05024	***** HARDWARE I/O STATUS COULD NOT BE OBTAINED. (PPERR 05024)**
CAUSE	Unable to copy I/O status block from data transfer buffer.
ACTION	Action dependent on preceding error message.

05025	***** THE REQUESTED COMMAND REQUIRES ! MODE. (PPERR 05025)**
CAUSE	The command function involved in your current request requires a more restrictive mode (disruptive or destructive) than you have been granted based on your security clearance.
ACTION	Acquire additional security clearance from the system manager. Consult the Diagnostic Program Development Guide for an explanation of modes.

05026	***** CHARACTER STRING CONTAINED SOMETHING OTHER THAN A VALID INTEGER NUMBER. (PPERR 05026)**
CAUSE	The response to a request for an integer number contained a non numeric character and/or an invalid base indicator.
ACTION	Enter numeric digits only.

05028	***** PPDIAG IS UNABLE TO PROPERLY COMMUNICATE WITH THE USER. (PPERR 05028)**
CAUSE	Either the message catalog is incorrect/corrupted or one or more commands are missing from the catalog. Normally this message cannot be printed intact since it indicates failure of the message display services of the diagnostic system. However, since its number will be displayed, this message is provided for lookup reference.
ACTION	Submit an SR against ppdiag.

05029	***** A PRINT JOB AND/OR ENVIRONMENT LOAD COULD NOT BE COMPLETED. (PPERR 05029)**
CAUSE	Could not close a print job on the printer. Some printout may be lost.
ACTION	Action dependent on I/O status displayed.

05030	***** PRINT DATA AND/OR ENVIRONMENT INFO COULD NOT BE TRANSFERRED TO THE PRINTER. (PPERR 05030)**
CAUSE	Could not complete a write request to the printer.
ACTION	Action dependent on I/O status displayed.

05031	***** ENVIRONMENTAL STATUS COULD NOT BE RESET FOR PRINT JOB. (PPERR 05031)**
CAUSE	Could not not clear previous environmental state and/or load new environment for next job.
ACTION	Action dependent on I/O status displayed.

05032	***** UNABLE TO PREPARE FOR PRINT JOB AND/OR ENVIRONMENT LOAD. (PPERR 05032)**
CAUSE	Could not open a new job on the printer.
ACTION	Action dependent on I/O status displayed.

05033	***** UNABLE TO RETRIEVE REQUESTED INFORMATION FROM DATA BUFFER. (PPERR 05033)**
CAUSE	Unable to remove information returned in response to your request from the data transfer buffer.
ACTION	Action dependent on preceding error message.

07001	***WARNING - Unable to mark printer as defective. (PPWARN 07001)**
CAUSE	The diagnostic has attempted to block further use of the tested device by the system. This attempt failed.
ACTION	The device should be electronically or physically removed from the system until it is repaired or deemed operational again by this diagnostic.

07002	***WARNING - Unable to convert number to readable form. (PPWARN 07002)**
CAUSE	The most likely cause is that the number could not fit into the designated space. In any case, asterisks will be substituted.
ACTION	This problem is not fatal to execution of the program, but may make interpretation of results difficult. This is normally unexpected and an SR should be submitted against PPDIAG.

07003	***WARNING - Data buffers received by the program were not as large as requested. One or more diagnostic functions may fail at a later time. (PPWARN 07003)**
CAUSE	PPDIAG did not receive as much data transfer memory as was requested. This may result in the failure of some or all diagnostic functions.
ACTION	This is normally a system restriction which you may not be able to overcome. Some diagnostic functions may work just fine with a less than maximum needed area.

07004	***WARNING - Expected ! bytes of response from the printer. Received ! bytes instead. (PPWARN 07004)**
CAUSE	This might be expected on a new development device. However, it can also result from an internal problem with the printer or any intervening hardware/software. Error message 05018 is normally issued if the expected response is too small.
ACTION	Submit an SR against ppdiag.

07005	***WARNING - The I/O path to the printer may be faulty. Any results (good or bad) shown below might not originate at at the printer. (PPWARN 07005)**
CAUSE	The I/O path between memory and the printer was not verified. This can result from a system internal error, an unimplemented test program, or an actual failure of the test, in which case a faulty field replaceable unit (FRU) should be displayed.
ACTION	If test failure, further testing of the I/O path should be done. In any case, communication with the printer should be considered unreliable from this point on.

07006	***WARNING - Device not recognized as a page printer. HPIB code returned = !. (PPWARN 07006)**
CAUSE	An unexpected HPIB code was received in response to an identification request. This diagnostic is intended to diagnose page printer devices (HPIB code 2004) only.
ACTION	The diagnostic will treat the selected device as though it were a page printer.

07007	***WARNING - Number of data bytes specified in variable record header does not agree with tha actual data length. (PPWARN 07007)**
CAUSE	Invalid assembly of spool block variable record. PPDIAG automatically truncates data to the length specified in the record header or the maximum length of a spool block, whichever is smaller.
ACTION	Advisory only. Submit an SR against ppdiag.

07008	***WARNING - Number of data bytes specified in variable record header exceeds size of spool block. (PPWARN 07008)**
CAUSE	Invalid assembly of spool block variable record. Data length is automatically truncated to size of spool block.
ACTION	Asvisory only. Submit an SR against ppdiag.

07009	***WARNING - Only the first ! bytes returned by the printer will be processed. (PPWARN 07009)**
CAUSE	Issued when printer returns more data than expected. In this case the expected number of bytes will be processed. This will yield incomplete and/or erroneous information, but is given as a partial aid to the user.
ACTION	Advisory only.

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