HEWLETT PACKARD

HP 1000 ICD/MAC Disc Diagnostic

Reference Manual

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MANUAL PART NO. 5955-4355
Printed in U.S.A. June 1984
U0684

Printing History

The Printing History below identifies the Edition of this Manual and any Updates that are included. Periodically, Update packages are distributed which contain replacement pages to be merged into the manual, including an updated copy of this Printing History page. Also, the update may contain write-in instructions.

Each reprinting of this manual will incorporate all past Updates, however, no new information will be added. Thus, the reprinted copy will be identical in content to prior printings of the same edition with its user-inserted update information. New editions of this manual will contain new information, as well as all Updates.

To determine what software manual edition and update is compatible with your current software revision code, refer to the appropriate Software Numbering Catalog, Software Product Catalog, or Diagnostic Configurator Manual.

Second Edition ..... Dec 1981
Third Edition Jun1984

Preface

This manual provides information on the use of four diagnostic utilities that apply to Multi-Access Controller (MAC) and Integrated Controller Discs (ICD) supported by HP 1000 computers via an HP-IB interface. A knowledge of HP 1000 computer systems and HP-IB disc technology at a Customer Engineer level is assumed. No attempt is made to explain the operation of the hardware, since this is more appropriately covered in related manuals referenced below and in Chapter 1.

Additional publications which will be valuable for referencing when using this manual are:

M/E/F-Series

1. Integrated Controller Programming Guide (Part No. 13365-90901).
2. Disc Drive Loader ROM Manual (Part No. 12992-90001).
3. 7910 Disc Drive Service Manual (Part No. 07910-90903).
4. RTE-IVE Operating System Ref. Manual (Part No. 92068-90015).
5. Data Systems Customer Support Handbook (Part No. 5950-3767).

L-Series

1. 13365A Integrated Controller Programming Guide (Part No. 13365-90901).
2. 7910 Drive Service Manual (Part No. 07910-90903).
3. RTE-L/XL Operators Guide (Part No. 92070-90002).
4. Getting Started With Your Model 9/10 (Part No. 92070-90001).

A-Series

1. 13365A Integrated Controller Programming Guide (Part No. 13365-90901).
2. RTE-A User's Manual (Part No. 92077-90002).
3. Getting Started With RTE-A (Part No. 92077-90039).
4. 12745A Disc Controller (13037) To HB-IB Adapter Kit Manual (Part No. 12745-90901).
5. 13037 Disc Controller Manual (Part No. 13037-90006).

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General Information

Introduction

HP product number 91711B (M/E/F-Series) and 24398B (A-Series) include the following diagnostics:

1. FORM formatting program
2. DIAG diagnostic program
3. ERT error rate test program
4. DISCZ disc analyzer program

HP product number 24398A for the L-Series contains the same programs except that the FORM program is not included. Each of the M/E/F-Series programs may be used as either stand-alone or single user routines.

FORM is an offline formatting program for M/E/F-Series and A-Series discs. It is a powerful physical-mode formatter that should only be used by experienced users, since it can erase all LU and spare track designations. FORM should only be used if a track map table is available.

Most users will find FORMT to be more convenient, yet suitable for most needs. FORMT is on online formatting program on the M/E/F-Series and an offline program on the A/L-Series. It is not included in this diagnostic package because it is included in your operating system software. FORMT is documented in the following publications:

1. RTE-IVB Utility Program Reference Manual (Part No 92068-90010).

2. RTE-6/VM Utility Program Reference Manual (Part No. 92084-90007).

3. RTE-L/XL Utilities Manual (Part No. 92070-90004).

4. RTE-A Utilities Manual (Part No. 92077-90004).

The ERT diagnostic is a program that reads and writes data to the disc to aid debugging in a dynamic testing mode. ERT in the A-Series Diagnostic has an optimized operator setup menu which is different than the M/E/F-Series and L-Series programs. For this reason, the general description for ERT is divided into two sections, one for the M/E/F and L-Series versions, and one for the A-Series version.

The following chart shows which disc drives are supported by these diagnostic products:

SUPPORTED DISCS

	7906H ICD	7910H ICD	7920H 7925H ICD	7906M MAC	7920M 7925M MAC
M/E/F	YES	YES	YES	---	---
L-SERIES	YES	YES	YES	---	---
A-SERIES	YES	---	YES	YES	YES

Hardware Requirements

The following HP 1000 M/E/F-Series or A/L-Series hardware is required to use the diagnostics:

M/E/F-Series

1. M/E/F-Series Computer.
2. 12966A Terminal Interface Card.
3. 12821A H-Series Disc Interface Card.
4. Minimum of 64k words of Main Memory.
5. 12731A Memory Expansion Module.
6. 12539C Time Base Generator.
7. 12892B Memory Protect.
8. 264x Display Terminal with 12966A/Opt 001, Asynchronous Serial Interface (if minicartridge media option is selected).
9. 7970B/E Magnetic Tape Drive (optional).

L-Series Computer

1. An L-Series Computer capable of running RTE-A operating system software.

2. A Diagnostic Input Device: a hard or flexible disc drive, a 1600 bpi magnetic tape drive, or 264x Display Terminal equipped with dual minicartridge option.

3. A Virtual Control Panel (VCP) Interface: 12005A/B Asynchronous Serial Interface PCA or 12007A/12044A HDLC Interface Card connected to a 26xx Display Terminal.

4. 12009A HP-IB Interface Card.

5. Minimum of 64k bytes of Main Memory.

A-Series

1. A-Series Computer capable of running RTE-A operating system software.

2. A Diagnostic Input Device: a hard or flexible disc drive, a 1600 bpi magnetic tape drive, or a 264x Display Terminal equipped with dual minicartridge option.

3. A Virtual Control Panel (VCP) Interface: 12005A/B Asynchronous Serial Interface PCA or 12007A/12044A HDLC Interface Card connected to a 26xx Display Terminal.

   OR

   12040B MUX Interface Card connected to a 37214A Systems Modem, if VCP terminal is connected to 12005A/B or 12007A/12044A.

4. 12009A HP-IB Interface Card.

5. Minimum of 256k bytes of main memory.

Required Software

This manual and related software are included in the 91711B Diagnostic and Verification Package for the M/E/F-Series, the 24398A Diagnostic Package for L-Series, and the 24398B Diagnostic Package for A-Series.

Cross reference to the Diagnostic and Verification Reference Manual (Part No. 91711-90006) should be made to establish that appropriate software for the M/E/F-Series diagnostics is available. Cross reference to the HP 12992 Loader ROM's Installation Manual (Part No. 12992-90001) should be made to ensure that the appropriate Loader ROM is available for the media on which your diagnostics were specified.

Media option choices for the HP 1000 A/L-Series include flexible discs, 264x minicartridges, CS/80 cartridge tape, or 1600 bpi magnetic tape. For the HP 1000 M/E/F-Series, these diagnostics are available on 264x minicartridges, 800 bpi magnetic tape, and 1600 bpi magnetic tape. See Table 1-1 for media listing by HP Part Number:

Table 1-1. Media Cross Reference Listing

	M/E/F-SERIES	L-SERIES	A-SERIES VCP VIA		UTILITY**
			ASIC	MUX	
3.5-INCH FLEXIBLE DISC	N/A	N/A	24398-13416	24398-13424	DIAG, ERT DISCZ, FORM
5.25-INCH FLEXIBLE DISC	N/A	24398-13402	24398-13410	24398-13421	DIAG, ERT DISCZ, FORM
8-INCH FLEXIBLE DISC	N/A	24398-13401	24398-13407	24398-13419	DIAG, ERT, DISCZ, FORM
MINICARTRIDGE (TERMINAL)	N/A 91711-13324 91711-13325 91711-13325 91711-13324	N/A 24398-13303 24398-13304 24398-13305 N/A	24398-13341 24398-13320 24398-13321 24398-13322 24398-13322	N/A N/A N/A N/A N/A	SYSTEM DIAG ERT DISCZ FORM
CS/80 CARTRIDGE TAPE	N/A	24398-13301	24398-13318	24398-13318	DIAG, ERT, DISZ, FORM
		N/A	02196-13301*	02196-13301*	DIAG, ERT, DISCZ, FORM
800 BPI MAGNETIC TAPE	91711-13503	N/A	N/A	N/A	DIAG, ERT, DISCZ, FORM
1600 BPI MAGNETIC TAPE	91711-13504	N/A	24398-13501	24398-13501	DIAG, ERT, DISCZ, FORM
			02196-13501*	02196-13501*	DIAG, ERT, DISCZ, FORM

* Supplied with CS/80 disc based systems

** The FORM utility is not available on L-Series computers

Chapter 2
Loading on M/E/F-Series

Relevant sections of the chart introduced in Chapter 1 illustrating supported discs are reproduced below, for your convenience.

SUPPORTED DISCS

	7906H ICD	7910H ICD	7920H 7925H ICD	7906M MAC	7920M 7925M MAC
M/E/F	YES	YES	YES	---	---

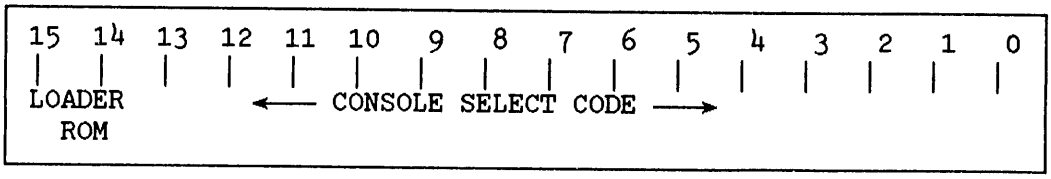
On the M/E/F-Series, diagnostics are supported on an RTE-IVE host which is included in the 91711B package. In this case, the RTE-IVE host must be loaded before loading the diagnostic module. The diagnostic may then be loaded either from a minicartridge or from mag tape.

CAUTION

Each of the diagnostic utilities will access the disc memory under evaluation (except for the A/L-Series version of DIAG). This will alter existing recorded data in the areas accessed, destroying your data files unless suitable precautions are taken. All removable disc cartridges should be temporarily replaced and fixed discs should be backed up for the duration of this test.

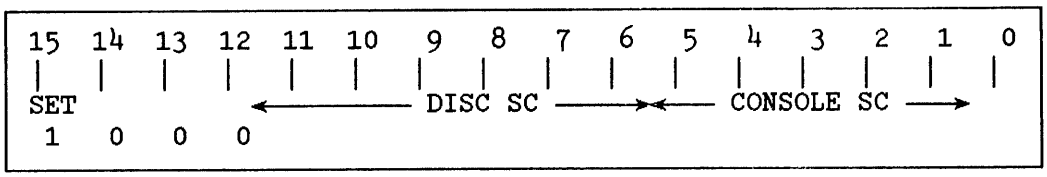
To load the RTE-IVE host, insert the appropriate media in the loading device and perform the following steps:

1. Select the S-Register.
2. Set the bits as follows:



3. Press STORE, PRESET, IBL, PRESET, RUN.
4. A good load will be signified by octal 102077 displayed in the T-Register.
5. Select the S-Register.

6. Set the bits as follows:



7. Press STORE.
8. Select P-Register.
9. Set bit 1=1 (P=2).
10. Press STORE, RUN.

At this point, the operating system will make all communications through the console.

Console Responses

Following is a typical example of the expected inputs and outputs. Required operator responses will be underlined:

```
END OF SESSION
START RECONFIGURATION
LIST DEVICE LU? 1
I/O RECONFIGURATION ALREADY PERFORMED;
CURRENT SELECT CODE, NEW SELECT CODE?
13,15    *SYSTEM CONSOLE
CURRENT I/O CONFIGURATION:
SELECT CODE 11= EQT 1, TYPE 32 :7906H DISC
SELECT CODE 13= TBG
SELECT CODE 16= EQT 4, TYPE 23 :MAG TAPE 1
SELECT CODE 17= EQT 5, TYPE 23 :MAG TAPE 2
SELECT CODE 20= EQT 2, TYPE 05 :264X TERMINAL
SELECT CODE 22= EQT 5, TYPE 00 :TTY
SELECT CODE 23= EQT 3, TYPE 12 :LINE PRINTER (2631)
```

At the I/O Reconfiguration stage, the system will allow the operator to enter the CURRENT SELECT CODE and NEW SELECT CODE. This will configure the I/O Map to match the actual system I/O structure. Terminate reconfiguration by entering /E.

