

Test Tools Manual

HP 9000 Series 200/300 Computers

HP Part Number 09800-90001



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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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Table of Contents

Chapter 1: Introduction and Built-in Tests

Overview	I-1
Package Contents	I-3
Manual Structure	I-4
Software History	I-4
Series 200 Computer Tests	I-5
Series 300 Computer Tests	I-6
Boot ROM Self-Tests	I-6
Running Self-Tests	I-6
Self-Test Overview	I-7

Introduction and Built-in Tests **1**

Overview

Series 200/300 Test Tools is a software package for verifying the integrity of Series 200 and 300 computer system installations. While the tests do not provide totally comprehensive system diagnostics, they are a valuable tool for trained, HP-qualified service personnel when installing, servicing, and troubleshooting Series 200 and 300 computer workstations. The tests can also be used by less-experienced users and operators for determining whether or not professional assistance is needed to identify and fix a system malfunction.

The tests described in this manual are mainly for testing and troubleshooting Series 200 and 300 systems that do not require formal verification of operation before use. Series 200 and 300 HP-UX systems have a more critical need for system verification tests, so those tests are included as part of the standard HP-UX operating system (HP-UX System Functional Tests and CS/80 Exerciser programs are very similar to the equivalent tests described in this manual). The Series 200/300 Computer Tests described in Part II of this manual can be used for troubleshooting beyond the testing level provided by HP-UX test programs, provided the system being tested has an internal or external flexible disc drive for loading and running the test software.

Series 200/300 Test Tools, when combined with the computer's Boot ROM self-test program, provide the following test capabilities:

- **Boot ROM Self-test** (explained in Part I of this manual) tests the computer (processor and memory) with about 90%¹ confidence that if a hardware defect exists, it will be found by the tests. I/O cards and most other accessories that plug into the computer accessory slots are tested to about 50%¹ confidence. These tests are permanently stored in the computer's Boot ROM, and are executed automatically each time power is applied to the computer. Boot ROM 4.0 and earlier versions do not recognize or test the HP 98635 Floating-point Math card (floating-point card tests are included in System Functional Tests).

- **Series 200/300 Computer Tests** (explained in Part II of this manual) are supplied on two discs, one for Series 200 and one for Series 300.
- **Series 200/300 System Functional Tests** (explained in Part III of this manual) are supplied on five discs. The first disc contains the Pascal-based operating system environment and the main menu; the other discs contain the test programs. These tests are used to verify communication between the computer and supported peripherals. They do not add significantly to the confidence levels achieved by the Boot ROM self-test program, though they expand confidence in overall system integrity by providing visible proof that communication with selected peripherals is correct and that interfacing is connected and set up correctly. The tests do not provide any worst-case tests at maximum speed or similar margin-of-safety tests.
- **CS/80 Exerciser Program** (explained in Part IV of this manual) is supplied on a single disc and is used to verify that CS/80 disc drives are correctly connected to the computer, and that the computer can successfully write and retrieve data to and from the disc or tape. The Pascal-based program also provides access to CS/80 disc and tape error logs for analyzing drive and media performance. This information is useful for troubleshooting, and for planning preventive maintenance programs.

¹ The figures shown are approximate, and may vary from test to test. The scope of each test is described in greater detail elsewhere in this manual. Note: If the probability (confidence) of detecting an existing error is 90%, there is a corresponding probability of 10% or less that the error will not be found. **This does NOT mean** that if no error is detected, there is a 10% probability that an undetected error exists. The probability that an undetected error exists is much lower (in fact, insignificant in most cases).

Package Contents

The combined Test Tools software package is provided on both 3.5 inch and 5.25 inch discs as follows:

Product Description and Part Number

Series 200/300 Test Tools, 3.5-inc disc	09800-10334
Series 200/300 Test Tools, 5.25-inch disc	09800-10534

Content of each package is listed below.

Software and Manual Contents

“X” in disc part number: 3 indicates 3.5 inch, 5 indicates 5.25 inch.

Description	Part Number
Series 200/300 Test Tools Manual	09800-90001
Series 200 Computer Tests Disc Rev. 1.2	09800-10X36
Series 300 Computer Tests Disc Rev. 3.0	98561-11X34
Series 200/300 System Functional Tests	
SFT0 Disc Rev. 1.2	09800-11X34
SFT1 Disc Rev. 1.2	09800-11X35
SFT2 Disc Rev. 1.2	09800-11X36
SFT3 Disc Rev. 1.2	09800-11X37
SFT4 Disc Rev. 1.2	09800-11X38
CS/80 Exerciser Disc Rev. 1.2	09800-11304 (3.5 inch) 09800-11604 (5.25 inch)

Manual Structure

This manual is divided into four parts:

- Part I (this part) provides an overview of the test software and describes the Boot ROM tests in the Boot ROM shipped as part of every Series 200 and 300 computer.
- Part II tells about Computer Tests operation.
- Part III describes System Functional Tests operation.
- Part IV covers CS/80 Exerciser operation.

Software History

Series 200/300 Test Tools is a merging of several independent test software packages into a single entity for accessibility and ease of use. Each program has existed for a different length of time and has been subjected to varying numbers of revisions. This section provides a brief summary of software changes in the Computer Tests program which has been revised several times to accommodate additions to the Series 200/300 computers. Other tests have not changed significantly. Minor changes were made in some cases to accommodate new products.

Series 200 Computer Tests

Here's a list of the current and previous versions of the Series 200 Computer Tests program:

Revision Major Changes Incorporated

- A Model 226 (HP 9826A) tests
- B Added Model 236 (HP 9836A) tests
- C Added Model 216 (HP 9816A), Model 220 (HP 9920A/S), and Model 236C (HP 9836C) tests
- D Added tests for Series 200 computers equipped with memory management hardware for use in HP-UX systems
- E Added Model 217 (HP 9817A) tests
- F Added Model 237 (HP 9837H) tests
- 1.0 Bug fix for RAM tests to allow testing of 1M-byte RAM card in high-address memory position. Also changed processor identification messages in ROM test status messages.

Series 300 Computer Tests

Here is a list of the current and previous versions of the Series 300 Computer Tests program.

Revision Major Changes Incorporated

- 1.0 Developed for Models 310 and 320. (HP 9856X)
- 1.10 Bug fix for Model 320 CACHE test.
- 2.0 Developed for Models 318, 330 and 350.
- 2.2 Developed for HP 985XX, 98556A Graphics Boards.
- 3.0 Add LAN Toggle.

Boot ROM Self-Tests

Boot ROM Self-Tests tests are automatically executed each time the computer goes through a power-up cycle. The tests are also executed when a Boot ROM exit sequence or command is encountered by any operating system that supports exit-to-boot-ROM capability.

A configuration switch on the processor card can be used to place the test software into a continuous repeated test loop if needed, but this feature **MUST** be disabled during operation of any test software not included in the Boot ROM. For switch settings, refer to the CE Handbook section related to the computer hardware.

Running Self-Tests

The intent behind the Boot ROM self-tests is to verify that the computer is working and able to successfully load and execute programs with the relative level of confidence discussed at the beginning of this chapter. Time and memory constraints make it impractical to test for total confidence in system integrity, and given the proven reliability of these computers, a comprehensive test each time power is applied is generally unnecessary.

Self-Test Overview

Self-tests performed by previous Boot ROM versions are similar in most regards. For this overview, a test failure that is fatal means the computer system cannot function.

CPU Test

CPU and processor card are tested. Any autolocating RAM on card is positioned upon successful test completion. Test failure is fatal.

Monitor and Video Output Tests

Checks video output electronics and display RAM, initializes video electronics and blanks the CRT raster. Test failure is not fatal. Test continues to next stage after a 1-minute delay.

Boot ROM Test

Verifies checksum on Boot ROM and ID PROM if present. If Boot ROM checksum fails, prompt message allows operator to continue at own risk.

Keyboard Electronics Test

Checks electronic interface to keyboard assembly, but does not test keys. This is the least thorough test. Errors are not fatal. If test passes, keyboard input is set up.

I/O Card Test

DMA card is checked, if present. All external select codes are checked for a card ID response. Valid response from the interface indicates the card is at least mostly functional. External HP-IB, Serial I/O, and microprocessor-based ("smart") cards are tested more thoroughly, or have on-card self-test capability where results are returned to the Boot ROM. Test failures on I/O cards are not fatal.

ROM Checksum Test

Verifies checksum on installed ROM-based operating systems. Failures are not fatal, but control cannot be transferred to a system operating from a failed ROM card.

RAM Test

Multiple write-then-read test data patterns are written to previously untested RAM addresses. Any errors encountered are reported to the test LED display and to the system monitor, if present. RAM failures are not fatal, but a system with failed RAM tests should not be used for obvious reasons.

Extended RAM and High-resolution Monitor Tests

A more extensive RAM test is also provided for use where the situation warrants. The test is accessed from “configure mode” which is entered by pressing **CTRL-C** before system loading begins.

When the display indicates that configure mode is active, press **T** to run the extended RAM test sequence. To test high-resolution CRT memory (Model 237 only), press **R** (the R option is displayed only on machines equipped with high-resolution hardware).

Note that the 50/60 Hz CRT options are pertinent only on computers where the vertical scan frequency on the CRT display can be switched to either frequency (Model 236 and HP 98204A/B Video Interface).

Boot ROM Error Messages

Boot ROM error messages are displayed on the default system console, if present, when an error condition is detected. A corresponding error code is displayed on the self-test LEDs in the computer. These LED's are used mainly for test errors in systems that do not have a monitor and keyboard for user interaction.

Most error messages are self-explanatory when they are displayed. A list of LED error codes and Boot ROM error messages are included in other CE Handbook sections Service Manuals, Installation Guides, and some operating manuals for the computer model being tested.

Table of Contents

Chapter 1: Test Start-up

Overview	II-1
Test Capabilities	II-1
Required Hardware	II-2
Running Computer Tests	II-3

Chapter 2: Series 200 Computer Tests

Overview	II-5
Test Initiation	II-6
Using the Test Options Menu	II-7
Selecting Tests	II-8
Starting the Test	II-8
Error and Status Messages	II-9
Error Logging	II-10
Exception Errors	II-10
Test Descriptions and Displayed Messages	II-11
Option 00: Processor Test	II-11
Option 01: ROM Test	II-12
Option 02: RAM Pattern Test	II-13
Option 03: CRT Alpha Test	II-16
Option 04: Keyboard Test	II-16
Option 05: Internal Disc Drive Test	II-16
Option 06: Extended RAM Test	II-19
Option 07: CRT Graphics Test	II-19
Option 08: Extended Graphics Test	II-20
Option 09: Internal Disc Diagnostic	II-21
Option 13: Turn Red LED Off	II-23
Option 14:	II-23
Option 15: HP-IB Log Toggle	II-23
Option 16: Turn-on Mode	II-23
Option 17: Exit to Boot ROM	II-23
Option 18: Execute Once	II-23
Option 19: Loop Forever	II-24
Option 20: Power-fail Test	II-24
Option 21: Extended ROM Test	II-24
Option 22: Special RAM Test	II-24
Option 23: 60 Hz CRT Patterns	II-24

Option 24:	50 Hz CRT Patterns	II-25
Option 25:	MMU and PTM Combination Test	II-25
Option 26:	I/O Test and Configuration Report	II-26
Option 27:	Cache Memory Test	II-26
Option 28:	RS-232C Serial I/O Test	II-27
Option 29:	MMU, Cache Memory, and PTM	II-28
Option 32:	Special RAM Test	II-28
Option 33:	Test Patterns for High-resolution Monitor	II-28
Option 37:	High-resolution Monitor Test	II-29
Option 38:	Extended High-resolution Monitor Test ...	II-29

Chapter 3: Series 300 Computer Tests

Introduction	II-31
Diagnostic Strategy	II-32
Software	II-33
Hardware	II-34
Operation Modes	II-35
Turn-On Mode	II-35
Test Mode	II-38
Error Logging	II-44
Error Reporting, Progress Status and Control	II-45
Display (Monitor)	II-45
Message Logging	II-46
Troubleshooting	II-46
Appendix 1: The Tests	II-48
Test Title and Copyright	II-48
Other Startup Messages	II-49
Test Mode Menu	II-50
Messages	II-51
Exceptions (from any error message logging device) ...	II-53
TDK Descriptions	II-54
Table 2-7. Bit-mapped Video Patterns	II-69

Test Start-up

Overview

Series 200 and 300 Computer Tests report detected hardware failures in Series 200 and 300 computers. Series 200 and 300 Computer Tests do NOT include tests for CS/80 (Command Set 1980) disc and tape drives (such as HP 7908, 7911, 7914, 7933, and others). The CS/80 Exerciser, described in Part IV of this manual, is used for testing CS/80 drives.

Computer Tests programs are provided on separate discs.

Test Capabilities

The following computers can be tested using the Series 200 or 300 Computer Tests.

Computer Tests

Series 200 Models	Series 300 Models ²
216 (HP 9816)	310 (HP 98561A)
226 (HP 9826)	318 (HP 98563A)
236A/C (HP 9836A/C)	320 (HP 98561B)
217 (HP 9817) ¹	330 (HP 98562A)
237 (HP 9837) ¹	350 (HP 98562B)

No provision is made for testing the HP 98259 Bubble Memory card. The HP 98635 Floating-point Math card can be tested using the System Functional Tests (Part III of this manual).

¹ These computer models cannot run I/O card (other than HP98626 or built-in RS-232C serial interfaces) and peripheral tests. Only the computer mainframe tests program can be used on these and any other model that is equipped with a microprocessor other than a MC68000 (some Series 200 machines use MC68010 or MC68012).

² Series 300 models with product number ending in "A" are sometimes referenced internally with an "X" suffix. The product numbers with a "B" suffix correspond to an internal "Y" suffix.

Required Hardware

Minimum requirements that must be met before the tests can be loaded and used are:

- At least 128 Kbytes of memory (except for HP 98625 Disc Interface test which requires 256 Kbytes).
- Computer must be equipped with built-in or external keyboard and monitor.
- Series 200/300 supported flexible disc drive to match the test software disc size.
- Cartridge tape drive for the HP9000 Series 300 System Support Tape.

Running Computer Tests

To run the computer mainframe tests, follow these steps:

1. Turn computer power OFF if it is not already off.
2. Insert test media into the appropriate drive.

Though not required, it is a good practice to remove flexible discs from any remaining drives in the system so that only the Computer Tests program disc is present.

3. Turn on the computer, wait a few seconds until after Boot ROM has displayed "KEYBOARD" on the monitor, then press the space bar to interrupt the boot ROM system-loading routine.

When power-up self test is complete, a list of available systems is shown in the upper right-hand corner of the display if enough hardware is working.

4. Find SYSTEM__S2 (Series 200) or SYSTEM__S3 (Series 300) in the displayed list of available operating systems and note the two-character identifier displayed at its left. Type these two characters to start system loading. If you make a mistake in typing, type the characters again.

When the boot ROM program has loaded the computer mainframe tests program, the mainframe tests program begins a continuous loop that terminates only when interrupted by error, power or hardware failure, or operator intervention. Test operation is discussed in detail in Chapter 2 for the Series 200 and Chapter 3 for the Series 300.

Overview

Series 200 Computer Tests check the processor, memory, built-in peripherals (if any), and any HP 98626 or built-in Serial Interfaces. It does not test other interface cards, bubble memory, or external peripherals (other than built-in or external keyboard and monitor including high-resolution monochrome monitor, if present. These items can all be tested by the Computer Tests program). This chapter:

- Explains test initiation and operation,
- Lists and explains error messages that result when specific tests fail,
- Provides limited troubleshooting information where appropriate.

Test Initiation

Test programs start by executing an endless-loop test sequence that is terminated only by operator intervention, detected error(s), or power failure. The test sequence is as follows (option numbers refer to the test selection menu discussed later):

- Option 00: Processor Test
- Option 01: ROM Checksum Test
- Option 02: RAM Pattern Test
- Option 26: I/O Configuration Test
- Option 03: CRT Alpha Test
- Option 04: Keyboard Test
- Option 05: Internal Disc Drive Test
- Option 07: CRT Graphics Test
- Option 37: High-resolution CRT Test
- Option 25: MMU and PTM Test
- Option 27: Cache Memory Test
- Option 29: MMU, Cache, and PTM Test
- Option 20: Power-fail Hardware Test
- Option 28: RS-232 Serial I/O Interface Test

Upon completion of the last test in the sequence, the sequence repeats, beginning with the first test. If an error is detected during the processor test, or if a power failure occurs, the sequence is terminated with the test where the error or power failure occurred. Behavior following such terminations is undefined for obvious reasons. The test sequence can be manually terminated by pressing **RESET**. Upon termination by **RESET**, the test options menu discussed in the next section of this chapter is displayed.

Status and error messages generated by the test are sent to the monitor's display. If the HP-IB Log Toggle is set, the messages are also sent to select code 7, bus address 01 (if set, an HP-IB printer is assumed to be connected at that address). Note that error logging must be enabled by Option 15.

Using the Test Options Menu

A Test Options Menu is used to select one or more tests then execute them. Up to 15 tests can be selected before testing actually begins. Here is the test options menu showing the available options. Each option is explained in detail later in this chapter.

Test Options Menu

	00 -> PROCESSOR TEST	20	POWER FAIL TEST
TEST	01 ROM TEST	21	EXTENDED ROM
	02 RAM TEST	22	SPECIAL RAM
TEST	03 CRT ALPHA TEST	23	60 Hz CRT
PATTERN	04 KEYBOARD TEST	24	50 Hz CRT
PATTERN	05 INTERNAL DISC TEST	25	MMU / PTM TEST
	06 EXTENDED RAM TEST	26	I/O
CONFIGURATION	07 CRT GRAPHICS TEST	27	CACHE MEMORY
TEST	08 EXTENDED GRAPHICS	28	RS-232 TEST
	09 DISC DIAGNOSTIC	29	MMU + CACHE +
PTM	10 (unused)	30	(unused)
	11 (unused)	31	(unused)
600000	12 (reserved)	32	(RAM TEST >
	13 TURN RED LED OFF	33	HI RES PATTERNS
	14 COMMAND FILE	34	(unused)
	15 HP-IB LOG TOGGLE	35	(unused)
	16 TURN-ON MODE	36	(unused)
	17 EXIT (re-boot)	37	HI RES CRT TEST
	18 EXECUTE ONCE	38	EXTENDED HI RES
	19 LOOP FOREVER	39	(reserved)

Use the KNOB/arrow to select then ENTER
or RETURN. To run once hit EXECUTE or SELECT.
To cancel use RESET.
TEST MODE

Selecting Tests

Using Knob or Arrow Keys to Select Tests

To select a test, move the cursor to the first test to be performed by using the knob or up/down arrow keys (left and right arrow keys can be used to move the cursor horizontally between columns without cycling through tests 19 and 20). Press **ENTER** (**SELECT** on HP 46021 HP-HIL Keyboard) to store the test selection. Use the same procedure to select other tests, if any, in the order they are to be executed, up to a maximum of 15 tests.

Using Function Keys to Select Tests

Tests can be selected directly by using function keys **k0** through **k9**, **CTRL**, and **SHIFT** (if the computer keyboard does not have special function keys **k0** through **k9**, use the number keys 0 through 9 along the top row of the typewriter keyboard area). To select a given option from the 39 available:

Tests 0 through 9: Press **k0** through **k9** (0 through 9) respectively

Tests 10 through 19: Press **SHIFT k0** through **k9** respectively

Tests 20 through 29: Press **CTRL k0** through **k9** respectively

Tests 30 through 39: Press **SHIFT-CTRL k0** through **k9** respectively

Starting the Test

Selected tests can be run only once, or they can be run in a continuous repetitive loop. To run the tests only once, press **EXECUTE** (**SELECT** on HP 46021 HP-HIL Keyboard), press **k18** (**SHIFT-k8** or **8**), or use the cursor to select Option 18 and press **ENTER** (**RETURN** on HP 46021 Keyboard). To run the selected test(s) in a continuous loop, select Option 19, using the same procedure as when selecting test option 18.

Error and Status Messages

Various tests report certain status and error conditions to the display and/or error logging device (such as an external printer).

- Any message containing a colon (such as `CPUBOARD: 09826-66517`, for example) is a **status or system configuration message**, and is usually only reported once during a test or during a repetitive test loop. In cases where the message appears more than once during a repetitive loop, the message given **must be identical each time it is given** or it is an error (such an error would occur, for example, when ROM or RAM responds at two or more different addresses).
- Messages that do not contain a colon are **true errors**, and usually relate to the card being tested when the error occurred. For example, the error message:

`NO BUS ERROR 200000 TO 3F0000` can occur during the ROM test. Since the ROM address range given in the error message is on the CPU card and the 09826-66517/18 processor card does not have ROM at that address, this error would occur when the processor has been identified as 09826-66517/18 and a processor card defect suppresses the bus error that should occur due to absent ROM at the normal CPU ROM address indicated in the message.

Some of the error messages listed under the various tests in this chapter occur only when the tests are used in conjunction with an HP 98206 Test Stimulus Card. They are included for the convenience of Test Stimulus Card users.

Error Logging

All errors and test status messages are automatically sent to the display (if the computer is equipped with multiple displays, the messages are sent to the built-in display or to the display connected to the HP 98204 Composite Video Interface). Test option 15 (HP-IB log toggle) provides an ON/OFF option for also sending the same messages to the internal HP-IB interface (select code 7) for communication to bus address 01 which can be an external hardcopy printer or other data recording or processing device. No provision is made for using other select codes or bus addresses.

Logging is disabled at start-up, and whenever **RESET** is pressed. To enable, move arrow to Test 15 or use **SHIFT-k5** to enable. The message **LOG ON** appears on the display, and is also sent to the HP-IB destination device, if present. If no response from the HP-IB output device is received within 3 seconds (3 minutes if not System Controller), logging is disabled, and the message **LOG OFF** is displayed.

Exception Errors

Unexpected exception errors produce an **EXCEPTION** error message followed by a series of numbers representing various processor and stack register contents. When this occurs, the test in progress is aborted and the next test in the sequence (if any) is started. If no tests remain to be started, the Test Options menu appears.

Test Descriptions and Displayed Messages

Option 00: Processor Test

The processor test is the first test executed in the automatic endless-loop start-up test sequence. No status or diagnostic messages are displayed unless the test fails, and the test takes less than a second to complete.

During the test, each instruction in the microprocessor instruction set is executed at least once. TRAP and exception processing are also tested as well as ROM and RAM memory referencing.

If a test failure is detected, one of the following messages may be displayed on the output device. Refer to computer service and repair documents (such as CE handbooks) for troubleshooting and repair procedures if any of these messages appear, or if the test stalls for more than several seconds.

```
NO RAM 0 FF
UNEXPECTED LVL <x> INT W/SR=2700
NO INTERRUPT ON LVL <x>
GOT INT LVL <x> EXPECTED <y>
SR was <xxxx> not <yyyy> AFTER INT
SR was <xxxx> not <yyyy> AFTER INT ON STACK
INT RTE ADDR was <xxxx> not <yyyy>
STACK POINTER was <xxxx> not <yyyy>
```

Option 01: ROM Test

ROM test is the second test executed in the automatic endless-loop start-up test sequence. No status or diagnostic messages are displayed prior to test completion. The test takes less than a second to complete.

It performs a checksum calculation on all ROMs installed in the computer, including the boot ROM, ID PROM, language ROMs, option ROMs, and the ROMs on the HP 98206 Test Stimulus Card, if present. If the checksum for a given ROM is not FFFF (hexadecimal), the test fails for that ROM.

Language ROM cards have eight 16-Kbyte ROMs (128 Kbytes total on card) or eight 64-Kbyte ROMs (512 Kbytes total on card). ROMs are addressed in pairs, so there are 64K addresses on a 128-Kbyte card and 256K addresses on a 512-Kbyte card. To maintain flexibility, the test accommodates ROM cards at any location in memory address space, and is not restricted to the addresses assigned for language ROM use. During first pass of the ROM test, the location of installed ROMs is displayed as follows:

Status and ID Messages:

```
BOOT REV: <x>
08Kb: <xxxxxx>, 16Kb: <xxxxxx>, 64Kb: <xxxxxx>
CPU BOARD: <CPU ID>, SERIAL#<xxxxxxxxxx>
CPU BOARD: <CPU ID>, NO PROM INSTALLED
CPU BOARD: <CPU ID>
CPU BOARD SW: <xx>, CPU = MC680<yy>
16Kb: <xxxxxx>, 48 Kb: <xxxxxx>, 64 Kb: <xxxxxx>
```

where <CPU ID> is <MMU> or <non-MMU> (starting at Revision G), or <098x6-665xx> (Revision F and earlier versions). <MMU> means the processor card is equipped with memory management hardware (used mainly for HP-UX and high-performance Pascal systems); <non-MMU> means the processor card is not equipped with memory management hardware.

Error Messages:

```
UNABLE TO REMOVE DRIVE
UNABLE TO DRIVE
<xxxxxx> REVERSED
<yyyyyy>
<yyyyyy>
<zzzzzz>
CPU BOARD SIZE ERROR <##>
5F0001
5F0001
NO BUS ERROR 200000 TO 3F0000
PROM SYS = <xxxxx> TEST CODE SYS = <zzzzz>
ROM L = "<language parameter>" at ROM <xxxxxx>
```

Option 02: RAM Pattern Test

The RAM test is the third test executed in the automatic endless-loop start-up test sequence. No status or diagnostic messages are displayed prior to test completion. The test takes from a few seconds up to a minute or more to complete, depending on how much memory is present.

All RAM installed in the computer or external bus expanders (except dedicated special-purpose RAM such as display memory) is tested with the following series of test patterns:

- 55AA (0101010110101010)
- AA55 (1010101001010101)
- Sequential data for addressability tests.

An additional dynamic RAM refresh test is performed. Addressability tests use both byte- and word-address modes.

Note

When using test software with Revision F or earlier, do not attempt to perform RAM tests if an HP 98257 1 Mbyte RAM card is installed at the highest (first card installed) address position. The test can be performed if four HP 98256 256-Kbyte RAM cards are installed in the highest megabyte of memory, followed by one or more 1-Mbyte cards then other smaller capacity cards, if present. A bug in the software places the processor in an irrecoverable state that can be overcome only by cycling the power switch.

This problem has been eliminated in System Tests software Revision G, which supports any standard Series 200 memory configuration.

