CS/80 Exerciser

for HP 9000 Series 500 Computers

Manual Part No. 09020-90046

Cartridge Tape Part No.	09040-11801	
$5\frac{1}{4}$-inch Flexible Disc Part No.	09020-11604	Disc#1
	09020-11605	Disc#2
	09020-11606	Disc#3

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Printing History

New editions of this manual will incorporate all material updated since the previous edition. Update packages may be issued between editions and contain replacement and additional pages to be merged into the manual by the user. Each updated page will be indicated by a revision date at the bottom of the page. A vertical bar in the margin indicates the changes on each page. Note that pages which are rearranged due to changes on a previous page are not considered revised.

The manual printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates which are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

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This manual applies to CS/80 Exerciser software beginning at Revision 1.00, Copyright 1985. Earlier versions are obsolete.

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Introduction 1

HP CS/80 (Command Set 1980) mass storage devices connect to HP 9000 Series 200 and 500 computers through an HP-IB interface. The computer, mass storage drive, interface, and cable must all function correctly before reliable data transfers can occur.

The Series 500 CS/80 Exerciser provides a comprehensive series of tests that detect and report any errors associated with the data transfer path. It is a menu-driven program for simple operation, and requires minimal initialization. Program error messages provide information that is helpful in diagnosing malfunctions. Up to 24 CS/80 devices can be connected to the computer while using the exerciser, provided the computer hardware and operating software can support such an equipment combination.

CS/80 Products

The CS/80 Exerciser can test any CS/80 product combination that is supported on Series 500 computers, including the following models **as well as others**:

- HP 7908 Disc Drive or Integrated Disc/Tape Drive
- HP 7911 Disc Drive or Integrated Disc/Tape Drive
- HP 7912 Disc Drive or Integrated Disc/Tape Drive
- HP 7914 Disc Drive or Integrated Disc/Tape Drive
- HP 7933 Disc Drive
- HP 7935 Disc Drive
- HP 7941 Disc Drive
- Other HP 794x drives

Consult the latest Series 500 supported peripherals list that is distributed monthly to HP Sales and Support offices for other supported models.

NOTE

The CS/80 Exerciser tests only CS/80 drives. It does **not** test SS/80 disc drives that use a subset of the 1980 Command Set supported by CS/80 drives.

Software Description

The HP-UX-based Series 500 CS/80 Exerciser is stored on disc or tape, together with a dedicated kernel. For additional convenience to the System Administrator or other authorized system users, the exerciser program can be copied, sans kernel, from the source tape or disc into the */usr/CE.utilities* directory of any standard Series 500 Release 4.0 or newer HP-UX operating system.

When the system administrator prefers to conserve disc space or restrict the amount of system access that is available to service personnel, the exerciser can be run with its own stand-alone kernel as a complete operating system/program that can be loaded from the original (or a back-up copy) disc or tape and run by a loader or boot ROM. This stand-alone capability does not reduce the need for care in using the exerciser program, especially in Service Engineer mode, because certain parts of the program are able to write to the device being tested (or to some other device if the device is incorrectly specified), and, in certain cases, can destroy valuable data (be sure the data has been properly backed up on another disc or tape). Situations where this capability exists are clearly identified in this manual, and most are password protected as indicated in the manual text.

The Series 500 CS/80 Exerciser program is available in two versions:

- Flexible Disc version for Model 520 computers (three 5¼-inch discs).
- CS/80 Cartridge Tape version for other Series 500 computers.

Required Hardware

Tape Drive

The cartridge tape version of the Exerciser requires a CS/80 cartridge tape drive. You can use the built-in tape drive included with some CS/80 disc drives, or the HP 9144 stand-alone cartridge tape drive. This version cannot be used with Model 520 computers. Use the flexible disc version instead.

Flexible Disc Drive

Model 520 computers use the flexible disc version of the Exerciser which requires an internal 5¼-inch flexible disc drive on the Model 520. This version is compatible **only** with the Model 520 computer.

Interfacing

CS/80 drives to be tested must be connected to the computer through a standard, supported HP-IB cable. The HP-IB interface in the computer and in the CS/80 drive must be correctly configured as recommended in hardware installation and operating manuals for the computer and CS/80 drives being tested.

Operating Terminal or Console

The computer must be equipped with built-in keyboard and display (Model 520) or a properly connected and functioning console terminal (other Series 500 models).

External Printer

An external printer can be connected to the system for hardcopy printout of test results. Any supported (non-CIPER protocol) HP-IB printer can be used. The default, and generally recommended (though not mandatory), printer is the internal printer on Model 520 machines, or an HP-IB printer at Interface Select Code 4, Primary (Bus) Address 01 on other models.

Multiple Drives

Up to 24 CS/80 devices can be connected to a single computer, but more than one interface may be required for multiple-drive systems to ensure that loading on each interface does not exceed the allowed maximum of eight device addresses per interface.

Software Requirements

The CS/80 Exerciser is a stand-alone system program that can be loaded directly by the loader ROM. It does not require an additional operating system before it can be used. However, part of the exerciser software can be transferred as a file system to an existing HP-UX system where it can be executed at any time by a system Super-user. The transfer procedure is described in Appendix A.

NOTE

The CS/80 Exerciser **program** can be transferred (without kernel) to an existing HP-UX file system. The program is identical for both software versions. However, the HP-UX kernels that support the program are not. The unique kernel for the Model 520 cannot be used on other Series 500 computers, and the kernel version for Models 530, 540, and 550 cannot be used on model 520 machines. Therefore, if the exerciser tape or discs are used as a stand-alone system (loadable) program, each version must be used only on those computer models for which it was intended.

NOTE

It is illegal to copy the exerciser program onto any operating system other than a properly licensed (purchased from HP in accordance with standard purchasing arrangements) Series 500 HP-UX system.

Program Loading and Start-Up Procedure

1. Be sure the CS/80 devices you want to test are properly connected to the computer HP-IB interface. Disconnect all other HP-IB devices except the external printer if it is being used to print test results (for best system performance, printers should not be connected to the same HP-IB interface as CS/80 disc drives). This ensures that a malfunction by other devices on the bus cannot interfere with interaction between the exerciser and the disc drive(s) being tested.

   Verify that the computer power switch is in its OFF position, then apply power to all peripherals that are connected to the HP-IB interfaces being used during program loading and exerciser operation.

   NOTE

   To ensure correct HP-IB operation, ALL devices connected to a given HP-IB interface must be powered during normal computer operation. If an HP-IB device must be unpowered, disconnect the HP-IB cable from the device to prevent improper bus loading.

2. Verify that the program tape or disc is **not** write protected:
   a. If the program is on a CS/80 tape cartridge, set the write enable screw so that the arrow points away from the SAFE label on the cartridge face.
   b. If the flexible-disc version is being used, be sure that the program disc is not write-protected (no tab affixed to the write enable slot). The two environment discs can be write-protected, if desired.
3. Make certain that no removable media (disc or tape cartridge) is present in any disc or tape drive in the system, except for the CS/80 Exerciser Environment Disc 1 (Model 520) or the CS/80 Exerciser tape (other Series 500 models).
4. Insert the *CS/80 Exerciser Environment Disc 1 of 2* into the internal disc drive (Model 520 only), or the Exerciser tape cartridge into an available CS/80 cartridge tape drive (other Series 500 models), then apply power to the computer. The computer automatically runs through its power-up sequences, then begins loading the program environment, followed by the exerciser program.

5. If the computer is **not** a Model 520, skip to step 6. To load the Model 520 Exerciser:
   a. About one minute is needed to load the first environment disc. A prompt message is then displayed:

      ```
      CS/80 Exerciser Environment    Disc 1 of 3
      Mount next volume
      ```

      Replace the first environment disc with the disc labelled *CS/80 Exerciser Environment Disc 2 of 2*. The computer continues loading automatically.
   b. When the second environment disc is loaded about a minute later, the display shows a similar prompt:

      ```
      CS/80 Exerciser Environment    Disc 2 of 3
      Mount next volume
      ```

      When this prompt appears, replace the second environment disc with the program disc labelled *CS/80 Exerciser Program Disc*. Loading continues automatically, and should be complete in about one minute.
6. When loading is complete (about two minutes for the cartridge tape version), several copyright notices are displayed, then the exerciser program begins constructing special (device) files from the program tape or disc. This process requires about five to seven minutes on tape; much less time on disc. When the files are ready, the Exerciser displays the message:

   ```
   Welcome to the CS/80 Exerciser.
   ```

7. Test results can be displayed on the CRT display, or diverted to a hardcopy printer. The default printer is the internal Model 520 printer, or an external, non-CIPER protocol, HP-IB printer located at select code 4, bus address 01. Other printers and locations can be selected as explained in this step. The following display appears on the CRT screen:

   Model 520:

   ```
   Default printer is the internal printer.
   Would you like to change the printer (y/n, default n)?
   ```

   Other Models:

   ```
   Default printer is Select Code 4, Address 01.
   Would you like to change the printer (y/n, default n)?
   ```

   a. To accept the current default printer location, press N or RETURN. Continue with Step 7.
   b. To change the printer location, press Y. The computer then prompts for new select code and address values:

      ```
      Use decimal values for select code and address.
      What is the printer select code? <xx>
      What is the printer address?     <yy>
      ```

      Type the requested values where <xx> is the select code in decimal, and <yy> is the HP-IB address, also in decimal. After typing each entry, press RETURN to store the value. The new printer location remains valid for the remainder of program operation. To change it, the program must be reloaded and restarted.