Generation for the host operating system has the TBG mapped to SC 13. If the disc or terminal is mapped into SC 13, it is important to note that the TGB will be overlaid and will show on the I/O map. This may be handled by moving the disc to a temporary SC, moving the TBG to the actual SC and then moving the disc back to SC 13.

After /E is entered, the following messages will appear:

```
CURRENT PHYSICAL MEM SIZE IS 64 PAGES

MEM RECONFIGURATION?  (YES/NO) NO

RECONFIGURATION COMPLETE
```

At this point, the operating system will bring in the mapped portions from the loading device. The system will prompt with a "*" and APLDR can now be used to bring in the program.

The first thing that should be done (before loading any program) is to run the I/O map display program:

```
RU,MAPIO,1
```

If the operator is unsure of the disc HP-IB address, a timeout should be set to keep the program from endlessly looping.

File Structure

Once the RTE-IVE host is loaded and running, the magnetic tape or minicartridge must be positioned to the file which contains the required utility:

Mag Tape Format

1)	Directory	
2)	RTE-IVE Host	
3)	⎫	
4)	⎪	
5)	⎪	
6)	⎪	
7)	⎪	
8)	⎬	System Files
9)	⎪	
10)	⎪	
11)	⎪	
12)	⎪	
13)	⎪	
14)	⎭	
15)	FORM	
16)	DIAG	
17)	ERT	
18)	DISCZ	

Cartridge Tape Format

Tape #1
1) Directory
2) RTE-IVE Host

Tape #2
1) Directory
2) FORM
3) DIAG

Tape #3
1) Directory
2) ERT
3) DISCZ

Using MTLDR

MTLDR is the mag tape loader program on minicartridge tape for use when the loader ROM is not available. Current, supported software is compatible with RTE-IVE. A compiler listing of MTLDR is included in Appendix B.

NOTE: MTLDR is the same as !MTLDR supplied on previous versions.

Load the MTLDR as follows:

1. Select the S-Register.
2. Set bits 15 and 14 to the minicartridge loader ROM location.
3. Set bits 6-11 to the console select code.
4. Press STORE, PRESET, IBL, PRESET, RUN.
5. HALT 102077 indicates a successful load.

To execute:

1. Select the S-Register.
2. Set bits 15 and 0 equal to 1.
3. Set bits 6-11 to mag tape select code. Press STORE.
4. Set the A-Register equal to 2 (bit 1 = 1) to load file #2. Press STORE.
5. Set the P-Register equal to 2 (bit 1 = 1).
6. Press STORE, PRESET, RUN. HALT 102077 indicates a good load.

Using the Mag Tape Loader ROM

1. Select S-Register.
2. Set bits 14, 15 to Loader ROM location.
3. Set bits 6-11 to select code of mag tape.
4. Set bit 0 = 0 to load the first sequential file or bit 0 = 1 to load the file specified in the A-Register. Press STORE.
5. Set the A-Register to the file number desired (i.e., To load the RTE-IVE host, 2 should be specified here).
6. Press STORE, PRESET, IBL, PRESET, RUN.

NOTE

The A-Register may be set to any number to load the file specified by that number. This can be very useful when the RTE-IVE host is stored on tape with other diagnostics.

Using Minicartridge Loader ROM

To use the minicartridge, the tape must be positioned using the off-line control keys on the 2645. Follow the standard procedure for loading a minicartridge using the 12992C Loader ROM:

1. Select the S-Register.
2. Set bits 15,14 to Loader ROM location.
3. Set bits 6-11 to Console select code.
4. Press STORE, PRESET, IBL, PRESET, RUN.
5. HALT 102077 signifies a successful load.
6. Select P-Register.
7. Set bit 1=1 (P=2).
8. Press STORE, RUN.

Standard I/O Configuration

Reconfiguration will not be necessary when the standard I/O configuration, shown below, is used.

Standard I/O Configuration

SELECT CODE	DEVICE
11	Disc DVR32
13	TBG
16	Magnetic Tape DVR23
20	264x type terminal

Using XCNTL

NOTE

Although XCNTL can be used with minicartridge, it is recommended that the tape control soft keys be used instead.

XCNTL is a program generated into the RTE-IVE host which provides tape positioning control:

```
RU,XCNTL,lu,function
```

where:

lu = 08 for mag tape; 04 for minicartridge

```
function = 13B file forward
           04B rewind
           02B record backward
           14B backspace one file
```

Each function allows movement of the tape one unit. It is important to note that when using the backspace one file command (14B), that each time this command is used the Read Gap is positioned behind the End of File mark. If the next file is to be read in reverse, enter RU,APLDR,<lu> twice or RU,XCNTL, <lu>,03B and RU,APLDR,<lu>. This will move the Read Gap past the File Mark and load the next program.

Using APLDR

Once the tape has been positioned, APLDR can be used to load the appropriate program:

```
RU,APLDR,<lu>
```

where:

```
lu 8 = magnetic tape logical unit and
lu 4 = minicartridge
```

The diagnostic modules take a maximum of three minutes to load from minicartridge. Following a successful load, a (READY) message will appear on the system console.

Execution

After loading, any of the four programs may be executed by entering:

```
RU,<program name>
```

where:

```
program name = FORM  ⎫
               DIAG  ⎬  depending upon which one
               DISCZ ⎬  was loaded by APLDR
               ERT   ⎭
```

Switching Between Programs

To execute a different module, the current module must be cleared from memory before the next module is loaded:

```
OF,<program name>,8
```

where:

```
program name = FORM
               DIAG    } depending on which one
               ERT     } was loaded by APLDR
               DISCZ
```

8 = clears the program from memory

If the current module is not cleared from memory and attempts are made to load another module, the message NO PARTITION BIG ENOUGH will appear at the output device. In this case, the first module was already in the single partition, and the system tried to read the next module into the same partition. At this point, the first module must be cleared from memory and the tape repositioned or the error message CHECKSUM ERROR will appear at the output device. This may be done by entering:

```
OF,<program name>, 8
RU,XCNTL,<lu>,14B
RU,XCNTL,<lu>,03B
```

Breakmode

Breakmode is supported in the diagnostics and may be entered during a loop by pressing any key and then entering:

```
*BR,<program name>
```

CAUTION

It is extremely important to always exit disc diagnostics carefully. Allowing diagnostic routines in process to run to completion should be considered. If diagnostic routines in process are terminated, a corrupt track will probably be left open without any operator notice. This (highly probable) corrupt track will inhibit return of the disc to on-line status. If a diagnostic routine in process must be interrupted, use BReakmode, and not OFf.

Chapter 3
Loading on the A/L-Series

Relevant sections of the chart introduced in Chapter 1 illustrating supported discs are reproduced below, for your convenience.

SUPPORTED DISCS

	7906H ICD	7910H ICD	7920H 7925H ICD	7906M MAC	7920M 7925M MAC
L-SERIES	YES	YES	YES	---	---
A-SERIES	YES	---	YES	YES	YES

On the L-Series, each of the diagnostics is a stand-alone, self-hosted RTE System and thus may be loaded as an absolute program.

On the A-Series, all four diagnostics are combined into one stand-alone, self-hosted RTE system and thus may be loaded as an absolute program.

CAUTION

Each of the diagnostic utilities will access the disc memory under evaluation (except for DIAG). This will alter existing recorded data in the areas accessed, destroying your data files unless suitable precautions are taken. All removable disc cartridges should be temporarily replaced and fixed discs should be backed up for the duration of this test.

Software Media Format For The A/L-Series

For the L-Series, each diagnostic is a stand-alone RTE system, available on the following media:

1. 5.25-in. mini-floppy disc
2. 8-in. floppy disc
3. 246x minicartridges
4. CS/80 cartridge tape

For the A-Series, all four diagnostics are combined into one stand-alone RTE system, available on these media:

1. 3.5-in. micro-floppy disc
2. 5.25 in. mini-floppy disc
3. 8-in. floppy disc
4. 264x minicartridges
5. CS/80 cartridge tape
6. 1600 bpi magnetic tape

Configuration With VCP

1. Turn off the power to the computer and the terminal.

2. Set the processor card switches to enter the VCP routine after power-up:

Processor Switch U1	#1	2	3	4	5	6	7	8
Setting	1	0	0	0	0	0	0	1

   where 1 = open = up; 0 = closed = down

3. If the diagnostic is to be loaded into memory from minicartridge tape, skip to step 4. Set the U1 switches on the HP 12009A Interface that is connected to the device drive unit as follows (U1 is the switch pack facing the rear of the computer card cage):

HP 12009A Switch U1	#1	2	3	4	5	6	7	8
Setting	1	0	0	1	0	1	1	1

   where 1 = open = up; 0 = closed = down

   The U16 switches on the HP 12009A Interface can be set to any position; their settings do not affect diagnostic operation (U16 is the switch pack facing the side of the computer card cage).

   Attach the device drive unit to the HP 12009A HP-IB Interface using an HP-IB cable. Note the device drive HP-IB address and unit number. These numbers are used during the boot loader command.

   The HP-IB card must have the correct load resistors installed for the HP-IB devices attached to the card. Refer to the HP 12009A HP-IB Interface Reference Manual (Part No. 12009-90001).

4. If the diagnostic is to be loaded into memory from minicartridge tape, set the U1 switches on the HP 12005A/B Interface that is connected to the minicartridge tape input device as follows (U1 is the switch pack which faces the rear of the computer card cage):

```
HP 12005A/B Switch U1   #1 2 3 4 5 6 7 8
Setting                  X 0 0 1 0 0 0 0
```

where X = 0 if VCP
X = 1 if not VCP
1 = open (up)
0 = closed (down)

The U21 switches on the HP 12005A/B Interface should be set for the normal operation of the input device attached to the card (U21 is the switch pack facing the side of the computer card cage).

5. MUX (12040B) card or 37222A Modem card switches:

```
Switch No.  --   1 2 3 4 5 6 7 8
Setting     --   X 0 0 1 0 0 1 1
```

where X = 0 if VCP
X = 1 if not VCP
1 = open (up)
0 = closed (down)

Loading the Diagnostic

To load the diagnostic into memory, first turn on the power to the terminal, then to the computer and tape drive. The diagnostic assumes the computer and terminal self-tests have passed. Load the diagnostic from the specified input device as described in the following sections.

Breakmode

Breakmode is supported in the diagnostics and may be entered during a loop by pressing any key and then entering:

*BR,<program name>

CAUTION

It is extremely important to always exit disc diagnostics carefully. Allowing diagnostic routines in process to run to completion should be considered. If diagnostic routines in process are terminated, a corrupt track will probably be left open without any operator notice. This (highly probable) corrupt track will inhibit return of the disc to on-line status. If a diagnostic routine in process must be interrupted, use BReakmode, and not OFf.

Booting from Minicartridge Tape

L-Series

1. Insert the minicartridge tape into the left tape unit of an HP 264x terminal.

2. Hit the break key to get the VCP prompt, then enter the following VCP command:

   VCP>%BCT10020 (for terminal connected to ASIC card with select code 20B)

   If loading from the right tape drive unit, enter %BCT10120.

The diagnostic will be loaded into memory. During execution, all the test messages will be printed on the console for operator reference. The bootable diagnostic file names are DIAG, ERT, and DISCZ. Operating instructions for running the specific diagnostics are described in Chapters 5, 6 and 7.

A-Series

The four A-Series diagnostic programs can all reside in memory at the same time. There are four tapes in the package. One tape contains the system, another contains FORM and DISCZ, another contains ERT, and the remaining tape has the DIAG program. To load the A-Series diagnostics:

1. Insert the minicartridge tape into the left tape unit on an HP 264x terminal.

2. Hit the break key to get the VCP prompt, then enter the following VCP command:

        VCP>%LCT00020 (use this for each tape on left CTU)

When all the tapes are loaded type %R to the VCP prompt:

        VCP>%R (boot up will then finish)

        RTE-A READY (will appear showing that the system is working)

Next, type RETURN and the RTE prompt will appear:

        RTE:

The programs can now be started by the RUN command:

```
RTE:RU,FORM
    (or)
RTE:RU,DISCZ
    (or)
RTE:RU,ERT
    (or)
RTE:RU,DIAG
```

If not all the programs are needed, only 2 tapes have to be loaded: the system tape and whichever tape contains the desired program. Once the system tape has been loaded, any combination of program tapes can be added, either immediately or later.