A memory map message is displayed when the test is complete, listing all memory cards in the computer and the starting address of each card using a format similar to:

```
1 Mb: xx0000, 256 Kb: xx0000, 64 Kb: xx0000,  
CPUbd: xx0000
```

where <xx> is two digits indicating the starting address of the first memory card of the size indicated (memory allocation starts at the highest address first, and proceeds downward). For example, the following message:

```
1Mb: F00000, 256Kb: EC0000, 64Kb: EB0000,  
CPU64: EA0000, CPU64: E90000
```

indicates this memory configuration: a 1-Mbyte card at address F00000 contains memory addresses F00000 through FFFFFFFF, a 256-Kbyte card at address EC0000 contains addresses EC0000 through EFFFFFFF, a 64-Kbyte card at EB0000 contains EB0000 through EBFFFFFF, and the 128-Kbyte autolocating memory on the processor board contains addresses D90000 through EAfffff (listed in two 64-Kbyte segments). The CPU memory map label is changed to **cpu256** for all processor boards equipped with 256 Kbytes of RAM.

If the test fails, one of the following messages may appear on the output device:

```
<xxxxxx> IN K#  
<xxxxxx>  
<xxxxxx> had <yyyyyyyy> not <zzzzzzzz>  
<xxxxxx> had <yyyy> not <zzzz>  
<xxxxxx> had <yyyyyyyy> not <zzzzzzzz>  
<xxxxxx> had <yyyy> not <zzzz>  
RAM GAP: <xxxxxx>  
RAM CPU GAP: <xxxxxx>  
RAM CPU COUNT <x> not <y>  
<xxxxxx>  
<yyyyyy>  
<xxxxxx> (<zzzz>, <www>)  
<xxxxxx> - KBD BAD?
```

All of the preceding error messages indicate a hardware malfunction requiring repair by HP-qualified service personnel in accordance with current service and repair documents.

The error message:

```
TOP 128K NOT TESTED
```

indicates that the computer does not have an additional contiguous 128 Kbytes of memory besides the memory where the test program currently resides so that the test program can be moved to alternate memory while testing the memory where the program is presently located. This error is most frequently caused by insufficient memory for the test, incorrect memory configuration, or a memory card failure.

Option 03: CRT Alpha Test

This test is the fifth test executed in the automatic endless-loop start-up test sequence. Five sequential patterns are displayed for four seconds each. To hold a pattern, press **PAUSE (STOP)** on HP 46021 Keyboard). To continue with the next pattern in the sequence, press **CONTINUE (RETURN)** on HP 46021 Keyboard).

Option 03: CRT Alpha Test

This test is the fifth test executed in the automatic endless-loop start-up test sequence. Five sequential patterns are displayed for four seconds each. To hold a pattern, press **PAUSE (STOP)** on HP 46021 Keyboard). To continue with the next pattern in the sequence, press **CONTINUE (RETURN)** on HP 46021 Keyboard).

Option 04: Keyboard Test

Sixth in the sequence test executed in the automatic endless-loop start-up test sequence. During the endless-loop test, the keyboard controller self-test is checked as well as system interrupts from the keyboard, but no tests are performed on individual keys.

To check individual keys, the test must be rerun manually under operator control.

Option 05: Internal Disc Drive Test

This test is the seventh test executed in the automatic endless-loop start-up test sequence (if no drive is present, the test exits and the next test in the sequence is initiated). If a flexible disc is present in the drive, more comprehensive test results are obtained.

The following tests are performed:

1. 256-byte drive-controller RAM is checked, including patterns, addressability, and bus speed tests.
2. Drive motor is cycled on and off.
3. Track, data, and sector registers and Track 0 switch are checked.

If a flexible disc is present in the drive(s), the following additional tests are also included:

4. Operating error margin is evaluated by verifying:
 - a. Time between index pulses,
 - b. Head/side selection,
 - c. Read address,
 - d. CRC test, and
 - e. Read sector.

If the disc has been initialized with LIF format, contains a file **TROMDATA** (type ASCII, 80 sectors), and is not write protected:

5. Test patterns are written on the file, then read back and checked for errors.
6. If a **RECORD NOT FOUND** or **CRC** error is detected, two additional read operations are performed to determine whether the error is "hard" or "soft".
7. If the optional files **TROMDATA1** and **TROMDATA2** also exist (each must be at least 80 sectors long), the same test is performed on each of those two files.

If the computer has two internal drives (Model 236), Drive 0 (right) then Drive 1 (left) are both tested. A complete test requires that a flexible disc with **TROMDATA** file(s) be present in each drive.

If the drive test fails, any of the following error messages may appear on the output device:

```
RAM @ 44E<xxx> had <yy> not <zz>
RAM @ 44E<xxx> had <yyyy> not <zzzz>
NO RAM SPEED @ <xxxxxx>-KBD BAD?
DRV <d> DISC FAST <yyyy> (<zzzz>, <www>)
DRV <d> DISC SLOW <yyyy> (<zzzz>, <www>)
DRIVE <d> DISC STS <xx> CMD <jy> XCMD <zz> TRK <ww> SEC <vv>
DRIVE <d> NO INT AFTER RES
DRIVE <d> DISC WRT <xxxxxxxx> RD <zzzzzzzz>
* DRIVE <d> WRT PROCT
DRIVE <d> TRK REG had <xx> not <yy>
DRIVE <d> TRK REG had <xx> not <yy> AFTER <zz> STS <ww>
DRIVE <d> SEC REG had <xx> not <yy>
DRIVE <d> DAT REG had <xx> not <yy>
DRIVE <d> NO TROO AFTER <xx>
DRIVE <d> TROO TRUE AFTER <xx>
DRIVE <d> CLR EXSTS FAILED
DRIVE <d> DISC BUSY <xxxxxx>
DRIVE <d> DISC TIMEOUT <xxxxxx>
* DRIVE <d> NO DISC OR NOT RDY
DRIVE <d> MOTOR OFF & RDY
DRIVE <d> NO INDEX
DRIVE <d> MARGIN
DRIVE <d> READ ADD <xxxxxx>
DRIVE <d> CRC
DRIVE <d> DISC FDC
* DRIVE <d> NO FILE OR NOT ASCII
* DRIVE <d> FILE SMALL
DRIVE <d> LVL 2 INT
RAM HOLD @ 44E<xxx> had <yy> not <zz>
RAM SPEED <yyyy> @ 44E<xxx> (<zzzz>, <www>)
```

Listed errors that are preceded by an asterisk are not related to drive performance. They may be due to defective media, or a missing or too small TROMDATA file. Using a drive that produces any of the remaining listed errors may cause discs to be incorrectly written, and may destroy data already recorded on the disc. MARGIN and NO INDEX errors can cause read errors or prevent write operations from occurring.

Option 06: Extended RAM Test

Only when specifically requested by the operator is this test performed. It is much more comprehensive than the Option 02 RAM test, and is therefore more likely to detect intermittent errors and addressing problems. However, because of its long execution time, it is usually reserved for diagnosing particularly difficult memory failures or intermittents. Approximate test times for various memory cards are as follows:

Size	Minutes
1-Mbyte	40
256-Kbyte	10
64-Kbyte	3

The test runs the entire Option 02 sequence, then performs additional tests on all RAM installed in the computer (and in HP 9888 Bus Expanders connected to the computer). To abort the test, press **RESET (SHIFT-PAUSE)** at any time except while the highest-address (first) memory card is being tested (RESET is ignored during testing of the first memory card).

Memory map and error messages are the same as for Option 02 RAM test. See Option 02 for list.

Option 07: CRT Graphics Test

Option 07 is the eighth test executed in the automatic endless-loop start-up test sequence. Bit isolation, addressability and refresh tests on the Graphics RAM are checked. During the refresh test, graphics display is enabled for viewing memory contents.

Displayed patterns consist of a rectangle with a diagonal line descending from the upper left corner at a 45-degree angle. A diagonal line passes through two characters; one located in the upper left corner, the other in the softkey area. The two characters should align with the diagonal line as shown in the Graphics Test

Pattern photographs. A series of graphics alignment patterns are then displayed for about four seconds each. To hold a pattern being displayed, press **PAUSE (STOP)** on HP 46021 Keyboard).

To resume, press **CONTINUE** (**RETURN** on HP 46021 Keyboard).

If no graphics is present, or if the Graphics RAM does not respond, the following message is sent to the output device:

```
NO GRAPHICS IN K<#>
```

If the graphics test fails, one of the following messages may appear on the output device:

```
53<xxxx> had <yyyy> not <zzzz>  
VERTICAL BLANK STUCK HIGH  
VERTICAL BLANK STUCK LOW  
VBLANK TIME <yy> (<zz>, <ww>)  
53<xxxx> had <yyyyyyyy> not <zzzzzzzz>  
53<xxxx> had <yyyy> not <zzzz>  
53<xxxx> had <yyyyyyyy> not <zzzzzzzz>  
53<xxxx> had <000000yy> not <000000zz>
```

Option 08: Extended Graphics Test

Performed only when specifically requested by the operator. It is much more comprehensive than the Option 07 CRT Graphics test, and is therefore more likely to detect intermittent errors and addressing problems. The test runs the Option 07 CRT Graphics test, then performs an extended test on Graphics RAM, taking about 100 seconds to complete.

If no graphics is present, or if the Graphics RAM does not respond, the following message is sent to the output device:

```
NO GRAPHICS IN K<#>
```

If the graphics test fails, one of the messages shown in the Option 07 test may appear on the output device.

Option 09: Internal Disc Diagnostic

When specifically requested by the operator, this test is performed. It is used for troubleshooting internal flexible disc drives (Model 226/236). To activate the test, select option 09, then option 18 (execute once).

The test begins by applying power to the drive motor and sending a "restore" command to the drive controller which places the head at track 0 and places the drive in a known state (if the computer has dual drives, the same action is performed on both the left- and right-hand drives).

Note

The disc drive motor is running during the entire duration of this test. Since the heads are in contact with the disc all the time, disc wear is accelerated; especially for extended tests such as overnight or over a weekend.

The test option keys are redefined as follows:

- k0 Sends "Step in (+) with update" to controller's command register. Head is moved to the next inward track.
- k1 Sends "Step out (-) with update" to controller's command register. Head is moved to the next outward track.
- k2 Toggles Head Select between heads 0 and 1.
- k3 Sends "restore" command to controller (sets head at track 0; the outside track on the disc).
- k4 Toggles Drive Select between 0 (right-hand drive) and 1 (left-hand drive, if present). If no left drive is present, an error message is returned.
- k5 Sends "Read Address" command to controller. Six bytes are returned and displayed in the form: **READ** <address>, **TRK**<xx>, **HD**<yy>, **SEC**<zz>, **BL01**, **CRC**<cyclic redundancy characters>. CRC is four hexadecimal digits.
- k6 Initiates a "Read Sector" command. You are prompted for the sector number. Respond with any valid one-digit hexadecimal value (digit 0 through 9 or A through F). The program then reads the specified sector on that track and displays the result in hexadecimal and in ASCII, if possible. 12 bytes are displayed per line with four bytes in the last line.
- k7 Initiates a "Read Full Track" command. Entire contents of current track are input to memory using fast handshake. Data is displayed 256 bytes (one sector) at a time. Press **CONTINUE** to display next sector (use **RETURN** on HP 46021 keyboard), or wait for program to automatically advance to next sector at 4-second intervals.

To ensure data accuracy, place a jumper between test points LOCK and VFOE on the 09826-66561 or 09826-66562 card being tested. Remove the jumper when finished.
- k8 thru k39 Exit to Test Options menu. Motor is turned off, and control transfers to the Test Options menu. **RESET** can also be used to exit to the test options menu.

Drive test and command options return messages to the display that refer to command/status and extended command/status registers. Regular command and status data is passed between the computer and the drive controller. Extended command/status data is passed between the controller and the drive, and is accessible by the computer. The following messages are displayed by various test options:

CMD<xx>	Command (CMD) was <xx>.
EXCMD <y>y	Extended command (EXCMD) was C<yy>.
STS <zz>	Status (STS) resulting from executed command was <zz>.
EXSTS <ww>	Extended status (EXSTS) is <ww>.

Option 13: Turn Red LED Off

Extinguishes the red LED indicator on the HP 98206 Test Stimulus Card. No other action is performed.

Option 14:

Option 14 is not used.

Option 15: HP-IB Log Toggle

Alternately enables and disables hardcopy output of test messages to a printer device on HP-IB select code 07, bus (primary) address 01. Select code 07 is the internal HP-IB interface.

Option 16: Turn-on Mode

Transfers control back to the endless-loop start-up sequence that is executed upon test program start-up. The loop can then be terminated by the same means that applied when the program was first loaded and run.

Option 17: Exit to Boot ROM

Terminates the test program and transfers control to the boot ROM which then performs power-up self-test followed by system loading.

Option 18: Execute Once

Sets a program flag causing the test program to execute the selected test once. Upon completion, the program returns to the Test Options menu.

Option 19: Loop Forever

This key is the complement of Option 18. The program flag is changed to indicate that the selected test should be repeated in a perpetual loop until interrupted by direct operator intervention or power failure.

To terminate the test loop, press **RESET**.

Option 20: Power-fail Test

Thirteenth in the automatic start-up test sequence. It checks the power-fail hardware's internal clock, self-test, RAM, and interfacing hardware. If the test fails, any of the following messages may appear:

```
PF IBF/OBF/F1
PF TIMEOUT 0 <xxxxxx>
PF FAILED SLFTST <xx>
PF RAM DATA was <xx> not <yy>
PF CLK SLOW <xxxx> (<yyyy>,<zzzz>)
PF CLK FAST <xxxx> (<yyyy>,<zzzz>)
```

Option 21: Extended ROM Test

A subset of Option 1: ROM Test with some extensions. It is intended primarily for factory use and is of limited value in installed systems.

Option 22: Special RAM Test

Identical to Option 02 RAM Test except when the test stimulus card is being used. The additional features implemented in this test are accessible to the test card only. See Option 02 for test status and error messages.

Option 23: 60 Hz CRT Patterns

Option 23 and 24 provide a convenient means for displaying standard monitor and graphics test patterns without waiting for the memory tests that precede displayed patterns in Options 03 and 07. Patterns from the alpha test are followed by patterns from the graphics test, each pattern appearing on the display for about four seconds. To hold a given pattern, press **PAUSE (STOP)** on HP 46021 Keyboard. To resume the sequence, press **CONTINUE (RETURN)** on HP 46021 Keyboard); to abort, press **RESET**.

Option 23 sets the vertical scan rate on display devices that have dual scan frequency capability to the higher frequency, usually 60 Hz (50 Hz on HP 98204A Composite Video Interface) during the test.

Upon completion or abort, the original (default) setting is restored.

Option 24: 50 Hz CRT Patterns

Identical to Option 23, except that the vertical scan frequency is set to the lower frequency, usually 50 Hz (41.7 Hz on HP 98204A Composite Video Interface – not used for normal operation) if the display device supports dual scan frequencies. The scan rate that existed before the option was selected is restored upon abort or completion of the test.

Option 25: MMU and PTM Combination Test

MMU/PTM combination test is tenth in the start-up test sequence. It is executed when a 09817-66511 or 09826-66517/18 processor card is present in the computer, and checks the memory management unit (MMU) and programmable timing module (PTM).

The MMU test checks user- and supervisor-segment pointer registers, segment table access, page table access, access violations, TLB purge, and selective TLB purge. All combinations of segment table, page table, user mode and supervisor mode read/write accesses are tested. The test uses system RAM down to address F00000, if present.

PTM checks write/read registers, level 6 interrupt, counter operation, status, and counter 3 input from counter 2 output.

Any of the following error messages may result from test failure:

```
NO MMU
MMU SYS REG was <xxxx> not <yyyy>
MMU USER REG was <xxxx> not <yyyy>
MMU CMD <xx>, STS <y>
MMU CMD <xx>, STS <y>/<z>
MMU CMD <xx>, STS <y>/<z>, LA <111111>,
BUS ERR 0 <wwwww>
MMU CMD <xx>, STS <y>/<z>, LA <111111>,
MMU CMD <xx>, STS <y>/<z>, LA <111111>, SUP TLB REPLACE
MMU CMD <xx>, STS <y>/<z>, LA <111111>, SEG TBL ACC
MMU CMD <xx>, STS <y>/<z>, LA <111111>, PAGE TBL ACC
MMU CMD <xx>, STS <y>/<z>, LA <111111>, NO TLB PURGE
MMU CMD <xx>, STS <y>/<z>, LA <111111>, NO REF BIT
MMU CMD <xx>, STS <y>/<z>, LA <111111>, NO TLB REPLACE
```

```

BUS ERROR 0 <ttttt>
MMU CMD <xx>, STS <y>/<z>, LA <111111>, DATA <nnnn>/<mmmm>
NO BE 0 <ttttt>
BUS ERROR 0 5F8002 (PTM)
PTM STATUS was <xx> not <yy> after RESET
PTM STATUS was <xx> not <yy> after CLR INT
PTM STATUS was <xx> not <yy> after COMMAND <zz>
PTM REG 2 was <xxxx> not <yyyy>
PTM REG 4 was <xxxx> not <yyyy>
PTM REG 6 was <xxxx> not <yyyy>
IN 10 ms PTM CR1 WENT FROM FFFF TO <xxxx> (<yyyy>,<zzzz>)
PTM CR3 SPEED ERROR <xxxx> (0-2)
PTM CR3 VALUES 0-7, PRESET <xxxx>
PTM CR2 VALUES 0-7, PRESET <xxxx>
PTM DUAL 8 CR3 <xxxxxxxx><yyyy><zz>
NO PTM SPEED - KBD BAD?
NO PTM INTERRUPT
PTM INTERRUPT WHEN NOT EXPECTED

```

Option 26: I/O Test and Configuration Report

The fourth test executed in the automatic endless-loop start-up test sequence. Minimal tests are performed on I/O cards and related accessories. A list of installed devices is displayed together with select code and interrupt level.

Option 27: Cache Memory Test

Checks cache memory on the 09826-66517 processor card, and is the eleventh test in the start-up test sequence if a cache-equipped processor is installed in the computer.

The test verifies that:

- Cache memory can hold data,
- I/O is not cached,
- Memory access speed with and without cache is correct, and
- Cache memory purges correctly.

Error messages include:

```
NO CACHE (a bus error indicates that no cache memory is present)
CACHE STATUS was <xxxx> not <yyyy>
CACHE DATA was <xxxx> not <yy> @ <zzzzzz>
CACHE DATA was <xx> not <yy> @ <zzzzzz>
CACHE IN I/O SPACE                (cache responding to memory
                                   addresses in I/O space)
NO RAM SPEED @ <xxxxxx> - KBD BAD?
CACHE SPEED <xxxx>, <yyyy>
    where <xxxx> is speed with cache on, and
    <yyyy> is cache-off speed.
```

Option 28: RS-232C Serial I/O Test

The Serial I/O test is last in the automatic endless-loop start-up test sequence. All interfaces identified as equivalent to the HP 98626 (including built-in serial interfaces such as in the Model 216) are tested regardless of select code setting(s). HP 98644 Serial cards cannot be tested by this option.

Option 28 test sequence checks modem lines, status-change interrupts, and serial data transfer. If an external test connector (part number 98626-67950) is attached, output signals are connected to the corresponding inputs. If no connector is present, loop-back capabilities on the interface are used instead for a less complete test. Serial data transfers are tested at selected rates ranging from 50 to 38 400 baud.

If the serial interface test fails any test, one of the following error messages may appear on the output device:

```
NO RS-232 IN 9816
RS-232 Sc <x> RESET FAILED (R<y>,<zz>)
RS-232 Sc <x> OUT R<y>,<zz>; IN RW=<uu> not <vv>
UNEXPECTED INT ON LVL <x>
INT NO CAUSE <xx>
RS-232 Sc <x> RATE <yyyy> SLOW
RS-232 Sc <x> SENT <yy> RCVD <zz>,
REG23 <ww>, RATE <vvvv>
RS-232 Sc <x> TIMEOUT <yyyyyy>
RS-232 Sc <x> NO INT
```

Option 29: MMU, Cache Memory, and PTM

A combination test is twelfth in the automatic endless-loop start-up test sequence. No status or diagnostic messages are displayed prior to test completion. The test takes less than 30 seconds to complete. The test checks memory management hardware, cache memory, and the programmable timing module if they are present on the processor card. If the processor has no MMU, PTM, or cache memory, no test is performed.

Option 32: Special RAM Test

Almost identical to the Option 22 test, except that it checks memory addresses only down to 600 000. See Option 22 description for test operation and displayed messages. This test is used for aging RAM cards during manufacturing, and has no practical application in installed systems.

Option 33: Test Patterns for High-resolution Monitor

Provided for convenience in testing the high-resolution monitor without running the high-resolution memory test. A sequence of test patterns are displayed for about four seconds each. To hold a pattern being displayed, press **PAUSE (STOP)** on HP 46021 keyboard), then press **CONTINUE (RETURN)** on HP 46021 keyboard) to resume with the next pattern. **CONTINUE** can also be used to advance to the next pattern without waiting for the four-second display time to expire.

Display patterns are similar to those used in Test Options 03 and 07:

- Full raster pattern is 768 pixels high by 1024 pixels wide.
- Focus pattern is composed of four-pixel holes.
- Alignment pattern is a grid of horizontal and vertical lines.

Option 37: High-resolution Monitor Test

The ninth test executed in the automatic endless-loop start-up test sequence if a high-resolution monitor is present (Model 237). Vertical sync timing, the Replacement Rule register, screen-buffer memory, and the screen bit mover are checked. The screen-buffer memory test is limited in scope to conserve test time. Pattern display is identical to Test Option 33. The test takes less than one minute to execute.

Option 38: Extended High-resolution Monitor Test

Similar to Option 37, except that a more extensive screen-buffer memory test is performed. The test requires several minutes to complete.

Introduction

This document describes the usage, capability, and special features of the set of assembly language modules that performs testing for all HP 9000 Series 300 computer products and selected accessory boards and interface electronics. The code is tuned for reasonable compactness, high speed, and survivability in either a good or malfunctioning computer.

The generic form of this test code is an operating system that provides a testing, exercising, and diagnostic capability during production as well as for customer engineering support.

Hardware and software characteristics of the test code are designed for flexibility of use and interchange between machines and bundling configurations. Initial Turn-On testing and user selectable exercising of specific sections of the hardware are provided.

Since revision 1.10 of the test tools software, tests have been added for the following:

- 32 bit Series 300 computer products, i.e. 318, 330, 350
- Error correction and checking (ECC) RAM
- Floating point accelerator (HP 98248A)
- VME interface bus (HP 98577)
- SCSI disc interface (HP 98265)
- Graphics Interface (HP 98548A, 98549A, 98550A)
- Graphics Accelerator (HP 98556A)
- LAN Toggle

Diagnostic Strategy

The Series 300 computer tests are off-line repair environment tests for the SPU. They provide low-level control of the hardware, the ability to isolate a fault to an FRU in the SPU hardware, and the ability to test to the level of confidence achieved during manufacture at the factory. They can verify that the hardware is fully functional prior to loading in an operating system. But these Level II¹ diagnostics may actually inhibit the ability to establish confidence in the customer's system in the customer environment with the customer's software. Level III¹, customer environment, tests are used for this.

A CE could use these Level II tests to locate the cause of a failure when:

- Series 300 computer tests exist to test the function that failed
- SPU power must be off during the repair
- Thorough testing is needed rather than simple verification

¹ "Diagnostic Strategy and Development for the HP9000 Series 300 HP-UX Workstation", Computer Support News, September 1987, pp21-24.

Software

Test code is executed from system RAM that has been booted from disk or tape. The test code provides complete testing of the processor board, all ROMs, system RAM, bit-mapped video boards, keyboards, Local Area Net, High-Speed HP-IB, DMA circuit, and RS-232 serial I/O. The "internal" HP-IB may be used for message logging. (Test code defaults to select code 7, device address 1, for the message logging device.)

Software

The software medium is a floppy disk, or cartridge tape, that contains the entire test set and operating system. "Boot Up" is like that for any other soft operating system or language. The test code can be copied from the disk or cartridge tape to an SRM or to another compatible media device. (Note that booting from a cartridge tape will be extremely slow.)

Booting

Booting the above system requires operational peripherals and functional BOOT ROMs. EPROM/ROM operating system and soft test code will not get loaded into the system RAM if there is no BOOT ROM or if the booting process is defective.

The BOOT ROM is required:

- For transfer of control between BOOT ROM and test code.
- To boot the soft form of the code.

Hardware

The test code is designed to operate in a system with less than a minimum hardware configuration. The test code may also be used in a system with a maximum hardware configuration. The following minimum hardware is required:

- Any HP 9000 Series 300 mainframe with a processor board, 512 K of RAM, and a power supply.
- If RAM and MMU testing is desired, the top 512 K of system RAM is required. (The code will temporarily move itself around to effect the tests.)

All of the tests are on line after the test code system has been successfully booted into the top of RAM. To set up the series 300 RAM, refer to the installation manual.

- BOOT ROMs are required for soft system code to boot.
- Although no output device is required, either an alpha or bit-mapped video board may be used. The alpha video board is the default choice when both video devices are present.

Note

HP 98720 bit-mapped video is not supported by this revision of test code. But systems with only an HP 98720 can message log to a printer. This will enable them to examine the rest of the system with this test code.

- Error logging may be sent to a device on the HP-IB. Device address is 701 (select code 7, address 01). A standard HP printer is the device.

Operation Modes

Turn-On Mode

Turn-On mode is the name given to a subset of the diagnostic tests. Turn-On mode also implies the execution of those tests. When the system successfully boots, execution of the Turn-On tests begins.

Turn-On mode is entered under either of the following conditions:

- The diagnostic software is accessible via disk, tape or SRM.

When power is applied and the BOOT ROM finds the "SYSTEM_S3" file on the local mass storage media, the file is loaded and control is passed to the start address of the test code.

- When the diagnostic software is operating in Test mode, and when Test Defined Key (TDK) 16 is selected and executed, processing returns to Turn-On mode. (See Test Mode for selecting and executing tests.)

Turn-On Test Sequence

Turn-On mode executes at power-on. It steps through the tests listed in Table 2-1. No adverse action takes place if a device is missing unless the device is defined as "must have", such as RS-232 at select code 9 for TDK28.

Under normal setup configuration Turn-On mode cycles through the test sequence again and again. The first pass through the sequence generates failure messages as well as a configuration list. Later passes produce only failure messages, if there are any, and a pass-count message.