8. When program initialization is complete, a copyright statement and display appears that is similar to the following:

```
c Copyright Hewlett-Packard Company, 1985.
* All rights reserved.

Command Set 80 (CS/80) Disc Exerciser for
Series 500 Computers       Rev [1.00]

CAUTION-Before resuming normal operations,
cycle the power switch on each CS/80 device that was exercised.

Press any key to continue.
```

   Upon completion of CS/80 device exercising and testing, all drives that were accessed during exerciser operation must have their power switches cycled off for a few seconds then on again. This causes the drive power-up sequence to enter a special state that alerts the computer operating system to a peripheral device power failure. The operating system then reconfigures the drive as necessary, thus ensuring correct system operation. If this is not done, unpredictable system errors may occur.

9. The program disc or tape is no longer needed by the program. The disc can now be removed from the internal disc drive. If a cartridge tape is being used instead, the tape drive is unloaded after one to two minutes. When the drive buzzer sounds, remove the tape.

10. To continue, see Chapter 2.

Running the Exerciser from HP-UX

To run the Exerciser program from a functional HP-UX operating system, use this procedure:

1. Log on as Super-User.

2. Verify that you are in single-user mode before continuing. The command

   ```
   ps -ef
   ```

   should show only three processes: `/etc/init`, your `ps -ef`, and `/bin/sh` (or `/bin/csh`). The exerciser checks for this environment, and cannot proceed if other processes are still running. Note that `cron` and the login monitors for each terminal (`getty`) must also be killed.

3. As super-user, invoke the program:

   ```
   /usr/CE.utilities/CS80/exerciser
   ```

4. When the welcome message appears, proceed with Step 7 in the preceding section to set up printer options.

Operating Instructions 2

Load the program as explained in Chapter 1. When loading is complete and the program discs or tape are no longer in their drives, continue with this chapter.

CS/80 Configuration Table

The first display following the copyright statement is the CS/80 Configuration Table which presents a list of all CS/80 devices in the system. Table contents vary, depending on the particular system configuration. Here is a sample table:

```
CS/80 Devices Available for Test:
Device   Select   Bus    Type
Number    Code    Addr
   1        5       0    7908
   2        5       3    7912
```

The drive number, select code, bus address, and device type are given for each CS/80 device. The meaning of each of these terms is as follows:

Device Number: The program assigns a device number to each CS/80 device it finds. If you have more than one CS/80 device on your system, remember the device number of the device you intend to test. You will need this information in the next stage of the program.

Select Code: This column gives the interface select code of each CS/80 device in the system. Each HP-IB interface has a unique select code which is shared by all devices connected to that interface. Select code 05 is the recommended default for the first HP-IB interface, but the value can vary, depending on system configuration.

Bus Address: This column contains the HP-IB bus (primary) address for every CS/80 device in the system. Each device connected to a given interface must have a unique address among all devices connected to that interface. The device address does not have to be unique in the system, provided any other device having the same address is connected to a different interface. CS/80 bus addresses are restricted to the range 00 thru 07.

Device Type: This column contains the model numbers for all CS/80 devices present in the system.

If any CS/80 device fails to appear in the Configuration Table, verify that the device is powered and properly connected. If the device still does not appear in the table, it is probably malfunctioning; that is, it does not respond when the Exerciser sends signals to it. The device can still be exercised, however, by manually adding the device to the table (see instructions for the 'Z' command in the Main Menu section that follows).

After looking over the table and noting which drive number(s) you want to test, press any key to proceed to the Main Menu.

Main Menu

The Main Menu contains exercise parameters and functions that allow you to set up and run the exercise as follows:

```
Exercise Parameter and Function Selection:

D - Device number to test   :     1  (Bus 5, Address 0)
U - Unit number to test     :     0
V - Volume number to test   :     0
O - Output device (Results): Screen
L - Loop count for test     :     1
Y - Long/short Test         : Short
C - Service Engineer Mode   : Off
S - Display CS80 devices available for testing
T - Display units & volumes on Device  1
Z - Identify a CS80 Device that can't be found
E - Begin exercising or printing logs
! - To exit the Exerciser

To change an exercise parameter or select a func-
tion, type the first letter on the item's line:
```

Example of Main Menu Display

The first seven menu entries represent exercise parameters. The final five entries represent available functions and provide an exit path from the exerciser program. Each menu entry is formatted into two or three columns:

- The left-hand column identifies which key to press when changing current value of a function or selecting an exerciser option.
- The center column contains a description of the function.
- The right-hand column, when present, shows the current setting for that option.

For example, the line:

```
D - Drive number to test : 1   (Bus 5, Address 0)
```

indicates that drive number 1 in the CS/80 Configuration Table, located at interface select code 5, HP-IB address 00, is currently selected for testing, and that pressing D enables you to select a different drive.

Default Parameter Values

At start-up, the exerciser program assigns default values to all parameters listed in the Main Menu. The default values have been chosen such that a minimum system configuration (a system containing only one CS/80 device and no printer) can proceed with testing immediately, avoiding any need to change default values.

If the default values correctly represent the tests you want to run, press E to begin the exercise, then skip to Chapter 4.

If the main menu does not correctly define the tests to perform, one or more parameters must be changed before continuing. The next two sections explain how to make the necessary changes.

Main Menu Parameters

D - Device number to test: Specifies the number of the device to be tested. To display the device numbers of all CS/80 devices connected to your system, press S. To change the value of this parameter, press D, answer the prompt with the number of the device you want to test, and press RETURN.

U - Unit number to test: Specifies the number of the **unit** (within the specified **device**) to be tested. A CS/80 device contains from 1 to 15 units. The units within a device are displayed by setting the device number to the desired device and pressing T. To change the value of this parameter, press U, answer the prompt with the number of the unit you want to test, then press RETURN. Valid parameter values are 0 thru 14.

V - Volume number to test: Reserved for future use. Presently, only volume 0 (the default value) is allowed.

O - Output device: Specifies the output device where all test results are to be printed. You can select the CRT display (`Screen:`) or a supported printer (`Listing:`), if present. To change output devices, press O.

L - Loop count for test: Specifies how many times the exercise is to be run before the results are displayed. To change the value of this parameter, press L, answer the prompt with the new value, then press RETURN. Up to 255 test loops can be specified.

Y - Long/short Test: Selects either a long or short test when the unit selected for testing is a tape drive. If the value of this parameter is `Long`, a full volume tape error rate test will be performed in addition to all other tests. If the value is `Short`, then the error rate test is not performed. The error rate test takes from 20 to 75 minutes, depending on the length of the tape. This parameter has no effect when a disc unit is being tested: all disc units receive the error rate test. If a `Long` test is selected, you will be prompted at the appropriate time (later, after the E key is pressed) to insert an initialized, write-enabled tape cartridge. Load the cartridge, then press RETURN to resume the test. To change the value of this parameter, press Y.

IMPORTANT

The **Long** (error rate) test described above erases data on whatever tape cartridge is present in the drive when testing begins. **Do not** insert a tape containing valuable data or programs.

C - Service Engineer Mode: Alternately enables and disables Service Engineer mode of Exerciser operation. During normal testing, Service Engineer mode should remain Off. It should be On only when used by authorized service personnel to obtain special technical diagnostic information. Chapter 5, Service Engineer Mode, describes the diagnostic aspects of the Exerciser.

IMPORTANT

Service Engineer Mode has capabilities which can erase the entire disc! Do not use this mode unless you are qualified to do so, or have been authorized by your HP service representative while working under his or her direction.

Main Menu Functions

S - Display CS/80 devices available for testing: Press S to re-display the CS/80 Configuration Table. This may take a little while, so don't be concerned if the table doesn't appear immediately.

T - Display units & volumes on Device x: Each CS/80 device contains from 1 to 14 units, and each unit contains from 1 to 8 volumes. Press T to display a table of all units and volumes contained on the device specified by the device parameter. Here is a sample table:

```
Units/volumes found within device  2:
 Unit   Unit type   Volumes
   0      Disc        0
   1      Tape        0    No Tape Installed
```

The *Unit* column lists the unit number for each unit in the device. Use this value when selecting the Unit Number to test in the main menu. *Unit type* indicates whether the unit is a tape or disc drive. The *Volumes* column is always zero. If the unit is a tape drive and no tape cartridge is present, a reminder is printed to the right of the volume number.

NOTE

Before the table is displayed, the exerciser performs an initial I/O test. Should this test fail, an error condition may exist such that one or more existing units may not appear in the table.

Z - Identify a CS/80 device that can't be found: Sometimes a malfunction in a CS/80 device makes it invisible to the Exerciser. In such cases, the device will not appear in the CS/80 Configuration Table and thus is not assigned a device number. Without a device number, a device cannot be tested. This command allows you to manually enter the unknown device into the CS/80 Configuration Table so that it can be tested.