During execution, all the test messages will be printed on the console for operator reference. Operating instructions for running the specific diagnostics are described in Chapters 4, 5, 6, and 7.

Booting from 8-inch Flexible Disc

L-Series

1. Insert the 8-inch floppy into the left or right disc drive unit.

2. Hit the break key to get the VCP prompt, then enter the following VCP command:

   VCP>%BDCbuscfile

   where:

   b = the HP-IB address of the flexible disc drive unit (0-7).

   u = the flexible disc drive unit number (0-1):

   0 if the floppy is in the left disc drive unit or if there is only one disc drive unit.

   1 if the floppy is in the right disc drive unit.

   sc = the octal select code of the HP 12009A HP-IB interface to which the flexible disc drive is connected.

   file = name of the diagnostic to be loaded:

   DIAG, ERT, or DISCZ

The diagnostic will be loaded into memory. During execution, all the test messages will be printed on the console for operator reference. Operating instructions for running the specific diagnostics are described in Chapters 5, 6, and 7.

A-Series

1. Insert the 8-inch floppy into the left or right disc drive unit.

2. Hit the break key to get the VCP prompt, then enter the following VCP command to load the system and all four diagnostics:

```
VCP>%BDCbuscfile
```

where:

b = the HP-IB address of the flexible disc drive unit (0-7).

u = the flexible disc drive unit number (0-1):

0 if the floppy is in the left disc drive unit or if there is only one disc drive unit.

1 if the floppy is in the right disc drive unit.

sc = the octal select code of the HP 12009A HP-IB interface to which the flexible disc drive is connected.

file = MACICD - for terminal connected to ASIC card.
MACICM - for terminal connected to MUX card.

When loaded, the system will prompt:

RTE-A READY (showing that the system is working)

Next, hit RETURN to get the RTE prompt and then type:

```
RTE:RU,FORM
   (or)
RTE:RU,DISCZ
   (or)
RTE:RU,ERT
   (or)
RTE:RU,DIAG
```

During execution, all the test messages will be printed on the console for operator reference. Operating instructions for running the specific diagnostics are described in Chapters 4, 5, 6, and 7.

Booting from 5.25-in. Minifloppy, L-Series

1. Insert the minifloppy or microfloppy into the left or right disc drive unit.

2. Hit the break key to get the VCP prompt, then enter the following VCP command:

   VCP>%BDCffbusc

   where:

   ff = file number =0 for DIAG or DISCZ
   =2 for ERT

   b = the HP-IB address of the flexible disc drive unit (0-7).

   u = the flexible disc drive unit number (0-1):

   0 if the floppy is in the left disc drive unit or if there is only one disc drive unit.

   1 if the floppy is in the right disc drive unit.

   sc = the octal select code of the HP 12009A HP-IB interface to which the flexible disc drive is connected.

During execution, all the test messages will be printed on the console for operator reference. Operating instructions for running the specific diagnostics are described in Chapters 5, 6, and 7.

Booting from 5.25-in. Minifloppy and 3.5-in. Microfloppy, A--Series

1. Insert the minifloppy or microfloppy into the left or right disc drive unit.

2. Hit the break key to get the VCP prompt, then enter the following VCP command to load the system and all four diagnostics:

   VCP>%BDCffbusc

   where:

   ff = file number =0 for both ASIC and MUX.

   b = the HP-IB address of the flexible disc drive unit (0-7).

u = the flexible disc drive unit number (0-1):

0 if the floppy is in the left disc drive unit or if there is only one disc drive unit.

1 if the floppy is in the right disc drive unit.

sc = the octal select code of the HP 12009A HP-IB interface to which the flexible disc drive is connected.

During execution, all the test messages will be printed on the console for operator reference. Operating instructions for running the specific diagnostics are described in Chapters 4, 5, 6, and 7.

When loaded, the system will prompt:

RTE-A READY (showing that the system is working)

Next, hit RETURN to get the RTE prompt and then type:

```
RTE:RU,FORM
   (or)
RTE:RU,DISCZ
   (or)
RTE:RU,ERT
   (or)
RTE:RU,DIAG
```

Booting from CS/80 Cartridge Tape

L-Series

1. Insert the CS/80 cartridge tape into the cartridge tape drive.

2. Hit the break key to get the VCP prompt, then enter the following VCP command:

```
VCP>%BDCffbusc
```

where:

ff = file number:

```
DIAG  = 10B
ERT   = 12B
DISCZ = 14B
```

b = the HP-IB address of the CS/80 tape drive unit (0-7).

u = the cartridge tape drive unit number.

sc = the octal select code of the HP 12009A HP-IB interface to which the cartridge tape drive is connected.

A-Series

1. Insert the CS/80 cartridge tape into the cartridge tape drive.

2. Hit the break key to get the VCP prompt, then enter the following VCP command to load the system and all four diagnostics:

```
VCP>%BDCffbusc
```

ff = file number:

```
Primary System Software:
 MACICD (ASIC) = 24B
 MACICM (MUX)  = 44B

Diagnostic on 24398B:
 MACICD (ASIC) = 10B
 MACICM (MUX)  = 30B
```

b = the HP-IB address of the CS/80 tape drive unit (0-7).

u = the cartridge tape drive unit number.

sc = the octal select code of the HP 12009A HP-IB interface to which the cartridge tape drive is connected.

After the booting process is finished, hit the RETURN key to get the RTE prompt and then type:

```
RTE:RU,FORM
   (or)
RTE:RU,DISCZ
   (or)
RTE:RU,ERT
   (or)
RTE:RU,DIAG
```

During execution, all the test messages will be printed on the console for operator reference. Operating instructions for running the specific diagnostics are described in Chapters 4, 5, 6, and 7.

Booting from 1600 bpi Mag Tape (A-Series)

1. Mount the magnetic tape.

2. Hit the break key to get the VCP prompt, then enter the following VCP command to load the system and all four diagnostics:

```
VCP>%BMTffbusc
```

where:

b = the HP-IB address of the magnetic tape drive unit (0-7).

u = the magnetic tape drive unit number.

sc = the octal select code of the HP 12009A HP-IB interface to which the magnetic tape drive is connected.

ff = file number:

```
ASIC = 5B
MUX  = 15B
```

All the programs will exist in memory at the same time. One load will boot the system and any program can be run. After the booting process is finished, hit the RETURN key to get the RTE prompt and then type:

```
RTE:RU,FORM
   (or)
RTE:RU,DISCZ
   (or)
RTE:RU,ERT
   (or)
RTE:RU,DIAG
```

The diagnostic will be loaded into memory. During execution, all the test messages will be printed on the console for operator reference. Operating instructions for running the specific diagnostics are described in Chapters 4, 5, 6, and 7.

Booting from CS/80 Disc (A-Series Only)

NOTE

Prior to booting the diagnostics from the CS/80 disc, the diagnostics must have been loaded onto the disc from one of the supplied media.

1. Hit the break key to get the VCP prompt, then enter the following VCP command to load the system and all four utilities:

   VCP>%BDCbuscfile

   where:

   b = the HP-IB address of the CS/80 drive.

   u = the CS/80 drive unit number.

   sc = the octal select code of the HP 12009A HP-IB interface to which the CS/80 drive is connected.

   file = name of the diagnostic to be loaded:

   MACICD (ASIC)
   MACICM (MUX)

The diagnostic will be loaded into memory. During execution, all the test messages will be printed on the console for operator reference. Operating instructions for running the specific diagnostics are described in Chapters 4, 5, 6 and 7.

Chapter 4
FORM Utility

Introduction

The following chart is similar to that introduced in Chapter 1, but notice that the L-Series has been deleted here, since the FORM utility is not supported on the L-Series.

SUPPORTED DISCS

	7906H ICD	7910H ICD	7920H 7925H ICD	7906M MAC	7920M 7925M MAC
M/E/F	YES	YES	YES	---	---
A-SERIES	YES	---	YES	YES	YES

The FORM program is an off-line, physical disc formatting utility for ICD and MAC disc drives. However, this powerful tool requires careful use by a knowledgeable user, because it is capable of erasing all LU and spare track designations.

The A-Series version of FORM differs slightly from the M/E/F version. The A-Series FORM program first requests the Select Code of the device instead of the LU. The HP-IB address and unit number are prompted for, and a check is made to ensure that the addressed device is supported. Following this check, a task is requested with the prompt "FORM:". Completion of this task results in another "FORM:" prompt. To address a different device, exit FORM and rerun the program.

The remainder of this chapter shows examples from the M/E/F-Series version only. The actual display will vary slightly for the A-Series.

NOTE

When testing HP-IB MAC type disc drives, the HP-IB address is selected by the thumbwheel switch in the 13037 controller on the 12745 interface board. The unit number is chosen by the front panel select switch and displayed by the LEDs on the front of the drive.

On the HP-IB ICD disc drives, the front panel select switch and the display LEDs indicate the HP-IB address. The unit number for the ICD is always 0.

To beneficially use this utility, the user should have a track map table and have had experience in its use. The user should also have a working knowledge of track sparing and disc formatting. The track map table may be found on the first page of the generation map for the system in question. If the user has no previous experience in disc formatting, it is recommended that diagnostic activities be limited to the use of FORMT. For information on FORMT, refer to the RTE-6/VM Utilities Manual (Part No. 92084-90007), the RTE-L/XL Utilities Manual (Part No. 92070-90004), or the RTE-A Utilities Manual (Part No. 92077-90004).

Running FORM

FORM will report any non-zero status conditions that occur due to soft errors (such as seek retries), as well as hard errors.

Once the program is loaded, the system will prompt:

RTE-A READY (showing that the system is working)

Next, hit RETURN to get the RTE prompt, then type:

RTE:RU,FORM

FORM will prompt:

DISC LU (IF A-SERIES, "ENTER DISC SELECT CODE")

ENTER HP-IB ADDRESS#

Enter the address number (0-7) of the drive. If the response is not between 0-7, FORM prints:

INVALID RESPONSE

NUMBER SHOULD BE 0-7

Re-enter the correct HP-IB address number.

ENTER 79xx DISC MODEL NUMBER (IF A-SERIES, "ENTER DISC UNIT")

Enter 7906, 7910, 7920 or 7925, which is the disc drive model number where the spare will take place. (In the A-Series version, the program will check the disc for proper ID. If an error occurs, verify the hardware configuration.) If an invalid disc model number is entered, FORM prints:

IMPROPER DISC SPECIFICATION

Re-enter the correct disc model number. If the disc has a functional problem, FORM prints:

DISC STATUS/IDENTIFY RETURNED ERROR

Refer to the section on DIAG in this manual for investigation.

After configuration, FORM responds with:

TASK? (If A-Series, "FORM:")

Enter one of the possible commands to be executed:

```
SP   > Spare a Track
VE   > Verify Tracks
RE   > Reformat Tracks
MD   > Mark a Track Defective
EX   > FORM will restart and prompt TASK
EN   > FORM will restart and prompt TASK
/E   > FORM will restart and prompt TASK
```

Spare A Track

SP will spare one track to another. A spare track is substituted for the defective track and as much data copied from the bad track as possible. Offset head reads are used in the recovery process and it is often possible to completely recover the data. In cases where this is not possible, usually only a single block will be lost.

For the track being spared, the D bit and the address of the spare track will be written in the preamble. For the spare track, the S bit and the address of the defective track will be written in the preamble.

CAUTION

This off-line utility is offered for troubleshooting only. Any normal sparing activity should be done using FORMT.

A direct seek to a track that is already being used as a spare is an illegal operation, but is possible to do with the spare function. The user should either clear the S bit on the track first (using the "RE" command) or be aware that the HP-IB disc controller will return bad status, SPD bits and data upon a direct seek to the track. This means that the new spare track being created will be written with random data rather than the recovered data from the first track.