Table 2-1. Turn-On Test Sequence

TDK	Opx	Description/Name
00		MC 680X0 Processor Test
01		ROM Checksum Test
02		System RAM Pattern Test
26		I/O Configuration
03	*	HP 98546 Standard Alpha Test
04	*	Keyboard / Real Time Clock Test
09		HP 98643 Local Area Network (LAN) Test
07	*	HP 98546 Graphics Test
35	*	HP 985XX Bit-mapped Video Electronics
25		MMU then PTM Test
40		MC 68851 PMMU Test
27		External System Cache Test
20		MC 68881 Floating Point Co-Processor Test
29		MMU + PTM + External Cache Test
28		RS-232 Serial I/O Test
30		MC 68020 Instruction Cache Test
37	*	HP 987XX Bit-mapped Video
50		HP 98248 Floating Point Accelerator
46		HP 98620 DMA Circuit Test (only Rev. B and later)
47	*	HP 98625 High Speed HP-IB Test (only Rev.B and later)
48		HP 98256 SCSI Disc Interface Test
51		HP 98577 VMEbus Test

(An * in the Op column means operator intervention is possible but optional.)

Refer to Appendix 1 for a description of each test listed above. Some of the tests in Appendix 1 are not included in the Turn-On mode sequence. This is because the other TDKs may test the same function at a more detailed level and therefore take much longer. Or because messages from the other tests may be a little more cryptic to the novice. Or because TDK 05 actually changes the time in the BBRTC; this requires the user or CE to reset the clock.

Processor Board LEDs

The eight LEDs on the processor board serve a special function during Turn-On mode. (They can be seen through the front grill of the Series 300 case.) If the high order LED (the left most of the eight) is lighted, a failure has occurred during at least one of the Turn-On tests. The next three LEDs are the binary representation of the tens digit of the TDK that is running; the last four LEDs (the rightmost four) are binary for the units digit of the TDK.

If the LEDs look like ○○○●●●● (filled circle indicates lighted LED), there has been no failure and TDK27 is currently running.

Exit to Test Mode

Exit from Turn-On mode and control transfer to Test mode occurs if **Reset** is pressed during Turn-On mode. (**Reset** is usually a combination of keys which varies with the keyboard used. The Test mode menu, Figure 2-6 on page 2-50, will be displayed on the monitor.)

Note

Note that if message log was active, pressing **Reset** will disable it. There will be no more HP-IB message logging until it has been toggled back on with TDK15.

Test Mode

Test mode is entered from Turn-On mode. Test mode enables you to select a specific test or test sequence to assist in troubleshooting. A test sequence is limited to 15 tests plus a termination key (see TDK 18 or 19 description).

Selection of Tests

There are two ways to select tests. The first is menu driven and is the easiest approach for the infrequent user. The second uses keystroke combinations and may be more efficient for the experienced/frequent user. In both cases you have already exited from Turn-On mode by pressing **Reset**. The TDK menu, a complete list of available tests and options, is on the display.

The two methods are as follows:

1. Inverse video highlighting points to one of the tests on the menu. The highlighting can be moved up, down, right, or left with the arrow keys, a mouse, or the knob. To select the highlighted test press **Return** (**Enter** or **Select** on some keyboards). To execute the selected test(s) once, press one of the keys labeled **K0** to **K4**, or **F1** to **F4**. To execute the selected test repeatedly, press one of the keys labeled **K5** to **K9**, or **F5** to **F8**. If a mistake is made press **Reset** to escape the situation, then start over (remember that error logging to a printer will be disabled when **Reset** is pressed).
2. The Test Defined Keys (TDKs) 00 to 59 are selected by pressing a number-row (not number-pad) key **SIMULTANEOUSLY** with various combinations of **Shift**, **CTRL** and **Extend char**. (With the HP 98203C keyboard substitute **V** for the **Extend char**.) The number key supplies the TDK units digit. The other keys supply the tens digit; see Table 2-2.

The selected tests are executed in the same way as in the first method.

Table 2-2. TDK Tens Digit

Tens Digit	Key Combination
0	(no keys)
1	Shift
2	CTRL
3	Shift-CTRL
4	Extend char (or V on HP 98203C)
5	Shift-Extend char (or Shift-V on HP 98203C)

- **Example:** To select the following TDKs, press the Key(s) for the Tens Digit at the same time as the number-row key for the Units Digit...

TDK	Key(s) for Tens Digit	Units Key
15	Shift	5
36	Shift-CTRL	6
57	Shift-Extend char	7

Selectable Tests

Table 2-3 lists the selectable tests and their associated Test Defined Keys (TDKs). An * in the Op column means that operator intervention is optional. Tests included in Turn-On mode are listed in Table 2-1.

Table 2-3. Selectable Tests

TDK	Op	Description/Name
0		MC 680X0 Processor Test
1		ROM checksum Test
2		System RAM Pattern Test
3	*	HP 98546 Standard Alpha Test
4	*	Keyboard / Real Time Clock Test
5		Extended Form of the Battery Backed-Up Real Time Clock Module.
6		Extended RAM Test [N LOG(N)]
7	*	HP 98546 Graphics Test
8	*	Extended HP 98546 Graphics Test [N LOG(N)]
9		HP 98643 Local Area Network (LAN) Test
20		MC 68881 Floating Point Co-Processor Test
22		RAM Test (speed message(s) and limit of 8 errors per half of any RAM board)
23	*	HP 98546 60hz Alignment Test Patterns
24	*	HP 98546 50hz Alignment Test Patterns for 98204B/98546
25		MMU then PTM Test
26		I/O Configuration
27		External System Cache Test
28		RS-232 Serial I/O Test

Table 2-3. Selectable Tests (cont.)

TDK	Op	Description/Name
29		MMU + PTM + External Cache Test
30		MC 68020 Instruction Cache Test
31		HP 98286 (80286) Test
32		RAM test similar to TDK2 except abbreviated to speed test time.
33	*	HP 987XX Graphics Test Patterns
34	*	HP 985XX Graphics Test Patterns
35	*	HP 985XX Graphics Test
36	*	HP 985XX Extended Graphics Test
37		HP 987XX Graphics Test
38		Extended HP 987XX Graphics Test
39		Debugger/Utility Program
40		MC 68851 PMMU Test
42		HP 98257 (RAS) Test
44		Sound Test
46		HP 98620 DMA Circuit Test (only Rev. B and later)
47	*	HP 98625 High Speed HP-IB Test (only Rev. B and later)
48		HP 98256 SCSI Disc Interface Test
50		HP 98248 Floating Point Accelerator Test
51		HP 98577 VMEbus Test
55	*	HP 98556A 2-D Graphics Accelerator Test

Refer to Appendix 1 for a description of each test listed in Table 2-3. Note that several tests are available in Test mode that are not included in the Turn-On mode sequence listed in Table 2-1.

Selectable Functions

In addition to the tests in Table 2-3, you may select the functions and capabilities listed in Table 2-4. TDKs 15 through 19 will be useful to all diagnosticians, but 10 through 14 will typically be used only in factory applications.

Table 2-4. Selectable Functions

TDK	Function/Capability
10	EPROM blank check
11	Program EPROMs.
12	Toggle halt on "TOO MANY PTM ITSs IN TDK29"
13	Turn off Red "Fail" LED
14	LAN message log on/off toggle
15	HP-IB message log on/off toggle
16	Return to Turn-On mode
17	Exit to the BOOT ROMs
18	Execute the test sequence once
19	Execute the test sequence repeatedly

Selecting/Running TDKs

Test mode enables you to select one or more individual test(s) and execute them sequentially either once or repeatedly. Select tests (TDKs) by using one of the first two methods listed under "Selection of Tests". Selecting undefined keys results in a beep. To execute several tests, select the TDKs for each of them. The tests will execute in the order selected (a maximum of 15 tests can be selected at one time). Note that TDK18 and TDK19 are "immediate execute" keys. If one of them is selected it must be the last TDK in a sequence.

Here is an example sequence:

(While in Test mode (menu optional)) TDKs 1 0 3

The test mode kernel overprints "Test Mode" with "TDKs" to let you know that a key entry sequence has started. Subsequent TDK entry numbers will appear as they are selected. The test sequence above is:

ROM test, Processor test, HP 98546 alpha test. If you now select TDK19, the tests immediately start to execute, and the word "Start" appears on the video display and/or the error logging device.

Because TDK19 follows tests 1, 0, and 3, testing will continue to loop through tests 1, 0, and 3, in that order, until you intervene. A "PASS ##" pass complete message will be displayed each time the sequence completes. To stop the test sequence looping, press **Reset**.

One Pass Testing

To execute a test or test sequence once, select TDK18 or press one of the **K0** through **K4**, or **F1** through **F4**, keys. Selecting TDK18 executes the test or test sequence immediately so it must be the last TDK selected. Upon returning to Test mode at the end of the sequence the test setup is forgotten.

Repeated Testing

To execute a test or test sequence repeatedly, select TDK19 or press one of the **K5** through **K9**, or **F5** through **F8**, keys. Selecting TDK19 executes the test or test sequence immediately so it must be the last TDK selected. To abort testing and return control to Test mode, press **Reset**. Note that if HP-IB message logging was turned on, it will now be turned off. To reselect HP-IB message logging, execute TDK15.

Exit Test Mode

To exit Test mode and return to Turn-On mode, cycle the power switch or execute TDK16.

Execute TDK17 to exit Test mode and enter the BOOT ROM.

Error Logging

Errors may be logged to a device connected to the internal HP-IB (Select code 7, address 1), or HP 98624 HP-IB (Select code 8, address 1), by executing TDK15. This output device is in addition to the display and is usually, but not necessarily, a printer. To return messages to the display only, execute TDK15 again. This TDK toggles error logging between a) display only, and b) display plus HP-IB device.

Note

Ciper HP-IB protocol printers can not be used for error logging, e.g. an HP 26085.

External Logging

The internal HP-IB (Select code 7) is the default interface. But if the test code finds an external HP-IB (HP 98624) at select code 8, it sends HP-IB message logging to it rather than to the internal HP-IB.

Multiple Unit Logging

It is possible to do message logging to a data collecting computer while testing multiple units. This capability is primarily for factory manufacturing use.

Error Reporting, Progress Status and Control

Error/progress reporting will normally appear on the display. However, since some units may not have a functioning display, several additional independent error/progress indicators have been provided.

Display (Monitor)

A message is placed on the display to indicate the present state or error condition.

If there is more than one display, the message log will be sent to the least complex device.

If an HP 98204B/98546 card and a bit-mapped video board are on line then the HP 98204B/98546, and not the bit-mapped video device, will be the log device.

If both an HP 985XX and an HP 987XX video board are present, then the HP 985XX is always the log device.

Note

If an HP 985XX and an HP 987XX video board are on line at the same time, then they must be at different frame buffer and video controller select codes.

If only the HP 987XXs are present then the messages will be logged to the first one that is found while scanning all possible select codes. The HP 987XX may be set to address 00560000_{16} or any of the unused I/O select code addresses between 00600000_{16} and $007F0000_{16}$. The frame buffer may be set for any unused 1M of address space in the machine, i.e. 00200000_{16} , 00300000_{16} , 00800000_{16} or 00900000_{16} (00300000_{16} is standard).

Remember that the HP 985XX video board resides at 00560000_{16} and 00200000_{16} (and 6 plane color hi-res at 00300000_{16}).

Note

HP 98556A functions only in DIO-II address range. If the host video board is set to internal select code space (56) then the presence of HP 98556 will cause an error during the video card test and the HP 98556 will not be tested.

Message Logging

If HP-IB message logging is in effect, all error and information messages will be directed to the HP-IB output device as well as the display.

The default is message logging on, and device address 1. The HP-IB on select code 8, if present, is used in place of the internal HP-IB.

Notice that pressing **Reset** turns logging off, but it can be restarted by executing TDK15.

Troubleshooting

For some boards/functions more than one TDK can be used to check functionality or to ferret out causes for sick system symptoms. For those situations where multiple TDKs apply, here are some suggestions as to which TDKs you should select, and in which order, when you want to test the indicated function or field replaceable unit (FRU). The order was determined based on the time and depth of testing, i.e. the first test listed usually takes the least time and tests less extensively than the second one. In some cases, i.e. video and RAM tests, you may need to execute only the first test to find the clue that identifies the guilty party. However, in the CPU board and human interface situations, all tests should be run in the order suggested.

In some cases, a TDK applies to only a particular board or model. These limitations/restrictions are indicated.

Table 2-5. TDK Sequences for Troubleshooting

Bit-mapped Video Boards and Monitors

All Bit-mapped TDK 35, 36

There is no need to run TDK 34 as it is entirely included in TDK 35.

RAM

HP 98257 RAM TDK 2, 6, 42

All other RAM TDK 2, 6

TDK 22 and 32 RAM tests are seldom needed. TDK 22 is recommended, however, if TDK 2 uncovers a seeming infinity of errors; TDK 22 has a limit on the number of errors/RAM it reports. TDK 32 may cause inappropriate error messages when I/O cards are in the system.

HP 98546 Video Boards and Monitors

All HP 98546 TDK 03, 07, 08

Refresh rate TDK 23, 24

CPU Boards

Model 310 TDK 00, 01, 02, 25, 29, 28, 05

Model 318/330 TDK 00, 01, 40, 20, 30

Model 320/350 TDK 00, 01, 25, 27, 20, 29, 30

Human Interface Boards

These TDKs do not apply to Models 310 or 318, since they do not have separate human interface boards.

Model 320 TDK 04, 28, 44, 05

Model 330/350 TDK 04, 09, 28, 46, 47, 48, 44, 05

HP 987XX Graphics Processor and Monitor

All HP 987XX TDK 37, 38

There is no need to run TDK 33 as it is included in TDK 37.

Appendix 1: The Tests

Test Title and Copyright

One of the following test title and mode indicator messages is sent to the display (and/or HP-IB output device if enabled) when the processor test completes. This happens on the first pass after booting the test code.

98561 TESTS Rev 3.XXX, date YY/MM/DD, log dev L

Series 300 TESTS Rev 3.XXX, date YY/MM/DD

Series 300 TESTS Rev 3.XXX, date YY/MM/DD, log dev L, Sys Cont

Series 300 TESTS Rev 3.XXX, date YY/MM/DD, LAN log, log dev L,

Sys Cont "98561 TESTS" indicates that output messages are logging via HP-IB and that the HP-IB is not the HP-IB system controller at HP-IB select code "L".

"Series 300 TESTS" is the normal prefix for all other conditions. Year/Month/Day (YY/MM/DD) refers to the date the code was made into a system. The real time clock is reset to this date when doing extended BBRTC tests.

Note

The test code revision number and the date revised are an important part of the turn-on message. All communications regarding test code problems and the group with Engineering Responsibility MUST include this information.

For message logging to the HP-IB, the device address (1 for soft code, and D4 through D0 of register F for TSB) appears in this message along with "sys cont" if the HP-IB in the unit under test is the system controller.

Copyright 1987, 1988, Hewlett-Packard Company.

(the year the system was made)

This message appears on the display but never is included on the HP-IB output device error log.

Other Startup Messages

!! System is not a Series 300 !!

This message is used as the title message if the test code is run in a series 200 or in a unit that the test code does not think is a series 300.

Any configuration message -> : <- etc.

Only configuration messages will have a “:” (colon symbol) in them. Configuration messages have this format so that other computers which are monitoring the HP-IB message log information, might be able to discern the difference between configure and failure messages.

Colons are NOT allowed in any error or information message. Some configuration messages continue on a second line; that second line begins with an “&” (ampersand) in column 1.

Only configuration messages and error messages are sent to the HP-IB logging device. So if a message appears on the HP-IB logging device, and the message does not contain a “:”, it is an error message.

Test Mode Menu

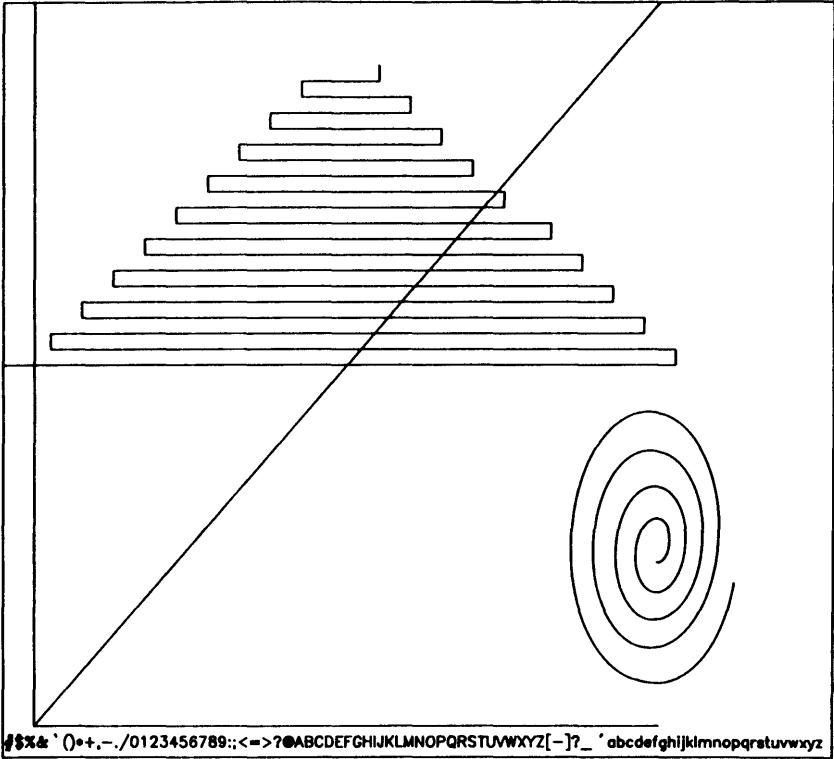


Figure 2-1. Test Mode Menu

This menu will appear when **Reset** is pressed. It will not be message logged. The four lines beginning with “Arrow keys...” are in inverse half-bright video on an alpha display (HP 98546), but in normal video on a bit-mapped display.

Messages

* (message)

Any message or line that begins with a leading asterisk is a comment rather than an indication of error. The preceding asterisk is associated with the PASS CYCLE message which is output every 1M of RAM in TDK2, TDK6, TDK22 or TDK32. This message is output only when HP-IB message logging is active and the unit under test is not the System Controller.

** NOTE No test TDK# **

This test was selected and does not exist.

XXXXXXXXX IN TDK TT

This error message indicates that an unexpected bus error has been detected at address XXXXXXXXX in test TT; test TT has no mechanism for handling its own bus error.

Can not move code

This error message indicates that the code was moved (relocated) by one of the RAM tests and can not be moved back where it was originally. Further tests should not be attempted until RAM is repaired!

Log off

Log off Dev 31 not allowed

The suppressed messages will appear on the display only when

- a timeout occurs on the HP-IB
- TDK15 is used in Test mode to disable HP-IB message logging

Note

Pressing **Reset** will turn off logging, but there will be display indication that the log has gone off.

Log on

This message is displayed upon the use of TDK15 to indicate that HP-IB message log is enabled.

Pass cycle = XX

This message displays the pass cycle when a test sequence is run in Test mode. This is the format of the pass message before the keyboard timer is set up in TDK4.

DDD days HH hr MM min SS sec

This message displays the pass cycle when a test sequence is run in Test mode or at the end of a pass through Turn-On mode. This message is used once TDK4 has run.

Test Mode

This message is displayed upon entering Test mode and when a test sequence is aborted

Turn-On Mode

This message is displayed upon entering Turn-On mode from Test mode.

****NOTE Error limit reached in TDK XX****

The maximum number (24) of errors has taken place in test TDK XX. Test has been aborted.

Exceptions (from any error message logging device)

This type information may help the factory troubleshoot a problem. The data could be logged to a printer for ease of communication.

```
+++ Exception XXXXXX in TDK## ● YYYYYYYY
Registers          SR = SSSS
DDDDDDDD, DDDDDDD, DDDDDDD, DDDDDDD
DDDDDDDD, DDDDDDD, DDDDDDD, DDDDDDD
AAAAAAAA, AAAAAAAAA, AAAAAAAAA, AAAAAAAAA
AAAAAAAA, AAAAAAAAA, AAAAAAAAA, AAAAAAAAA
VBR = VVVVVVVV, SFC = W, DFC = Y
CACR = QQQQQQQ, CAAR = TTTTTTT (this line for MC68020 only)
USP = UUUUUUUU, SSP = SSSSSSS
Stack
ZZZZ ZZZZ ZZZZ ZZZZ . . . (etc. this could get quite lengthy)
```

Figure 2-2. Exception Information

-where the “D” and “A” register arrangement is-

D0	, D1	, D2	, D3
D4	, D5	, D6	, D7
A0	, A1	, A2	, A3
A4	, A5	, A6	, A7

This message will appear when an unexpected exception is detected. The present test is aborted and the next test will be started.

If no additional tests are to be run then Test mode will be entered.

The value given by XXXXXX is the MC 680X0 exception vector offset from the vector base register (see the MC 68020 manual under “Table 6-2. Exception Vector Assignments” in the Vector Offset column labeled “Hex”). This value indicates the cause of the exception.

The “##” following “TDK” is the number of the TDK that was executing when the exception was encountered. The YYYYYYYY is the address where the exception should have occurred. This address, as well as the TDK number, is accurate most of the time (in extreme cases the values may be garbage). See the CE Handbook or Service Manual for the typical I/O map (configuration) to tell where the item for that address is located.

The values given by DDDDDDDD and AAAAAAAA are the MC 680X0's eight "D" data and "A" address registers, 0 to 7 respectively. Hexadecimal values displayed are the contents of the registers at the time of the exception.

The SSP (Supervisor Stack Pointer, SSSSSSSS) is displayed along with the USP (User Stack Pointer, UUUUUUUU). The values ZZZZ(etc.) are the values on the Supervisor Stack and usually contain return addresses and the status register. ZZZZ is listed starting at the Stack Pointer (A7) and up.

VBR is the Vector Base Register, SFC is the Source Function Code register and DFC is the Destination Function Code register. For more detail, see the MC 68020 manual.

The line CACR and CAAR will appear if the processor type is MC 68020. CACR is the Cache Control Register and CAAR is the Cache Address Register.

TDK Descriptions

The following pages contain descriptions of each TDK. The TDKs appear in numerical order.

TDK0 - MC 680X0 Processor Test

This is the first test that gets executed at power-on. This test does not require operator intervention.

The processor test exercises each MC 680XX instruction at least once. It checks all the effective addressing modes with a select set of instructions. The TRAP and exception processing is tested; both ROM and RAM memory references are made.

TDK1 - ROM Checksum Test

This test is included in Turn-On mode and requires no operator intervention. This test performs a checksum on all computer ROM parts except display ID ROMs. (These are tested in their own test sections.) Language ROMs and the Test EPROMs (0048XXXX₁₆ and 004AXXX₁₆) are checked. EPROM mass storage volumes are not checked. The scan for ROMs is from 00000000₁₆ to 001FC000₁₆. The region between 00200000₁₆ and 003FFFFFF₁₆ is reserved for bit-mapped display frame buffers. In all ROM tests, the checksum is done on a byte addressing basis.

This test takes about 1 second to run.

TDK2 - System RAM Pattern Test

This test is included in Turn-On mode and requires no operator intervention. All system RAM present in the computer is tested. TDK2 may find several types of RAM, including parity detecting and error correcting RAM.

TDK2 will test units only if they contain more than 256K of system RAM. The following patterns are used in this RAM test:

- **BUS speed:** Various BUS timing speeds are used during RAM testing. When an error is detected, the BUS speed being used will be output to the error logging device.
- **Ones and zeros:** An alternate ones and zeros pattern, and its complement, is tested. The patterns $55AA55AA_{16}$ and $AA55AA55_{16}$ are used.
- **Addressing modes:** A check is made of byte, word and long word addressing modes. (In this context a long word has four bytes, i.e. 32 bits.)
- **Parity circuit:** The parity circuit is checked by forcing a parity error in both the upper and lower bytes of memory. The parity RAMs on the board under test are tested with a simple all zeros and all ones patterns. Parity checking is left enabled for the remainder of the RAM test.
- **Addressability:** Sequential data is used to check addressability. Three passes are used.
- **Random:** A random pattern is placed in the RAM. The pattern is later checked.
- **N LOG(N):** A pattern test similar to the N LOG(N) test (TDK6) is done next.
- **RAM refresh:** A dynamic RAM refresh test is done. The RAM is filled with test data and one "ROW" is accessed on each RAM board. This is done to place the "Refresh Arbitration" logic under test. After about 20 seconds the RAM is checked for the test pattern. The above testing is repeated with complemented test data. On the next pass of the test code a different ROW will be used. This is done to provide testing of refresh on all ROWs.

- **Board addressability:** RAM testing is completed with a check of board addressability. This is done with each location holding a unique value (its own address or its complement). It is done using long word (4 bytes) addressing mode. This test is the same as in the BOOT ROM.

If a RAM error is detected by this test a MEMORY speed message will also be output.

A memory map will be generated on the first pass or on other passes if a configuration change is detected, e.g. a board fails. This map gives the RAM board size and address. It is output before any of the RAM is actually tested.

TDK3 - HP 98546 Standard Alpha Test

NOTE

This test has nothing to do with the HP 985XX bit-mapped video interfaces or the HP 987XX display system, only the video compatibility board (HP 98546).

This test is intended for the “original” format of series 200, i.e. 80 column alpha type displays similar to the HP 98204B/98546A.

TDK3 is part of Turn-On mode. Its provision for operator intervention enables you to temporarily suspend execution of the test code while alignment patterns are present on the monitor. During this time you may examine and/or adjust the monitor.

This test places several patterns on the screen and holds them there for 4 seconds each. If you press **Stop** on the keyboard (**PAUSE** on some keyboards), the test code will hold the pattern until **Return** (or **Enter**) is pressed. This allows time for adjustment and verification. To advance quickly through the test, use **Return**.

A display RAM test is included in TDK3. It is similar to the Extended RAM test. At the completion of this test, messages about detected errors will be output to the display. (If the display RAM is defective the possibility exists that there will be no display or an unreadable one.) And, if message logging is active, these messages will be logged to a printer as they occur.

TDK3 causes the screen to blink and display the following patterns. A "good" sequence can be recognized by visual inspection.

Here is the description of the four patterns displayed in the Character test: (See tests TDK23 and TDK24 for a set of all display test patterns.)

1. **Full bright raster:** Full screen of inverse space characters are used in the HP 98204B/98546.
2. **Focus test pattern:** In the HP 98204B/98546 lower case "hp"s are alternated on all rows and every other column to fill the screen.
3. **All displayable characters:** There is no way to verify the contents of the character ROM while it is in the computer, but a visual check of the monitor can be made. In the HP 98204B/98546, all characters are displayed on the monitor in combination with all four video enhancements. When Return is pressed or the 4 second timeout expires, a large no-blink cursor travels around the border of the screen. The contents of the cursor register in the MC 6845 are read and verified in a HP 98204B/98546.
4. **Scroll:** In the HP 98204B/98546 the screen is scrolled up, then down.