When entering an unknown device, you must specify the interface select code and device's HP-IB address. Press Z and the following prompt will appear immediately below the Main Menu:

```
Select code of interface?
```

Type the select code of the undetected device (range of 0 thru 23) and press RETURN. The HP-IB bus address prompt appears:

```
Bus address of Device?
```

Type the device's bus address (range of 0 thru 7) and press RETURN.

If you now press S, the device just identified should appear in the CS/80 Configuration Table. The device type is listed as "Unknwn". It is your responsibility to verify that the select code and bus address correspond to an existing CS/80 device; the program only checks to be sure the specified values fall within acceptable ranges.

E - Begin exercising or printing logs: Press E to begin the selected exercise process on the selected CS/80 device. Main Menu parameter values specify which device will be tested.

Exiting and Aborting the Program

This program runs continuously until you press [!], or until power to the computer is interrupted. After all passes of an exercise are completed and the test results have been displayed or printed, the program returns to the CS/80 Configuration Table. Pressing any key then advances the program to the Main Menu, from which a new test can be initiated.

To terminate the exerciser, press [!] while the main menu is displayed. If the program was run from an active HP-UX operating system, the necessary clean-up activities are performed to prevent corrupting the HP-UX system, then the super-user prompt is restored.

If a stand-alone exerciser/kernel is being used, a message is displayed that indicates re-booting an operating system or system program to continue. In this case, cycle the power switch on each CS/80 device used during the test to ensure proper initialization of the drive controller(s), then use normal procedures for loading a new system. If operating the exerciser from a live HP-UX system, do not cycle drive power to prevent system corruption.

IMPORTANT

The Exerciser must change the internal configuration of a device in order to test it. This "test state" may or may not be compatible with the operating system being loaded. To ensure the device is returned to its "operational state," use the [!] key to exit from the main menu.

When using a stand-alone exerciser, turn each CS/80 device you tested OFF, and then ON again before using it. Do not cycle drive power when running the exerciser from a live HP-UX operating system.

You can abort the test in progress at anytime by pressing [BREAK]. When an exercise is aborted, the results obtained up to the time of the abort are printed. Note that such results are incomplete and conclusions drawn from them may not accurately reflect the true state of the device under test.

NOTE

The exerciser program may take a while to relocate the CS/80 device whose exercise was aborted. Press [S] at five second intervals until the device reappears in the CS/80 Configuration Table.

Exerciser Checklist

You should check all Exerciser parameters before testing a device. The following list gives you a quick reference guide for this procedure:

- Is the device number correct?
  - Press D to change it.
  - Press S to get the CS/80 Configuration Table.
  - Press Z to define an unknown device.
- Is the unit number correct?
  - Press U to change it.
  - Press T to get the table of units and volumes.
- Is the output device correct?
  - Press O to change it.
- How many times do you want to run the test?
  - Press L to change the loop count.
- If testing a tape unit, do you want the long or short test?
  - Press Y to change the current setting.
- Make sure Service Engineer Mode is `Off`, then press E to begin.

Testing HP 7912 Drives: An Example

3

This chapter demonstrates how to exercise an HP 7912 integrated disc and tape drive, with test results output to an external printer. Five exercise cycles are run on the disc drive, followed by a single long-test exercise sequence on the tape drive. To interpret test results, refer to Chapter 4.

System Configuration for this Example

- Model 520 Computer with 1 Mbyte of memory.
- HP 7908 Integrated Disc/Tape Drive connected to an HP-IB interface at select code 5, bus address 00. Each unit has only one volume.
- HP 7912 Integrated Disc/Tape Drive connected to the same HP-IB interface at select code 5, bus address 03. Each unit has only one volume.
- An HP 2673A printer connected to the internal HP-IB (select code 4) on bus address 01.

Getting Started

1. Load the exerciser program as explained in Chapter 1.
2. Continue after the copyright statements as instructed by the computer display until the CS/80 Configuration Table appears on the display.

CS/80 Configuration Table

The CS/80 Configuration Table for the system is now displayed on the CRT screen. For discussion purposes, let's assume that the configuration table resembles the following:

```
CS80 Devices Available for Test:
Device  Select   Bus    Type
Number  Code     Addr
   1       5       0    7908
   2       5       3    7912
```

An HP 7908 at select code 05, bus address 00 is identified as device number 1. The HP 7912 that is to be tested resides on the same select code, but at address 3. It is device 2.

Setting Parameters for the Disc Unit

The Main Menu appears as follows:

```
Exercise Parameter and Function Selection:

D - Device number to test  :     1  (Bus 5, Address 0)
U - Unit number to test    :     0
V - Volume number to test  :     0
O - Output device (Results): Screen
L - Loop count for test    :     1
Y - Long/short Test        : Short
C - Service Engineer Mode  : Off
S - Display CS80 devices available for testing
T - Display units & volumes on Device  1
Z - Identify a CS80 Device that can't be found
E - Begin exercising or printing logs
! - To exit the Exerciser

To change an exercise parameter or select a func-
tion, type the first letter on the item's line:
```

Main Menu

Run through the checklist to make sure all parameters are set correctly:

1. The device number is set to 1 (HP 7908). To test the HP 7912, change to device 2 by pressing D, then typing 2 RETURN in response to the prompt.
2. The unit number is set to 0. Type U to list the units and volumes on device 2:

   ```
   Units/volumes found within device  2:
   Unit   Unit type   Volumes
   0      Disc        0
   1      Tape        0    No Tape Installed
   To continue hit any key
   ```

   To test the disc unit (Unit 0) first, no action is needed because the parameter is already set to 0. Press any key to return to the Main Menu.
3. The output device is set to `Screen` (the CRT display). Press O to print a hardcopy `Listing` of the exerciser messages and reports.
4. The test is currently set to run only once. Change the loop count to five by pressing L, then typing 5 RETURN in response to the prompt.
5. A disc unit is being tested, so the Long/short Test parameter is ignored.
6. All parameters are now set. Service Engineer Mode is `Off`. Press E to begin the exercise.

Disc Unit Exercise Results

Computer Screen Output

```
Exercising...
Begin pass       1
Initial I/O Tests Finished
.
Set Unit 0
Cleared ERT logs
Start Full Volume Read-Only Error Rate Test
.............
Error Rate Test Finished
Begin pass       2
Initial I/O Tests Finished
.
Set Unit 0
Cleared ERT logs
Start Full Volume Read-Only Error Rate Test
.............
Error Rate Test Finished
Begin pass       3
Initial I/O Tests Finished
.
Set Unit 0
Cleared ERT logs
Start Full Volume Read-Only Error Rate Test
.............
Error Rate Test Finished
Begin pass       4
Initial I/O Tests Finished
.
Set Unit 0
Cleared ERT logs
Start Full Volume Read-Only Error Rate Test
.............
Error Rate Test Finished
Begin pass       5
Initial I/O Tests Finished
.
Set Unit 0
Cleared ERT logs
Start Full Volume Read-Only Error Rate Test
.............
Error Rate Test Finished
To continue hit any key
```

Printer Output

```
                          Test Result Report

Status bits set: none

The tests have passed. The drive is ready for use.
The test recommends sparing a location on the
disc.  Please save the information on the disc
and re-initialize it.
```

Explanation of Disc Results

No errors were reported during the exercise. However, in this example, an area on the disc was found where the media is damaged or faulty (defective areas are called bad tracks). Data recorded on bad tracks might be lost, but this is **not** a serious problem. No disc is perfect, so "spare" tracks are provided to take the place of any bad tracks that might be found. The initialization routine provided by your language system logically redistributes track assignments to take care of this situation. See your language manuals or System Administrator's manual for more information on initializing media.

Setting Parameters for the Tape Unit

Before starting the tape test, run through the checklist to make sure that all parameters are set correctly:

1. Device number is already 2 (7912), so no change is needed.
2. Unit number is set to 0 (disc unit). To change the unit number to 1 (tape unit), press U, then type 1 RETURN in response to the prompt.
3. Output is set to `Listing`, so no change is needed.
4. The loop count is set to 5. Change it to 1 by pressing L, then typing 1 RETURN in response to the prompt.
5. The Long/Short Test parameter is set to `Short`. Press Y to change it to `Long`.
6. All parameters are set. Service Engineer Mode is Off. Press E to begin the exercise.

Tape Unit Exercise Results

Computer Screen Output

```
Exercising...
Begin pass      1
Initial I/O Tests Finished
.
Set Unit 1
If not already done, insert a write enabled tape
cartridge, wait for it to load, then hit a key.
CAUTION-The data on the tape WILL BE DESTROYED.
```

[A tape cartridge was inserted here, then a key was pressed]

```
Start Full-Volume Tape Error-Rate test
```

Printer Output

```
                              Test Result Report
Error code:   160 was reported.
Status bits set: 30  33

The power failed during the test.  Please restart
it.
The tape media appears to be uninitialized.
Please initialize it and re-run the test.
```

Explanation of Tape Results

In this test, two errors were reported. One was caused by a momentary power outage, but probably does not indicate a hardware failure. The other was caused by an oversight; the tape cartridge used in the exercise was not previously initialized.

Power failure errors occur randomly, and are difficult to prevent. It is improbable that another power failure would occur if the test were re-run.