It is the user's responsibility to make sure that the track is spared within the confines of the disc LU and subchannel spare pool as defined in the user system track map table.

For subsequent tasks, a "space,CR" will default to the address number and model number that was last specified for any task, unless an invalid command is given once.

To prevent any interruption of the defective/spare track chain, a read full sector is performed on the designated track. If the S bit is set and the preamble points to a valid track, a read full sector is also performed on the other track to verify that it too, points back. If a valid defective/spare link exists, FORM will notify the operator of the other track and prepare to perform the MD function on both tracks.

If the operator does not want this to occur, the question "OK to proceed?" should be answered with "NO". If it is desired to mark only the tracks defective, the operator may break up the chain using the RE or MD commands before proceeding.

FORM then will prompt:

```
FROM CYLINDER#?
TO CYLINDER#?
FROM HEAD#?
TO HEAD#?
```

A "space,CR" in response to TO CYLINDER#? or TO HEAD#? will default to the previous FROM CYLINDER#? or FROM HEAD#? value given for that cylinder or head, unless an invalid response has been given.

After answering those prompts, FORM warns and asks:

```
DATA WILL BE DESTROYED, OK TO PROCEED?
```

Enter YE(S) or NO.

If you attempt to spare to a track with the S or D bit set, FORM prints:

```
INDICATED SPARE IS CURRENTLY UNUSABLE
```

To recover, either pick another track to spare to, or reformat the track and retry.

When FORM has completed the sparing, it prints out a description of the tracks involved and comes back with:

```
TASK ?
```

Verify Tracks (VE)

Verify all tracks in the rectangle whose points are defined from cylinder A, head B to cylinder C, head D. See the Physical Disc Addressing and Rectangular Format section of this chapter. The verification process reads and verifies all data on the hard disc. The contents of the disc are not altered or destroyed. If the data fails to verify, the non-zero status is reported with the appropriate messages.

CAUTION

VE does an automatic seek to a spare track. So if a track is logically spared to another track, the spare track is verified. A verify done directly to a spare track will be reported to be in error because the S bit will be set. The user must decide whether these "bad" tracks are actually in error or not.

Due to the way the "MD" command marks a track defective, any future verify operations to that track will cause the operator to be notified of a controller status 7 or 11 condition (depending on its original cylinder/head value). With the 7906, 7920 and 7925, since the MD command zeroed the preamble cylinder/head designations, reference to this track by a verify operation will obligate the disc controller to return bad status. In this situation, the controller gives up reading the preamble so the operator should be advised that the non-zero status printout will contain invalid SPD information. With the 7910, the MD function simply sets the defective track bit and leaves the address unaltered; while for other discs, the cylinder/head and sector address is zero. On subsequent operations, the status return in such a track will be different for different discs.

If the VE function reports a track as a spare, and the user needs to know where it was spared from, direct the MD function at the spare track (which will read preambles and designate the other track only if the two are correctly spared) to get the information and abort the action by answering "NO" to the question "OK to proceed?".

Refer to the section on Verifying the Disc in the RTE-IVB Utility Programs Reference Manual, HP Part No. 92068-90010.

FORM then will prompt:

```
FROM CYLINDER#?
TO CYLINDER#?
FROM HEAD#?
TO HEAD#?
```

A "space,CR" in response to the prompts TO CYLINDER#? or TO HEAD#? will default to the previous FROM CYLINDER#? or FROM HEAD#? value given for that cylinder or head unless an invalid response has been given.

After answering those prompts, FORM performs the read only verify. When it has completed the verify, it comes back with:

TASK? ("FORM:")

In verifying tracks that have been normally spared, track A will be spared to track B. This means that the preamble of track A has been changed so that the defective bit is set and the cylinder/head designation is that of track B. Track B is called a valid spare track because its preamble has been changed so that the spare bit is set and the cylinder/head designation is that of track A. So, in a normal situation, track A (bad track) points the controller to track B (spare track) and vice versa.

Since the verify function does automatic seek to spare, a verify operation directed at track A will actually be done at track B. The operator should be advised that any reported non-zero status will refer to track A but will hold the SPD information from track B. In the case of a normal spare operation (A or B), a future verify operation made directly to track A will probably indicate all OK, even though it automatically did a seek/verify to track B. However, if the verify operation is directed at track B specifically by the operator, an illegal access to spare track (CS20) will be reported. This only means that the disc controller never expected anyone to ever want to do that, not that anything is necessarily wrong. If an unlikely situation is created by the operator by first sparing track A to B and then sparing track B to C, a verify operation directed at track A will cause an automatic seek to B and finally to C. However, track C will not point to A so an error will be reported.

Reformat Tracks (RE)

The RE operation will reformat all tracks in a rectangle whose points are defined from cylinder A, head B, to cylinder C, head D. See the Physical Disc Addressing and Rectangular Format section of this chapter. Using the RE command in a disc area that crosses old disc LU designations will cause a defective track-to-spare-track chain to be interrupted. It will also wipe out any directories within the area. Since all operations are performed on the actual designated track, there is no seek to a spare.

The reformat function clears the status bits on the disc. It rewrites the preamble, writes zeros in the data area and rewrites the postamble. It does not verify this data nor does it spare bad tracks. This allows the user to clear all accumulated bad track bits (including factory designated bad tracks) and clears the spare and protect bits as well.

FORM will prompt:

```
FROM CYLINDER#?
TO CYLINDER#?
FROM HEAD#?
TO HEAD#?
```

A "space,CR" in response to TO CYLINDER#? or TO HEAD#? will default to the previous FROM CYLINDER#? or FROM HEAD#? value given for that cylinder or head unless an invalid response has been given.

After answering those prompts, FORM asks:

```
DATA WILL BE DESTROYED, OK TO PROCEED?
```

Enter YE(S) or NO.

When FORM has completed the reformatting, it comes back with:

```
TASK?  ("FORM:")
```

Mark Defective (MD)

In 7906, 7920, and 7925 discs, mark the track defective at cylinder A, head B by setting the preamble D bit and zeroing the cylinder head and data fields. In the 7910, it simply sets the D bit in the 7910 and leaves the address alone.

CAUTION

Indiscriminate use of the MD command on "bad track/spare track" chains may cause unpredictable results on future disc operation. If there is any doubt as to whether "bad track/spare track" chains have been altered incorrectly, the entire area should be reformatted before proceeding.

FORM will prompt:

```
ENTER CYLINDER NUMBER
AND HEAD#?
```

After answering those prompts, FORM asks:

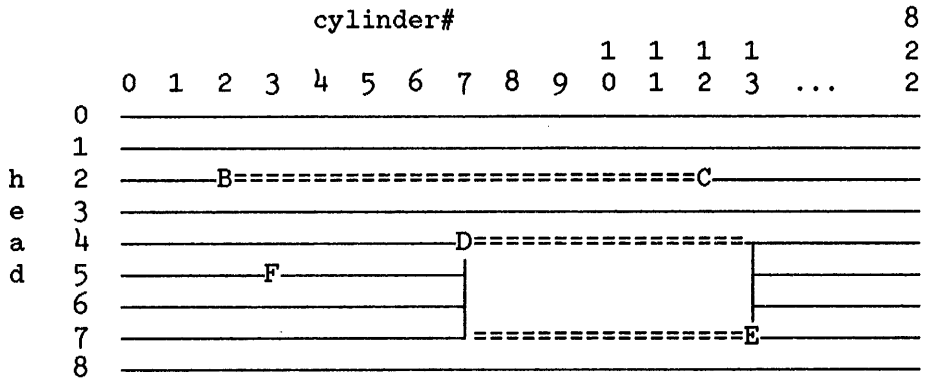
```
DATA WILL BE DESTROYED, OK TO PROCEED?
```

Enter YE(S) or NO.

When FORM has completed marking the track defective, it comes back with:

```
TASK?  ("FORM:")
```

Physical Disc Addressing & Rectangular Format



All action will proceed top to bottom, left to right.

A VE command that will verify an entire 7925 disc would designate:

```
from cylinder 0
to cylinder 822
from head 0
to head 8
```

A VE command that will verify the tracks on the line between points B and C would designate:

```
from cylinder 2
to cylinder 12
from head 2
to head 2 (or space,CR)
```

A VE command that will verify all tracks within the rectangle designated by points D and E would designate:

```
from cylinder 7
to cylinder 13
from head 4
to head 7
```

A VE command that will verify the track at point F would designate:

```
from cylinder 3
to cylinder 3 (or space,CR)
from head 5
to head 5 (or space,CR)
```

Chapter 5
DIAG Utility

Introduction

The chart introduced in Chapter 1 illustrating supported discs is reproduced below for your convenience.

SUPPORTED DISCS

	7906H ICD	7910H ICD	7920H 7925H ICD	7906M MAC	7920M 7925M MAC
M/E/F	YES	YES	YES	---	---
L-SERIES	YES	YES	YES	---	---
A-SERIES	YES	---	YES	YES	YES

DIAG is an interactive, stand-alone disc diagnostic which tests the disc through physical references to the disc and references to the other control sections of the drive.

DIAG runs on the L-Series with logical addressing. Therefore, it is important that the object system LU tables are identical to those generated in the DIAG system. LUs 12, 13, 14 and 15 are designated for the 7906H. LUs 40, 41, 42, and 43 are designated for the 7910H. In any other case, the diagnostic system must be regenerated to be identical to the object system. A sample answer file for the L-Series is contained in Appendix D.

In contrast to the L-Series, DIAG runs on the A-Series with physical addressing. Therefore, no device-specific LUs are needed. This means that any configuration is supported without any need to regenerate the diagnostic system.

The A-Series disc version of DIAG differs slightly from the M/E/F and L-Series versions. These changes are noted at the appropriate places.

NOTE

When testing HP-IB MAC type disc drives, the HP-IB address is selected by the thumbwheel switch in the 13037 controller on the 12745 interface board. The unit number is chosen by the front panel select switch and displayed by the LEDs on the front of the drive. On the HP-IB ICD disc drives, the front panel select switch and the display LEDs indicate the HP-IB address. The unit number for the ICD is always 0.

DIAG should be run only after the completion of the system installation and running self-test. If self-test fails, follow the troubleshooting procedure outlined in the appropriate manual. Once the self-test is passed, run the verification test supplied with the system. If the system will not boot up, fails verification test, or abnormal conditions are encountered, this diagnostic can be utilized. The diagnostic returns information which can be used to isolate a fault at the module level.

The first running of the program will allow the input of parameters to configure the program to particular needs. When the diagnostic completes or aborts itself, the operator is given the opportunity to restart the diagnostic. This is done by entering RU,DIAG after the system prompt. When rerunning the diagnostic, the same run parameters will remain in effect.

Test Track Selection

The diagnostic requires two scratch tracks to be used for its tests. Although the data is destroyed on these tracks, the preambles (formatting information) are restored in most cases (if the diagnostic completes with no errors).

The default test tracks are allocated from an unused area of the disc. The unused area is determined by reading the directory on the test LU, which the diagnostic expects to find on the last track of the LU. If a valid directory is not found, the diagnostic produces a message to that effect and chooses the default tracks. The operator always has the opportunity to accept the default tracks or to choose the tracks explicitly, and any tracks may be chosen except the last two tracks.

When the operator selects the test tracks explicitly, the diagnostic checks that the tracks are on the specified LU. If not, an error message results and the operator is asked to again select tracks.

If a directory was expected but the diagnostic did not find one, the default tracks should be rejected by the operator. This could happen for one of two reasons:

1. The user specified the last track parameter explicitly when the disc was mounted (File Manager, MC command) rather than letting it default.

2. The disc LU configuration in the diagnostic's system does not match the configuration of the system which is usually used to access the disc.

Test Track Requirements

If the information which is in the preambles of the test tracks before the diagnostic begins does not meet certain requirements, the diagnostic will indicate failures even though there may be nothing wrong with the drive or media. The test tracks should be correctly initialized and should not be spare, protected, or defective tracks.

The diagnostic attempts to check for these conditions. If it detects a corrupt, spare, protected, or defective track, it will output an error message and give the operator two options:

1. Choose new test tracks and start again.

2. Continue, ignoring the error.

The second option is given because it is possible that, due to an independent failure, the track was not actually protected (spare or defective). Although this will seldom occur, the diagnostic should be allowed to continue.