TDK4 - Keyboard / Real Time Clock Test

This test is included in Turn-On mode, but it does allow (actually, somewhat needs) operator intervention. A hardware RESET instruction is executed which causes the 8042 keyboard processor to do its self-test. The keyboard processor is accessed and checksummed. The following 10 ms timer interrupts are verified: on match, on cycle, fast handshake (NMI).

A short 3 second test of the Battery Backed Real Time Clock (BBRTC) is included in the keyboard test. The time is read and stored, the BBRTC is tested and the time is restored (+3 sec). The total error per execution of TDK4 will not be more than +/- 1 second.

The following three patterns are used to test the BBRTC rollover:

23:59:59 to
00:00:00

23:59:59 to
00:00:00

11:59:59 PM to
12:00:00 AM

The key switch test puts a picture of the keyboard on the display, and waits for 4 seconds for your response on the real keyboard. The test assumes you are there if it detects that any key is down (pressed).

To proceed with the test press any keyboard key, then check that the corresponding key in the keyboard picture on the display responds with a filled image. Pressing that key again unfills the key image. The keys may be pressed in any order desired. To check **[Shift]** or **[CTRL]**, press it in combination with another key on the keyboard.

The knob controls the movement of the large cursor at the bottom of the display. The Shift or CTRL spot on the display diagram is open, or inverse video, according to whether **[Shift]** or **[CTRL]** is normal or pressed down when another keyboard key is pressed. Pressing a key or turning the knob also causes update of the keyboard status and data register at the bottom of the display. If an invalid key code is detected, a message is output. If log is enabled then all key codes appear in a message.

Press **[CTRL]**-**[0]** to exit the keyboard test and continue to the next test. The test also terminates if no key is pressed within 10 minutes. To abort all testing and enter Test mode, press **[Reset]** (**[Reset]** is a combination of keys that varies with the keyboard used.)

To test the speaker run the sound test (TDK44).

TDK5 - Extended BBRTC Test

This test is an extension of TDK4, the Battery Backed Real Time Clock test. It is not included in Turn-On mode. This test provides an exhaustive test of the real time clock IC. It DOESN'T save the real time. All valid values of seconds (units, tens), minutes (units, tens), hours (units, tens), day of week, date (units, tens), month (units, tens) and year (units, tens) are tested. All overflows from units to tens, seconds to minutes, minutes to hours, hours to days, days to months and months to years are tested, as are leap year and non-leap years. Here is an example of values tested.

23:59:59 becomes
00:00:00

23:59:59 becomes
00:00:00

Note

When this test completes, the test code revision day and date, not the current day and date, are left in the BBRTC. The customer or CE will need to reset the day and date by using the standard capabilities of the customer's operating system.

TDK6 - Extended RAM Test [N LOG(N)]

This test is an extension of the TDK2 RAM test. It is not included in Turn-On mode because it takes SEVERAL minutes per RAM board to execute. It does not require operator intervention. This test performs an "N LOG to the base 2 of N" test on all system RAM present. This test may be aborted by pressing on the keyboard (except while testing the top RAM board).

TDK7 - HP 98546 Graphics Test

NOTE

This test has nothing to do with the HP 985XX bit-mapped video interfaces or the 987XX display system. This test is intended for the "original" format of series 200 alpha type displays with optional graphics memory.

This test is part of Turn-On mode, but it has some options for operator intervention. The graphics memory is tested using a bit isolation test, refresh test and addressability test. During the refresh test the character display is turned on for viewing.

During TDK7, patterns appear on the display. You determine how long each pattern will remain by choosing one of the following options:

- Do nothing and the patterns will remain on the display for 4 seconds.
- While a pattern is displayed, press **Stop** (on some keyboards you may press **PAUSE**). The pattern will remain until you press **Return** (**Enter** on some keyboards).

During part of the test, a box 512 dots wide and 390 dots high (HP 98204B/98546) is placed on the screen. This pattern has a diagonal line descending at a 45 degree angle from the top left corner to the bottom. This line passes through some characters.

The graphic display should align correctly with the character display.

There is another pattern which is displayed on the HP 98204B/98546. This pattern is a large rectangle with its sides bisected and with its corners connected with diagonal lines that meet in the center.

TDK8 - Extended HP 98546 Graphics Test [N LOG(N)]

This test is not a part of Turn-On mode because it takes about 100 seconds to execute. Part of it is the same as the HP 98546 Graphics Test (TDK7), but it does an additional extended "N log N" test on graphics RAM.

TDK9 - HP 98643 Local Area Network Test

WARNING

Never run this test while connected to an active LAN.

The LAN card is one of the newest “built-in” options. This test is stand-alone in the sense that an actual LAN is not attached to the HP 98643 (or built-in LAN interface). The test does, however, require that a terminating load resistor set be attached. The load resistor usually consists of two “HP 92227 P” loads connected to a BNC “T” connector and then installed onto the BNC connector of the LAN card.

This test verifies LAN interface functionality; testing of the LAN itself is done from the operating system.

TDK10 - EPROM Blank Check

This TDK is not a test selection. It is an immediate command to Test mode driver software. It checks for blank EPROMs (missing EPROMs are considered blank). If all EPROMs are blank, a 'Complete' message is sent to the message logging device. CEs can ignore this; it is for factory production use.

TDK11 - Program EPROMs

This TDK is not a test selection. It is an immediate command to Test mode driver software. CEs can ignore this; it is for factory production use.

TDK12 - Toggle halt on “TOO MANY PTM ITSs IN TDK29”

This TDK is not a test selection. It is an immediate command to Test mode driver software. CEs can ignore this; it is for factory production use.

TDK13 - Turn off Red “Fail” LED

This TDK is not a test selection. It is an immediate command to Test mode driver software. It is used to turn off the red “Fail” LED on the optional Test Stimulus Board (TSB).

TDK14 - LAN Message Log on/off Toggle

This TDK is not a test selection. It is an immediate command to Test mode driver software. If messaging logging is on, selecting TDK14 turns it off. If logging is off, selecting TDK14 turns it on.

LAN Log on

This message is output to both video and the lan to inform user that message log has been turned on and to cause some output to the LAN to find out if it is possible to message log.

LAN Log off

This message results when LAN message Log is unsuccessful. It is only output to the video.

TDK15 - HP-IB Message Log on/off Toggle

This TDK is not a test selection. It is an immediate command to Test mode driver software. If message logging is on, selecting TDK15 turns logging off. If logging is off, selecting TDK15 turns it on.

When message log is toggled on, messages are logged to an HP-IB printer at select code 7, device address 01.

TDK16 - Return to Turn-On Mode

This TDK is not a test selection. It is an immediate command to Test mode driver software. It returns testing to Turn-On mode.

TDK17 - Exit to the BOOT ROMs

This TDK is not a test selection. It is an immediate command to Test mode driver software.

TDK18 - Execute the Test Sequence Once

This TDK is not a test selection. It is an immediate command to Test mode driver software. In Test mode several TDKs can be selected before any of them are executed. After they have been selected, TDK18 causes that test sequence to be executed once.

TDK19 - Execute the Test Sequence Repeatedly

This TDK is not a test selection. It is an immediate command to Test mode driver software. In Test mode several TDKs can be selected before any of them are executed. After they have been selected, TDK19 causes that test sequence to be executed repeatedly until a) a failure occurs that halts the system, or b) **Reset** is pressed.

TDK20 - Floating Point MC68881/2 Co-Processor Test

This test is included in Turn-On mode. It will do no testing if the processor board has no provision for a MC68881/2. This test progresses through the Co-Processor instruction set and tests the floating point exceptions.

Communication between the MC68020 and the MC68881/2 is tested first. This is followed by a test of the floating point conditional instructions. The floating point control and status registers are tested. The floating point data registers are used for source and destination. Some data conversions are done.

The test is completed with the execution of a limited set of general floating point instructions.

TDK21 - UNUSED

TDK22 - RAM Test With Speed Message

This test is different from the TDK2 RAM test in that it a) displays the memory (RAM) speed message for all RAM boards present, and b) places a limit on the number of errors it will report for a RAM board, e.g. 16 for a 4M board.

This test has the same messages as TDK2. Only failed BUS (RAM) speeds and MEMORY SPEEDS will get logged. All BUS speeds will be displayed.

TDK23 - 60 Hz Alignment Test Patterns for HP 98204B/98546

See TDK24.

TDK24 - 50 Hz Alignment Test Patterns for HP 98204B/98546

TDK23 and TDK24 are the video-device alpha alignment patterns and graphic alignment patterns. If TDK23 is selected, the video device is set up for 60 Hz. If TDK24 is selected it is set up for 50 Hz. When the test is completed, or aborted, the video-device is reinitialized at the indicated frequency for the hardware.

This test is provided for operator convenience. The operator does not have to wait for video board RAM test to execute. The patterns will appear and remain on the display for about 4 seconds. If no action is taken during that time, the next pattern is displayed.

If you press **Stop** (**PAUSE** on some keyboards) the test code will hold the pattern until you press **Return** (or **Enter**) or **Reset** (a key combination that varies with the keyboard). If your keyboard has a **CONT** (or **Return**) key, you may press it to advance quickly from one pattern to the next.

See test TDK3 and TDK7 and Table 2-6 for a description of the patterns.

Table 2-6. Alpha Video Patterns for HP 98204B/98546

Description of Test Pattern	Notes
A full alpha raster	formed from spaces with inverse video
Focus pattern	formed from hp's and small "e"s.
All displayable characters	all characters plus enhancements
A box is placed on the screen. This pattern has a diagonal line descending at a 45 degree angle from the top left corner to the bottom and enters the UDK area.	
A box with its corners connected and its four sides bisected.	

Error messages for TDK23 and TDK24 are the same.

TDK25 - MMU and PTM Test

This test is part of Turn-On mode and does not require operator intervention. It is executed when the unit under test has an HP 9856X MMU processor board. TDK25 tests the MMU and the PTM. The MMU is tested first. The MMU user and supervisor segment pointer registers, Segment Table access, Page Table access, Access violations, TLB purge and selective TLB purge are tested. All combinations of segment table, page table, supervisor mode, user mode write and read accesses are tested. The MMU testing uses system RAM, if present.

In the MC6840 PTM the following items are tested: The write/read registers, interrupt on level 6, counter operation, status and counter 3 input from the output of counter 2.

TDK26 - I/O test and Configuration

This test is a part of Turn-On mode and does not require operator intervention. It begins by examining the internal HP-IB to see if it is a system controller. Next it checks for a HP 98620 DMA card. It then goes on to the external I/O interfaces. The test code makes only minimal checks on the condition of these I/O interfaces. In pass one, or if a change in the I/O configuration is detected, a map of the I/O is output. This map will include the HP-number of the interface or name of the internal device followed by its Select Code and interrupt level. If the I/O identification can not be recognized then its ID, Select Code and interrupt level will appear.

For some interfaces, such as the HP 98624, additional information (SYS CONT) may be output.

TDK27 - External (to the processor chip) Cache Test

This test is a part of Turn-On mode and does not require operator intervention. It is executed when the unit under test has the appropriate MMU/CACHE control registers. There must be RAM at the top of memory in order to test cache RAM.

The MMU is also used in this test. The MMU provides invisible RAM rewrites that don't purge cache data. This test operates in both SUPERVISOR and USER cpu MODE. If the MMU test fails, this test may also fail. If this test fails, the cause may be in the processor chip or the actual Cache circuitry.

TDK28 - RS-232 Serial I/O Test

This test is a part of Turn-On mode and does not require direct operator intervention other than to install a test hood on the RS-232 port connector, if possible.

Note

The 50 pin test hood, to use with a 98626 card, is p/n 98629A. The 25 pin test hood is p/n 98644-67950.

The 9 pin test hood can be created at your workbench by connecting the pins as shown in Figure 2-9 below. The connections are presented in the figure as you would see them while looking at the back side of the test hood when it is attached to the RS-232 card.

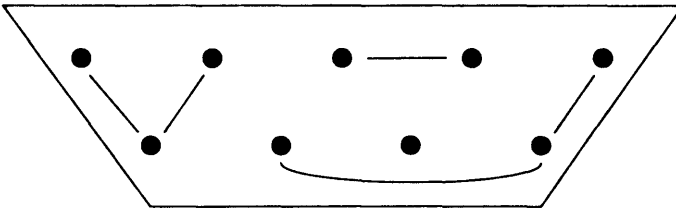


Figure 2-3. 9 Pin Test Hood Connections

All Select Codes from 0 to 31 are checked for an RS-232 interface. If a machine has more than one RS-232, then all will be tested, even though they are not at Select Code 9. The final result is that all RS-232 interfaces (HP 98644 [like] or HP 98626) will be tested.

This test checks the modem lines, status change interrupts and serial data. If the test hood is not installed the "LOOP" capability of the 8250 or 8250A is set to internally loop signals back. Serial data is sent/received at all standard baud rates from 38.4K to 50.

TDK29 - MMU + PTM + Cache Test

This test is a part of Turn-On mode and does not require operator intervention. It is executed when the unit under test has an HP 9856X MMU processor board. This test combines the Cache (if any), MMU and PTM. If the processor board has a cache then the MMU is set-up to inhibit cache on pages to check cache inhibit.

Then the following memory areas, if present, are mapped: Boot ROM, Alpha video board, Graphics video board (HP 98204B/98546), 64K of System RAM and the area of memory where the test code is located. This test operates in User Mode and is interrupted by the PTM. Logical addresses are assigned at random (repeatable), and changed five times while this test is executing. While this test executes, a graphic and alpha pattern is visible on the display. (In order to map system RAM, 128K of RAM is required for hard test code, i.e. the test stimulus board. 196K is required for soft test code, i.e. floppy disk or tape cartridge.)

TDK30 - Instruction Cache Test

This test is included in Turn-On mode. ICACHE is a function of the MC680XX processor. The test will not execute if the processor is not a MC680XX.

TDK31 - DOS Co-processor Board Test.

This test will check the functionality of the HP 98286. This test is not a part of Turn-On mode. The shared RAM is tested and the control and status registers. This test will down-load iAPX 80286 code into the RAM and cause the co-processor to execute it with a 'GO SLAVE' command. MC 680xx is removed as the current bus master and the co-processor test is performed with the 80286 in control of the mainframe bus.

TDK32 - Abbreviated RAM/TDK2 Test

This test is the same as TDK2 except that it will test RAM in less time by being less thorough. Different sections of the test have been abbreviated. It is recommended that TDK2 be used for all testing and to ignore this test unless time is critical.

This test has the same messages as TDK2. Only failed BUS (RAM) speeds and MEMORY SPEEDs will get logged. All BUS speeds will be displayed.

TDK33 - Bit-mapped Video Patterns for HP 987XX Graphics Processors

This is a utility and not a test. The alignment patterns will appear during Turn-On mode, or when running the specific bit-mapped video test. This utility is provided for operator convenience; it permits checking of the alignment of the supported monitor.

By selecting TDK33 from Test mode the operator does not have to wait for Hi Res RAM test to execute. The patterns will appear and remain on the monitor for about 4 seconds. Then, if no operator keyboard intervention is taken, the next pattern will be displayed.

If **Stop** (**PAUSE** on some keyboards) is pressed, the current pattern will remain until **Return** (or **Enter**) is pressed, or until **Reset** (a combination of keys that varies with the keyboard) is used. To advance quickly from one pattern to the next use **Return** (or down **CONT**).

See Table 2-7 for a description of the patterns.

Table 2-7. Bit-mapped Video Patterns

Table 2-7 presents a description of the patterns for all bit-mapped video-devices. It applies mainly to the HP 987XX, with variations for HP 9854x video-devices as noted.

Table 2-7 is divided into four parts. They deal with the following pattern areas:

Part	Pattern Area
2-7.1	Color Map, Purity, and Intensity
2-7.2	Focus Grid and Convergence
2-7.3	D/A Color Map Converter Linearity
2-7.4	Convergence, Focus, Geometry

A special word appears at the beginning of each phase description. That word is AUTO, OPERATOR or ALT. These words are defined as follows:

Function

Definition

AUTO

AUTO pattern segments require no operator intervention. Once a pattern is on the screen, the pattern will "hold" for approximately 4 seconds before going on to the next AUTO segment or exiting the patterns utility upon completion.

OPERATOR

OPERATOR may intervene in the test at any point in the AUTO segments by pressing **Stop** (or **PAUSE** on some keyboards). Then the monitor will hold the current pattern until **Select**, or one of the soft keys, is pressed. When any of the soft keys 0 through 4 is pressed, the color will step RED, GREEN, BLUE and WHITE. Pressing any of the soft keys 5 through 9 either changes the black/white intensity or inverts the shown color.

ALT

ALT color and intensity for HP 985XX video systems is due to a different method of color mapping implemented in this series of tests. This allows a little more versatility in the ability to manually see other color combinations.

Table 2-7.1 - Color Map, Purity, and Intensity

Phase	Pattern	Phase Description
A	Full Raster; White	AUTO; Full screen of maximum intensity

This pattern is used to do photometer readings of the screen and to set the white maximum brightness (as allowed by the monitor and its support electronics). The white screen, along with the color screens could also be used to verify the purity and full on voltage regulation at the monitor anode.

WARNING

The anode voltage is very high and requires special probes and precautions to measure. Have someone nearby when making anode measurements.

By pressing **Stop** (or **PAUSE** on some keyboards) during the automatic mode, the monitor will hold the current display and allow the operator to push one of the soft keys 0 through 4 to change the color of the screen (it doesn't matter which one is pushed as they all do the same thing). Pressing one of the softkeys 5 through 9 will change the brightness of the display. See phase I, below, for variation for HP 985XX.

Phase	Pattern	Phase Description
B,C,D	Full Raster; Red, Green, Blue	AUTO; Full screen of maximum intensity; Color monitors only

If the monitor is left unattended then the following sequence of full brightness colors will be displayed; Red, Green and Blue. The operator may intervene at any time by pressing **Stop** (or **PAUSE**). Otherwise the automatic test will proceed to the next phase, the focus pattern.

Table 2-7.1 - Color Map, Purity, and Intensity (cont.)

Phase	Pattern	Phase Description
E,F,G	Minimum Raster; White, Red, Green, Blue	OPERATOR; Full screen of minimum intensity

(OPERATOR intervention is required during the 4 second maximum white or color "hold" period in order to enter this mode.)

Not to be confused with ZERO intensity, this pattern is set to the least value that can be input to the video board D/A converter that will produce a viewable raster.

The color palate D/A converter has a resolution of 256 shades of intensity in the 8 plane configuration, and of 16 shades of intensity in the 4 plane.

Phase	Pattern	Phase Description
H	ZERO Raster; Black	OPERATOR; Full screen of ZERO intensity (Black)

Full screen of ZERO intensity raster. Drive a color to a D/A level of 0 or 0.0% brightness.

Phase	Pattern	Phase Description
I	Alt color mix	OPERATOR; Select alternate colors and intensities (HP 985XX only)

Softkey functions for the HP 985XX are slightly different in that extra (ALternate) color mappings appear for each stroke of a softkey. Softkeys 0 through 4 change the color/intensity of the target symbol, e.g. turning a white sharp-sign red. Softkeys 5 through 9 change the background color/intensity, e.g. black background goes to blue-green. The softkey must be pushed 16 times to return the pattern to its original color map value.

Table 2-7.2 - Focus Grid and Convergence

Phase	Pattern	Phase Description
A	Focus Pattern; White	AUTO; Screen full of “#” characters

A screen full of 10 pixel by 10 pixel symbols that look like sharp or pound (#) signs. The following is the specific pixel placement for these symbols:

```

|<3 >|1|<2>|1|<3 >| (The same dimensions on all sides.)
|  *   *   |
|  *   *   |
|  *   *   |
* * * * *
  *   *
  *   *
* * * * *
  *   *
  *   *
  *   *
  
```

The important part is that there is a blank spot in the center of the sharp symbol that is 2 pixels by 2 pixels. The pattern density for hires video is 32 columns by 24 rows. These symbols are pushed to the extreme corners of the monitor so that some anomaly, some strangeness, will exist at the center of the monitor. So always use the geometry test to determine the pincushion or other alignment.

Phase	Pattern	Phase Description
B,C,D	Focus Pattern; Red, Green, Blue	OPERATOR; Screen full of “#” characters in color

As with the color raster selection in Table 2-7.1, softkeys 0 through 4 enable the operator to select the color of the “#” characters.

Table 2-7.2 - Focus Grid and Convergence (cont.)

Phase	Pattern	Phase Description
E	Focus Pattern; Invert	OPERATOR; Screen full of “#” characters in inverse video

Softkeys 5 through 9 swap the selected color and background (black) to give a form of inverse video.

Phase	Pattern	Phase Description
F	Focus Pattern; (See Table 2-7.1 Phase I)	OPERATOR; ALT; Screen full of “#” characters in alternate colors and intensity; (HP 985XX only)

Table 2-7.3 - D/A Color Map Converter Linearity

Phase	Pattern	Phase Description
A	Grey Scale; White	AUTO; Screen has 2 grey scale sets

The top 1/3rd of the screen has a dithered grey scale that starts with a bar of black on the left side and progresses through 31 graduations of increasing brightness to a bar of white on the right side. In a color monitor system with 4 frame buffer planes the maximum number of grey tones that is available is 16. By the "dithering" of every other pixel, one shade of grey is mixed with the next shade of grey which gives the optical illusion of actually being a discrete grey scale with 31 steps.

There is a black band running horizontally across the center of the screen. This serves no purpose other than to separate the top and the bottom of the screen.

The lower 1/3 rd of the screen looks similar to the top except that only the "real" grey scale tones are used; there is no dithering. An 8 plane system would have 256 shades of grey while a 4 plane setup would have only 16 shades (both include black).

For HP 985XX displays, the grey scale is divided into as many parts as the number of planes allows (so for a 6 plane system this is 2^6 or 64 shades of grey). The top grey scale is dark on the left side and bright on the right side while the bottom grey scale is in the inverse order, bright on the left and dark on the right.

Phase	Pattern	Phase Description
B,C,D	Grey Scale; Red, Green, Blue	AUTO; Grey scale with one of the three colors; (HP 987XX only)

Same as grey scale for white but uses Red, Green or Blue color.

This was not implemented in the HP 985XX test.

Table 2-7.4 - Convergence, Focus, Geometry

Phase	Pattern	Phase Description
A	Alignment pattern; White	AUTO; Grid pattern for convergence or pincushion adjustments

A double pixel width cross hair goes through the center of the monitor. A box is drawn around the extreme perimeter of the screen and is filled with a grid pattern. The grid is supposed to be square +/- 1 pixel. Located around the center of the screen are 2 concentric circles. The curve of the circles will appear a little ragged as the circle approaches the perpendicular cross hair points. This is normal. The linearity of sweep may be checked by measurement with a ruler but it is recommended that a custom alignment mask be used to check both images.

For hi res monitors the grid consists of 33 vertical and 25 horizontal lines, including sides. The 2 concentric circles have a radius of 6 and 11 1/2 "square widths".

For medium res monitors the grid consists of 17 vertical and 15 horizontal lines, including sides. In order to make the majority of the squares "square", the top and bottom appear to be smashed (rectangles of 5 pixels high). The 2 concentric circles have a radius of 3 and 6 1/2 "square widths".

Note

Since the definitions for "high res" and "medium res" may change with technology improvements, be sure that the video board and monitor have compatible resolutions.

Phase	Pattern	Phase Description
B,C,D	Alignment; Red, Green, Blue	OPERATOR; Same as above, but the grid is in a selected color with black background.

Phase	Pattern	Phase Description
E,F,G	Alignment; Red, Green, Blue; Invert	OPERATOR; Same as above, but the grid is black with background in a selected color

Table 2-7.4 - Convergence, Focus, Geometry (cont.)

Phase	Pattern	Phase Description
H	Alt colors; (See Table 2-7.1 Phase J)	OPERATOR; ALT; Same as above, but the grid is in an Alt color as well as the background; (HP 985XX only)

TDK34 - Bit-mapped Video Patterns

This is a utility and not a test. Alignment patterns appear as a result of running Turn-On mode or the specific bit-mapped video interface test. This utility is provided for operator convenience and will allow for checking/adjusting monitor alignment.

By selecting TDK34 from Test mode the operator does not have to wait for Hi Res RAM test to execute. The patterns will appear and remain on the monitor for about 4 seconds. Then if no operator keyboard intervention is taken the next pattern will be displayed.

If **STOP** (**PAUSE** on some keyboards) is pressed, the current pattern will remain until **Return** (or **Enter**) is pressed, or until **Reset** (a combination of keys that varies with the keyboard) is used. To advance quickly from one pattern to the next use **Return** (or **CONT**).

For a description of the alignment patterns, see Table 2-7.

Once finished with a "standard set" of patterns, TDK34 presents an additional display to allow one last test and alignment phase.

FOR COLOR VIDEO ONLY:

For both the medium resolution and high resolution color monitors, a pattern of concentric boxes are moved onto the screen.

Each box is smaller than the previous box and exhibits a color or white/grey scale characteristic that is distinct from that of the previous box. This gives a final screen appearance of having 16 concentric rectangles (with wide lines).

The sequence is as follows:

1. An all white screen (100% intensity) is first turned on; the entire viewable surface will light.
2. Next, a black (0% intensity) box will be displayed on the screen. This box is smaller than the white box by 1 pixel on each of the 4 sides. The result is that there appears to be a white line, one pixel wide, going around the perimeter of the display.
3. Finally, 9 color boxes and 7 shades-of-grey boxes are displayed, one at a time, on the screen.

The color box series will be :

1. GREEN, BLUE, RED, PURPLE, YELLOW, and BLUE-GREEN (all at 100% intensity).
2. RED, GREEN, and BLUE (all at 50% intensity).
3. The grey box sequence is MINIMUM WHITE (at 0.39% intensity, this is not black), WHITE (at 20% intensity), WHITE (at 40% intensity), WHITE (at 60% intensity), WHITE (at 80% intensity), WHITE MAX (at 100% intensity).

In the center of the screen is the last box, a box of black.

In all of the above cases the box that overlays the previous box is smaller by 20 pixels vertically (10 fewer on both the top and bottom), and 40 pixels horizontally (20 fewer on both the left and right). The resulting picture on a medium resolution monitor appears to have all lines the same width. (The medium resolution monitor treats the horizontal pixels in half pixel steps.) The high resolution monitor, however, will have the vertically drawn lines twice as wide as the horizontally drawn lines.

Next, a pattern of odd/even dithered pixels are put into the center of the screen. This pattern is necessary for adjustment of the clock symmetry in the color controller chip.

For 5-plane (or greater) systems, a grey scale is drawn down from the dithered pixels to the bottom edge of the pattern, otherwise, nothing further is done.

FOR MONOCHROME VIDEO ONLY:

For both the medium resolution and high resolution monochrome monitors, an all white screen (100% intensity) is turned on; the entire viewable surface lights.