To correct the second error, run the tape through an initialization procedure.

After referring to the language manual, the tape cartridge is initialized, then the test is re-run. Here are sample results from such a new test:

New Tape Unit Exercise Results

Computer Screen Output

```
Exercising...
Begin pass     1
Initial I/O Tests Finished
.
Set Unit 1
If not already done, insert a write enabled tape
cartridge, wait for it to load, then hit a key.
CAUTION-The data on the tape WILL BE DESTROYED.
```

[A new initialized tape cartridge was inserted here, then a key was pressed]

```
Tape ERT log cleared
Start Full-Volume Tape Error-Rate Test
.............................................................
.............................
Tape Error Rate Test Finished
To continue hit any key
```

Printer Output

```
                              Test Result Report

Status bits set: none

The tests have passed. The drive is ready for use.
```

IMPORTANT

Upon completion of CS/80 device exercising and testing, all drives that were accessed during exerciser operation must have their power switches cycled off for a few seconds then on again. This causes the drive power-up sequence to enter a special state that alerts the computer operating system to a peripheral device power failure. The operating system then reconfigures the drive as necessary, thus ensuring correct system operation. If this is not done, unpredictable system errors may occur.

Explanation of New Tape Results

No errors were reported on the second pass. Note that both problems reported in the first pass were easily removed without the need for professional service. The time and expense of a hardware troubleshooting and repair procedure was thus saved. Had real hardware failures been found, the Exerciser would have produced a message calling for service by a qualified service representative.

Interpreting Test Results 4

Exercise Progress Messages

During exerciser operation, progress messages are displayed on the CRT. Messages include such items as the name of the test in progress and the number of the current pass in the exercise loop. Whenever a lengthy test is underway, a dot is printed every ten seconds to assure you that the test is still working.

Test Result Report

Exercise results are summarized in the Test Result Report. This report either indicates that the tests passed, or lists the errors that were found. If professional service is warranted, the test produces a message calling for assistance from a qualified service representative. Otherwise, instructions are provided for correcting the problem without assistance.

The Test Result Report appears on the output device specified by the output (O) parameter. If the CRT display is the output device, you must press a key after the tests are finished to display the Test Result Report.

Up to five items of error information may appear in the Test Result Report:

- Exerciser error messages
- Status bits set
- Error codes
- System error messages

Exerciser error messages are designed to provide an easy-to-understand description of the problem, assuming little or no knowledge of CS/80 operation. The proper corrective action is clearly stated.

The remaining message categories are intended to help service personnel isolate the source of detected problems. Training in CS/80 operation and architecture is assumed. The tables and listings which follow describe these other errors in greater detail.

NOTE

I/O error messages **or** system error messages (but not both) may appear in a Test Result Report. Otherwise, any combination of messages is allowed.

Exerciser Error Messages

Exerciser error messages are textual descriptions of error conditions. They usually provide instructions for correcting the problem or advise you to call for service. These messages are self-explanatory.

Status Bits

CS/80 drive controllers contain internal status bits that are set whenever a corresponding type of error occurs. Status bits that are set during exerciser operation are listed in the Test Result Report with the following message: `Status bits set:` The identifying number(s) for any status bits that have been set are listed after the colon; if no bits were set, the word `none` appears instead. The following table lists each status bit and its corresponding error condition:

Status Bit	Error Type
2	Channel parity error: A channel command was received without odd parity.
5	Illegal opcode: An unrecognizable opcode was received.
6	Module addressing: An illegal volume or unit number was specified for this device.
7	Address bounds: The target address has exceeded the bounds for this device.
8	Parameter bounds: A parameter (other than unit, volume or target address) is not allowed for this device.
9	Illegal parameter: A parameter field was the wrong length for the opcode preceding it.
10	Message sequence: The message sequence has been violated. (Error suppressed if any reject or fault errors have occurred prior to sequence error.
12	Message length: The total length of the execution message differs from the current default value.
17	Cross unit: An error has occurred during a Copy Data operation.
19	Controller fault: A hardware fault occurred in the controller.
22	Unit fault: A hardware fault has occurred in the unit addressed.
24	Diagnostic result: The hardware failed the diagnostic indicated in the parameter field.
26	Operator release required: Release required for operator request (e.g., load/unload, restore).
27	Diagnostic release required: Release required for diagnostics initiated from control panel (e.g., HIO, self test).
28	Internal maintenance required: Release required for internal maintenance (e.g., head alignment, error log).

Status Bit	Error Type
30	Power fail: The power to the unit failed, a diagnostic destroyed configuration, or a pack was loaded. Device should be reconfigured.
31	Retransmit: The preceding transaction should be retried.
32	Illegal parallel operation: The requested operation cannot be executed in parallel with some other operation(s) currently in progress.
33	Uninitialized media: The host attempted to access unformatted media, or an unusable media has been loaded.
34	No spares available: Spare Block cannot be executed due to lack of spare media.
35	Not ready: The selected unit is not ready for access at this time (e.g., heads or media not yet fully loaded).
36	Write protect: The selected volume is write protected.
37	No data found: A block accessed during a read has not been written.
40	Unrecoverable data overflow: The previous transaction generated more than 1 unrecoverable data error. The entire transfer should be considered in error.
41	Unrecoverable data: Unrecoverable data at indicated block(s).
43	End of file: End of file encountered on file structured device.
44	End of volume: The host attempted to access across a volume boundary.
48	Operator request: Release requested for operator request.
49	Diagnostic request: Release request initiated from diagnostic control panel.
50	Internal maintenance request: Release requested for internal maintenance.
51	Media wear: Only one spare track (disc) or one spare block (tape) remaining.
52	Latency induced: A latency was induced during the transfer due to slow transfer rate or seek retry.
55	Auto sparing invoked: A defective block has been automatically spared by the device.
57	Recoverable data overflow: The previous transaction generated more than 1 recoverable data error.
58	Marginal data: Data was recovered, but with difficulty.
59	Recoverable data: A latency was introduced in order to correct a data error.
61	Maintenance track overflow: Error and fault log area is full.

Error Codes

Error codes specify which test in the exercise sequence failed. Whenever an error occurs, the following message is included in the Test Result Report:

```
Error code: <x> was reported.
```

Where <x> represents the error code number. Error codes are listed in the following table:

Error Number	Test or Function	Error Number	Test or Function
10	System I/O Test	240	Read Disc ERT Log
20	Cancel	270	Interleave Table
40	Read Loopback	280	Interleave Value
50	Write Loopback	290	Clear ERT Log
60	Internal Diagnostic	300	WTR Tape FV ERT
70	Set Unit	305	WTR Disc FV ERT
80	Describe	310	Read Tape ERT Log
90	Read Disc Run Log	320	System Test
110	Uncorrectable Rate	1000	Amigo Clear
130	Clear ERT Log	2000	Read Fault Log
140	Disc Read-only ERT	3000	Read Tape Run Log
150	Read Disc ERT Log	4000	Read Sensors
160	Clear ERT Log	4100	Read Revision Numbers
170	Read-only ERT (FV)	4200	Read Error Summary
180	Read Disc ERT Log	5000	Read Drive Tables
200	Uncorrectable Rate	6000	Read Use Log
220	Clear ERT Log	7000	Flag Plot Error
230	Partial Disc RO ERT	8000	Final Unit Status

Abbreviations in this table: ERT = Error Rate Test, WTR = Write Then Read, FV = Full Volume, RO = Read-Only.

System Errors

The following System Errors may occur during execution of the Exerciser. When a system error occurs, the message:

```
Non-exercise-related error occurred:
exerciser: <nn> <msg>
Errinfo: <mm>
Check system.  If error persists, call service.
```

where <nn> is the value of *errno(2)*, <msg> is its corresponding text, and <mm> is a value from *errinfo(2)*. Errors of this sort can originate from a multitude of sources including, but not limited to:

- An I/O device not powered,
- An internal error in the Exerciser program,
- A hardware fault, or
- A software fault.

Verify that all devices are connected properly and powered, then try again. If this does not correct the problem, remove power from all system devices except the computer, repower them, then rerun the exerciser. If the problem persists, remove power from all system devices, including the computer, repower the peripherals, then apply power to the computer. Reload the exerciser and try again. If the problem has not been corrected, troubleshoot the hardware if you are an HP-qualified service expert, or call for service if you are not.

Service Engineer Mode 5

Description

IMPORTANT

Service Engineer Mode provides access to a great deal of diagnostic information that is intended for qualified service personnel only. This information requires training in CS/80 hardware architecture, operation and maintenance procedures. If you do not have this training, use Service Engineer Mode **only under the recommendation and guidance of a qualified service person. Improper or uninformed use of Service Engineer Mode may result in the total loss of all data stored on the CS/80 disc and/or tape!**

Service Engineer Mode lists the internal error logs of a CS/80 device. Error logs are cumulative records of data errors that have occurred during normal device operation, or during error rate tests. Occasional errors occur at random times during the normal life of a device, so error logs alone are usually insufficient to correctly diagnose a hardware problem. They should be used carefully **in conjunction** with other exercise error messages when determining the condition of a disc or tape drive. Without additional testing, it is impossible to tell whether the error resulted from damaged media (which can be corrected by sparing), from hardware failure, or from an isolated, random event.