Just before the diagnostic completes, it attempts to restore the test track preambles to their initial states. This process has the side effect of correcting corrupt test tracks. Therefore, allowing the diagnostic to run to completion once should enable it to run again without corrupt track errors.

Running DIAG

Once invoked, DIAG will reply with the following questions:

DIAG: List LU (0 for none)?:

This is the device that logs all printouts to the console (or optionally to the line printer). The A-Series version skips this query.

DIAG: Do you want to trace disc operations?:

Enter YE here and the program will output to the listing device, a listing of operations performed on the disc.

DIAG: Start trace at what step?:

Here enter the test step (0-97) in which trace should start. See test descriptions below.

DIAG: Trace operations that are not part of the test steps?:

See the note below.

DIAG: Stop after first failure?:

Any test that fails will stop the diagnostic and ask for a YE(S) or NO?

DIAG: Disc LU?:

Logical Unit number of the disc under test. The A-Series version requests the disc select code instead of the LU number.

DIAG: Disc HP-IB address?:

Enter HP-IB disc address. The A-Series version prompts for the "Disc Unit#" after this request. It then does a check on the disc to verify that a correct drive type exists.

DIAG: Drive model number?:

Enter 7906 or 06, for example. The A-Series version skips this query.

DIAG: Do you want to run the interactive part of the test? (Not asked on 7910):

NOTE

When running DIAG for the first time, tracing can be very helpful in attaining a conceptual overview of the test. However, the use of tracing operations that are not part of the actual diagnostic test steps is not advised. When trace is used, information is output that interrupts the normal logical flow of the test steps. Typical operations that are not a normal test step are: searching the entire disc for directory tracks, sending out a DSJ (Device Specific Jump, octal) before the first test step, sending out a DSJ before the preamble is checked after the last test, and finally sending out a DSJ before resetting the file mask. If there is no interest in using trace at this time, the answer to the above query should be 'NO'.

DIAG Test Step Descriptions

PART 1.

Step 0. WRITE LOOPBACK RECORD, READ LOOPBACK RECORD, and check data.

Step 1. INITIATE SELF-TEST, wait for the drive to come on-line, and RETURN SELF-TEST RESULT. If the result is not zero, send END command. The A-Series version skips this test for MAC drives.

Step 2. Check that DSJ = 2, indicating a power-on condition, which should result from completion of self-test. The A-Series version skips this test for MAC drives.

Step 3. REQUEST STATUS and check for NORMAL COMPLETION status. Also check drive type subfield of status and IDENTIFY value against correct values for the MODEL being tested.

PART 2.

Step 4. SEEK to track A, sector 0. Check for DRIVE ATTENTION status.

Step 5. REQUEST DISC ADDRESS. Check address against address SEEKed to in step 4 (track A, sector 0).

Step 6. RECALIBRATE and check for DRIVE ATTENTION status.

Step 7. SEEK to track B, sector 0.
REQUEST SECTOR ADDRESS.
Check that DSJ = 0 (no error).

Step 8. CLEAR drive (opcode, not secondary clear).
Wait for the drive to come on-line.
Check that DSJ = 2.
REQUEST STATUS to clear DSJ.

Step 9. SEEK to track A, sector 0, and READ FULL SECTOR.
Check the address in the preamble against the address SEEKed to.
Keep the full sector read in a buffer for use in later steps.

Step 10. Change 1 word in the buffer read in step 9 (READ FULL SECTOR).
SEEK to track A, sector 0, and WRITE FULL SECTOR, using the altered data in the buffer.
The resulting sector on the disc will have a DATA ERROR (CRC).

Step 11. SEEK to track A, sector 0, and VERIFY one sector.
Check that DATA ERROR status results.

Step 12. SEEK to track A, sector 0, and READ one sector.
Check that DATA ERROR status results, and check the data read against the data in the buffer written in step 10.

NOTE

Steps 13, 14, 16, 17, 18, 19, 20, 55, 59, and 60, and also all the steps in the interactive part of the test (PART 3) do not apply to the 7910 and are not attempted on that drive.

Step 13. Repeat step 12 for the READ WITH OFFSET command.

Step 14. Repeat step 12 for the READ WITHOUT VERIFY command.

Step 16. SET FILE MASK to surface mode, no auto seeks (MASK = 0).
SEEK to track A, maximum sector.
READ FULL SECTOR for 140 words (2 sectors).
Check for END OF CYLINDER status.

Step 17. SET FILE MASK to cylinder mode, no auto seeks (MASK = 2).
SEEK to track A, maximum sector.
READ FULL SECTOR for 140 words (2 sectors).
Check for NORMAL COMPLETION status.

Step 18. SET FILE MASK to cylinder mode, no auto seeks (MASK = 2).
SEEK to cylinder A, maximum head, maximum sector.
READ FULL SECTOR for 140 words (2 sectors).
Check for END OF CYLINDER status.

Step 19. SET FILE MASK to cylinder mode, auto incremental seek (MASK = 3).
SEEK to cylinder B, maximum head, maximum sector.
READ FULL SECTOR for 140 words (2 sectors).
Check for NORMAL COMPLETION status.
REQUEST DISC ADDRESS and check that the cylinder is cylinder B + 1.

Step 20. SET FILE MASK to cylinder mode, auto decremental seek (MASK = 11).
SEEK to cylinder B, head 0, maximum sector.
READ FULL SECTOR for 140 words (2 sectors).
Check for NORMAL COMPLETION status.
REQUEST DISC ADDRESS and check that the cylinder is cylinder B - 1.

Step 21. Initialize track A defective (SPD = 1) with track B as spare. The data written by the initialize has each data word in sector 0 equal to the SPD value. This is true of every full track initialize done in subsequent steps, although this fact does not usually matter and is therefore not usually stated.

Make the following checks after the initialization. These same checks are made every time a track is initialized, but this will not be stated in subsequent steps.

1. SEEK to sector 0 of the track just initialized (track A here), and READ FULL SECTOR for 3 words in order to read the preamble. Check that the SPD bits and the address in the preamble are correct.

2. SEEK to sector 0 again and READ one sector. Check the status after the READ to see that the SPD bits in the status match the bits specified in the initialize. This check is not made on the 7910 if the D bit was set in the initialize; in that case the SPD values are not expected to match.

   Unless 7910, check for DEFECTIVE TRACK status on access to sector 0.

Step 22. Initialize track B spare (SPD = 4) for track A. Check for ILLEGAL ACCESS TO SPARE TRACK status on access to sector 0.

Step 25. Initialize track B as protected (SPD = 2).

Step 26. Initialize track B as protected and spare (SPD = 6) for track A. Check for ILLEGAL ACCESS TO SPARE TRACK status on access to sector 0.

Step 28. Initialize track B as protected and defective (SPD = 3). Unless 7910, check for DEFECTIVE TRACK STATUS on access to sector 0.

Step 30. Initialize track B as spare (SPD = 4) for track A. Unless 7910, SET FILE MASK to cylinder mode, auto seek to spare (MASK = 6). (The 7910 always has auto seek to spare enabled.)
SEEK to track A, sector 0, and READ one sector.
Check the data from the READ to determine that the spare track (track B) was read, not the defective track (track A).

Step 31. Reinitialize track A as a normal track (SPD = 0).

Step 32. Reinitialize track B as a normal track (SPD = 0).

Step 35. SEEK to track A, sector 0, and WRITE a sector which, for all I, has the Ith word equal to I.

Step 36. SEEK to track A, sector 0, and READ one sector. Check that, for all I, the Ith word of the sector is equal to I.

Step 40. For a series of cylinders, SEEK to head 0, sector 0. Use cylinder 1 the first time, and double the cylinder for each successive SEEK, unless the cylinder address exceeds the maximum cylinder, in which case the maximum cylinder is used. Stop after the SEEK to the maximum cylinder.

Step 45. Repeatedly SEEK to track A, sector 0, and VERIFY a number of sectors. VERIFY 1 sector the first time and twice as many each successive time unless this number exceeds the number of sectors per track, in which case only one track is verified. Stop once the whole track has been verified.

Step 49. Verify that illegal secondaries cause I/O PROGRAM ERROR status. Control type secondaries 2 through 15 are tested. The A-Series version skips this test for MAC drives.

Step 50. Illegal opcode tests. Verify that opcode 1 causes ILLEGAL OPCODE error status if 7910, or that it does not cause ILLEGAL OPCODE status if 7906H/20H/25H. Verify that opcodes 15 and 26 cause ILLEGAL OPCODE status (any drive). The A-Series version skips this test for MAC drives.

Step 52. Cause cylinder miscompare.
Initialize track B with another cylinder address and with SPD = 0.
SEEK to track B, sector 1, and READ one sector.
Check for CYLINDER MISCOMPARE status.

Step 54. Cause head miscompare.
Initialize track B with another head address and with SPD = 0.
SEEK to track B, sector 1, and READ one sector.
Check for HEAD/SECTOR MISCOMPARE status.

Step 55. Cause sector miscompare.
Initialize track B as a normal track (SPD = 0).
SEEK to sector 5 and READ FULL SECTOR.
SEEK to sector 0 and WRITE FULL SECTOR, using the data from the read.
SEEK to sector 1 and READ one sector.
Check for HEAD/SECTOR MISCOMPARE status.

Step 56. Send an incomplete disc read sequence
(READ without SECONDARY READ DATA).
Check for I/O PROGRAM ERROR status.
The A-Series version skips this test for MAC drives.

Step 57. Send SECONDARY WRITE DATE in illegal context (not preceded by write command).
Check for I/O PROGRAM ERROR status.
The A-Series version skips this test for MAC drives.

Step 59. SET FILE MASK to cylinder mode, auto incremental seek (MASK = 3).
SEEK to maximum cylinder, maximum head, maximum sector. READ FULL SECTOR for 140 words (2 sectors).
Check for END OF CYLINDER status.

Step 60. SET FILE MASK to cylinder mode, auto decremental seek (MASK = 11).
SEEK to cylinder 0, maximum head, maximum sector.
READ FULL SECTOR for 140 words (2 sectors).
Check for END OF CYLINDER status.

Step 72. SEEK to cylinder B, maximum head + 1, sector 0. Check that STATUS-2 error is detected, and that SEEK CHECK bit in drive status is set. Then SEEK to cylinder 0, head 0, sector 0, ignoring status.

Step 73. Repeat step 72 for SEEK to maximum cylinder + 1, head 1, sector 0.

Step 74. Repeat step 72 for SEEK to cylinder A, head 1, maximum sector + 2.

PART 3 (This interactive part does not apply to the 7910.)

Step 80. Tell operator to put RUN/STOP switch in STOP position. Check for DRIVE ATTENTION controller status, check that ACCESS NOT READY and DRIVE NOT READY bits in drive status are set, and check that the E-bit in the status is set.

Step 81. Tell operator to put RUN/STOP switch in RUN position. Wait for the drive to come on-line. Check for NORMAL COMPLETION controller status and check that FIRST STATUS bit in drive status is set.

NOTE: Waiting for the drive to come on-line involves the following sequence of operations:

1. Suspend the diagnostic program for 5 seconds.
2. Attempt to make a DSJ request.

If the DSJ request times-out, start again at (1).
If the DSJ request does not time-out, then the drive is on-line.

Step 82. Initialize track B as protected (SPD = 2), so that FORMAT switch can be checked.

Step 83. Tell operator to turn off FORMAT switch.
Check that FORMAT bit in drive status is clear.

Step 84. SEEK to track B, sector 0, and attempt WRITE.
Check for ATTEMPT TO WRITE ON PROTECTED TRACK status.

Step 85. SEEK to track B, sector 0, and attempt WRITE FULL SECTOR.
Check for STATUS-2 error.

Step 86. SEEK to track B, sector 0, and attempt INITIALIZE.
Check for STATUS-2 error.

Step 87. Tell operator to turn on FORMAT switch.
Check that FORMAT bit in drive status is set.

Step 89. Tell operator to turn on PROTECT or READ ONLY switch.
SEEK to track A, sector 0.
Check that READ ONLY bit in drive status is set.

Step 90. SEEK to track A, sector 0, and attempt WRITE.
Check for STATUS-2 error.