FOR ALL HP 985XX VIDEO: (the last item in the final display)

The test code character font set is installed into invisible video board RAM space and window moved up to the viewable area of the RAM just below the top of the screen where all of video board RAM is tested.

TDK35 - HP 985XX Bit-mapped Video/Accelerator Boards

(short version)

This test is a part of turn-on mode. It is an abbreviated version of the test, TDK36. The difference between this test and TDK36 is that the bit-mapped video board test will sense if the test number is odd or even and will act upon that information to select either the long or short version of frame buffer RAM and other functional testing.

There is no discrete TDK34 or TDK35, TDK36 or TDK55; there is one test program module that covers all situations. Entry into various situations of the HP 985XX tests is controlled by the value of the TDK.

TDK36 - HP 985XX Bit-mapped Video/Accelerator Boards

(long version)

This test is not a part of Turn-On mode.

The bit-mapped video board includes these subsystem components:

- **ID ROM:** Just as the name implies, there is an ID ROM. It contains initialization and ID info, as well as character fonts.
- **VIDEO CONTROLLER CHIP:** It supplies the timing signals and provides all access to the internal frame buffer RAM.

- **FRAME BUFFER RAM:** There may be 1/2 or 1 mega address locations that are from 1 to 4 (but up to 8) bits wide and are indirectly accessible through the video controller chip interface. They will appear to be like real RAM most of the time in that they may be read from and written to. For accurate reproduction of bits input to this RAM area the Replacement Rule Register must be set to a value of 3.
- **COLOR MAP CONTROLLER/CONVERTER:** This is the color map controller and D/A converter for COLOR monitors.

This test does a number of things that are unique to the 985XX bit-mapped monitor.

- **ID PROM:** For any type video board, a checksum (also referred to as CRC) is done. All initialization for any HP 985XX configuration, as long as the ID ROM checksum is good, is done.
- **VIDEO CONTROLLER CHIP TESTS:** The video controller chip is thoroughly tested by register reads and writes, and by various timing tests. Also, the video controller chip performs some self test by exercising the internal SIGNATURE ANALYSIS (SA) meter. The SA meter reads the value of the viewable frame buffer RAM between vertical retrace periods. RAM testing is through the video controller chip, too.
- **RAM TESTING:** All frame buffer memory planes - up to 8, that is - will be tested. The RAM test will sense if the bit-mapped video test is in the long or short format; less exhaustive tests are performed for the short format.
- **COLOR MAP CONTROLLER/CONVERTER TESTING:** Just as with the video controller chip tests, the color map controller/converter will perform standard and self (SA) tests.

Included in the video display test (TDK 35 or TDK36) is the test for the HP 98556A 2-D graphics accelerator.

Error messages are the same as for TDK35.

TDK37 - HP 987XX Test

This test is a part of Turn-On mode. TDK37 will test any HP 987XX graphics processor present. The Vertical Sync timing, the Replacement Rule Register, screen buffer RAM and the screen bit mover are checked. The screen buffer RAM test is limited to hold down execution time. For the complete RAM test RUN TDK38. TDK37 displays the same patterns as TDK3.

TDK38 - Extended HP 987XX Test

This test is not a part of Turn-On mode. It is like TDK37 except that a more complete screen buffer RAM test is done.

Error messages are the same as for TDK37.

TDK39 - Debugger/Utility Program

This TDK is for test code development and debugging.

TDK40 - MC 68851 Paged Memory Management Unit Test

This test is quite similar to the standard MMU test. All of the functionality of the PMMU is not tested as it isn't supported at this time. Items placed under test are: SRP, CRP, PSR, TC, page descriptor, page table, PTEST, PLOAD and more.

TDK41 - UNUSED

TDK42 - HP-98257 Row Address Strobe (RAS)

This test does a special (timing) test of system RAM that will detect a unique parity RAM failure mode. This problem has affected a very small percentage of RAM chips used with HP 98257 memory boards.

TDK43 - UNUSED

TDK44 - Sound (beeper) Test

This test provides a method to demonstrate the 3 tone noise beeper chip in the keyboard controller electronics. There is an independent frequency sweep of all 3 tone generator sections at constant amplitude. This is followed by an explosion-like noise, and then by 3 separate constant pitch tones with ascending amplitude.

There is no specification on the quality of sound or any other parameter. However, the sound should be repeatable and should be free of abnormal noises and distortion.

TDK45 - UNUSED

TDK46 - Direct Memory Access (DMA) Circuit Test

Note

This concerns internal HP-IB and the High Speed HP-IB tests too!

If the unit under test has DMA circuitry or a DMA HP 98620B (rev B compatible DMA format) then the circuitry will be tested.

There must be 3 circuits present: Internal HP-IB, DMA, and High Speed HP-IB. In order to completely test any of the 3 circuits, all must be present and, if possible, reasonably operational.

The internal HP-IB must be system passive and the HS HP-IB must be system controller. The HS HP-IB cable will be connected to the internal HP-IB.

The DMA test will test only enough functionality of the DMA so that a flag is set to indicate that the DMA passed preliminary setup.

The sequence of tests is: 1) internal HP-IB setup, 2) DMA setup, 3) HS HP-IB setup and combined testing.

There is not much testing that can be done to a stand alone DMA. The HS HP-IB and internal HP-IB need to be functional and present in order to test DMA. Without good support boards, the DMA testing will only include rudimentary testing such as register read/write.

The DMA will do some short byte-wide testing in the HS HP-IB section if 1) the internal HP-IB is bad, or 2) the HS HP-IB cable is not connected to the internal HP-IB.

Actual REAL LIFE testing requires that all 3 electronic sections be operational. A failure in the HS HP-IB test could be caused by a failure in any one of the three devices.

All error messages are prefixed by "DMA".

TDK47 - High Speed HP-IB Test

Revision B or later cards will be tested; testing of a Rev A card will yield a configuration error.

Any number of High Speed boards may be installed and all will receive at least internal loop back testing with DMA. To completely test a card, the HS HP-IB must be: a) the system controller, b) in the high speed mode (config switches), and c) connected to the internal

HP-IB which is NOT system controller. Only one HS HP-IB can be connected to the internal HP-IB at a given time.

Without good support boards, the HS HP-IB testing will include only rudimentary testing such as register read/write.

For cross ref, see TDK46.

All error messages are prefixed by "HS HP-IB SC SS".

TDK48 - HP 98265 SCSI Test

This test is a part of Turn-On mode. It does not require any operator intervention. This test checks most of the registers in the interface and the SDC chip. A manual transfer using the 'diagnose' mode is performed. If the SCSI test hood is connected then the cable, data and control lines are checked before the test is completed. If the SCSI test hood is not present then a programmed transfer and a DMA transfer are done. Because the test checks different parts of the interface with and without the test hood, it is suggested that this test be run both ways for the most complete testing.

Note

The SCSI test hood is p/n 5061-6565.

TDK49 - UNUSED

TDK50 - HP 98248 Floating Point Accelerator Test

This test is a part of Turn-On mode. The Writable Control Store (WCS) and the Map RAM are tested as memory if the HP 98248A/B is being tested. The register file is tested with a bit-isolation test. Bank selection is checked. In the HP 98248A, several micro-code instructions are tested, including most of the ALU and MLU instructions. In the HP 98248B, both 2 and 4 byte displacement commands are tested to exercise the ALU and MLU.

When the passcount is negative and this test is run, the arguments that are used and the micro-code instructions will be output for the HP 98248A. For the HP 98248B, the arguments, result, and command will be output.

TDK51 - HP 98577 VMEbus Test

This test is a part of Turn-On mode. It will execute only on a model 330 or model 350. If no VME is found the test is aborted.

If a VME bus test assembly (98577-66540) is not present in the VME bus, an abbreviated test sequence is performed. The abbreviated sequence includes data path, interrupt handling, and arbitration tests in the Bus Converter Assembly. After these tests are finished, TDK51 looks for the VME bus test assembly. If there is none, the VME test is terminated.

If the test assembly is there, TDK51 proceeds to check DTACK on the test card. It does several tests that check for stuck addresses, data bits or data lines. It also tests the bus interrupt module. Arbitration and bus error, as well as a variety of data transfers, are then tested. Finally, unaligned transfers, address-only cycles, and 'TAS' instructions are tested.

Error and information messages for TDK51 all begin with the words 'VMEbus Sc XX', where XX is the primary select code of the VMEbus translator. If a message requires two lines, the second one begins with an ampersand (&).

TDK52/TDK54 - UNUSED

TDK55 - HP 98556A 2D Graphics Accelerator Test

This test is not part of the Turn-On mode.

This is a psuedo stand alone test for the HP 98556A. The test is imbedded within the video patterns test of TDK34 for quicker access to HP 98556 test routines. See TDK35 and TDK36 for description of tests.

TDK56/TDK59 - UNUSED

Table of Contents

Chapter 1: Test Start-up

Introduction	III-1
Test Capabilities	III-1
Media Description	III-1
Loading the Test Program	III-2
Required Hardware	III-2
Loading Procedure	III-2
Test Termination	III-5
Stop SFTs	III-5
Stop SFTs and Load an Operating System	III-5
Stop SFTs and Retain the Pascal System	III-5

Chapter 2: Test Operation

Mass Storage Tests	III-7
Procedure	III-8
Test Results	III-9
Printer Tests	III-11
Procedure	III-11
Test Output	III-12
Test Results	III-13
Plotter/Graphics Tests	III-14
Procedure	III-14
Test Results	III-17
Graphics Alignment Patterns	III-18
Start-up Procedure	III-19
Pattern Selection	III-20
Digitizer Tests	III-21
Test Procedure	III-21
Test Results	III-24
HP 98710 Graphics Accelerator Test	III-25
Hardware Requirements	III-25
Test Description	III-26
Test Procedure	III-27
Test Results	III-31
HP-HIL Tests	III-33
HP-HIL Menu	III-33
HP-HIL Loop Configuration	III-34

HP 35723A HP-Touchscreen Bezel	III-35
HP 46060A HP Mouse	III-37
HP 46083A Rotary Control Knob	III-40
HP 46084A ID Module	III-43
HP 46085A Control Dials	III-43
HP 46086A Button Box	III-45
HP 46087/8 Digitizers	III-46
HP 46094 Quad Port Devices Test	III-48
HP 92916A Barcode Reader	III-51
Interfaces and Accessory Cards	III-52
The Interface and Accessory Card Menu	III-52
HP 98625A/B High-Speed HP-IB Card Tests	III-53
HP 98635 Floating-Point Math Card Tests	III-56

Test Start-up

Introduction

System Functional Tests check computer/peripheral communication between HP 9000 Series 200 or 300 computers and various supported peripherals connected to the computer's interfaces. The tests are especially helpful for verifying that all devices are connected and working properly when installing a new system, or after relocating, reconfiguring, or repairing an existing system. They are not comprehensive diagnostic tests, and do not necessarily exercise all the capabilities of each peripheral device.

Test Capabilities

System Functional Tests provide an indication that the interface and cabling to a given peripheral device are working correctly. Various operations to and/or from given devices are performed by the computer to determine that data is being handled correctly, either by verifying data electronically or by providing an image that can be visually inspected. While some peripheral device capabilities may not be accessed during the test, if a given device passes the functional test, it is highly probable that all other functions are also working for that device.

These tests supplement the power-up self-test programs contained in the computer's boot ROM (the self-test programs verify computer operation during power-up). Using both sets of tests establishes a high degree of confidence that the system is working correctly and can be expected to provide reliable operation.

Media Description

System Functional Tests are contained on four discs in the Test Tools package. Test discs are identified by their System Functional Test (SFT) number.

- **SFT0** contains the operating system environment used by the test program to access and control the devices being tested as well as the main menu.
- **SFT1, SFT2, SFT3 and SFT4** contains the test program files.

Loading the Test Program

Required Hardware

To run the functional tests, your system must be equipped with at least the following hardware:

- Series 200 or 300 computer with built-in or external monitor and keyboard (HP 98203A/B or HP 46021A). Tests cannot be used with a remote terminal connected to a serial interface configured for remote keyboard operation. At least 512 Kbytes of memory is required.
- 3.5- or 5.25-inch disc drive to match the software disc size. 5.25-inch flexible discs can be used in both internal and external 5.25-inch drives.
- The peripheral to be tested, such as printer, plotter, digitizer, or HP-HIL device.

Loading Procedure

Follow these steps to load the System Functional Tests:

1. Be sure all peripherals are connected to the computer, powered, and ready for use.
2. Insert the disc labelled SFT0 into your disc drive.
3. Perform one of these steps, depending on your computer system:
 - a. If no other operating systems (disc or ROM based) exist in your system, the computer will automatically boot the SFT0 environment disc when it's turned on. In this case, skip to Step 5.
 - b. If other operating systems are present, go on to Step 4.

4. In this step you must perform two sequential actions with three seconds time between them. These actions must be done as described to prevent the boot ROM program from automatically booting an operating system.

The two actions in sequence are:

- a. Turn ON (or cycle power to) the computer.
- b. Wait three seconds, then press any key once.

Go ahead and perform these two actions, then skip to Step 6.

5. Turn ON the computer (or cycle power if the computer is already running).
6. You'll need to do two things:
 - a. Wait for the operating systems and their identifying number and letters to appear in the upper-right-hand section of the display.
 - b. Type the number and letter appearing next to the operating system displayed as `SYSTEM_SF` to start loading the tests.

An example display with several operating systems is shown below. For this example, note the SFT's are identified as 1P.

```
Copyright 1985,
Hewlett-Packard Company.
All Rights Reserved.
BOOTROM Rev. A
MC68020 Processor
Bit Mapped Display
Keyboard
HP-IB
HP98620B
HP98644 at 2
HP98642 at 8
:HP8290X, 706, 0
  1P SYSTEM_SF
:HP7908, 803, 0
  1H SYSTEM_HP-UX
  2P SYSTEM_PASCAL
```

You should press , then to identify the SFTs for booting.

7. System Functional Tests environment will boot, or be loaded. This program runs automatically and displays this opening menu:

System Functional Test Menu		
Selection	Test	SFT Disc

0	Exit Test Program	
1	Mass storage devices	SFT1:
2	Printers	SFT1:
3	Plotters/graphics	SFT1:
4	CRT Alignment Patterns	SFT1:
5	HPIB or HP-HIL Digitizers and 2-Axis HP-HIL Input Devices	SFT2:
6	HP 98710 Graphics Accelerator	SFT2:
7	HP-HIL Menu	SFT3:
8	Interface and Accessory Card Menu	SFT3:

Type Menu Selection, Press [Return]:

- From the SFT Menu right-hand column, identify the SFT disc for the test(s) you want to run.

For example, if you wanted to run a test on an HP-HIL device, note disc SFT3 is the one from the drive and insert the disk labeled SFT3 in the disc drive.
- Remove disc SFT0 from the disc drive and insert the SFT disc identified in Step 8 in the disc drive.
- From the SFT Menu left-hand column, identify the SFT Selection number for the test(s) you want to run.

For example, if you wanted to run a test on an HP-HIL device, the Selection number would be 7.
- Type the test selection number of the test.
- Press **ENTER** or **RETURN**.

Other Chapters in Part III describe how to run the tests and interpret results.

Test Termination

Three methods to stop the tests exist. Each one is for different situations.

Stop SFTs

1. Return to the SFT Main Menu.
2. Press **[0]**, then **RETURN**.

Stop SFTs and Load an Operating System

1. Insert the operating system disc in a connected disc drive.
2. Do one of the following:
 - a. Return to the main menu and Press **[0]**, then **RETURN**, or
 - b. Press **[RESET]** and follow specified booting procedures for the system being loaded.

Stop SFTs and Retain the Pascal System

1. Press the **[STOP]** key.
2. The main command line of Pascal will be displayed. From there, a Pascal File or other program may be run.

Note

System Functional Tests modify the standard Pascal environment. It is recommended that computer be rebooted to set pascal to its standard configuration.

Test Operation

Procedures for running each individual test shown in the opening menu are described in this chapter.

Mass Storage Tests

The mass storage test opening menu lists all disc drives found during power-up. Each drive is listed with its select code and bus address. Do not have more than 15 drives connected at a time during test program operation. If a disc drive is connected but not included in the mass storage opening menu, make sure that it has power applied, is set to the correct bus address, and all cables are connected.

If a drive is identified as one of several models that use similar or identical controllers (such as the HP 9133 and HP 9135), a lowercase "x" is substituted for the variable digit in the model number.

Here is an example mass storage opening menu:

```
                Disc Drive Menu
-----
0      Return to Main Menu
1      HP 9885
2      HP 9895
3      Tape Cartridge
4      Right-Hand Internal
5      Left-Hand Internal
6      CS/80 or SS/80
7      Flexible Disc
8      HP 913x
```

Type Menu Selection, Press [Return]:

Sample Mass Storage Test Menu

Note

The disc drive to be tested must contain a disc that has been initialized in LIF (Logical Interchange Format). System Functional Tests software has no disc initialization capability. For disc initialization procedures, refer to the User's Guide for the language used during normal computer operation.

Procedure

To return to the main menu, type 0, then **ENTER** or **RETURN**.

To test a disc drive, first select the drive to be tested. Be sure the drive is ready for operation, then type the number appearing in the left column of the test menu for that drive and press **ENTER** or **RETURN** to start the test.

During the test, the computer creates and records (writes) a file on the disc, reads it back, compares the recovered data with the original, then removes the file from the disc (cleanup operation). If any operation (write, read, compare or cleanup) fails, a corresponding error message is displayed. Error messages are listed in the Test Results section. If the test passes, this message is displayed below the disc drive menu:

TEST COMPLETE - SUCCESSFUL

When a test ends, you can either select another drive or return to the main menu.

If the disc being tested has been divided into multiple volumes, the test attempts to use the first volume. If no space is available for the temporary test file, it checks the next volume, then continues to other volumes if necessary, until space is available or no more volumes remain.

If adequate file space is found, the test is performed. If no space is available, a *disc full* error message is given. .new

Test Results

If the test successfully runs to completion, **TEST COMPLETE** is displayed. If an error is detected, one of the following error messages results:

WRITE FAILED

Means that the program could not write a file on the target disc or tape. Possible causes include:

- Disc is write-protected.
- Disc drive is not on-line (message: **Off-line/not ready**).
- Disc is defective or no disc is present in drive.
- Disc drive is not connected, or cable or interface is defective.
- Disc is not formatted (initialized) or incorrectly formatted.
- Directory and/or file records on disc cannot be located or read correctly (defective or corrupt disc).

READ FAILED

The file was written by the disc drive, but cannot be read back.

Possible causes include:

- Disc is defective.
- Disc drive is defective.
- Interface or cable may be defective, but this is unlikely because the write operation was completed.

COMPARE FAILED

After data is read back from the disc, it is compared with the original data sent to the disc. If the comparison fails, it is usually due to errors in data transmission between the computer and the disc drive. Comparison errors can be caused by external interference, loose or noisy connectors, intermittent cable, or interface malfunction. Most disc drives have error detection capability, essentially eliminating the possibility that comparison errors are due to faulty disc media or disc read/write electronics.

CLEANUP FAILED

This rare error occurs when the test program is unable to purge the temporary test file. It usually occurs when the disc is removed from the drive being tested before the purge has been completed. It can also occur if power is lost to the drive during cleanup but computer power remains uninterrupted.

UNRECOGNIZED DIRECTORY

This error occurs in conjunction with **WRITE FAILED** when the disc is formatted in a non-LIF format, or the directory is corrupt and cannot be read correctly.

DISC FULL

This error occurs in conjunction with **WRITE FAILED** when the target volume does not have sufficient space available for the file to be written. Two causes are possible:

- Single-volume disc is full and space is not available.
- CS/80 disc has been divided into multiple volumes by the operating system or environment, and the test program cannot find an allocated volume with sufficient space to write the test file.

Printer Tests

Procedure

Verify that the printer is connected to its interface, has paper, and is on-line before starting the test. Verify that printer HP-IB address switches are set correctly.

The printer test prompts for select code and bus address of the printer you want tested. How you respond depends on whether the printer uses an HP-IB or RS-232C interface. The following menu is displayed:

```
Printer Menu
-----
0      Return to Main Menu
1      HP-IB Printer at Default Setting (701)
xyy    HP-IB Printer at Alternate Setting'
        x = Select Code
        yy = Bus Address
x      Serial Printer
        x = Select Code
```

Type Menu Selection, Press [Return]:

HP-IB Printers

If you are testing an HP-IB printer, respond with:

<xx><yy> **ENTER** or **RETURN**

where <xx> is the 1- or 2-digit decimal HP-IB interface select code, and <yy> is the 2-digit HP-IB address of the device being tested (use leading zero if needed). For example, to test a printer on select code 8 (HP 98624 HP-IB interface) at HP-IB address 3, respond to the prompt by typing:

803 **ENTER** or **RETURN**.

RS-232C Printers

If the printer is connected to an RS-232C interface, type the select code of the RS-232C serial interface, then press **ENTER** or **RETURN** to start the test. The interface baud rate, bits-per-character, parity, and handshake switches must be set to match printer expectations.

Test Output

Fourteen 80-character lines of text is printed. Each successive line is shifted one character to the left. The test terminates with a form feed. Here is an example printout:

```
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcde fghijklmnop
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdef ghijklmnopq
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdefg hijklmnopqr
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdefgh ijklmnopqrs
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdefghi jklmnopqrst
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdefghij klmnopqrstu
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdefghijk lmnopqrstuv
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdefghijkl mnopqrstuvw
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdefghijklm nopqrstuvwx
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdefghijklmn opqrstuvwxy
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdefghijklmno pqrstuvwxyz
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdefghijklmnop qrstuvwxyz{
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdefghijklmnopq rstuvwxyz{|
ABCDEFHGHIJKLMNOPQRSTUVWXYZ[\]^_`'abcdefghijklmnopqr stuvwxyz{|}
```

Example of Printer Output

When the printout is complete, the computer displays the printer test menu.

To return to the main menu, press , then or **RETURN**.

Test Results

One or more of the messages can be output to the display:

Text Printed

If you obtained printed text from the test, verify operation by comparing the printout with the sample shown previously. Examine both the character sequences and print quality. Refer to the printer manual when diagnosing print quality problems. If text is scrambled, check cable connections for loose or dirty connectors.

Test Failed

The error message **PRINTER FAILED** indicates the printer did not respond within its allowed time limit. When this happens, the test program displays the message:

****Timeout - fix or press STOP to abort ****

Check the printer to be sure it is not off-line or out of paper. If there is no apparent cause, cycle the printer power switch off for several seconds then back on, and rerun the test.

If you are testing an RS-232C printer, check the Data In/Data Out pin wiring. Pins 2 and 3 may need to be reversed on one connector. Also check baud rate and other configuration options on the interface card.

No Printed Text

If no message appears, and no text was printed, the printer could be disconnected or set to an incorrect HP-IB address. However, in most cases, this occurs when the printer is off-line or out of paper, or when some other error condition prevents it from printing.

If the printer has paper and is on-line, cycle the printer power switch off for several seconds then back on, and rerun the test.

If you are testing an RS-232C printer, check the Data In/Data Out pin wiring. Pins 2 and 3 may need to be reversed on one connector. Also check baud rate and other configuration options on the interface card.

Plotter/Graphics Tests

Procedure

The graphics test can be run on supported HP-IB plotters, or on graphics-display devices. Select the procedure that meets your needs.

Plotters

Before starting the plotter test, be sure the plotter is loaded with paper and pen, and is ready for use. If the plotter was in use prior to running the test, cycle the plotter power switch to clear any error conditions that may remain. Be sure cables are connected and verify the HP-IB address switch setting.

The following menu is displayed:

```
0      Return to Main Menu
1      CRT
2      HPIB Plotter at Default Setting (705)
xyy    HPIB Plotter at Alternate Setting
        x = Select Code
        yy = Bus Address
3      HP 98627 Color Interface Card
        at Default Select Code (28)
x      HP 98627 at Alternate Setting
        x = Select Code
```

Type Menu Selection, Press [Return]:

The frame rate menu for HP 98627 output is:

```
0      US Std
1      Euro Std
2      High Res
```

Type Menu Selection, Press [Return]:

If your plotter is not at the default setting, type:

<xx><yy>|t, then **ENTER** or **RETURN**

where <xx> is the 1- or 2-digit decimal HP-IB interface select code, and <yy> is the 2-digit HP-IB address of the device being tested (use leading zero if needed). For example, to test a plotter on select code 8 (HP 98624 HP-IB interface) at HP-IB address 5, respond to the prompt by typing:

805 **ENTER** or **RETURN**.

When completed the following message is displayed with the plotter menu:

Plotter Test Complete. Press [Return] to Continue

To return to the main menu (before or after the test), type 0, then **ENTER** or **RETURN**.

Graphics Displays

To display graphics on an internal display, respond to the select code prompt with

1 **ENTER** or **RETURN**

For color displays connected to an HP 98627 Color (RGB) Interface not at the default setting, type the select code of the interface followed by **ENTER** or **RETURN**.

To return to the main menu (before or after the test), type 0, then **ENTER** or **RETURN**.

The plotter test selects pen 1 and scales the drawing according to the plotter's **P1** and **P2** settings. Here is a sample output pattern for plotters and displays:

00 MC680X0 processor	20 MC6888X FP co- <i>proc</i>	40 PMMU test
01 ROM test	21 (unused)	41 (unused)
02 System RAM	22 Special Sys RAM	42 HP 98257 (RAS)
03 HP 98546 alpha	23 HP 98546 60Hz disp	43 (unused)
04 Keyboard test	24 HP 98546 50Hz disp	44 Sound test
05 Xtended BBRTClock	25 MMU then PTM	45 (unused)
06 Xtended sys RAM	26 I/O configuration	46 DMA test
07 HP 98546 graphics	27 System CACHE test	47 HiSpeed HP-IB test
08 Xtended HP 98546	28 RS-232 test	48 HP 98265 SCSI test
09 Local Area Net(s)	29 MMU/sys-CACHE/PTM	49 (unused)
10 EPROM blank check	30 MC68020 ICACHE	50 HP 98248 FPA test
11 Program EPROMs	31 HP 98286 (80286)	51 HP 98577 VME test
12 (reserved)	32 Quick system RAM	52 (unused)
13 red error LED off	33 HP 987XX patterns	53 (unused)
14 LAN log toggle	34 HP 985XX patterns	54 (unused)
15 HP-IB log toggle	35 HP 985XX video	55 HP 98556A Test
16 Turn-On Mode	36 Xtended HP 9854X	56 (unused)
17 Exit (re-boot)	37 HP 98700 video	57 (unused)
18 Run once	38 Xtended HP 98700	58 (unused)
19 Loop until RESET	39 Debugger utility	59 (unused)

Arrow keys position pointer. SELECT or RETURN selects a test.
 F1-F4 = run once; F5-F8 = loop until RESET; # keys = K0>K9;
 SHIFT #s = K10>K19; CTRL #s = K20>K29, SHIFT&CTRL #s = K30>K39;
 EXTEND #s = K40>K49; CTRL&EXTEND #s = K50>K59. RESET to erase.