When to Use

Qualified service personnel usually invoke Service Engineer Mode only after an error has been reported in the CS/80 Exerciser's Test Result Report. If the source of the error is not immediately apparent from the information given there, Service Engineer Mode is used to access detailed tables and logs for diagnostic information.

System users may be authorized by a qualified service expert to enter Service Engineer mode so that certain portions of the logs can be read back from the console display for use in making a preliminary diagnosis when the service person needs to make sure he has the proper equipment with him when arriving for a service call. In such a case, directions must be **carefully** followed.

Operating Procedure

To select Service Engineer Mode from the main menu, press C. The display now changes to:

```
You are about to enter a mode which CAN
DESTROY DATA!  Enter the correct password
to select this mode; anything else to not
select this mode:
```

Service Engineer mode provides access capabilities that can be dangerous to the preservation of valuable data if it is used by inexperienced or unqualified users. Therefore a password is required for entry.

To activate Service Engineer mode, type `corium` in lowercase letters, then press RETURN (this is the only response that provides entry). The display changes to the following options menu:

```
Exercise Parameter and Function Selection:

    D - Device number to test  :     1  (Bus 5, Address 0)
    U - Unit number to test    :     0
    V - Volume number to test  :     0
    O - Output device (Results): Screen
    L - Loop count for test    :     1
    Y - Long/short Test        : Short
    C - Service Engineer Mode  : On
    X - Do Test or display Logs: Test
    Q - Clear all logs on selected unit
    W - Write allowed on disc  : No
    S - Display CS80 devices available for testing
    T - Display units & volumes on Device  1
    Z - Identify a CS80 Device that can't be found
    E - Begin exercising or printing logs
    ! - To exit the Exerciser

    To change an exercise parameter or select a func-
    tion, type the first letter on the item's line:
```

Service Engineer Mode Options Menu

Notice the three new functions that were added:

```
X - Do Test or display Logs
Q - Clear all logs on selected unit
W - Write allowed on disc
```

They are available only in Service Engineer Mode because they produce highly-technical diagnostic information or permit potentially dangerous operations on the disc.

X - Do Test or display Logs: Press X to toggle between `Test` and `Logs`. When set to Test, the exerciser behaves as if in normal mode; exercising the specified device and reporting the results. Switch to Logs to list the internal error logs and tables of the specified device.

Q - Clear all logs on selected unit: Press Q to erase all of the internal error logs of the specified device. This is normally done after the device has been repaired to eliminate past history and provide a new starting point for future diagnosis. All previously recorded errors are cleared by this operation.

BE CAREFUL

The following key activates options that can erase the entire contents of the disc.

W - Write allowed on disc: Press W to select a read/write error rate test on the specified device. This test is generally used as a last resort, and only after the device has been properly backed up. The entire disc is erased, destroying any existing files, when this option is selected. Use it with extreme caution.

Printing Logs

To print the error logs of a particular device:

1. Press C to enable Service Engineer Mode.
2. Type the correct password, then press RETURN.
3. Press X to switch Test/Logs Mode to Logs.
4. Set all other parameters as usual to specify the desired device and unit.
5. Press E to begin printing the error logs.

Clearing Logs

The **Q** option immediately clears the following logs on a CS/80 device:

- Fault Log
- Run Log
- ERT Log
- All Error Summaries (disc units only)

This operation is normally performed after the drive has been serviced and existing diagnostic records have no further value.

To clear the internal error logs of a CS/80 device:

1. Press C to activate Service Engineer Mode.
2. Type the correct password, then press RETURN.
3. Select the needed parameters that specify the desired device and unit.
4. Press Q to enable log-clearing option.
5. Read the warning on the screen. If you decide to go ahead with the log-clearing operation, press $ to begin. To cancel the test, press any other key.

Performing Read/Write Error Rate Tests

If the **W** option is set to `Yes`, press E to perform a write-then-read error-rate test instead of a read-only error-rate test.

takes about 10 mins on 7914

IMPORTANT

All information stored on the selected mass storage unit will be lost. Therefore, a complete and verified disc backup should be performed BEFORE this test is run.

When you select this mode, a warning message is displayed asking if you understand the impact of what you're about to do. Although setting the mode does not begin execution of the test, it does move you one step closer to destroying the contents of the disc. Every attempt has been made to prevent you from entering this mode accidentally. This is a test of last resort.

If a Read/Write ERT is necessary, follow this procedure:

1. **Perform a verified backup of the disc to be tested.**
2. Press C to enable Service Engineer Mode.
3. Type the correct password, then press RETURN.
4. Use the correct parameters to select the desired mass storage device and unit number.
5. Press W to allow writing on disc.
6. Read the warning on the screen. To proceed with the Read/Write ERT, press $. To cancel the request, press any other key.
7. Press E to begin the test.

NOTE

The **W** option has no effect on tape units. All tape units automatically use a write-then-read error rate test.

CS/80 Disc Logs and Tables

The CS/80 Exerciser can access the following types of information from the disc drive error logs for troubleshooting and analysis purposes:

- Describe Information
- Fault Log
- Run Log
- ERT Log
- ROM Revision Numbers
- Recent Error Summary (not on HP 7933/7935)
- Previous Error Summaries (not on HP 7933/7935)
- Disc Spare Track Table
- Head Alignment Offset Table (HP 7933/7935 only)
- Circumferential Skew Table (HP 7933/7935 only)
- Current Cylinder Offset Table (HP 7933/7935 only)
- Pressure and Temperature Information (HP 7933/7935 only)
- Hardware, Read/Write Fault Registers (HP 7933/7935 only)

Each of these data reports is described in the following sections.

Describe Information

The Describe Information table identifies the drive model and configuration characteristics. This information is read from the disc, rather than measured. To correctly interpret most of the entries, a good understanding of disc organization is required.

Here is the Describe Information table for a typical HP 7935 Disc drive:

```
              Logs, Tables, and Status - Unit:  0

                  Describe Information

  Installed Unit   Max instantaneous   Controller
       Bytes          Xfer Rate          Type
1000000000000001         1250              0

Device   Device   Bytes per   Blocks which can
 Type    Number     Block        be buffered
   1     079350       256            16

Recomded Burst   Block    Cont Avg    Optimal
     Size        Time     Xfr Rate   Retry Time
       0          240        930        80

Access Time   Max Inter-   ----Volume Bytes------
 Parameter    leave Fct.     Fixed      Removable
      84          31       00000000     00000001

----------Maximum Addresses---------    Current
Cylinder  Head  Sector  Single-Vector   Interleave
   1320   12      91        1579915          1
```

Installed Unit Byte is a bit map showing which units are installed, the least significant bit representing unit 0. A 1 bit indicates the unit represented by that position is installed. In the sample table shown, units 0 and 15 are installed.

Max instantaneous Xfer Rate is the maximum rate at which data can be transferred across the bus, measured in units of 1024 bytes per second.

Controller Type indicates the type of controller installed in the device. Possible values include:
- 0 – Integrated single-unit controller
- 1 – Integrated multi-unit controller
- 2 – Integrated multi-port controller

Device Type tells what type of device is being described. Possible values include:
- 0 – disc unit
- 1 – removable disc or combination
- 2 – tape unit.

Device Number gives the model number of the CS/80 device being described.

Bytes per Block gives the number of bytes in each block on the disc or tape.

Blocks which can be buffered gives the amount of RAM space (measured in blocks) that resides in the drive controller for use as read/write buffers. For optimum performance, data transfers exceeding this capacity should not be requested.

Recomded Burst Size is based on the amount of available buffer RAM in the controller, and is the recommended number of 256-byte segments in each bnrst. A zero here indicates bursting is not recommended.

Block Time is the time required for the mass-storage read/write head to travel from the beginning of one block to the beginning of the next block, measured in microseconds.

Cont Avg Xfr Rate is the number of bytes in a full disc or tape volume divided by the time required to transfer the volume over HP-IB in a single, continuous transfer. The value given, when multiplied by 1024, produces the correct transfer rate in bytes per second.

Optimal Retry Time is the maximum time required to perform read retries for optimum recovery from a read/write error, measured in tens of milliseconds.

Access Time Parameter is the maximum time delay from the end of a command message to the assertion of parallel poll, measured in tens of milliseconds.

Maximum Interleave Factor specifies the maximum number of physical blocks allowed from the beginning of one logical block to the beginning of the next logical block.

Volume Bytes shows two bit maps: one that tells which of the eight possible fixed volumes are present; a second that tells which of the 8 possible removable volumes are present. The least significant bit represents volume 0. A "1" bit indicates the volume represented by that position is present. In the sample table shown, no fixed volumes are present, and removable volume 0 is present.

Maximum Addresses specifies the maximum legal address on the disc. The maximum address is expressed in two ways: one refers to the cylinder, head, and sector address; the other is the single-vector address. (The single-vector address is a sequential, linear expression of disc address space, beginning at address 0.)

Current Interleave lists the current spacing, in physical sectors, from the beginning of one logical disc sector to the next.

Fault Log

The Fault log contains disc system faults. For example, any head movement problems occurring during a seek operation would be recorded in the Fault Log. If no fault log entries have been recorded on the disc, the message:

```
No Fault Log Entries
```

is displayed.