Step 91. SEEK to track A, sector 0, and attempt WRITE FULL SECTOR.
Check for STATUS-2 error.

Step 92. SEEK to track A, sector 0, and attempt INITIALIZE.
Check for STATUS-2 error.

Step 97. Tell operator to turn off PROTECT/READ ONLY switch.
SEEK to track A, sector 0.
Check that READ ONLY bit in drive status is clear.

Chapter 6
Error Rate Detection Program

Introduction

The first two sections of this chapter contain program operation information for the M/E/F-Series and L-Series, followed by two sections containing the same information for the A-Series. Test information at the end of the chapter is common to all processor families.

The chart introduced in Chapter 1 illustrating supported discs is reproduced below.

SUPPORTED DISCS

	7906H ICD	7910H ICD	7920H 7925H ICD	7906M MAC	7920M 7925M MAC
M/E/F	YES	YES	YES	---	---
L-SERIES	YES	YES	YES	---	---
A-SERIES	YES	---	YES	YES	YES

M/E/F-Series and L-Series

The Error Rate Detection Program, ERT, should be used only when the error rate of the disc drive and/or a particular media is suspected to be exceptionally high.

The Error Rate Program has the following functions:

a. Writes and reads back test patterns, checking for bad media or marginal heads.

b. Writes and reads back random data from random locations to check seek and data transfer operations.

c. Writes the media with checksummed data, then randomly reads back data to verify that the correct sector has been read.

There are several run options available to select test functions and test time. As this is a very lengthy test, it should only be run after DIAG has failed to isolate the problem. The operator designates units, cylinders and heads used in the tests.

Test results could point to a particular head and cylinder for a given address as possibly being a marginal track on the test media. Even if this does not show up as an equivalent track error during system operation or during the VE or IN functions of the FORM or FORMT utility, the operator may still want to spare (SP) the track in question using the FORM or FORMT utility. If so, a careful translation must be performed by the operator from physical address, cylinder, and head (as given by the ERT program) to the equivalent LU and track number for the drive.

CAUTION

This program is a dedicated system test and assumes no other system activity. There are no precautions, warnings, or other features written into the program to protect the user, the program, or other users. This program has complete access to all system discs and platters. Data will be overwritten and lost from the physical unit/cylinder/head combinations used by this test.

Even though the operator is requested to input LU (logical unit) numbers, the program only uses the LU number to direct itself to a particular select code (I/O channel). From that point on, the program deals only with physical address, cylinder, head, and sector for all devices on that I/O channel. There are no checks made by the program to restrict testing to the specified LU. Once the LU is specified, ERT has access to all physical addresses, cylinders, and heads on that I/O channel. Removable media should be removed and replaced with test media. If the test media or fixed platters contain valuable information, they must be backed up. Since ERT destroys all data in the test areas (any part of any disc), the areas must be backed up before running ERT and restored afterward.

Program Operation and Description

To start the Error Rate Test, enter "RU,ERT", followed by a carriage return.

The program will output the following query:

```
1 IN UNIT TBL
CHANGE?(YE/NO)
```

If only one unit is to be tested, enter "NO" followed by a carriage return. The program will then request the unit's address and type, as follows:

```
ENTER UNIT 1'S HPIB #(0-7), LU #(1-63), AND DRIVE TYPE(79??)
```

Here, 10 should be input for the LU of the disc as can be seen in the generation answer file (Appendix C). LU is only used to locate the select code of the disc and LU conventions are not observed.

Enter the unit's HP-IB address, LU number, and the last two digits of the drive type, followed by a carriage return. Use commas to separate the three items. The program will output the following:

```
UNIT x'S HPIB #-  x
          LU #- xx      DRIVE IS 79xx
CHANGE?(YE,NO)
```

If the values are correct, type "NO" followed by a carriage return. If not, type "YE" followed by a carriage return. If "YE" is entered, the program will request the unit's address and drive type again. If "NO" is entered, the program will output the main menu.

If more than one unit is to be tested, and "YE" is entered after the first query, the program will output the following:

```
UNITS TO TEST?

ENTER 1-4 ( units tested)
```

Enter a number between one and four (number of units to be tested) followed by a carriage return. The program will then request each unit's address and drive type. After each unit has had its correct address and drive type entered, the logical response to the above CHANGE?(YE,NO) query is "YE" and enter changes, or "NO" allowing the program to output the main menu.

Main Menu

The program will output the main menu as follows:

```
UNIT TBL(1),HEAD TBL(2), RUN OPTIONS(3),CYL TBL(4),ERROR
LIMITS(5),PATT TBL(6),PASS #(7),OUTPUT LU #(8),END(9),
RUN TEST(10)

?
```

Each menu item is selected by entering the corresponding number followed by a carriage return. All the menu items have default values except the unit table which is the first thing to be set up. The default values are as follows:

```
HEAD TABLE          0 to n     n = 3 for 7906H
                               n = 1 for 7910H
                               n = 4 for 7920H
                               n = 8 for 7925H

RUN OPTIONS         - SKIP SPARE/DEFECTIVE TRACKS
                      EXECUTE TEST
                      LONG PASS
                      USE ALL CYLINDERS
                      PRINT NON ERROR MESSAGES
                      PRINT MESSAGES

CYLINDER TABLE      - 0,1,2,4,8,16,32,64,128,256,300,410

ERROR LIMIT         - 40

PATTERN TABLE       - 155555,177777,125252,055555,007417
                      170360,162745,000000,163346,022222

PASS NUMBER         - 1

OUTPUT LU NUMBER - x  (where x is the LU number of the terminal being used).
```

All responses to queries are checked except those which are not bound, such as error limit, pass number, and cylinder and head table. If invalid responses are entered, the query is repeated until a correct response is entered.

Head Table

If "2" is entered in response to the "?" following the main menu, the program requests the HP-IB address of the drive that corresponds to the head table to be displayed:

```
UNIT HPIB #?
```

Input the HP-IB address of the drive for which the change is desired (the HP-IB address is the Front Panel LED digit on the 7906/20/25H or the thumbwheel switch on the 7910H). If the number entered does not correspond to any of the HP-IB addresses in the unit table, the program will then request the HP-IB address again. After the HP-IB address has been entered, the program will output the following:

```
TABLE = 0,1,2,3,4,5,6,7,8
CHANGE?(YE,NO)
```

If a change is desired in the head table, type "YE" followed by a carriage return. The program will output the following:

```
ENT HEAD
```

The program will request each head to be tested. Enter the number of the head to be tested (0 to 8 inclusive), followed by a carriage return. The program will request for the next head until a maximum of nine heads have been entered or a "-1" is entered. A "-1" in the head table follows the last head to be tested. Remember, the default is to test all of the heads of the unit. After all the heads have been entered, the program will output the head table for the unit again, for the operator to check, and output the CHANGE?(YE,NO) query again. If "YE" is entered, the program will request the heads to be entered. If "NO" is entered, the program will output the main menu. If a number less than zero or greater than eight is entered, the program will output the following:

```
HEADS 0-8,-1 TO STOP
```

The program will then request entry of head selection again.

NOTE

The program always prints out nine heads in the head table, but only the maximum number of heads for the drive or the number of heads preceding the -1 will be used.

Run Options

To change the run options, enter a "3" after the question mark following the menu. The program outputs the name and number of the run options as follows:

```
SPARE/DEFECTIVE (1), DUMP ERTBL (2), SHORT TEST (3),
RESTRICT CYL (4),LIMIT OUTPUT (5), SUPPRESS OUTPUT (6),
EXIT(7)

?
```

Each selected run option is displayed as it is enabled, followed by the question:

```
CHANGE?(YE,NO)
```

If you want the alternate mode for the option, press any character and RETURN. The alternate condition will be displayed with the query:

```
CHANGE?(YE,NO)
```

If the option is as desired, press RETURN and the list of run options will be displayed again. To exit the run option mode, enter "7"; the program will list the menu.

A description of the run options is given in the following paragraphs.

Spare/Defective (1)

Default mode: SKIP SPARE/DEFECTIVE

Alternate mode: REPORT SPARE/DEFECTIVE AS ERRORS

Default action allows the program to skip spared and defective tracks with no error indication. The alternate mode is to report all spared and defective tracks with error messages.

Dump ERTBL (2)

Default mode: EXECUTE TEST

Alternate mode: DUMP ERTBL

Default is to execute the error rate test. The alternate mode is to output the current error summary and return to the main menu.

Short Pass (3)

Default mode: LONG PASS

Alternate mode: SHORT PASS

Default is to run the full length of each of the sections of the error rate test, i.e., use all ten data patterns in the first section, loop 1024 times through the second section, and loop 8192 times through the third section.

The alternate mode uses only two data patterns in the first section, loops 64 times through the second section, and loops 256 times through the third section.

Restrict Cyl (4)

Restrict Cyl Run Option, M/E/F and L-Series ERT Program

Default mode: USE ALL CYL'S

Alternate mode: USE CYL TBL

Default is to use all cylinders. The alternate mode is to restrict seeks to those cylinders in the cylinder table.

Limit Output (5)

Default mode: PRINT NON ERR MESSAGES

Alternate mode: PRINT ERR MESSAGES ONLY

Default is to output error and status messages. The alternate mode allows only error messages to be printed.

Suppress Output (6)

Default mode: PRINT MESSAGES

Alternate mode: NO OUTPUT

Default is to output all messages. The alternate mode is to suppress all messages and output only the error summary at the end of the test.

Exit (7)

This exits the run option mode and returns to the menu mode.

Cylinder Table

When menu item 4 (CYL TBL) is selected, the program outputs the cylinder table as follows:

```
TABLE = 0  1  2  4  8  16  32  64  128  256  300  410
CHANGE?(YE,NO)
```

If no changes are desired, type "NO" followed by a carriage return and the program will return to the main menu. If a change is desired, type "YE" followed by a carriage return. The program will make twelve requests for cylinder numbers as follows:

```
ENT CYL
```

NOTE

The cylinder table must have twelve entries. Cylinders may be repeated if desired, but the program will always request twelve cylinders for the cylinder table.

Error Limit

Menu item 5 (ERROR LIMIT) allows the changing of the limit of the number of errors a drive is allowed to make per pass before it is removed from the unit table. If "5" is entered, the program outputs the following:

```
MAX ERRS PASS-      40
CHANGE?(YE,NO)
```

If no change is wanted, type "NO" followed by a carriage return, and the program will request to clear the error tables as follows:

```
CLEAR ERROR TABLES?(YE,NO)
```

The program keeps track of the number of errors each unit makes, along with the number of sectors of data the unit has read. The program uses these numbers to determine if the unit meets the error rate criteria. Because the program can run many sessions, the tables will accumulate errors and sectors of data read from session to session. This option allows the operator to clear these tables when a new testing session is begun, after a previous session with errors has been run.

If "NO" is entered, the program will return to the main menu without clearing the error tables. If "YE" is entered, these tables will be set to zero. The program will then output the main menu again.

If "YE" is entered to change the maximum number of errors per pass, the program will output the following:

```
ERRS/PASS?
```

Enter any number desired greater than zero. Numbers greater than 32767 will be reduced to 32767. If a number less than zero is entered, the program will request for the maximum number of errors per pass until a number greater than zero is entered. When the number has been entered, the program will output the number of errors per pass message again for the operator to check, followed by the CHANGE?(YE,NO) query. If "NO" is entered, the program will go through the sequence for clearing the error tables as noted above.

PATT TBL

Menu item 6 (PATT TBL) allows changing the pattern table. This entry is unlike the others in that the location of the inputs is important. For any other option, the input can have many spaces or no spaces in front of it. This is not the case for this option. The input must start in the first column of the line and be a six digit octal number. If there are less entries than patterns, the remaining patterns will be set to zero. The patterns must be separated from each other by one comma or one space. If there is more separation, the program could stop. If it did not stop, it still would not work as intended.

The program prompts:

```
PATTERNS
155555 177777 125252 055555 007417
170360 162745 000000 163346 022222
CHANGE?(YE,NO)
```

If no change is wanted, type "NO" and carriage return; otherwise, type "YE" followed by a carriage return. The program will prompt:

```
INPUT 10 6-DIGIT OCT #'S SEPARATED BY COMMAS
```

Carefully enter the patterns and press RETURN. The program will output the patterns for you to check and then ask for any more changes.