Test Mode

Typical Plotter/Graphics Test Pattern

Test Results

Visually verify the output results against the example shown, allowing for scale alteration by the **P1** and **P2** settings. If you are using a plotter, examine line quality to detect pen wear or other media or device problems. Refer to plotter manual when diagnosing plot quality problems.

If the plotter does not respond to the test, check interface cable connections and HP-IB address switch settings. If other devices connected to the same interface are working, the problem is probably in the plotter itself, or in the cable connecting the plotter to other devices that share the same HP-IB interface.

Graphics Alignment Patterns

Three graphics patterns for monitors are provided by this test option:

- White, pattern-free graphics raster,
- Grid pattern with two concentric circles, and
- Vertical color bars.

To exit the Graphics Alignment Patterns, type 0 **ENTER** or **RETURN**.

The following graphics alignment menu is displayed:

```
          CRT Alignment Menu
-----
0      Return to Main Menu
1      CRT
2      HP 98627 Color Interface Card
        at Default Select Code (28)
x      HP 98627 Color Interface Card
        x = Select Code
```

Type Menu Selection, Press [Return]:

The frame rate menu is:

```
          Frame Rate Menu
-----
0      US Std
1      Europe Std
2      Hi Res
```

Type Menu Selection, Press [Return]:

A pattern menu is displayed as:

Pattern Menu	
0	Return to Main Menu
1	White screen
2	Alignment Grid
3	Color Bars

Type Menu Selection, Press [Return]:

Start-up Procedure

Before the patterns can be displayed, the test program must be set up to match the display device. When the opening menu asks for the display address, respond as follows:

- For internal graphics device, type 1 and press **ENTER** or **RETURN**.
- For 98627 at select code 28, type **2**.
- For external color monitor not at the default settings, type the select code of the color interface card.

After the device address is accepted, the second menu appears with the frame rate options as follows:

- 0 - US STD
- 1 - EURO STD
- 2 - HI RES

Type Menu Selection, Press [Return]:

followed by the prompt:

Enter frame rate: _

Enter the frame rate by performing one of the following:

- To select US STD (U.S. standard rate), press **[ENTER]** or **RETURN** (default) or 0 **[ENTER]** or **RETURN**.
- To select the European standard rate or the high-resolution frame rate, type 1 or 2, respectively, then **[ENTER]** or **RETURN**.

Pattern Selection

The third menu now appears, showing pattern-selection options:

```
0 - RETURN TO MAIN MENU
1 - White Screen
2 - Alignment Grid
3 - Color Bars
```

followed by the prompt:

```
Type Menu selection, press [RETURN]
```

Type the number corresponding to the desired option, then press **[ENTER]** or **RETURN**.

- Press **[0]** to return to the main menu.
- Press **[1]** to select a clear white raster in the graphics display area.
- Press **[2]** to display a grid of squares that contains two concentric circles centered in the graphics frame.
- Press **[3]** to display a series of eight vertical color bars starting with black on the left, followed by white, red, yellow, green, cyan, blue, and magenta progressively toward the right-hand side of the display.

To exit or make the next pattern selection, press **[ENTER]** or **RETURN**, then select the new option.

Digitizer Tests

Test Procedure

Set-up

Before starting, verify the digitizer's HP-IB cable connections and address setting. Be sure the digitizer is powered and ready for use.

Digitizer Address

If your digitizer is not at the default setting, type in:

<xx><yy> , then **[ENTER]** or **RETURN**

where <xx> is the 1- or 2-digit decimal HP-IB interface select code, and <yy> is the 2-digit HP-IB address of the device being tested (use leading zero if needed). For example, to test a graphics tablet on select code 9 (HP 98624 HP-IB Interface) at HP-IB address 3, respond to the prompt by typing:

903, then **[ENTER]** or **RETURN**.

The following menu is displayed:

```
0      Return To Main Menu
1      Knob or Arrow Keys
2      HPHIL Digitizer
3      HPIB Digitizer at Default Setting (704)
xyy    HPIB Digitizer at Alternate Setting
        x = Select Code
        yy = Bus Address
```

Type Menu Selection, Press **[Return]**:

The output device menu is:

- 0 Return to Main Menu
- 1 CRT
- 2 HP 98627 Color Interface Card
at Default Select Code (28)
- x HP 98627 Color Interface Card
x = Select Code

Type Menu Selection, Press [Return]:

A frame rate menu is displayed:

- 0 US STD (default)
- 1 EURO STD
- 2 HI RES

Type Menu Selection, Press [Return]:

Output Device

When the test program prompts for the output device, respond as in the plotter/graphics test. To select the internal display, type:

1, then or **RETURN**

If you are using the HP 98627A Color Interface and external color display, type the interface select code instead.

Press or **RETURN** to start the test.

Test Operation

The test begins by placing a small square in one corner of the display and showing a cursor in the drawing area. To check operation of the digitizer or graphics tablet,

1. Place the digitizer pen point on the digitizing surface and watch the cursor track the pen position as you move the pen on the digitizing surface.
2. Either the digitizer or the keyboard's knob/arrow keys may be used to move the cursor:

- a. When using a digitizer:

To start line drawing, move the pen to a location outside the square, and press down with the pen. Move the pen to a second point outside the square and press down again. The test program then freezes a line between the corresponding points on the display.

- b. When using the knob or arrow keys:

To start line drawing, move the cursor to a location outside the square, and press any letter key. Move the cursor to a second point outside the square and press any letter key. The test program then freezes a line between the corresponding points on the display.

3. To draw additional lines, move the pen from the last point to the next point and press again.
4. To terminate the test, use the pen to move the cursor inside the square, then press. The message **TEST COMPLETE** appears on the display.

Aborting the Test

If the digitizer is not functioning (moving the pen on the digitizing surface does not move the cursor or pressing down does not freeze the selected point on the display), you can press **STOP** on the computer keyboard to terminate the test and return to the opening menu. The message **TEST ABORTED** is displayed as the test terminates.

Test Results

In most cases, you will find that the digitizer works well or not at all. Occasionally you may find that the pen does not freeze a point when depressed, usually due to a bad pen switch or other related cause. If the pen controls the cursor on the display, the digitizer is successfully transferring data to the computer, indicating that the cable and interface are working.

If you get no response, verify cable connections then HP-IB address switch settings. If the address is set incorrectly, you should get a **TEST FAILED** message.

HP 98710 Graphics Accelerator Test

Hardware Requirements

Only Series 300 computers can be used for the HP 98710 Graphics Accelerator Test with the HP 98700 Graphics Display Station. Before running this test, the following hardware should be configured and installed correctly as shown:

- **Series 300 Computer System with at least 1M-byte of RAM.**
- **Supported monitor for the Series 300 Computer.**
- **HP 9854X Video Board for the computer's monitor.**
- **HP 98700 Graphics Display Station, consisting of:**
 - **HP 98710 Graphics Accelerator.**
 - **HP 98287A Graphics Interface installed in backplane or bus expander.**

Configuration Switch 2 on the HP 98287 must have its switches set as follows:

- Bit 3 set to 0 for external Select Code.
- Bit 4 through 8 set to a Select Code that does not conflict with any other interface or accessory select code.
- **Supported monitor for the HP 98700 Graphics Display Station.**

Test Description

Fundamental operation of the HP 98710 Graphics Accelerator in the HP 98700 system is tested. While the monitor associated with the HP 98700/710 is tested somewhat, it can be more thoroughly tested using the CRT Alignment Pattern Test. When using the CRT Alignment Test enter the select code for the HP 98700 as the output device.

The HP 98710 Graphics Accelerator Test is divided into 3 main sections:

- Frame Buffer Test.
- Writable Control Store Test.
- Modules Test.

Frame Buffer Test

Frame Buffer Test is a test of the interface to the frame buffer. Frame Buffer locations are written to and read from. In doing this test, the HP 98700 is tested. A test pattern is displayed on the display station monitor.

Writable Control Store Test

Writable Control Store Test checks the path of getting microcode data into the writable control store.

Modules Test

The Modules Test downloads a series of microcode modules into the transform engine. Each of these modules reports pass/fail information back to the HP 98710 Graphics Accelerator Test program. Modules forming the core of the test are shown in the Modules Test Table.

Modules Test Table

Module	What Is Tested
KERNAL	Micro control store, micro sequencer, condition code selector. Passing this module is required to interpret the results of subsequent modules.
SEQUENCER	A more thorough test of the micro sequencer. Passing this module is also required to interpret the results of subsequent modules.
ALU	Arithmetic and logic functionality of the integer ALU.
PRAM	Pointer RAM.
DRAM	Data RAM.
FPCHIPS	Floating point chips.
SCAN	Arc and line generation, and fast area-fill circuitry to write specific patterns to the frame buffer and read them back. A test pattern is displayed.

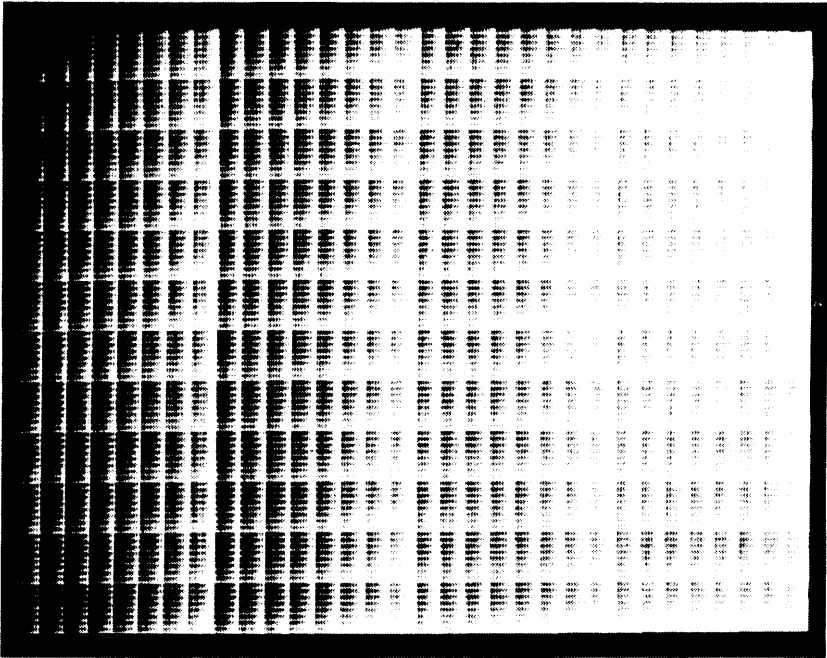
Test Procedure

From the Main Menu level of the System Functional Tests, the HP 98710 Test can be selected. Examples of test displays and messages are provided.

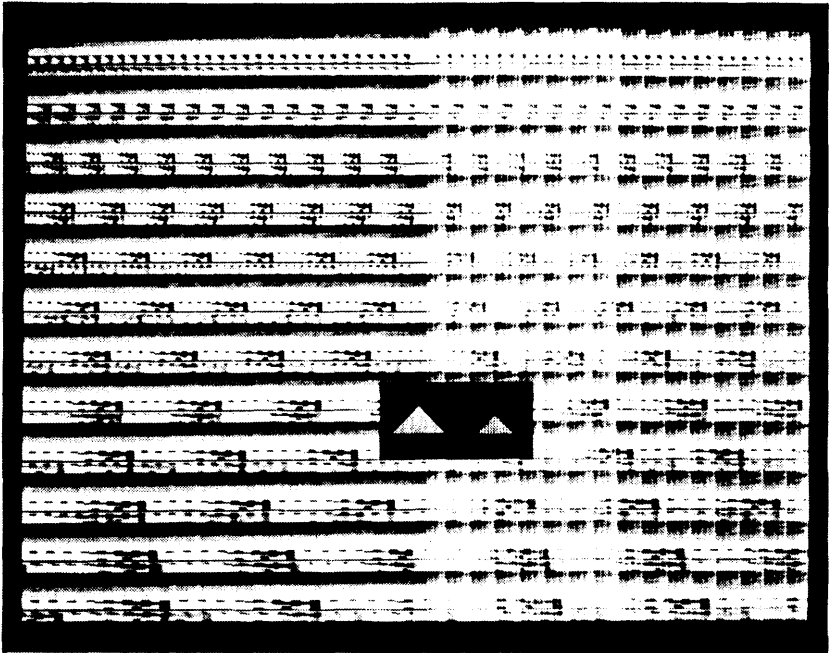
Test Displays

Two test patterns are displayed on the Graphics Display Station's

monitor: Frame Buffer Test Display and the SCAN Test Display. The SCAN Test Display remains for the rest of the test.



Frame Buffer Test Graphics Display Pattern



SCAN Test Graphics Display Pattern

Test Messages

During the test, several information messages are displayed on the computer's monitor. These messages appear in sequence from the top down as specific test actions occur. All messages for a successfully completed test are shown in the display example below.

```
HP 98700 found at select code SC
Starting test on MM-DD-YY at HH:MM.SS. Select code = SC
Self-Test: Begin HP 98700 FRAME BUFFER test
Self-Test: End   FRAME BUFFER test
Self-Test: Begin WRITABLE CONTROL STORE test
Self-Test: End   WRITABLE CONTROL STORE test
Self-Test: Begin KERNAL test
Self-Test: End   KERNAL test
Self-Test: Begin SFT2:SEQ.0 test
Self-Test: End   SFT2:SEQ.0 test
Self-Test: Begin SFT2:ALU.0 test
Self-Test: End   SFT2:ALU.0 test
Self-Test: Begin SFT2:PRAM.0 test
Self-Test: End   SFT2:PRAM.0 test
Self-Test: Begin SFT2:DRAM.0 test
Self-Test: End   SFT2:DRAM.0 test
Self-Test: Begin FPCHIPS.0 test
Self-Test: End   FPCHIPS.0 test
Self-Test: Begin SFT2:SCAN.0 test
Self-Test: End   SFT2:SCAN.0 test
All Valid 98700/98710 Graphics Units Have Tested.
Press [Return] to Continue.
```

In the first two messages:

```
HP 98700 found at select code SC
Starting test on MM-DD-YY at HH:MM.SS. Select code = SC
```

there are letter designators for month-day-year (MM-DD-YY), hour:minute.second (HH:MM.SS), and Select Code (SC). Numbers will be displayed for each of the date and time letter designators.

Although the words "Self-Test" appear in the "Begin" and "End" messages, they are not true self-tests. These tests are RAM based tests loaded from the SFT discs.

Test Results

It can be assumed that the HP 98710 and HP 98287 are tested to about 100% confidence. For the HP 98700, it's about 95%; the one area not extensively tested is the Replacement Rule Register.

If a failure occurs, a **HW FAULT** (hardware fault) message will be displayed between the **Begin** and **End** statements of the test that failed. An example is:

```
Self-Test: Begin SFT2:ALU.0 test
HW FAULT
Self-Test: End   SFT2:ALU.0 test
```

Note which test fails and refer to the Graphics Accelerator Test Troubleshooting Table to determine which assembly is most likely at fault.

The message:

```
All Valid 98700/98710 Graphics Units Have Been Tested.
```

will be displayed at the completion of the test. Note: the word *Valid* means the tests have been completed. *It does not indicate passing or failure of the test.*

On the next page, a troubleshooting table is provided to help you determine what assembly may be the most probable cause of a failed test. Each test performed by the HP 98710 Graphics Accelerator Test program has one or more assemblies listed in descending order of their percentage rate of causing the test to fail. Assemblies with the highest percentage values should be replaced first.

Graphics Accelerator Test Troubleshooting Table

Failing Test	Assy. P/N	Probability of Failure (%)
FRAME BUFFER	98700-66570	40
	98700-66572	40
	98700-66573	5
	98700-66582	5
	98700-66576	5
	98700-66577	5
WRITABLE CONTROL STORE	98700-66577	90
	98700-66570	5
KERNAL	98700-66582	5
	98700-66577	95
SFT2:SEQ.0	98700-66576	5
	98700-66577	95
SFT2:ALU.0	98700-66577	95
SFT2:PRAM.0	98700-66577	95
SFT2:DRAM.0	98700-66577	95
SFT2:FPCHIPS.0	98700-66577	95
SFT2:SCAN.0	98700-66576	95

HP-HIL Tests

System Functional Tests exist for the following HP-HIL devices:

- HP 35723A HP Touchscreen Bezel
- HP 46060A HP Mouse
- HP 46083A Rotary Control Knob
- HP 46084A ID Module
- HP 46085A Control Dials
- HP 46086A Button Box
- HP 46087/8 Digitizer Tablets
- HP 46094A Quad Port Devices
- HP 92916A Barcode Reader

Tests for the HP 92916A Barcode Reader are also explained in its manual and on the back panel of the barcode reader.

HP-HIL Menu

Any of the HP-HIL device tests can be selected from the HP-HIL menu. In addition, the HP-HIL loop configuration can be determined and displayed. Below is the HP-HIL Menu. To select a test to run type the appropriate number and press return.

```

                                HP-HIL Menu
                                -----
0      Return to Main Menu
1      HP-HIL Loop Configuration Report
2      HP 35723A  HP-Touchscreen Bezel
3      HP 46060A  HP Mouse
4      HP 46083A  Rotary Control Knob
5      HP 46084A  ID Module Utility
6      HP 46085A  Control Dials
7      HP 46086A  Button Box
8      HP 46087/8 Digitizers
9      HP 46094A  Quad port Devices:
                    HP 46095A  3-Button Mouse or
                    other 'Quad-format' devices.
10     HP 92916A  Barcode Reader
```

Type Menu Selection, Press [Return]:

HP-HIL Loop Configuration

Only 7 devices can be active on an HP-HIL loop at one time. The first 7 devices found on the loop will appear in the loop configuration display if more than 7 are connected.

An example loop configuration display is shown below. The display you get depends on the actual HP-HIL devices configured in your computer system.

The Following HP-HIL Devices Were Found:

Device	Address
ID Module	1
Keyboard	2
B-Size Digitizer	3
Quad Port	4
ID Module	5
Mouse	6

Press [Return] to Return to HP-HIL Menu

Under the Address heading of the loop configuration display is the HP-HIL Address Code for a particular device. An address code represents the device's physical location on the HP-HIL loop. The device in the loop closest to the computer will have address 1, the next device will be at address 2 and so on up to a maximum of 7. This can be a valuable tool in determining exactly what HP-HIL devices the system sees connected in the loop.

If an HP 92916A Barcode Reader is found in the loop configuration check, it will be listed as a keyboard.

HP 35723A HP-Touchscreen Bezel

After selecting the HP-Touchscreen test you can select which output device the test results will be sent to.

Output Device Menu

-
- | | |
|---|--|
| 0 | Return to HP-HIL Main Menu |
| 1 | CRT |
| 2 | HP 98627 Color Interface Card
at Default Select Code (28) |
| x | HP 98627 Color Interface Card
x = Select Code |

Type Menu Selection, Press [Return]

Frame Rate Selection

If the HP 98627 is selected for output, frame rate must be selected.

Frame Rate Menu

-
- | | |
|---|------------|
| 0 | US Std |
| 1 | Europe Std |
| 2 | Hi Res |

Type Menu Selection, Press [Return]

Note

Some non-linearity in the horizontal direction may exist. This is due to a compressed graphics window used by the Touchscreen test. It does not indicate any defect in the hardware.

HP 46060A HP Mouse

The HP 46060A HP Mouse is a relative positioner and run tests that follow the output format discussed below.

Test Description

After selecting the HP Mouse test you are given the option of selecting which output device to send test results. Options are shown as:

```
                Output Device Menu
-----
0      Return to HP-HIL Main Menu
1      CRT
2      HP 98627 Color Interface Card
        at Default Select Code (28)
x      HP 98627 Color Interface Card
        x = Select Code
```

Type Menu Selection, Press [Return]

If the HP 98627 is used for output, the appropriate frame rate must be selected.

```
                Frame Rate Menu
-----
0      US Std
1      Europe Std
2      Hi Res
```

Type Menu Selection, Press [Return]

After the output device is determined the test pattern below will be displayed.

Locate Cursor in Box or Press [Stop] to exit

```
.....  
:      :  
:      :  
:.....
```

```
  .  
  .  
 . . . .  
  .  
  .
```

Test Results

By moving the Mouse the cursor can be moved about the display. When testing any relative positioner the sensitivity of the device's action can be varied simply by typing any number 1 through 9 on the keyboard, 1 being the least sensitive and 9 the most sensitive (i.e., causes the most travel on the display for a given travel by the relative positioner).

The positioning (or locating) of the cursor is accomplished by a means particular to the individual input device. For the HP 46060A HP Mouse pressing either of the buttons will locate the cursor. The locating process, generally, can indicate the functionality of the particular buttons on the Mouse.

To exit the HP Mouse test, draw a line to the box in the upper-right-hand corner, or press **STOP**.

A sample test output is illustrated on the next page.

HP 46083A Rotary Control Knob

The HP 46083A Rotary Control Knob is classified as a relative positioner and can accept tests that follow the output format discussed below.

Test Description

After selecting the device to test you are given the option of selecting which output device to send test results to, as illustrated below.

Output Device Menu	

0	Return to HP-HIL Main Menu
1	CRT
2	HP 98627 Color Interface Card at Default Select Code (28)
x	HP 98627 Color Interface Card x = Select Code

Type Menu Selection, Press [Return]

If the HP 98627 is used for output, the appropriate frame rate must be selected.

Frame Rate Menu	

0	US Std
1	Europe Std
2	Hi Res

Type Menu Selection, Press [Return]

After the output device is determined the test pattern below will be displayed.

```
Locate Cursor in Box or Press [Stop] to exit  .....
                                                : .....
                                                : .....
                                                : .....
                                                : .....
```

```
    .
    .
. . . . .
    .
    .
```

Test Results

Positioning the cursor is done with the Rotary Control Knob. When testing any relative positioner, the device's sensitivity can be changed by pressing a number key (1 through 9) on the keyboard. **[1]** being the least sensitive and **[9]** the most sensitive (causes the most travel on the display for a given travel by the relative positioner). The positioning of the cursor is accomplished by a means particular to the individual input device.

The HP 46083 Rotary Control Knob and keyboard arrows require the use of the keyboard to locate the cursor. By pressing any key during the test the cursor is positioned and a line drawn (if there was a previous point located).

To exit the Rotary Control Knob test, draw a line to the box in the upper-right-hand corner, or press **[STOP]**.

A sample test output is illustrated on the next page.

HP 46084A ID Module

Test Description

The ID Module test will identify and display the presence of any ID Modules or Exchange Modules on the HP-HIL loop.

Test Results

The Serial Numbers for each individual module will also be printed out. Illustrated below is a typical display for the ID Module test.

ID Serial Number Report

```
-----  
46084A      ID Module      Serial Number: 2519A00057  
46084-69001 Exchange Module Serial Number: 2523A00006
```

HP 46085A Control Dials

Test Description

HP 46085A Control Dials is a 9-knob device used at graphics workstations for input. The individual control dials cannot be tested as a relative positioner like the HP 46085A Rotary Control Knob. A separate test is required. When running the Control Dials test an example output as shown will appear on the display.

Dots will be produced on CRT depending upon the following convention:

Left Knob ==> Produces Dots in Horizontal Direction

Center Knob ==> Produces Dots in Vertical Direction

Right Knob ==> Produces Dots at 45-Degree Angle

To return to HP-HIL Menu press [STOP] key or attempt to create dots off-screen.

Test Results

As each control dial is turned dots will be created on the display as follows:

- Left column of knobs produce dots in the horizontal direction.
- Center column of knobs produce dots in the vertical direction.
- Right column of knobs product dots at a diagonal direction.

To exit the Control Dials test either press the **STOP** key or attempt to create dots off-screen.

While the Control Dials test does not uniquely test individual rows of control dials, it is sufficient for most situations.

HP 46086A Button Box

Test Description

The HP 46085A is a 32-button box used for keyboard-type entry into the computer workstation. Each individual key of the Button Box can be tested using the Button Box test. Instructions in the following display tell you what to do to run the test:

Press individual keys on the 32-Button Box. As each key is pressed "XX" will appear in its corresponding position on the CRT.
To return to HP-HIL Menu press and release the lower-right-hand key, or press the [STOP] key.

Test Results

While pressing individual keys on the Button Box "XX" will appear on the display in a position corresponding to the key's position on the Button Box. If a key's activation does not result in the appropriate display, there is a defect in that particular key.

In the following display example, each button's relative position on the box is indicated by XX. This display will appear below the displayed instructions:

```

                XX    XX    XX    XX
XX    XX    XX    XX    XX    XX
XX    XX    XX    XX    XX    XX
XX    XX    XX    XX    XX    XX
                XX    XX    XX    XX
```

To exit the test either press [stop] or press key in the lower-left-hand corner of the Button Box.

HP 46087/8 Digitizers

Test Description

After selecting the HP Digitizer test you can then select which output device the test results should be sent to.

Output Device Menu

```
-----  
0    Return to HP-HIL Main Menu  
1    CRT  
2    HP 98627 Color Interface Card  
      at Default Select Code (28)  
x    HP 98627 Color Interface Card  
      x = Select Code
```

Type Menu Selection, Press [Return]

If the HP 98627 is selected for output, frame rate must also be selected.

Frame Rate Menu

```
-----  
0    US Std  
1    Europe Std  
2    Hi Res
```

Type Menu Selection, Press [Return]

CAUTION

Before digitizing points on the digitizer, ensure the digitizer is at least 200 mm (8 inches) from the face of the CRT. Otherwise, static electricity may cause errors in digitized points.

A graphics cursor can be positioned on the display by using the pen or the cursor (depending on what is supplied with the individual digitizing tablet). See sample test display on the next page.

Locate Cursor in Box or Press [Stop] to exit

.....
.....
.....
.....

.....
.....
.....
.....

Test Results

By digitizing the various points, a line will be drawn from point to point. Any area of the digitizer which is suspected of being non-functional can be exercised by using this test. This process will verify that the digitizer is fully functional. To exit the Digitizer test draw a line to the box in the upper-right-hand corner or press **[STOP]**. If there is no digitizer connected to the loop the test will display "Device Initialization Failed" and then automatically return to the HP-HIL Menu.

HP 46094 Quad Port Devices Test

HP's Quad Port converts an industry standard quadrature format for relative positioners (joy-stick, mouse, track-ball, ect.) into the HP-HIL format. It allows access to other relative positioners by HP customers. The HP 46094A Quad Port device is classified as a relative positioner and runs tests discussed below.