Here is a typical HP 7912 Disc Drive fault log:

Logical Addresses						UProc	Derror/	
-- Current --			-- Target --			Fault	Terror	
Clndr	Hd	Sctr	Clndr	Hd	Sctr	Register	Type	Num
32768	1	27	32768	1	27	NA	TERR	33
32768	1	27	32768	1	27	NA	TERR	33
395	1	23	395	1	20	NA	DERR	229
395	1	23	395	1	20	NA	DERR	229
395	1	7	395	1	7	NA	DERR	229
395	1	7	395	1	7	NA	DERR	229
108	6	7	108	6	7	NA	DERR	229
395	1	7	395	1	7	NA	DERR	229
395	1	7	395	1	7	NA	DERR	229
395	1	7	395	1	4	NA	DERR	229
395	1	7	395	1	7	NA	DERR	229
395	1	7	395	1	7	NA	DERR	229
32768	1	27	32768	1	27	NA	TERR	32
395	1	7	395	1	7	NA	DERR	229
395	1	7	395	1	7	NA	DERR	229
395	1	7	395	1	7	NA	DERR	229
395	1	7	395	1	7	NA	DERR	229
395	1	7	395	1	7	NA	DERR	229
33079	2	62	33079	2	61	NA	DERR	114
33079	2	62	33079	2	61	NA	DERR	114

Logical Addresses identifies the locations in the disc address space that were associated with an access error. "Current" refers to the last cylinder, head, and sector accessed prior to the "Target" cylinder, head, and sector access attempt that produced the error.

UProc Fault Register displays the contents of the microprocessor fault register. Only certain types of errors record information in the microprocessor fault register. If the register contains error information, each bit of the register will be displayed. See the disc drive service manual to determine its meaning. If the register contains no error information, "NA" is placed in this column.

Derror/Terror identifies the type of error that occurred. Drive errors (Derrors) are run-time errors; Test errors (Terrors) are errors that were reported during an error rate test. See the service manual of the device under test for an explanation of the Derror/Terror numbers.

Some types of errors show a cylinder address that falls outside the drive's address range (32768 and 33079 in the HP 7912 log shown). Such cylinder addresses indicate the error is not associated with a specific disc address. For instance, the first error in this fault log (TERR 33) is a tape error, so a disc address does not apply.

Run Log

The Run log stores all data errors occurring during normal disc operation (that is, errors occuring when a test, diagnostic, or utility was **not** being run). Run Log entries pertain to reading and writing data, whereas the Fault Log records disc drive-system failures.

Here is a typical HP/tn7912 Disc Drive run log:

```
Head:   0
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
3.037E+005        6              0

Head:   1
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
2.608E+005        6              0

Head:   2
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
2.626E+005        6              0

Head:   3
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
2.606E+005        6              0

Head:   4
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
2.585E+005        6              0

Head:   5
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
2.573E+005        6              0

Head:   6
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
2.584E+005        8              0
```

The Run log is divided into several sections, one for each disc head.

Sectors Read gives the cumulative total of all sectors read by the specified head since the logs were last cleared.

Correctable Errors are errors which the error correction circuitry was able to correct.

Uncorrectable Errors are errors which the error correction circuitry could not correct.

ERT Log

The ERT log is identical to the Run log, except that all ERT log entries are recorded during an error-rate test – **not** during normal operation. Here is an example of a typical ERT log produced during an HP 7912 error-rate test. Note that no errors were encountered during the test, except on head #6.

```
Head:   0
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
1.098E+005       0              0

Head:   1
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
1.098E+005       0              0

Head:   2
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
1.098E+005       0              0

Head:   3
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
1.098E+005       0              0

Head:   4
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
1.098E+005       0              0

Head:   5
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
1.098E+005       0              0

Head:   6
  Sectors    Correctable    Uncorrectable
   Read        Errors          Errors
1.099E+005       3              0

Logical    Logical   Logical   Occurrence   Error
Cylinder    Head     Sector     Count       Byte

   314        6        28           1     00000000
```

Sectors Read gives the cumulative total of all sectors read by that head since the logs were last cleared.

Correctable Errors are errors which the error correction circuitry was able to correct.

Uncorrectable Errors are errors which the error correction circuitry could not correct.

As indicated in the example test-results output, each head on the specified drive is tested individually (not all drives have multiple heads). At the end of the test on a given head, the test log is displayed. If any errors are encountered, error description information is also included as in the example for head #6. Error correction circuitry is disabled during the test to ensure that errors are properly detected and logged for output. To interpret the error byte, see "Decoding the Error Byte" at the end of this chapter.

ROM Revision Numbers

The ROM Revision Numbers display shows the revision numbers for the control ROMs currently installed in the controller. Here is a typical example for an HP 7908 disc drive:

```
ROM Revision Numbers:
1- 4   1-10   1-10   1- 8   1- 7   1- 4
```

Recent Error Summary (Not on HP 7933/7935)

The Recent Error Summary gives the results from the most recent self-test performed. All TERROR numbers that occurred during the test are listed. If no TERRORs were reported in the last ERT test, "None" is displayed. For an explanation of any TERRORs reported, see the appropriate device service manual.

Here is an example Recent Error Summary from an HP 7908 disc drive:

```
TERRORs listed in recent error summary
 33
```

Previous Error Summaries (Not on HP 7933/7935)

The Previous Error Summaries list the results from the last four self-tests preceding the most recent one. A typical HP 7908 Disc drive Recent Error Summary is shown below. For an explanation of any TERRORs reported, see the appropriate device service manual.

```
TERRORs listed in previous error summary #1
 33
TERRORs listed in previous error summary #2
 34
TERRORs listed in previous error summary #3
 34
TERRORs listed in previous error summary #4
 None
```

Disc Spare Track Table

The Disc Spare Track Table provides a record of all sparing operations, listed in sequence according to head number. The number of sparing operations, the number of spare tracks used, and the number of spared logical tracks are given for each head.

Here is an example Spare Track Table for an HP 7908 disc drive:

```
                Disc Spare Track Table

Head     Spare        Spare          Logical
 No    Operations   Tracks Used   Spared Tracks
  0          0            0             0

Head     Spare        Spare          Logical
 No    Operations   Tracks Used   Spared Tracks
  1          0            0             0

Head     Spare        Spare          Logical
 No    Operations   Tracks Used   Spared Tracks
  2          0            0             0

Head     Spare        Spare          Logical
 No    Operations   Tracks Used   Spared Tracks
  3          0            0             0

Head     Spare        Spare          Logical
 No    Operations   Tracks Used   Spared Tracks
  4         10            4             2
```

Whenever a bad sector is detected on a track, a sparing operation is performed. All CS/80 discs have one spare sector per track, so the sparing operation first attempts to logically replace the bad sector with this spare sector. If the spare sector has been used in a previous sparing operation, the entire track must be replaced with one of the spare tracks provided on the disc surface.

Spare Operations shows how many sparing operations have been performed on the head's disc surface. This is a direct indication of the number of bad sectors sparing operations have been performed on head 4.

Spare Tracks Used lists the number of spare tracks required by these sparing operations. Remember, a spare track is required only when no spare sector is available on the track where the bad sector was found. In the sample table, four out of the ten sparing operations on head 4 required spare tracks to fix the problem.

Logical Spared Tracks tells you the number of *logical* tracks that have undergone sparing operations. Note that a single logical track can be spared more than once. In the sample table, only two logical tracks on head 4 have been replaced by physical spare tracks. Since four physical spare tracks have been used, you can assume that at least one of the logical spared tracks on head 4 has been replaced more than once.

Head Alignment Offset Table (HP 7933/7935 only)

The Head Alignment Offset Table shows the relationship between the servo code and the head alignment bands. It is used to determine how precisely each head is aligned with respect to the tracks recorded on the associated disc platter.

Here is an example Head Alignment Table for an HP 7935 disc drive:

Head Alignment Offset Table:

Head No	Band 0	Delta 0-1	Band 1	Delta 1-2	Band 2
0	-5	-8	-13	5	-8
1	-11	-1	-12	14	2
2	0	-6	-6	7	1
3	-2	-5	-7	4	-3
4	1	-7	-6	3	-3
5	4	-8	-4	0	-4
6	-2	-4	-6	6	0
7	2	-6	-4	-5	-9
8	-1	-7	-8	-1	-9
9	3	-12	-9	-2	-11
10	-4	-8	-12	-2	-14
11	0	-11	-11	-3	-14
12	-8	-7	-15	3	-12

Each count in the table represents 6.25 microinches. The maximum allowable head offset is +/- 60 counts. The delta values represent the difference between band offsets. Heads with offsets greater than 40 should be aligned. Deltas exceeding 15 counts may contribute to an error rate problem. In this sample table, head 1 has a defective alignment band on the media surface, and head 2 needs alignment. Head 2 would cause the drive to fail with DERR 61.

Circumferential Skew Table (HP 7933/7935 only)

The Circumferential Skew Table indicates how well the sectors in a cylinder are aligned (vertical alignment).