PASS

Menu item 7 (PASS#) allows changing the number of passes that each unit shall run before printing the error summary and ending. The program will query the operator as follows:

```
1 PASSES
CHANGE?(YE,NO)
```

If no change is wanted, type "NO" followed by a carriage return; otherwise type "YE" followed by a carriage return. The program will prompt:

```
# OF PASSES?
```

Enter the number of passes to be run. The number can be from 1 through 32767 inclusive. When the number has been entered, the program will output the number and again ask for any changes.

OUTPUT LU

Menu item 8 (OUTPUT LU #) allows changing the output LU device. The default is to have the terminal being used for input also be the output device. The program will query the operator as follows:

```
OUTPUT LU- xx
CHANGE?(YE,NO)
```

If no change is wanted, type "NO" followed by a carriage return; otherwise type "YE" followed by a carriage return. The program will prompt:

```
OUTPUT LU #?
```

Enter the LU number of the output device. After the LU number has been entered, the program will output the LU number and again ask for any changes.

END

Menu item 9 (END) exits the menu mode and returns control to file manager.

RUN TEST

Menu item 10 (RUN TEST) allows the program to exit from the menu mode and start execution of the error rate test. Before actually starting the test, the program will print to the output LU, a listing of all the menu tables and run options. The program will print a message to the output LU indicating the beginning of the actual test as follows:

```
BEGIN ERROR RATE TEST
```

After listing the error tables at the end of the test, the program will print to the output LU an ending message as follows:

```
END OF TEST

  UNIT x      OK
or
  UNIT x NOT OK
```

The last message indicates whether or not the unit under test meets the error rate criteria. If the unit has not transferred enough data to make an accurate calculation for this message, another message will follow. This condition will exist, for example, if the unit has run just one short pass. The message will appear as follows:

```
NOT ENOUGH DATA TRANSFERRED TO ACCURATELY DETERMINE
IF UNIT HAS MET ERROR RATE SPECIFICATIONS
```

The program will output the main menu at the end of the test, in case the operator wants to do some further testing. The parameters do not change from one testing session to another without the operator changing the parameters from the menu.

The only parameter that might change is the unit table. If, during a test, a unit exceeds the error limit, it will be removed from the unit table.

The operator may at any time, interrupt the test and have the main menu listed by using the RTE Break Mode as follows:

```
*BR,ERT
```

After getting the RTE prompt "*", enter BR, ERT. Within several seconds, depending on what section of the test is executing, the program will output the main menu. If execution of the test is to continue after using the break mode, execution will begin at the start of the test and not at the point at which the test was interrupted.

For more information on the testing procedure, see the Test Description and Error Information sections of this chapter.

A-Series

The Error Rate Detection Program, ERT, is designed to run on HP 1000 A-Series computer systems with 7906, 7920, and 7925 disc drives. It should be used only when the error rate of the disc drive and/or a particular media is suspected to be exceptionally high. The Error Rate Program has the following functions:

a. Writes and reads specific data patterns, checking for bad media or marginal heads.

b. Writes and reads random data from random locations to check seek and data transfer operations.

c. Writes to the media with checksummed data, then reads from random locations to see that the correct data has been read.

There are several run options available to select the test functions and test length. The operator designates drives, cylinders, and heads used in the test.

Test results can point to a particular head and track for a given address as possibly being a marginal track on the test media. Even if this does not show up as an equivalent track error during system operation or during the VE or IN functions of the FORM or FORMT utilitiy, the operator may still want to spare (SP) the track in question using the FORM or FORMT utility. If so, a careful translation must be performed by the operator from physical address (track, head as given by the ERT program) to the equivalent LU and track for the drive.

WARNING

This program is a dedicated system test and assumes no other system activity. There are no precautions, warnings, or other features written into the program to protect the user, the program, or other users. This program has complete access to all system discs and platters. DATA WILL BE OVERWRITTEN AND LOST from the physical unit/ track/head combinations used by the Error Rate Program.

There are no checks made by the program to restrict testing to the specified LU. Once the select code is specified, ERT has access to all physical addresses on that I/O channel. Removable media should be removed (if it is not to be tested) and replaced with test media. If the test media or fixed platters contain valuable information, they must be backed up before running ERT. Since ERT destroys all data in the test areas (any portion accessed by ERT), those areas must be backed up before running ERT and restored afterward.

NOTE

When testing HP-IB MAC type disc drives, the HP-IB address is selected by the thumbwheel switch in the 13037 controller on the 12745 interface board. The unit number is chosen by the front panel select switch and displayed by the LEDs on the front of the drive. On the HP-IB ICD disc drives, the front panel select switch and the display LEDs indicate the HP-IB address. The unit number for the ICD is always 0.

Program Operation

Number of Drives and Configuration.

To start the Error Rate Test, type RU,ERT followed by return. ERT will output the following query:

```
# of drives to test = 1
CHANGE?
```

If only one unit is to be tested, type in "NO", carriage return. ERT will prompt for the drive's configuration as follows:

```
Enter drive 1's Select Code (21-47)
Enter drive 1's HPIB address# (0-7)
Enter drive 1's unit# (0-7)
```

Enter the drive's Select Code, HP-IB address, and unit. ERT will then output the following:

```
Checking disc ID ...
```

If the drive status is good for the specifications given, ERT writes:

```
disc ID okay!
```

If there is an error, ERT will report "ERROR!" and loop back to the configuration dialogue. There may be situations that will cause this status check to hangup. ERT can be re-run by first using the OFF command (OF,ERT) and then restarting the program (RU,ERT).

After the status check, ERT will output the configuration table:

```
Drive 1's HPIB   x  UNIT   y
Select Code vv     Drive is 79zz
```

Where x is the HP-IB address
y is the LU number
vv is the Select Code
zz is the last two digits of the drive type

If more than one drive is to be tested, and "YE" was entered after the first query, ERT will request for the number of drives to be tested as follows:

```
Drives to test?(1-4)
```

Enter a number between one and four inclusive for the number of drives to be tested followed by a carriage return. ERT will then prompt for each drive's address and type. After all the drives have had proper addresses and drive types assigned, ERT will output the main menu.

Main Menu

ERT will output the main menu in the following form:

```
DT  Drive Table      SD  Report Spare/Defective    (NO)
HT  Head Table       CY  Cylinders                 (All)
CT  Cyl Table        PR  Print Non-error Messages  (YES)
PT  Pattern Table    OE  Output Enabled            (YES)
RU  Run Test         EL  Error Limit               40
DI  Display output   TL  Test Length              (Long)
RS  Reset output     NL  Number of Loops           1
EX  Exit             LI  Output List device        1

ERT:
```

Each menu item is selected by typing the two-character code to the left of each selection, then pressing "RETURN".

There are three different classes of selections.

1. Execute immediately
   - Run Test
   - Display output
   - Reset output
   - Exit

These codes will be executed upon reception of the code followed by a carriage return.

2. Change option
   - Report Spare/Defective
   - Cylinders
   - Print Non-error Messages
   - Output Enabled
   - Test Length

These codes change the options shown in the menu to the right of the code in parentheses. The option changes to the alternate value upon reception of the code followed by a carriage return.

3. Operator selectable values	Drive Table
	Head Table
	Cylinder table
	Pattern Table
	Error Limit
	Number of Loops
	Output List device

These codes allow the operator to change the default values of the test to tailor the testing to specific needs. Permissable values are as follows:

Drive Table	Number of drives	1 to 4
	Select Code	21 to 47
	HPIB address #	0 to 7
	Drive unit #	0 to 7
Head Table		0 to 8
Cylinder Table		0 to 822
Error Limit		0 to 32767
Number of Loops		0 to 99
Output List Device		0 to 63

Drive Table

Contains up to four drives with select code, address, and unit. The description of this selection can be found in the Main Menu section above.

Head Table

Contains the head numbers for each drive to be tested. To check or change the values, type "HT". Press "RETURN". ERT will query the operator for the HP-IB address of the drive corresponding to the head table to be displayed:

```
Drive HPIB #?
```

Enter the drive's HP-IB address (the front panel LED digit for 7906H/20H/25H or the thumbwheel switch number on the 12745 interface board for MAC drives). Press "RETURN".

If the number does not correspond with any number currently in the drive table, ERT will query the operator for the number again.

Once a valid HP-IB address is entered, ERT will output the existing head table values for the drive as follows:

```
Table = 0,1.....n       where n is the number of heads
Change?(YE,NO)          in the head table
```

If a change is desired, type "YE" followed by "RETURN". ERT will query the operator for each head number as follows:

```
ENT HEAD
```

Enter the desired head number followed by "RETURN". ERT will prompt for up to nine heads or until a negative number is entered. If an invalid head number is entered, ERT will output

```
Heads 0-8,-1 to stop
```

and prompt for the head number again. Once nine heads or a negative number is entered, ERT will display the head table and ask if a change is desired. If "YE" is entered, ERT will prompt for the head numbers again. If "NO" is entered, ERT will output the main menu again.

Default values are to test all the heads.

```
Default Values  0 to n      n = 3 for 7906H
                            n = 4 for 7920H
                            n = 8 for 7925H
```

Cylinder Table

Contains the cylinders which ERT will restrict itself to when directed to use the cylinder table only. Twelve values are used. To check or change the cylinder table, type "CT" followed by "RETURN". ERT will display the table:

```
Table =   0   1   2   4   8  16  32  64 128 256 300 410
Change?(YE,NO)
```

If no changes are desired, type "NO" followed by "RETURN". ERT will return to the main menu. If "YE" is entered, ERT will prompt for twelve numbers as follows:

```
ENT CYL
```

Enter a cylinder number followed by "RETURN". If the number is less than zero or greater than 822, ERT will output:

```
CYLS 0-822
ENT CYL
```

Once twelve cylinder numbers have been entered, ERT will display the table and query for a change. If "YE" is entered, ERT will prompt for twelve cylinder numbers again. If "NO" is entered, ERT will return to the main menu.

Twelve cylinder numbers must be entered. Numbers may be duplicated if desired.

Default values 0,1,2,4,8,16,32,64,128,256,300,410

Pattern Table

Contains the data patterns, in octal, for use during the pattern test portion of the error rate test. To check or change the patterns, type "PT" followed by "RETURN". ERT will display the pattern table and ask for changes:

```
Patterns
155555 177777 125252 055555 007417
170360 162745 000000 163346 022222
Change?(YE,NO)
```

If no changes are desired, type "NO" followed by "RETURN". ERT will return to the main menu. If "YE" is entered, ERT will query the operator for the patterns as follows:

Input 10 6-digit oct#'s separated by commas

Carefully enter ten patterns in octal followed by "RETURN". Do not include any extraneous spaces or leave out any preceding zeros. The patterns must start in the first column. If fewer than ten patterns are input, the rest will be zeros.

Once the patterns have been entered, ERT will output them and prompt for changes. If "NO" is entered, ERT will return to the main menu. If "YE" is entered, ERT will prompt for the ten patterns to be entered again.

```
Default values  155555 177777 125252 055555 007417
                170360 162745 000000 163346 022222
```

Run Test

Exits the operator selection phase of the test and begins the actual error rate test sequence. To begin the test, type "RU" followed by "RETURN". ERT will then output all of the menu choices as they exist at that time and begin testing the drive(s).

Display Output Command, A-Series ERT Program

Display Output commands ERT to output the error tables. The tables are dumped at the end of the test, but the operator can [BR]eak ERT and dump the tables in the middle of testing. When a break is encountered, ERT will complete the loop it is in, then halt testing and display the main menu. To output the error tables, type "DI" followed by "RETURN". ERT will output the error tables to the output LU and return to the main menu.

Reset Output

Commands ERT to clear the error accumulators that are used to judge whether or not a drive must be removed from the drive table. Type "RS" followed by "RETURN" and ERT will clear the error tables and output:

Error tables cleared

ERT will then display the main menu again.

Exit

Commands ERT to terminate and return control to the operating system. Typing "EX" followed by "RETURN" will cause ERT to terminate without execution of any further testing.