Test Description

After selecting the device to test you are given the option of which output device to send test results to, as illustrated below.

```
                Output Device Menu
-----
0      Return to HP-HIL Main Menu
1      CRT
2      HP 98627 Color Interface Card
        at Default Select Code (28)
x      HP 98627 Color Interface Card
        x = Select Code
```

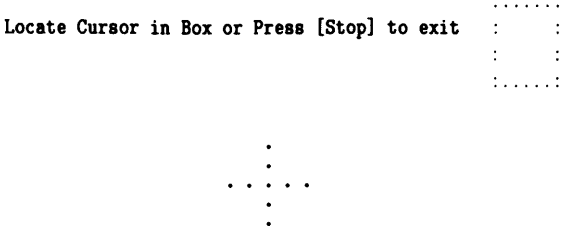
Type Menu Selection, Press [Return]

If the HP 98627 is used for output, the appropriate frame rate must be selected.

```
                Frame Rate Menu
-----
0      US Std
1      Europe Std
2      Hi Res
```

Type Menu Selection, Press [Return]

After the output device is determined the test pattern below will be displayed.



Test Results

Positioning the cursor is done with the Quad Port input device. The positioning of the cursor is accomplished by a means particular to the individual input device. When testing any relative positioner, the device's sensitivity can be changed by pressing a number key (1 through 9) on the keyboard. [1] being the least sensitive and [9] the most sensitive (causes the most travel on the display for a given travel by the relative positioner).

The HP 46095A 3-Button Mouse used with the Quad Port, can locate a cursor when any of its 3 buttons are pressed. The locating process, generally, can indicate the functionality of the particular buttons on a device. By pressing any key during the test the cursor is positioned and a line drawn (if there was a previous point located). A sample test display is shown on the next page.

HP 92916A Barcode Reader

Test Description

The Barcode Reader is tested with the SFT Keyboard Test. As ASCII codes are sent by the reader, its outputs are like a keyboard. In a loop configuration, the barcode reader appears to the computer as a keyboard.

Barcode Reader Test Configuration

Remove the cover from the barcode reader's configuration switches, then set them to the following pattern:

00100000 00100000

If necessary, refer to the readers Instruction Manual (92916-90001).

Test Results

When the reader test is selected, the following display should appear:

Set Configuration Switches on Barcode Reader to:

0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0

Read Barcode Reader Test Message on back of reader.

The correct output is: TEST OK 5

Barcode Reader output ==>

A Barcode Reader Test Message printed on the back of the reader may be referenced to run this test. If desired, another barcode reader may be used as long as it conforms to the configuration switch settings. In general, using the Test Message will be sufficient. The proper output of the reader is TEST OK5 when using its Test Message. Results from this procedure are shown on the next page as they will appear on the display:

Set Configuration Switches on Barcode Reader to:

0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0

Read Barcode Reader Test Message on back of reader.

The correct output is: TEST OK 5

Barcode Reader output ==> TEST OK 5

Press [Return] to Return to HP-HIL Menu

Interfaces and Accessory Cards

The Interface and Accessory Card Menu

When the Interface and Accessory Card Tests are selected from the Main Menu, this display should appear:

```
                I/O Card Test Menu
-----
0      Return to Main Menu
1      HP 98625A/B High-Speed HP-IB
2      HP 98635A Floating-Point Math
```

Type Menu Selection, Press [Return]:

Press to test the HP 98625A/B High-Speed HP-IB cards, or to test the HP 98635A Floating-Point Math Card. Pressing will return the display to the System Functional Test Main Menu.

HP 98625A/B High-Speed HP-IB Card Tests

Hardware Requirements

HP 98625A/B Tests requires an HP 98620A 2-Channel DMA card to be installed in the computer's backplane, not in a bus expander. The HP 98625A/B can be in either the computer or bus expander.

No test hood or external connections are required for the HP 98625A/B Test.

Note

Disconnect the HP-IB cable from the HP 98625 card before testing the card to avoid possible undesired interactions with any mass storage device or other peripheral during the test.

Any valid select code may be used as long as there are no bus conflicts from duplicated select codes or any interrupt level set on the HP 98625 card. Cards set to either fast- or slow-speed can be tested.

Test Description

Up to ten HP 98625A/B High-Speed HP-IB Interface Cards in the system will be identified. Each card found will have its product number and select code displayed. Cards are listed in order of their select codes, as shown in the following example display:

```
Test  HP98625A/B Test Menu
```

```
-----  
0  Return to I/O Card Menu  
1  98625B at 14  
2  98625A at 16  
3  98625B at 18
```

```
Enter test number: _
```

When a test is selected, five tests are performed on the card:

- Register Test
- Interrupt Test
- I/O Loopback Test
- Input DMA Test
- Output DMA Test

The first section of the test checks the card's registers. All registers are written to and read from to insure that there are no 'stuck' bits in the registers.

Next, the ability of the board to send interrupts is tested. Most interrupt conditions are checked to test the operation of the interrupt block.

An I/O Loopback Test checks the ability to do transfers through the High-Speed HP-IB controller chip without DMA transfers.

DMA transfer capability is checked in the last two tests. Input DMA evaluates the ability to transfer data from the card to system memory. Output DMA evaluates the transfer of data from system memory to the High-Speed HP-IB card through the DMA card. Byte-wide DMA transfers are performed for the HP 98625A card. In the HP 98625B test, word-wide DMA transfers are performed.

Test Limitations

HP 98625A/B card tests are not exhaustive. They test the primary functions of the card. Areas not tested are:

- HP-IB transceivers.
- Some interrupt conditions.
- Parallel polling.
- Odd-byte transfers.

Test Procedures

After the HP 98625A/B menu is displayed, perform these steps:

1. Determine the select code of the card you wish to test.
2. Note the number in the **Test** column for the card/select code combination you want to test.
3. Press the number key corresponding to the number in the **Test** column for the card to test.

For example, if the HP 98625A card identified in the previous Test Menu display at select code 16 is to be tested, press **[2]**. Pressing **[0]** will return the test to the Interface and Accessory Card Menu.

HP 98620A 2-Channel DMA Cards may be checked for proper operation with this test. It is a practical way to test the card since the DMA card cannot run independently from the High-Speed HP-IB (or GP-IO) card. This correlation between the DMA and High-Speed HP-IB cards should be kept in mind for troubleshooting purposes.

Note

Neither the HP 98625 or HP 98620A cards are tested to their limits by this test. This test only checks the main functions of the cards and is not intended for performance benchmarking.

Test Results

After a successful running of the HP 98625A/B Test the following results will be displayed.

Passed Register Test
Passed Interrupt Test
Passed I/O Loopback Test
Passed Input DMA Test
Passed Output DMA Test

Press **[Return]** to Return to HP98625A/B Test Menu

If any of the above tests fail the test program will display **Failed Test** instead of **Passed Test**.

To return to the HP 98625A/B Test Menu, press **RETURN**.

Troubleshooting Considerations

If an HP 98625 card is thought to be defective, it may be impossible to boot the System Functional Test through the High-Speed HP-IB card. In this case the internal HP-IB interface should be used for booting the System Functional Tests, then the HP 98625 card can be tested.

If there is a failure in one of the DMA transfer tests (either input or output) the HP 98620A card may be defective. You should test another interface card that uses the HP 98620A, or the HP 98620A can be replaced and the tests repeated. In this way, the problem will be isolated to an individual card.

HP 98635 Floating-Point Math Card Tests

Test Procedures

The floating-point test performs thorough verification tests on the floating-point card. If the card passes the test, all registers and other support functions have been verified, and appear to be functioning correctly. If any function fails to perform as expected, the card fails.

Test Results

If the card passes the test, **TEST COMPLETE** is displayed.

Should no card be found, the following message is displayed:

CARD NOT PRESENT

If the card fails the test, **TEST FAILED** is displayed, and the card should be replaced or repaired. The test does not reveal the nature of the failure or provide diagnostic messages beyond those described here.

Table of Contents

Chapter 1: CS/80 Exerciser

Introduction	IV-1
CS/80 Products	IV-2
Mass Storage Options	IV-3
Interfacing Requirements	IV-4
Optional Accessories	IV-5
Software Requirements	IV-5
Installing Your System	IV-6

Chapter 2: Operating Instructions

Start-up Procedure	IV-9
CS/80 Configuration Table	IV-11
Main Menu	IV-12
Default Parameter Values	IV-13
Main Menu Parameters	IV-13
Main Menu Functions	IV-15
Exiting and Aborting the Program	IV-17
Exerciser Checklist	IV-18

Chapter 3: Demonstration - Testing the HP 7912 Drives

Introduction	IV-19
System Configuration for This Example	IV-19
Getting Started	IV-20
CS/80 Configuration Table	IV-21
Testing the Disc Unit	IV-21
Setting Disc Unit Parameters	IV-21
Disc Unit Exercise Results	IV-23
Testing the Tape Unit	IV-25
Setting Parameters for the Tape Unit	IV-25
Tape Unit Exercise Results	IV-25
New Tape Unit Exercise Results	IV-26

Chapter 4: Interpreting Test Results

Exercise Progress Messages	IV-29
Test Result Report	IV-29
Status Bits	IV-31
Error Codes	IV-34

System Errors	IV-36
I/O Errors	IV-36
Exerciser Error Messages	IV-36

Appendix A

Service Engineer Mode?	IV-37
When to Use Service Engineer Mode	IV-38
How to Run Service Engineer Mode	IV-39
Printing the Logs	IV-40
Clearing the Logs	IV-40
Performing a Read/Write ERT	IV-41
CS/80 Disc Logs and Tables	IV-42
Describe Information	IV-42
Fault Log	IV-45
Run Log	IV-46
ERT Log	IV-48
ROM Revision Numbers	IV-49
Recent Error Summary (Not on HP 7933/7935)	IV-49
Previous Error Summaries (Not on HP 7933/7935)	IV-50
Disc Spare Track Table	IV-50
Head Alignment Offset Table (HP 7933/7935 only)	IV-52
Circumferential Skew Table (HP 7933/7935 only)	IV-53
Current Cylinder Offset Table (HP 7933/7935 only)	IV-54
Pressure and Temperature Information (HP 7933/7935 only)	IV-54
Fault Registers	IV-55
CS/80 Tape Logs and Tables	IV-56
Describe Information	IV-56
Manufacturer's Block	IV-58
Disc Starting Block Address (HP 7914 only)	IV-59
Tape Use Log	IV-59
Tape Spare Table	IV-60
Tape Run-time Log	IV-60
Tape ERT Log	IV-62
Flag Plot	IV-64
Decoding the Error Byte	IV-65
Tape Logs Error Byte ¹	IV-65
Disc Logs Error Byte 1	IV-66
HP 7941 Disc Log Error Byte1	IV-66
Additional Information	IV-67

Appendix B

CS/80 Tape Drive Operation	IV-69
Write Enabling a Tape Cartridge	IV-69
Loading a Tape Cartridge	IV-69
Unloading a Tape Cartridge	IV-69

Appendix C

Using a Remote Console	IV-71
What Is a Remote Console?	IV-71
Special Instructions	IV-72
Limitations	IV-73

CS/80 Exerciser

Introduction

HP CS/80 (Command Set 80) devices connect to Series 200 and 300 computers via an HP-IB¹ interface. All three of these components (the computer, the HP-IB interface, and the CS/80 device) must function properly for reliable data transfers to occur.

The CS/80 Exerciser provides a comprehensive series of tests that detect and report any errors that arise along this data transfer path. The program is menu-driven for simple operation, and requires minimal initialization. Program error messages tell you when to call for service, and may provide information that will help your service representative diagnose the problem. The Exerciser will support up to 20 CS/80 devices configured to a single Series 200 or 300 computer.

If you suspect that data is not flowing accurately between your computer and your CS/80 device, you should determine the source of the error before calling Hewlett-Packard for assistance. Perhaps the problem is simple - an improper connection, for example. Perhaps there is a bug in your program which is causing the problem. In either case, calling for professional service could be an expensive mistake. Instead, run the CS/80 Exerciser first to screen problems and isolate their sources.

¹ HP-IB (Hewlett-Packard Interface Bus) provides compatibility between the computer and external devices conforming to the IEEE

CS/80 Products

CS/80 Exercisers test the following CS/80 products:

Note

Ability to exercise a CS/80 product on a Series 200 or 300 computer does not imply the product is supported. For a list of supported CS/80 products for Series 200 or 300 computers, contact your HP Sales Representative.

- HP 7908 Disc Drive or Integrated Disc/Tape Drive
- 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

Note

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

Two versions of the test programs exist:

- **Flexible Disc Version:** Intended for use on Series 200/300 computers equipped with an internal or external 5 1/4- or 3 1/2-inch flexible disc drive. It is designed to test systems that are not to be used for HP-UX. However, it can test HP-UX systems provided the HP-UX system console is **not** a terminal connected to an RS-232C interface that has its remote keyboard bit **set**.

Requires built-in or external keyboard and CRT display.

It's available in two sizes:

- 3.5-inch (09800-11304).
- 5.25-inch (09800-11604).
- **HP-UX Utilities Version:** Part of the HP-UX Utilities tape included with Series 200/300 HP-UX Operating System software. Requires boot ROM revision 3.0 or later and is intended for use in any Series 200 HP-UX system. This version is not available except as part of the HP-UX software package, and can be used if your computer displays a message similar to:

BOOTROM 3.0 or BOOTROM 4.0

shortly after you turn the power on.

Mass Storage Options

- **Flexible Disc Version:** Requires an external or internal flexible disc drive for loading the exerciser program. Supported external drives include the HP 82901, 82902, 9133A/B, 9135A, 9135A Opt 0101, and 9121S/D.
- **HP-UX Utilities Version:** HP-UX-supported CS/80 disc drive with integral CS/80 cartridge tape drive.

Interfacing Requirements

- **Flexible Disc Version:** Computer must be equipped with built-in keyboard and CRT display or an external keyboard and display connected to the computer through keyboard and composite video interfaces. This version of the exerciser does not support RS-232C interfaces that have the remote keyboard bit set (used for remote system console terminal in HP-UX systems).
- **HP-UX Utilities Version:** System Console must be internal keyboard and CRT, external keyboard and CRT connected through keyboard and composite video interfaces, or supported terminal connected through HP 98626 Serial I/O interface whose remote keyboard jumper has been removed (remote keyboard bit **set**). See Appendix C if you are using a remote terminal as the System Console.
- **Both Versions:** CS/80 drive(s) to be tested must be connected to the computer through an HP 98625 Disc Interface (preferred), an HP 98624 HP-IB Interface, or the internal HP-IB interface.

Optional Accessories

- An external printer: HP 2602A, 2631A/G, 2671, 2671G, 2673A, 2932A, 2934A or 9876A. The printer must be connected to an HP-IB at select code 7, bus address 1.
- Up to 20 CS/80 devices.

Software Requirements

The CS/80 Exerciser is a stand-alone system program (i.e., a system which is booted by the boot ROM) and requires no additional support software.

Important

Do not run this program with any other program or operating system.

Installing Your System

If the CS/80 devices you want to test are not yet connected to your Series 200 computer, follow these directions. Otherwise, proceed to Chapter 2 for operating instructions.

1. Get one of the HP-IB cables (shown below) for each CS/80 device you want to connect.

Cable Length	Product Number
10.5 metres	10833A
1 metre	10833B
2 metres	10833C
4 metres	10833D

2. Connect one end of your HP-IB cable to the HP-IB connector on the back of your computer.

CS/80 devices are connected to your computer via an internal or a plug-in HP-IB interface. If using an HP-IB that is not already installed in your computer, refer to the installation manual that accompanied the interface card for instructions.

Once a snug connection between plug and socket is obtained, screw in the thumb screws to secure the cable.

3. Connect the other end of your HP-IB cable to the HP-IB connector on the back of the CS/80 device.

Once a snug connection between plug and socket is obtained, screw in the thumb screws to secure the cable.

4. Set the HP-IB bus address for the CS/80 device you have just connected. Do this by setting the address switches on the back of your CS/80 device. Refer to the CS/80 disc drive's installation manual for instructions.
5. Verify the disc is initialized.

The Exerciser cannot test disc units that are not initialized. If you have not previously initialized your disc, procedures are explained in the User's Guide for the language you are using (except HP-UX). If you are using HP-UX, see Chapter 2 of the System Administrator's manual for instructions on using the media initialization utility.

To connect additional devices to your computer, attach a cable from the first CS/80 device to the second, and so forth to other devices until all are connected, or until you have reached the limit supported by the interface (only four CS/80 devices can be connected to a given HP 98625 Disc Interface). Set the bus address for each device and initialize the disc, if necessary, as previously explained.

Operating Instructions

2

Start-up Procedure

1. Be sure the computer power switch is OFF, then apply power to all peripherals
2. Ensure the CS/80 devices you want to test are properly connected to the computer through an internal or plug-in HP-IB interface.

The HP 98625 Disc Interface is the preferred interface for CS/80 devices, but others also can be used at a lower performance level.

3. Disconnect all other HP-IB devices from the interface card(s) connected to the CS/80 drive(s) **except**:
 - a. An external printer if it is being used to print test results.
 - b. The disc or tape drive containing the exerciser software disc or tape cartridge.

Removing extra devices and leaving only devices required ensures that a malfunction by other devices on the bus cannot interfere with interaction between the exerciser and the disc drive(s) being tested.

4. Turn ON 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 should 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.

5. Boot the Exerciser program as described for your version of the test:

- a. **Flexible Disc Version:** Turn computer power switch ON. The Exerciser program is loaded automatically.
- b. **HP-UX Utilities Version:** Turn computer power switch ON, then hold space bar down for a few seconds to prevent automatic system loading.
- c. When the boot ROM program is ready to load a system, a message similar to the following appears in the upper right-hand corner of the system console display:

```
:HP7908    TAPE, 1400, 1, 0
|M|M1T    SYSTEM_TB
|M|M1M    SYSTEM_MI
|M|M1E    SYSTEM_EX
```

- d. Type 1E to boot the CS/80 Exerciser.

The program is ready to run when the following copyright statement appears on the screen.

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

```
Command Set 80 (CS/80) Disc Exerciser for
Series 200/300 Computers  Rev [3.0] 6/18/84
```

```
CAUTION-Before re-starting your regular opera-
ting system, switch off and on each device that
was exercised.
```

```
If you are using a printer with this program, it
must be on HP-IB at select code 7, bus address 1.
To continue, press any key.
```

6. Press any key to continue with the test.

The display will show configuration information. An explanation of the configurations is covered in the next section.

CS/80 Configuration Table

First, a CS/80 Configuration Table is displayed. It lists all CS/80 devices connected to your computer. The actual table you see depends on your particular system configuration, but will be like the one shown below:

CS80 Device Available for Test:

Device Number	Select Code	Bus Addr	Type
1	7	6	7908
2	7	7	7912

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. All devices connected via the internal HP-IB will have select code 7; devices connected via a plug-in HP-IB will have a select code dependent upon your particular installation.
- **Bus Address:** This column contains the HP-IB bus address for every CS/80 device in the system. CS/80 bus addresses are restricted to the range 0 thru 7.
- **Device Type:** This column contains the model numbers for all CS/80 devices found in your system.

If one of your CS/80 devices fails to appear in the Configuration

Table, check that the device is turned on and properly connected. If the device still does not appear in the table, the device is probably malfunctioning, i.e., 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 you are going 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. An example Main Menu is:

```
Exercise Parameter and Function Selection
D - Device number to test : 1
U - Unit number to test : 0
V - Volume number to test : 0
O - Output device (Results): CONSOLE:
L - Loop count for test : 1
Y - Long/short Test : Short
C - Service Engineer Mode : 1
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
```

Exerciser programs are indicated by the first seven menu entries.

The last four entries represent available functions. Menu line format is:

```
KEY - DESCRIPTION : VALUE
```

where:

KEY = key to press to change the parameter value or access the function.

DESCRIPTION = description of the parameter or function.

VALUE = value of the parameter (does not appear in function lines).

For example, the line:

```
D - Device number to test : 1
```

tells you that device number 1 in the CS/80 Configuration Table will be tested, and that pressing will provide you with a prompt to change this value to a device number other than 1.

Default Parameter Values

When the Exerciser begins, all parameters are assigned the default values indicated in Main Menu illustration above. The default values have been chosen so that a minimum system configuration (a system containing only one CS/80 device and no printer) can proceed immediately to the test without changing any of the default values.

If these values correctly define your system, or if they represent the device, unit and volume you want to test first, simply press **[E]** to begin the exercise. Then skip to Chapter 4.

If the main menu does not define the drive to be tested, you must change the value of one or more parameters before continuing. The next two sections describe all menu parameters and functions in more detail. Use them as a reference when changing parameter values.

Main Menu Parameters

D - Device number to test: This parameter 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 **[Enter]**.

U - Unit number to test: This parameter specifies the number of the unit (within the specified **device**) to be tested. A CS/80 device contains from 1 to 14 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 **[Enter]**. Valid parameter values are 0 thru 13.

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

O - Output device: This parameter specifies the output device where all test results will be printed. Permissible devices are the computer's screen (**CONSOLE:**) or a printer (**PRINTER:**) connected to an HP-IB at select code 7 on bus address 1. To change the output device, press **[O]**.

L - Loop count for test: This parameter specifies how many times the exercise will be run before the results are displayed. To change the value of this parameter, press , answer the prompt with the new value, then press . The maximum value allowed is 255.

Y - Long/short Test: This parameter 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 to insert an initialized, write-enabled tape cartridge. Load the cartridge and then press to resume the test. For more information on loading and unloading a CS/80 tape drive, see Appendix B, Tape Drive Operation.

Important

The **Long** (error rate) test described above erases data on the tape cartridge you insert. **Do not** insert a tape containing valuable data or programs.

To change the value of this parameter, press .

C - Service Engineer Mode: This parameter specifies the mode of Exerciser operation. This parameter should remain **Off** while testing a CS/80 device. Service Engineer Mode should be **On** only when used by authorized service personnel. Service Engineer Mode provides technical diagnostic information. Appendix A, Service Engineer Mode, describes this portion of the Exerciser.

Important

Service Engineer Mode has capabilities which may erase your disc!

Do not use this mode unless authorized by your service representative.

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. See the following sample table:

```
Units/volumes found within device2:
Unit  Unit type  Volumes
  0     Disc      0
  1     Tape      0  No Tape Installed
To continue hit any key.
```

The column labeled "Unit" gives the unit number for each unit in the device. Enter the unit number as the value of the unit (U) parameter to specify which unit you want to test. "Unit type" indicates whether the unit is a tape or disc drive. The "Volumes" column will always be zero. If the unit is a tape drive and the tape cartridge is not loaded, 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. If this test should fail, an error condition may exist and 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 may be tested.

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

Select code of interface?

Type the select code of the invisible device, in the range of 0 thru 31, and press . Now the bus address prompt appears:

Bus address of Device?

Type the bus address of the device, in the range of 0 thru 7, and press .

Now if you press , the device just identified will appear in the CS/80 Configuration Table. Its device type will be "Unknwn." It is your responsibility to check that the select code and bus address correspond to an actual CS/80 device; the program checks only that the entered values fall within the specified ranges.

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

Exiting and Aborting the Program

This program never exits: it will run continuously until the machine is turned off or **Reset** (**Shift-PAUSE**) is pressed (remote consoles do not have a **Reset** key, so the machine must be turned off to terminate the program). After all passes of an exercise are completed and the test results have been displayed, the program returns to the CS/80 Configuration Table. Pressing any key then advances the program to the Main Menu, and the Exerciser is then ready for a new test.

When finished with the Exerciser, you can return to the boot ROM to select another system by pressing **Reset**, or by turning the computer's power off and then on again (in the case of a remote console).

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 you are loading. To ensure the device is returned to its "operational state," turn each CS/80 device you tested OFF, and then ON again before using it.

You can abort the test in progress at anytime by pressing **Stop**. 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 represent the true state of the device under test.

Note

The 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 to change it.
 - Press to get the CS/80 Configuration Table.
 - Press to define an unknown device.
- Is the unit number correct?
 - Press to change it.
 - Press to get the table of units and volumes.
- Is the output device correct?
 - Press to change it.
- How many times do you want to run the test?
 - Press to change the loop count.
- If testing a tape unit, do you want the long or short test?
 - Press to change the current setting.
- Make sure Service Engineer Mode is **OFF** and Press to begin.

Demonstration- Testing the HP 7912 Drives

3

Introduction

A demonstration of exercising both disc and tape units of an HP 7912 is described in this example. Test results will be printed on an external printer. The disc unit will be exercised five times.

The tape unit will be exercised once, and a long test will be run. See Chapter 4 for an explanation of test output.

System Configuration for This Example

- Model 236 with 262 144 (256K) bytes of memory.
- HP 7908 Integrated Disc/Tape Drive connected to the internal HP-IB on bus address 6. Each unit has only one volume.
- HP 7912 Integrated Disc/Tape Drive connected to the internal HP-IB on bus address 7. Each unit has only one volume.
- An HP 2673A printer connected to the internal HP-IB (select code 7) on bus address 1.

Getting Started

1. Turn the computer OFF.
2. Insert the CS/80 Exerciser program disc into the right internal drive and close the door.
3. Turn the computer ON to boot the exerciser from the disc.

The copyright statement appears on the screen as shown below:

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

```
Command Set 80 (CS/80) Disc Exerciser for
Series 200/300 Computers Rev [3.0] 6/18/84
```

```
CAUTION-Before re-starting your regular opera-
ting system, switch off and on each device that
was exercised.
```

```
If you are using a printer with this program, it
must be on HP-IB at select code 7, bus address 1.
To continue, hit any key.
```

3. Press any key to continue.

CS/80 Configuration Table

A CS/80 Configuration Table for this system (shown below) now appears on the screen. In this example, only the HP 7912 will be exercised. Note that this is device number 2 in the table.

CS80 Device Available for Test:

Device Number	Select Code	Bus Addr	Type
1	7	6	7908
2	7	7	7912

Press any key to proceed to the Main Menu.