Here is an example Circumferential Skew Table for an HP 7935 disc drive:

```
Circumferential Skew Table:
Head    Band    Delta    Band    Delta    Band
 No       0      0-1       1      1-2       2
----    ----    -----    ----    -----    ----
  0      -3        0      -3        1      -2
  1       5        0       5        1       6
  2      -4        0      -4        0      -4
  3      -2        0      -2        0      -2
  4       0        0       0        1       1
  5       3        0       3        1       4
  6       5        0       5        0       5
  7      -1       -1      -2       -2      -4
  8       1        0       1        0       1
  9      -1       -2      -3       -2      -5
 10      -3       -2      -5       -2      -7
 11      -3       -2      -5       -2      -7
 12      -5       -2      -7       -4     -11
```

The Circumferential Skew Table is listed in the same format as the Head Alignment Offset Table. Circumferential skew represents the position of the sector circumferentially on the track. The HP 7933/7935 has a very wide range of electronic compensation for circumferential skew, so this table is not used extensively.

A potential problem should be suspected if the values in this table exceed 25 counts, though 25 is not an absolute specification. If the difference between the skew values on head 0 band 0, and head 0 band 2 is greater than 25 counts, and the number of data errors is unusual, suspect a rail alignment problem. If data errors are not a problem, rail alignment is probably unnecessary.

Current Cylinder Offset Table (HP 7933/7935 only)

The Current Cylinder Offset Table extrapolates or interpolates from the Head Alignment Offset Table to determine how well the heads are aligned in their current positions.

An example Current Cylinder Offset Table for an HP 7935 disc drive is shown below.

```
Current Cylinder Offset Table:

Head    Offset
  0       -5
  1      -11
  2        0
  3       -2
  4        1
  5        4
  6       -2
  7        2
  8       -1
  9        3
 10       -4
 11        0
 12       -8
```

This table is rarely used in a typical operating system environment. The current cylinder position usually changes significantly by the time the computer can access the information originally placed in the internal table by the drive controller, thus rendering it useless in most situations.

Pressure and Temperature Information (HP 7933/7935 only)

The HP 7933 and HP 7935 contain internal temperature and pressure sensors for monitoring the drive's operational state. Readings from these sensors are displayed in the following table.

Here is an example of typical pressure and temperature information for an HP 7935 disc drive:

```
---Pressures----      --------Temperatures-------
Blower    Filter     Exhaust Air   Actuator Coil
OK        OK            24             35
```

If there is a problem with blower or filter pressure, `BAD` appears in the table instead of `OK`. Temperatures predict disc performance because hotter temperatures degrade disc access time. The drive controller monitors these temperatures, and shuts down the drive if they become too high.

Fault Registers

The HP 7933 and HP 7935 logs also contain the values of the hardware and read/write fault registers at the time the Exerciser was run. A value of zero in these registers indicate no faults. Other possible values are decoded in the following tables.

Hardware Fault Register Value	Error Condition
00000001	Spindle speed down
00000010	Heads off track
00001000	Track follower PLL error
00010000	Top door is open
00100000	Emergency retract is set
01000000	Power Failure
10000000	Read/Write fault

Read/Write Fault Register Values	Error Condition
00000001	Write without AC write current
00000010	DC write current without write
00000100	Write without DC write current
00001000	Multiple heads are selected

Fault registers for an HP 7935 disc drive are listed as follows:

```
Hardware fault register: 00000000
Read/Write fault register: 00000000
```

CS/80 Tape Logs and Tables

Tape error logs provide the following history and reference information:

- Describe Information
- Manufacturer's Block
- Disc Starting Block Address (HP 7914 only)
- Tape Use Log
- Tape Spare Table
- Tape Run-time Log
- Tape ERT Log
- Flag Plot

Describe Information

Tape drive Describe Information has the same format as for disc drives, although some column headings do not apply. For those cases, 0 is entered (such as for the Cylinder, Head, and Sector columns, for example). Here is a typical Describe Information example:

```
              Logs, Tables, and Status - Unit:  1

                  Describe Information

 Installed Unit   Max instantaneous   Controller
      Bytes          Xfer Rate           Type
1000000000000011         1250              1

Device   Device   Bytes per   Blocks which can
 Type    Number     Block        be buffered
   2    079080      1024             4

Recomded Burst   Block    Cont Avg    Optimal
     Size        Time     Xfr Rate   Retry Time
       0         30000        35         10

Access Time   Max Inter-   ----Volume Bytes------
 Parameter    leave Fct.     Fixed      Removable
   24000           0       00000000     00000001

----------Maximum Addresses---------    Current
Cylinder  Head  Sector  Single-Vector   Interleave
       0    0       0          16531           0
```

Installed Unit Byte is a bit map showing which units are installed, the least significant bit representing unit 0. A 1 bit indicates the unit represented by that position is installed. In the sample table shown, units 0, 1, and 15 are installed.

Max instantaneous Xfer Rate is the maximum rate at which data can be transferred across the bus, measured in units of 1024 bytes per second.

Controller Type indicates the type of controller installed in the device. Possible values include:
0 – Integrated single-unit controller
1 – Integrated multi-unit controller
2 – Integrated multi-port controller

Device Type tells what type of device is being described. Possible values include:
0 – disc unit
1 – removable disc or combination
2 – tape unit.

Device Number gives the model number of the CS/80 device being described.

Bytes per Block gives the number of bytes in each block on the disc or tape.

Blocks which can be buffered gives the amount of RAM space (measured in blocks) that resides in the drive controller for use as read/write buffers. For optimum performance, data transfers exceeding this capacity should not be requested.

Recomded Burst Size is based on the amount of available buffer RAM in the controller, and is the recommended number of 256-byte segments in each burst. A zero here indicates bursting is not recommended.

Block Time is the time required for the mass-storage read/write head to travel from the beginning of one block to the beginning of the next block, measured in microseconds.

Cont Avg Xfr Rate is the number of bytes in a full disc or tape volume divided by the time required to transfer the volume over HP-IB in a single, continuous transfer. The value given, when multiplied by 1024, produces the correct transfer rate in bytes per second.

Optimal Retry Time is the maximum time required to perform read retries for optimum recovery from a read/write error, measured in tens of milliseconds.

Access Time Parameter is the maximum time delay from the end of a command message to the assertion of parallel poll, measured in tens of milliseconds.

Maximum Interleave Factor specifies the maximum number of physical blocks allowed from the beginning of one logical block to the beginning of the next logical block. For tape drives, blocks cannot be interleaved, so this value is always zero.

Volume Bytes gives two bit maps, one that tells which of the eight possible fixed volumes are present, and another that tells which of the 8 possible removable volumes are present. The least significant bit represents volume 0. A "1" bit indicates the volume represented by that position is present. In the sample table shown, no fixed volumes are present, and removable volume 0 is present.

Maximum Addresses: Cylinder, Head, and Sector do not apply to tapes. The single-vector value specifies the highest available tape address.

Current Interleave does not apply to a tape unit and is, therefore, always 0.

Manufacturer's Block

The Manufacturer's Block contains information about the tape presently in the drive. Decode the block as follows:

First Line: gives the length of the tape:
`DC600HC` indicates a long tape
`DC615HC` indicates a short tape

Second Line: gives the number of blocks per track.
`1024` for a short tape
`4096` for a long tape

Third Line: gives the tape format copyright notice.

Fourth Line: gives the manufacturer's control code and date code for the tape cartridge.

A Manufacturer's block for a tape drive is given below:

```
Manufacturer's Block:

DC615HC
1024
FORMAT (C) 1980, MINN. MINING & MFG. CO.
02005J8205260831
```

Disc Starting Block Address (HP 7914 only)

The HP 7914 tape log also contains the disc starting block address. Because the capacity of an HP 7914 disc exeeds that of a single tape cartridge, more than one tape is required to back up the disc. Thus, each tape records the starting location on the disc from which the back-up data on the tape was taken. When the back-up data is restored from tape to disc, the disc controller can read the disc starting block address from the tape cartridge and determine where to record the information on the disc.

Here is a sample Disc Starting Block Address for an HP 7914:

```
Disc starting block address:  0
```

Tape Use Log

The Tape Use Log lists the number of blocks that have been accessed during the life of the tape, and the number of autoloads (number of times the tape has been loaded) that have been performed.

Here is a typical Tape Use Log for a CS/80 tape drive:

```
Tape Use Log:
Number of autoloads:    37
Number of blocks accessed: 6.526e+004
```

Tape Spare Table

The Tape Spare Table provides the physical addresses of all blocks that have been spared on the tape. If no blocks have been spared, the message:

```
No Tape Spare Table Entries
```

is displayed. If one or more blocks are spared, an output similar to the following is displayed:

```
                    Tape Spare Table
Block Number    Track Number
501               5
```

This sample table shows that block 501 on track 5 of this tape was defective, and was replaced by a spare block.

Tape Run-time Log

The Run-time log contains only run-time errors. Here is an example tape unit run-time log for a given tape cartridge:

```
                        Tape runtime log

   Uncorrectable     Unlocatable    Certification
     Errors            Errors          Type
         1                 1          On-line


   Logical Block      Error          Other
      Address          Byte        Information

        2611         10000000    Unlocatable
         607         01101000    Uncorrectable
```

The first table in the log summarizes the number of uncorrectable and unlocatable errors that have occurred, and gives the certification type of the tape.

Uncorrectable Errors are those which could not be corrected by error correction circuitry.

Unlocatable Errors result when a block of data cannot be located due to an unreadable key.

Certification Type tells how the tape was certified. Tape certification is similar to disc initialization. "On-line" indicates the tape was certified in the CS/80 tape unit after it was received from the factory. `3M cert`, "Not cert", or some other similar message may appear if the tape is factory-certified, not certified, or subjected to use or processing in some other, possibly unknown, operating environment.

Next, a detailed listing of each error is printed.

Logical Block Address is simply the address of the logical block where the error was detected.

Error Byte is a bit map giving specific information about the nature of the error. See the "Decoding the Error Byte" section at the end of this chapter.

Other Information tells what type of error was found, and whether it was correctable or uncorrectable.

Tape ERT Log

The ERT log contains only errors that occurred during an error-rate test. Here is an example tape unit ERT log:

Blocks Accessed	Errors: Permanent	Errors: Transient	Errors: Uncorrectable	Errors: Unlocatable
3.3E+04	36	626	1	0

Logical Block Address	Error Byte	Other Information
203	00000100	
667	00000001	
703	00100000	
750	00000001	
824	00000001	
926	00000011	
2118	00001000	
3605	00001000	
3795	00000010	
3861	00000100	
4043	00000100	
4101	00001000	
4110	00100000	
4226	00001000	
4253	00100000	
4286	00000010	
4297	00001000	
4408	00000100	
4787	00000001	
4841	00000100	
5055	00000001	Uncorrectable
5111	00010000	
5313	00000100	
7172	00011000	
7173	00000100	
7426	00000100	
8419	00000001	
8910	00000010	
9204	00000010	
10627	00000100	
14297	00000010	
14823	00010000	
etc.		

The first table of the log summarizes the number of blocks accessed, the number of permanent errors found, the number of uncorrectable errors fouud, and the number of unlocatable errors found.

Permanent Errors are blocks that have one or more frame errors after three retries and are usually caused by a defect in the tape.

Uncorrectable Errors are blocks which cannot be corrected by the tape drive's error correction circuitry.

Unlocatable Errors are blocks that cannot be found due to an uureadable key.

Transient Errors are blocks that have a frame error that disappears on retries.

The final table of the log provides a detailed map of all permanent errors found.

Logical Block Address is simply the address of the logical block where the error was detected.

Error Byte is a bit map giving specific information about the nature of the error. See the "Decoding the Error Byte" section at the end of this chapter.

Other Information tells what type of error was found, whether it was correctable or uncorrectable.

Flag Plot

The ERT flag plot creates a visual map showing the types and locations of tape errors. The track number runs along the vertical axis (0 thru 15), and the number of blocks runs along the horizontal axis. The track and block where each error occurred can then be estimated by using the relative position of the corresponding flag in the output plot.

Three types of errors are indicated:

- `+` – marks the position of a permanent error
- `U` – marks the position of an uncorrectable error
- `K` – marks the position of an unlocatable key.

Here is an example flag plot of an extremely distressed tape:

```
   ______________________________________________________________________
15 ______________________________________________________________________
14 ______________________________________________________________________
13 ______________________________________________________________________
12 ______________________________________________________________________
11 ______________________________________________________________________
10 ______________________________________________________________________
9  ______________________________________________________________________
8  ____________________+_________________________________________________
7  _+____________________+___________+___________________________________
6  +__++______________+_+_______________+___________+____________________
5  +U++++_______________++_______________________________________________
4  +++K_+___+__________________________________+__________+______________
3  ++_++________________+________________________________________________
2  _+_+++___+__________++______________________________+_________________
1  +_++++______________++___________________________+____________________
0  _____+_________________________________+______________________________
   0                                                                 1023
```

Decoding the Error Byte

Here is how to decode the error byte found in the ERT and run logs:

Tape Logs Error Byte[1]

Bit 0 = 0 frame 1 NO CRC error (least significant bit)
= 1 frame 1 CRC error

Bit 1 = 0 frame 2 NO CRC error
= 1 frame 2 CRC error

Bit 2 = 0 frame 3 NO CRC error
= 1 frame 3 CRC error

Bit 3 = 1 frame 4 CRC error
= 1 frame 4 CRC error

Bit 4 = 0 ECC 5 - NO CRC error
= 1 ECC 5 - CRC error

Bit 5 = 0 ECC 6 - NO CRC error
= 1 ECC 6 - CRC error

Bit 6 = 0 correctable error
= 1 uncorrectable error

Bit 7 = 0 Frame error (most significant bit)
= 1 Key error

Disc Logs Error Byte[1]

The following error bit definitions are for HP 7908, 7911, 7912, 7914, 7933, and 7935. HP 794x decoding is explained in the next topic.

Bits 1,0 = 00 ECC detected a correctable error (ERT only) (least significant bit)
= 01 ECC detected an uncorrectable error
= 10 ECC did not detect an error

Bit 2 = 0 error is in sector body
= 1 error is in sector header

Bit 3 = 0 CRC indicated error
= 1 CRC did not indicate error

Bit 4 = 0 data recovered on first retry
= 1 data not recovered on first retry or retries not allowed

Bit 5 = 0 no extra offset used
= 1 extra offset used (ERT only)

Bit 6 = 0 no Formatter/Separator error
= 1 Formatter/Separator error occurred

Bit 7 = 0 recovered with read retries (most significant bit)
= 1 unrecoverable (run-time only)

[1] Abbreviations used: CRC = Cyclic Reduudancy Check, ECC = Error Correction Code, ERT = Error Rate Test.

HP 794x Disc Log Error Byte[1]

xxxxxx10 = Type REC: recoverable data error
xxxxx1x0 = Type M-RE: marginal data, corrected by retries
xxxx1xx0 = Type M-EC: marginal data, corrected by ECC
xxx1xxx0 = Type UNC: uncorrectable error

Additional Information

Additional details related to interpreting CS/80 internal error logs can be found in the *CE Handbook* section and service manual for the drive in question.

[1] Abbreviations used: CRC = Cyclic Redundancy Check, ECC = Error Correction Code, ERT = Error Rate Test.

Operation from an HP-UX System

A

Software Environment

The CS/80 Exerciser program can be copied from the supplied software tape or disc and installed as part of an existing HP-UX system. In such a case, the exerciser program (without its kernel) is copied to the HP-UX system where it can be run by any super user at any time, given the appropriate circumstances. The exerciser program requires an HP-UX system that does not precede the HP-UX Revision 4.0 release.

Once the program is installed in the HP-UX file system, it can be executed at any time, provided the proper precautions have been taken with regard to system operating status prior to running the program. These precautions are explained in Chapter 1.

Program Copy Procedure

To copy the exerciser program from either cartridge tape version to a corresponding Series 500 HP-UX system:

1. Log on as Super-user, insert the exerciser cartridge tape into an available tape drive, then execute the tape mount command:

   `mount` <source drive special file> <temporary directory name>

   where <source drive special file> is the directory path name of the block special (device) file assigned to the cartridge tape or disc drive containing the exerciser program tape cartridge or disc (such as */dev/ct7914*). <temporary directory name> is any existing HP-UX system directory (other than any directory in the destination directory path where the program is to be copied) that temporarily represents the root directory in the Exerciser tape cartridge or disc file system while the program is being copied to the system disc (such as */mt*). The original directory cannot be accessed now until the source device using the temporary name is unmounted.

2. Copy the exerciser program onto the HP-UX disc:

   ```
   mkdir /usr/CE.utilities/CS80
   cp /<temporary directory name>/exerciser /usr/CE.utilities/CS80
   ```

   where <temporary directory name> is the same as the name used in Step **1**. Directory *CS80* may already exist. In that case, a new directory will not be created, and the original directory will be used instead. When the copy operation is complete, the super-user prompt reappears on the console or terminal screen, and the exerciser now resides in file */usr/CE.utilities/CS80/exerciser.*.

3. When the copy operation is complete and the super-user prompt is again displayed, unmount the source drive:

   `umount` <source drive special file>

   This command cleans up the previous mount command, and restores the temporary directory to its original interpretation.

4. Remove the disc or tape and store it in its protective container in a safe place for future use. To remove a CS/80 tape cartridge, press the UNLOAD button, wait about two minutes for the drive to manipulate the tape, then slide the eject lever to the right to eject the tape.

NOTE

If the tape drive is connected to a shared controller that is also connected to a currently mounted (or root) disc drive, the UNLOAD button is ignored by the controller. To unload the tape, execute the following command:

```
tcio -uVr <source drive special file>
```

where <source drive special file is the **character** special file (such as /dev/rct7914) associated with the cartridge tape drive. This performs the same function as the UNLOAD button on the drive. After the drive finishes manipulating the tape, the cartridge can be removed.

Note that while the Exerciser program is identical for all Series 500 computers, the two kernels are distinctly dissimilar. One is compatible with the Model 520 **only**, while the other kernel can be used with all other supported Series 500 computers.

Invoking the Exerciser Program

To invoke the exerciser from HP-UX, follow the procedure at the end of Chapter 1.