Testing the Disc Unit

Setting Disc Unit Parameters

Verify all parameters in the Main Menu are set correctly. The Main Menu is displayed as:

Exercise Parameter and Function Selection

```
D - Device number to test : 1
U - Unit number to test   : 0
V - Volume number to test : 0
O - Output device (Results): CONSOLE:
L - Loop count for test   : 1
Y - Long/short Test       : Short
C - Service Engineer Mode : 1
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 change an exercise parameter or select a function, type the first letter on the item's line:

Should a parameter on your display not be correct, follow these steps to set the parameters for the disc unit:

1. The device number is set to 1 (HP 7908). To set the device to the HP 7912, press **[D]** and type 2 **[Enter]** in response to the prompt.
2. The unit number is set to 0. Type **[U]** to get the following display of units and volumes on device 2:

```
Units/volumes found within device2:
Unit   Unit type   Volumes
  0     Disc       0
  1     Tape       0   No Tape Installed
To continue hit any key.
```

The disc unit (unit 0) will be exercised first. The unit parameter is already set to 0 so no further action is needed. Press any key to return to the Main Menu.

3. The output device is set to CONSOLE (the computer's screen). A hard copy of the output is needed, so this must be changed to PRINTER.

Press **[O]** to make the change.

4. The test is currently set to run one time. Change the loop count to five by pressing **[L]** and typing 5 **[Enter]** in response to the prompt.

Since a disc unit is being tested, the Long/short Test parameter is ignored.

5. All parameters are now set. Service Engineer Mode is Off. Press **[E]** to begin the exercise.

Disc Unit Exercise Results

Computer Display 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

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, 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. Refer to your language manuals or System Administrator’s Manual for more information on initializing media.

Testing the Tape Unit

Setting Parameters for the Tape Unit

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

1. Device number is 2 (7912). Correct.
2. Unit number is set to 0 (disc unit). Change the unit number to 1 (tape unit) by pressing **[U]** and typing 1 **[Enter]** in response to the prompt.
3. Output is set to PRINTER. Correct.
4. The loop count is set to 5. Change this to 1 by pressing **[L]** and typing 1 **[Enter]** in response to the prompt.
5. The Long/Short Test parameter is set to Short. Press **[Y]** to change this value to Long.
6. All parameters are set. Service Engineer Mode is Off. Press **[E]** to begin the exercise.

Tape Unit Exercise Results

Computer Display 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.
```

Inserted tape cartridge and press a key.

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

Printer Output

Test Results Report

Error code: 160 was reported
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 test.

Explanation of Tape Results

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

The power failure error was randomly generated and thus cannot be controlled. This same error will probably not recur if the test is re-run.

The second error can be corrected by simply running the tape through an initialization procedure.

After referring to the language manual, the tape cartridge was initialized. The test was then re-run. The results of this new test are reproduced below.

New Tape Unit Exercise Results

Computer Display Output

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

[Inserted the new initialized tape cartridge and press a key]

Printer Output

Test Result Report

Status bits set: none

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

Explanation of New Tape Results

No errors were reported on this pass. Note that both problems reported in the first pass were easily removed without the help of professional service. The expense of a service call was thus saved. Had real hardware failures been found, the Exerciser would have told you to call your service representative for assistance.

Interpreting Test Results

Exercise Progress Messages

During an exercise, messages regarding the exercise's progress are printed on your computer's screen. These messages may include 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 will either tell you that the tests have passed, or it will provide details on the errors that were found. If professional service is warranted, you will be told to call your service representative for assistance. Otherwise, instructions are given for correcting the problem yourself.

A Test Result Report will appear on the output device specified by the output (O) parameter. If the computer screen is the output device, you must press a key after the tests are finished to display the Test Result Report.

Five items of error information may appear in the Test Result Report:

- Status bits set
- Error codes
- System error messages
- I/O error messages
- Exerciser error messages

Exerciser error messages are designed for the computer user. They provide an easy-to-understand description of the problem and assume little or no knowledge of CS/80 operation. The proper corrective action is clearly stated.

The other four error messages are intended to help service personnel isolate the source of the problem. Training in CS/80 operation and architecture is assumed.

In the following sections, each type of error message is explained in more 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.

Status Bits

Each CS/80 device contains internal status bits that flag errors.

Each bit represents a different type of error. Whenever a bit is “set”, the error which the bit represents has occurred.

Status bits that are set during the exercise are listed in the Test Result Report with the following message: **Status bits set:**. Set bits are listed after the colon; if no bits were set, the word **none** will appear. The table below 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.

Status Bit Error Type

- 22 Unit fault: A hardware 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).
- 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.

Status Bit	Error Type
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 will appear in the Test-Result Report:

An error code of **X** was reported.

The **x** above represents the error code number. Look up the error code in the table below to find the test that failed.

Error Number	Test or Function
10	System I/O Test
20	Cancel
40	Read Loopback
50	Write Loopback
60	Internal Diagnostic
70	Set Unit
80	Describe
90	Read Disc Run Log
110	Uncorrectable Rate
130	Clear ERT Log
140	Disc Read-Only ERT
150	Read Disc ERT Log
160	Clear ERT Log
170	Read-Only ERT (FV)
180	Read Disc ERT Log
200	Uncorrectable Rate
220	Clear ERT Log
230	Partial Disc RO ERT
240	Read Disc ERT Log

Error Number	Test or Function
270	Interleave Table
280	Interleave Value
290	Clear ERT Log
300	WTR Tape FV ERT
305	WTR Disc FV ERT
310	Read Tape ERT Log
320	System Test
1000	Amigo Clear
2000	Read Fault Log
3000	Read Tape Run Log
4000	Read Sensors
4100	Read Revision Number
4200	Read Error Summary
5000	Read Drive Tables
6000	Read Use Log
7000	Flag Plot Error
8000	Final Unit Status

Abbreviations used in this table are:

Abbr.	Meaning
ERT	Error Rate Test
WTR	Write Then Read
FV	Full Volume
RO	Read Only.

System Errors

Two Pascal run-time error messages may occur during execution of the Exerciser. When a system error occurs, the message:

A system error of **X** was reported.

will appear in the Test Results Report. The **x** represents the number of the error message. Error messages and their meaning are:

Error Number	Meaning
-2	Not enough memory
-26	Error in I/O subsystem.

If a system error different from these two is reported, the Exerciser program is probably at fault. In such cases, re-run the tests. If the same system error recurs, call your HP Service Office for assistance.

An exhaustive list Pascal System Errors may be found in the *Pascal Language System User's Manual*.

I/O Errors

I/O error messages appear in the Test Result Report in the following form:

I/O error: **desc**
was reported

A prose description of the errors appears where **desc** appears in the error message. I/O errors are not directly related to the exercise and may or may not require repair.

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.

Appendix

Service Engineer Mode?

Service Engineer Mode provides access to a great deal of diagnostic information and is intended for qualified service personnel only.

Most (if not all) of 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 trained service person. Improper or uninformed use of Service Engineer Mode may result in the loss of the entire contents of your CS/80 disc!**

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. Because infrequent random errors are bound to occur during the life of a device, the error logs alone are usually not sufficient to diagnose a hardware problem. They should be considered only **in conjunction** with other exercise error messages to draw conclusions about the state of a device. 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 Service Engineer Mode

Your service representative will 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 of diagnostic information.

When you call your service representative to report a problem, he may authorize you to enter Service Engineer Mode so you can read certain portions of the logs to him. This way, he can make a preliminary diagnosis over the phone and bring the proper equipment with him on a service call. Follow his directions **carefully**.

How to Run Service Engineer Mode

To enter Service Engineer Mode, simply press the **C** key in the Main Menu. The display then changes as shown in the following diagram:

Exercise Parameter and Function Selection:

```
Exercise Parameter and Function Selection
D - Device number to test   :    1
U - Unit number to test    :    0
V - Volume number to test   :    0
O - Output device (Results): CONSOLE:
L - Loop count for test     :    1
Y - Long/short Test        : Short
C - Service Engineer Mode   :    1
X - Do Test or display Logs: Test
Q - Clear all logs on selected unit
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 change an exercise parameter or select a function, type the first letter on the item's line:

Notice the three new functions that are available:

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

These keys are made available only in Service Engineer Mode because they contain highly-technical diagnostic information or permit potentially dangerous operations on the disc. Each of these functions is briefly described below:

X - Do Test or display Logs When you press the **X** key, this parameter toggles between **Test** and **Logs**. When the parameter is set to **Test**, the exerciser behaves as if in normal mode: exercising the specified device and reporting the results.

When the parameter is switched to **Logs**, the internal error logs and tables of the specified device are listed.

Q - Clear all logs on selected unit When **[Q]** is pressed all of the internal error logs of the specified device are erased. This is normally done by an authorized service representative after the device has been repaired. This way, the device is given a “clean slate”: all errors recorded prior to the repair are cleared.

W - Write allowed on disc Pressing **[W]** allows you to perform a read/write error rate test on the specified disc. This test is generally used as a last resort and only after the disc has been properly backed up. **This key enables the exerciser to erase the entire contents of the disc.**

Printing the Logs

To print the error logs of a particular device, follow these steps:

1. Press **[C]** to switch Service Engineer Mode to **On**.
2. Press **[X]** to switch the Test/Logs Mode to **Logs**.
3. Set all other parameters as usual to specify the desired device and unit.
4. Press **[E]** to begin printing the error logs.

Clearing the Logs

Choosing the “**Q**” command enables the exerciser to clear 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, when the past diagnostic records have no further value.

To clear the internal error logs of a CS/80 device, follow this procedure:

1. Press **[C]** to switch Service Engineer Mode to on.
2. Set all parameters as usual to specify the desired device and unit.
3. Press **[Q]** to indicate readiness to clear the logs.
4. Read the warning on the screen. If you decide to go ahead with the log-clearing operation, press **[S]** to begin. To retreat, press any other key.

Performing a Read/Write ERT

If the "W" parameter is set to **yes** and **[E]** is pressed, the exerciser will perform a write-then-read error-rate test, instead of a read-only error-rate test. **All information stored on the unit specified by the other parameters 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 you decide a Read/Write ERT is necessary, follow this procedure:

1. **Perform a verified backup of the disc to be tested.**
2. Press **[C]** to switch Service Engineer Mode to on.
3. Set all parameters as usual to specify the desired device and unit.
4. Press **[W]** to allow writing on disc.
5. Read the warning on the screen. To proceed with the Read/Write ERT, press **[S]**. To retreat, press any other key.
6. Press **[E]** to begin the test.

Note

Note The “W” command has no effect on tape units. All tape units automatically use a write-then-read error rate test.

CS/80 Disc Logs and Tables

Disc error-logging is divided into the following sections:

- Describe Information
- Fault 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 sections is described in the following sections.

Describe Information

A table, Describe Information, provides identifying characteristics of the device. Values shown in the examples on the next page are read from the disc, rather than measured. An understanding of disc organization is required to understand most of the entries.

Logs, Tables, and Status - Unit: 0

Describe Information

Installed Unit Bytes	Max instantaneous Xfer Rate	Controller Type		
10000000000000001	1250	0		
Device Type	Device Number	Bytes per Block	Blocks which can be buffered	
1	079350	256	16	
Recomded Burst Size	Block Time	Cont Avg Xfr Rate	Optimal Retry Time	
0	240	930	80	
Access Time Parameter	Max Inter-leave Fct.	----Volume Fixed	Bytes----- 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 Kbytes/second.

Controller Type indicates the type of controller installed in the device. Possible values are:

- 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 are:

- 0 - 6 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.

Blocks which can be buffered gives the amount of RAM space, measured in blocks, that resides inside the controller. To maximize performance, blocks of data larger than this amount should not be requested.

Recommended Burst Size is the recommended number of 256-byte segments in each burst. A zero here indicates bursting is not recommended.

Block Time is the time from the beginning of one block to the beginning of the next block, measured in microseconds.

Cont Avg Xfr Rate is time needed to transfer a full volume of the disc divided by the number of bytes in the volume.

Optimal Retry Time is the time required to perform read retries for error recovery, measured in tenths of a millisecond.

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

Maximum Interleave Factor gives the maximum spacing (interleave) allowed between logical blocks.

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 simply gives the maximum legal address for the disc. The maximum address is expressed in two ways, giving both the cylinder, head and sector address, and the single vector address. (The single vector address is a sequential, linear expression of the disc address space, beginning with address 0.)

Current Interleave gives the current distance between logical sectors on the disc.

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 logs have been recorded on the disc, the message:

No Fault Log Entries

will be displayed.

The fault log of an HP 7912 disc drive is shown below.

Derror/ Error Num	Logical Addresses						UProc	
	-- Current --			-- Target --			Fault	
	Cln dr	Hd	Sctr	Cln dr	Hd	Sctr	Register	Type
33	32768	1	27	32768	1	27	NA	TERR
33	32768	1	27	32768	1	27	NA	TERR
229	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
32	32768	1	27	32768	1	27	NA	TERR
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							
	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 refer to the locations in the disc address space which were being accessed when an error was detected. "Current" refers to the cylinder, head and sector which was last accessed. "Target" refers to the cylinder, head and sector which the device was trying to access when the error occurred.

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 printed in this column.

Derror/Terror identifies the types of errors that have 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; thus a disc address does not apply.

Run Log

The Run log stores all data errors occurring during normal disc operation (i.e., anytime a test, diagnostic or utility was **not** being run). Run Log entries are concerned with the reading and writing of data, as opposed to the Fault Log which records disc drive system failures. Examples are on the next page.

Run Log of an HP 7912 Disc Unit

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	6	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 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.

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

Error	Logical	Logical	Logical	Occurrence
Byte	Cylinder	Head	Sector	Count

	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 appendix.

ROM Revision Numbers

The ROM Revision Numbers give the revision numbers of the disc's control ROMs (firmware). Example ROM Revision Numbers of an HP 7908 disc drive are given below.

Rom Revision Numbers:

1- 2 1- 3 1- 1 1- 2 1- 0 15- 1

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 which occurred are listed. If no TERRORs were reported in the last ERT test, "None" is displayed. See the service manual for the device under test for an explanation of any TERRORs reported.

An example Recent Error Summary from an HP 7908 disc drive is shown below.

TERROR's listed in recent error summary

None

Previous Error Summaries (Not on HP 7933/7935)

The four Previous Error Summaries give the results from the four self-tests that were run before the most recent one. The Recent Error Summaries from an HP 7908 disc drive are given below. See the service manual for the device under test for an explanation of any TERRORS reported.

TERROR's listed in recent error summary #1
33

TERROR's listed in recent error summary #2
34

TERROR's listed in recent error summary #3
34

TERROR's listed in recent error summary #4
None

Disc Spare Track Table

The Disc Spare Track Table provides a record of all sparing operations, broken down by head. The number of spare operations, the number of spare tracks used, and the number of spared logical tracks are given for each head.

An example Spare Track Table for an HP 7908 disc drive is given below.

Disc Spare Track Table

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

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

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

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

Head No	Spare Operations	Spare Tracks Used	Logical 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 tells you how many sparing operations have been performed on the head's disc surface. This is the number of bad sectors that have been found on this surface. In the sample table shown, ten sector sparing operations have been performed on head 4.

Spare Tracks Used tells you how many spare tracks were required in 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 on its disc's tracks (horizontal alignment).

An example Head Alignment Table for an HP 7935 disc drive is given below:

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 of greater than 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).

The Circumferential Skew Table for an HP 7935 disc drive is shown below.

Circumferential Skew Table:

Head No	Band 0	Delta 0-1	Band 1	Delta 1-2	Band 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

An example Circumferential Skew Table appears in the same form 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, thus this table is not used a great deal.

A potential problem should be suspected if the values in this table exceed 25 counts, although this 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, a rail alignment problem should be suspected. If there is no data error problem, then no rail alignment action should be taken; otherwise pursue rail alignment as a possible source of the error.

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 because, in an operating system, the cylinder will most probably change between the time it is specified and the time the table is read.

Pressure and Temperature Information (HP 7933/7935 only)

The HP 7933 and HP 7935 devices 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---		-----Temperature-----	
Blower	Filter	Exhaust Air	Actuator Coil
OK	OK	24	35

If there is a problem with the blower or filter pressure, "BAD" will appear in the table in place of "OK." Temperatures indicate the performance of the disc: hotter temperatures degrade disc access time. The disc monitors these temperatures and will shut down 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
0000001	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

The fault registers of an HP 7935 disc drive is shown below.

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

CS/80 Tape Logs and Tables

Tape error logging is divided into the following sections:

- 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

The Describe Information for a tape drive has a format identical to a disc drive's Describe Information, although not all of the column headings apply. For example, the Cylinder, Head and Sector columns don't apply to a tape, so 0 is entered for these parameters. Here is a typical 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	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	0	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 and 15 are installed.

Max instantaneous Xfer Rate is the maximum rate at which data can be transferred across the bus, measured in Kbytes/second.

Controller Type indicates the type of controller installed in the device. Possible values are:

- 0 - Integrated single-unit controller
- 1 - Integrated multi-unit
- 2 - Integrated multi-port controller

Device Type tells what type of device is being described. Possible values are:

- 0 - 6 disc unit
- 1 - removable disc or combination
- 2 - tape unit.

Device Number is 079080 or 091440 for all CS/80 tape units.

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

Blocks which can be buffered gives the amount of RAM space, measured in blocks, that resides inside the controller. To maximize performance, blocks of data larger than this amount should not be requested.

Recomded Burst Size is the recommended number of 256 byte segments in each burst. A zero here indicates bursting is not recommended.

Block Time is the time from the beginning of one block to the beginning of the next block, measured in microseconds.

Cont Avg Xfr Rate is time needed to transfer a full volume of the disc divided by the number of bytes in the volume.

Optimal Retry Time is the time required to perform read retries for error recovery, measured in tenths of a millisecond.

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

Maximum Interleave Factor does not apply to tape units and is, therefore, always 0.

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 7 is present.

Maximum Addresses does not apply to a tape unit, and is, therefore, always 0.

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 you have inserted in the drive. The block is decoded 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 copyright notice for the tape.

Fourth Line: gives the manufacturer's control code and data code of tape.

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 the 7914's disc exceeds 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 where it retrieved its information from. When the backed-up information on a tape is ready to be rewritten onto the disc, the 7914 can read the disc starting block address from the tape cartridge and determine where on the disc the information belongs.

A sample Disc Starting Block Address for an HP 7914 is shown below.

Disc starting block address 0

Tape Use Log

The Tape Use Log indicates the number of blocks that have been accessed over the life of the tape, and the number of autoloads (number of time the tape has been loaded) that have been performed.

Here is a typical Tape Use Log for a tape drive:

Tape Use Log:

Number of autoloads: 37

Number of blocks accessed: 6.25E+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 found bad and was replaced by a spare block.

Tape Run-time Log

The Run-time log contains only run-time errors. An example tape run-time log of a tape unit appears below.

Tape runtime log		
Uncorrectable	Unlocatable	Certification
Errors	Errors	Type
1	1	On-line

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 the error correction scheme could not correct.

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` will appear if a tape is certified by the factory. If a tape is not certified, `Not cert` will appear.

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 appendix.

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

Tape ERT Log

The ERT log contains only errors that occurred during an error-rate test. The tape ERT log of a tape unit appears below.

Blocks	Errors			
Accessed	Perman-	Transi-	Uncorrect-	Unlocat-
	ent	ent	able	able
-1.1E+009	36	626	0	0

Logical Block	Error	Other
Address	Byte	Information
49120	00000000	
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	
5111	00010000	
5313	00000100	
7172	00011000	
7173	00000100	
7426	00000100	
8419	00000001	
8910	00000010	
9204	00000010	
10627	00000100	
14297	00000010	
14823	00010000	

The first table of the log summarizes the number of blocks accessed, the number of permanent errors found, the number of uncorrectable errors found, 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 unit's error correction scheme.

Unlocatable Errors are blocks that cannot be found due to an unreadable 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 appendix.

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

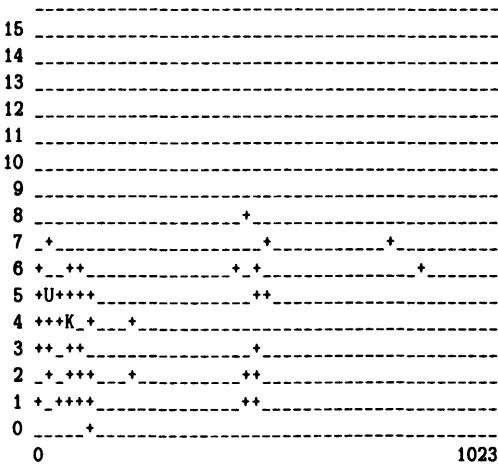
Flag Plot

The flag plot of the preceding ERT log shows a visual map of 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. This way, you can estimate the track and block where each error occurred.

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 unit:



Decoding the Error Byte

The error byte found in the ERT and run logs is decoded below. This information is found in no other documentation.

Tape Logs Error Byte¹

- 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 7941 decoding is explained in 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)

HP 7941 Disc Log Error Byte1

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

More detailed accounts of CS/80 internal error logs can be found in the following manuals:

HP 7911/7912 section of the *CE Handbook*, part number 07912-90905.

HP 7908 section of the *CE Handbook* part number 07908-90905.

HP 7933 section of the *CE Handbook*, part number 07933-90905.

CS/80 general section of the *CE Handbook*, part number 5957-4227.

Service Manual for the HP 7911/7912, part number 07912-90903.

Service Manual for the HP 7908, part number 07908-90903.

Service Manual for the HP 7933, part number 07933-90903.

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

Appendix

CS/80 Tape Drive Operation

Write Enabling a Tape Cartridge

Before running a full-volume tape error rate test, the tape cartridge used in the test must be write enabled. To write enable a tape, turn the screw in the upper-left corner of the cartridge until the arrow points away from the SAFE mark. See the diagram below.

Loading a Tape Cartridge

1. Insert the tape cartridge with the label side up into the tape drive.
 2. When the busy light goes off, the cartridge is loaded and ready for use.
-

Unloading a Tape Cartridge

1. Press the UNLOAD button. The busy light will then come on.
2. Wait for the busy light to go off and the buzzer to sound.
3. Pull the tape release lever to the right to eject the cartridge from the drive.

Note

If you are unable to remove the tape cartridge due to tape drive failure, press **Stop** to about the test in progress. Then turn the CS/80 device OFF and ON, and retry the tape unloading procedure.

Appendix

Using a Remote Console

What Is a Remote Console?

A remote console is a terminal that is used as the primary control access to a Series 200 HP-UX computer, usually when the computer does not have a built-in keyboard and CRT display. The terminal is connected through an RS-232C interface that has the remote keyboard bit set. For example, on the HP 98626 Serial Interface card, the remote bit is set by cutting a jumper on the interface. A switch on the HP 98628 selects the remote keyboard option (refer to the console interface installation manual for instructions on how to set the remote keyboard bit); however, the HP 98628 Datacomm Interface is not supported by Boot ROM 4.0 or any earlier versions.¹

¹ While the HP 98628 Datacomm Interface cannot be used with the boot ROM, it can be used with the remote System Console in HP-UX systems once the system is installed and configured. However, when the datacomm interface is used in an HP-UX system instead of an HP 98626 Serial Interface, boot ROM messages cannot be sent to the System Console. In normal operation, this is not a problem. To boot the CS/80 Exerciser while using a remote console, you must use a CS/80 tape cartridge version of the Exerciser (HP-UX Utilities tape part number 98670-10035 or 98680-10035).

Special Instructions

Instructions for using a remote console with your computer are included in the computer installation manual. The following points are especially important when using the CS/80 Exerciser:

- The baud rate on the RS-232C interface and remote console terminal **must** be identical.
- Parity settings on the interface and terminal must be identical.
- Set Transmit Pace on the terminal to Xon/Xoff.
- Set Receive Pace on the terminal to Xon/Xoff.

If your computer's boot ROM is revision 3.0 or earlier, HP 2642B terminals and computers running a Block-mode Terminal Emulator will probably garble printed messages from the boot ROM to the terminal display when operating at 9600 baud. The problem can be eliminated by reducing the baud rate to 4800. This problem was corrected in Boot ROM 4.0, so if your computer has the later version boot ROM, you should be able to operate at 9600 baud without difficulty. You can identify which boot ROM version you have from the printed message on the CRT display during power-up, which should resemble one of the following examples (some boot ROM versions prior to 3.0 do not display the version during power-up):

`BOOTROM 3.0` or `BOOTROM 4.0`

Note that while boot ROM messages may be garbled, messages from the exerciser to the terminal should be displayed clearly, independent of the boot ROM version.

If these settings are correct, boot ROM messages similar to these should appear on the screen when the computer is turned on:

```
Copyright 1982                               :HP 7908
Tape,
705, 1, 0
Hewlett-Packard Company,                     1M
SYSTEM_Mi
All Rights Reserved.                         1T
SYSTEM_TB
BOOTROM 3.0                                  1E
SYSTEM_EX
Keyboard
Graphics
HP-IB
HP98620
HP98625 at 14
1834848 Bytes
```

```
SEARCHING FOR A SYSTEM (ENTER To Pause)
RESET To Power-Up
```

After you have selected the CS/80 Exerciser as the system program to boot (see Chapter 2, "Start-up Procedure"), a series of messages will be displayed on your remote console. If your computer has boot ROM 3.0, you may see garbled messages on your screen. Don't be concerned about this—it in no way affects the booting process and the messages are not important. When the booting of the CS/80 Exerciser is completed, your screen will return to normal. Messages sent from the CS/80 Exerciser should not be garbled.

Limitations

Flag plots of tape cartridges cannot be displayed on a remote console because remote console terminals do not support the required graphics capability.

Please print or type your name and address.

Name: _____

Company: _____

Address: _____

City, State, Zip: _____

Telephone: _____

Additional Comments: _____

Test Tools Manual
HP Part Number 09800-90001
E0888



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UNITED STATES



BUSINESS REPLY MAIL
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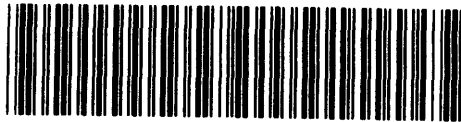




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09800-90651

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KIT CONTENT LIST

Kit Number: 09800-12300

Description	Unit of Measure
-----	--
TEST TOOLS S200	EA

Component Part	Description	UM	Quantity Per
-----	-----	--	-----
CO# 09800-10336	DISC #COMPUTER TESTS 3SS S200	EA	1.0000
09800-11304	DISC CS/80 EXERCISER 3SS	EA	1.0000
09800-11334	DISC SFT0: 3SS FCTNL TEST	EA	1.0000
09800-11335	DISC SFT1: 3SS FCTNL TEST	EA	1.0000
09800-11336	DISC SFT2: 3SS FCTNL TEST	EA	1.0000
09800-11337	DISC SFT3: 3SS FCTNL TEST	EA	1.0000
09800-11338	DISC SFT4: 3SS FCTNL TEST	EA	1.0000
09800-90001	CO#MNL-TEST TOOLS S200/300	EA	1.0000
1540-0922	DISC CONTAINER	EA	2.0000
5180-3045	LABEL-TAMPER DISC	EA	2.0000
9320-5091	CERTIFICATE RIGHT TO USE	EA	1.0000
98561-10334	CO#-DISC MAINFRAME TEST 3SS S2	EA	1.0000
End of retrieval			1016