Report Spare/Defective

Allows ERT to report all tracks marked as spared or defective when they are encountered during the test, or skip them without reporting any error. Successive typing of "SD" followed by "RETURN" will cause ERT to toggle the option from 0(NO) to 1(YES) or 1 to 0 when the main menu is displayed again.

Default value (0) skip all spare/defective tracks

Cylinders

Restricts ERT to using the cylinder table only or all allowable cylinders for each type of drive. Successive typing of "CY" followed by "RETURN" will cause ERT to toggle the option from "All" to "Table Only" or "Table Only" to "All" when the main menu is displayed again.

Default value (All)

Print Non-error Messages

Commands ERT to output all information when an error occurs, not just the error messages, but status as well. Successive typing of "PR" followed by "RETURN" will cause ERT to toggle the option from 0(NO) to 1(YES) or 1 to 0 when the main menu is displayed again.

Default value (1) Output non-error messages

Output Enabled

Allows the operator to have ERT output messages to the output LU or suppress all output. Successive typing of "OE" followed by "RETURN" will cause ERT to toggle the option from 0(NO) to 1(YES) or 1 to 0 when the main menu is displayed again.

Default value (1) Output messages to output LU

Error Limit

Establishes the maximum number of errors any drive will be allowed to make prior to being removed from the drive table. To change the number of errors, type "EL" followed by "RETURN". ERT will query for the number of errors as follows:

Errs/Pass?

Type in the desired maximum number of errors allowed per pass followed by "RETURN". ERT will display the main menu with the new number shown.

Default value (40)

Test Length

The length of the test, short or long. Successive typing of "TL" followed by "RETURN" will cause ERT to toggle the option from "Long" to "Short" or "Short" to "Long" when the main menu is displayed again.

Default value (Long)

	Short	Long
Pattern test	2 patterns	10 patterns
Random test	64 loops	1024 loops
Checksum test	256 loops	8192 loops

Number of Loops

The number of test sequences or passes each drive is to run before ERT will stop. To change the number of passes, type "NL" followed by "RETURN". ERT will query for the number of passes as follows:

```
# of passes ?
```

Enter the desired number of passes followed by "RETURN". The new number of passes will be displayed when ERT displays the main menu again.

```
Default value  = (1) loop
```

Output List Device

The logical unit number of the output device, CRT terminal or hard copy printer. To change the output LU, type "LI" followed by "RETURN". ERT will query for the new output LU as follows:

```
Output LU   ?
```

Enter the LU number of the output device followed by "RETURN". The new output LU number will be displayed when ERT displays the main menu again.

```
Default value  (1)
```

Test Section 1

This section of ERT writes and reads back patterns checking for bad packs or marginal heads.

Depending on the selected run option (4), this test uses only the cylinders in the cylinder table, or all cylinders.

NOTE

If run option 3 (short pass) is selected, Test Section 1 uses only the first two data patterns in the pattern table. The steps in section 1 are performed for each pattern in the pattern table. The first pattern is transformed into 48 bits, rather than the normal 16 bits stored in the pattern table. The direction through the cartridge/pack is reversed between patterns.

Step Description

256 Write a track of data to the disc. Check for errors. If track is defective or spare, skip Step 259 and do not print an error message, depending on run option (1).

259 Read the data written in Step 256. Check for errors. Compare read data with written data. If any errors or data is mismatched, print error message.

NOTE

Standard reads are performed for the 7910H. For the 7906/20/25H, reads with offset are performed for patterns 9 and 10. The offset is removed for a read retry. The offset for pattern 9 and pattern 10 is 350 microinches. If read fails after five retries, one write retry is allowed. This will be indicated by an "R" next to the location in the error summaries. A hard or non-recoverable error will be indicated by an "F" next to the location in the summaries, and also after the error location in the summaries. Also, after the error message is printed, a message will be printed saying whether the write retry was successful or not. This will only occur after a hard read fail and only for this test section.

Error Information

The ERT program performs data reads and writes. It therefore uses all of the data path circuitry, but problems could be caused by other elements. For troubleshooting purposes, it is best to analyze the error messages received and the error patterns. Refer to the Error Messages paragraph.

In General

The following are possible causes of the errors which may occur in Test Section 1:

A. A faulty head will usually cause errors on the high-numbered tracks.

B. The Preamp may cause random data errors for a particular head, or several heads, however the heads involved may be faulty.

C. The Drive Control circuits may cause random data errors on any head.

D. Repeated data errors on a particular cylinder, head, and sector indicate a bad spot on the media. If errors occur on all the heads, a defective servo code (needs re-servo formatting) is indicated.

Test Section 2

This section writes and reads back random data from random locations to check seek and data transfer operations. The random locations include a head randomly chosen from the head table, and a cylinder randomly chosen from the cylinder table depending on the selection of run option (4). The sector is chosen randomly as is the length of the data transfer. The data transfer will be in the range of 0 to 1024 words and the length will be adjusted to fit on one track if the sector selection requires it.

NOTE

The diagnostic repeats steps 305 and 310, 1024 times (only 64 times if run option (3) is selected).

Step Description

305 Pick a random cylinder, head and sector. Get a random word count in the range 0 to 1024 or a length that will fit on the rest of the track from the random sector. Generate a buffer of random data of word count length. Write this buffer onto the disc at the chosen location. Check for errors. If chosen track is defective, get another location without incrementing the loop counter.

310 Seek to the location written in Step 305. Read the written data and compare the read data with the written. If any errors, print an error message.

Test Section 3

This section fills the pack with **checksummed data, then randomly reads the** data to verify that the correct sector has been read. Each sector is checksummed separately. The entire sector sums to zero. The first two words sum to the cylinder number while the next two sum to the packed head/sector number.

NOTE

Run option (4) is used to select all cylinders or just use the cylinders in the cylinder table.

Step Description

476 Generate a track of the checksummed data. Write the data onto the disc and check for errors. If the track is defective, skip with no error indication.

NOTE

Steps 479 and 480 are only executed if the current head is head 1 and the current cylinder is in the cylinder table.

479 Read sector 0 of the track just written with maximum positive offset. If a data error is detected, do not report it, as data errors are expected with a maximum offset.

480 Repeat Step 479 for sector 33 and a maximum negative offset.

NOTE

Steps 481 and 482 are repeated 8192 times or 256 times depending on run option (3).

481 Choose a random cylinder, head and sector location. Depending on run option (4), only choose cylinders from the cylinder table or all cylinders.

482 Read a sector from the chosen location. If the chosen location is a defective track, get a new location without incrementing the loop counter. Check for errors during the read and check the read data for the correct checksummed information.

Error Messages

Diagnostic Status Message

Throughout the diagnostic, status messages can be printed. For more information on status, see the description of the Request Status command in the Integrated Controller Programmer's Guide or the 7910 Disc Drive Service Manual, HP Part No. 13365-90901 and 07910-90903, respectively. These status messages are of the form:

```
          SPD   STAT1 E  TYP   STAT2

STATUS IS 0     00    0  00    000

STAT IS SSSSSSSSSS, SHOULD BE SSSSSSSSSS
```

Where the 0's are octal digits, the S's indicate a ten letter status description (detailed below), SPD is the state of the Spare, Protect and Defective bits for the track accessed, STAT1 is the IDC status word, E is the state of the E bit, TYP is the drive type number set by the jumpers on the processor board and STAT2 is the drive status word.

STAT1	SSSSSSSSSS	Explanation
0	NORM COMP	Normal complete. No error detected.
3	ILL DRVTYP	Illegal drive type as set by the jumpers on the processor board.
7	CYL MISCMP	Cylinder Miscompare.
10	DATA ERROR	Data Error Detected.
11	HD/SEC MIS	Head or Sector Miscompare.
12	I/O PRG ER	I/O Program Error.
13	SEC SYNCH	Sector Synch not Received in Time Allowed.
14	END OF CYL	End of Cylinder.
16	DAT OVRRUN	Data Overrun.
20	ILL ACC SP	Illegal Access to Spare Track
21	DEF TRACK	Defective Track.
22	ACC NT RDY	Access not Ready During Data Operation.
23	STAT-2 ERR	Status-2 Error (drive status error).
26	WRT PRO TK	Attempt to Write on Protected Track.

Messages For Test Sections 1 and 3.

RETRY WRITE SUCC

Will appear only during Test Section 1. The write retry to correct the hard read error or the data miscompare error succeeded.

RETRY WRITE FAIL

Will appear only during Test Section 1. The write retry to correct the hard read error or the data miscompare error failed.

STEP AAA WRT ATT FAIL SOFT CCC / H / SS TRY= T

Will appear in both test sections. AAA stands for 256 (section 1) or 476 (section 3). The location of the error is given and the number of attempts at a Write before the DSJ value was 0. A status message follows.

STEP BBB RD ATT FAIL SOFT CCC / H / SS TRY= T

Will appear in both test sections. BBB stands for 259 (section 1) or 481 (section 3). The location of the error is given and the number of Read attempts before the DSJ value was 0. A status message follows. Also, for section 1 only, a data miscompare message will be given.

STEP 259 DATA MISCMP SOFT CCC / H / SS TRY= T

Will appear only in Test Section 1. The data read did not correspond to the data written and there was no error indication (the DSJ = 0). A status message and a data miscompare message is printed. A write retry is performed once.

STEP EEE WRT ATT FAIL HARD CCC / H / SS

Will appear in both test sections. EEE stands for 256 and 476. The location of the error is given and a status message follows. This error is flagged as an unrecoverable error.

STEP FFF RD ATT FAIL HARD CCC / H / SS

Will appear in both test sections. FFF stands for 259 and 476. The location of the error is given and a status message follows. This error is flagged as a non-recoverable error. For Test Section 1 only, a data miscompare message is given and a write retry is allowed once. If the write retry is successful, the non-recoverable status is changed to a retry indication.

STEP 279 DATA MISCMP HARD CCC / H / SS

Will only appear in Test Section 1. The read data miscompares with the written data after a write retry without error indication from the drive. This is flagged as a non-recoverable error and the user is notified by data miscompare and non-recoverable error messages.

STEP 481 CHECKSUM DAT ERR CCC / H / SS

This will only appear in Test Section 3. A random sector of checksummed data has been read with no errors reported by the drive. A status message will be printed along with a message on what is wrong in the checksummed data.

STEP JJJ STAT DIF FRM EXP CCC / H / SS

This will appear in both test sections. JJJ stands for 256,259,476, 479,480 and 481. The DSJ after a seek command is non-zero. A status message follows.

STEP KKK RD MAX OFF FAIL CCC / H / SS

This will only appear in Test Section 3. KKK stands for 479 (read with maximum positive offset) and 480 (read with maximum negative offset). The read with maximum offset command has produced a status other than Normal Complete or Data Error. A status message follows.

ERROR IN PRE- OR POST-AMBLE OF SECTOR SS

This will only appear in Test Section 1. When the read failed (either soft or hard) and the data read matched the data written, then this message will be printed. The drive will be asked where it thought the error was and the sector returned will be printed for SS.

CYLINDER WRONG. VALUE READ =CCC
HEAD/SECTOR WORD WRONG. VALUE =(OCT) OOOOOO
CHECKSUM NOT ZERO. VALUE =(OCT) OOOOOO

These three messages will only appear after a Checksum Data Error or a Read Attempt Fail Hard error in Test Section 3. Only one, two or all of the messages may appear depending on where in the sector the data error occurred.

Error Messages For Test Section 2

TEST DESCRIPTION

305 ERROR IN RANDOM SEEK OPERATION

The DSJ after a seek operation is non-zero. A status message follows:

ERROR IN RANDOM WRITE OPERATION

The DSJ after a Write operation is non-zero. The status is checked and if the track is defective or spare (depending on the run options) then it is skipped with no error message. A status message follows:

310 ERROR IN RANDOM SEEK OPERATION

The DSJ after a seek operation is non-zero. A status message follows:

ERROR IN RANDOM READ OPERATION

The DSJ after a Read command is non-zero. A status message follows:

DATA ERROR AT CCC / H / SS WORD WWW

WORD READ 000000 SHOULD BE 000000

The read random data does not correspond to the written random data. 000000 stands for the octal value of the data. The location of the miscompare is given.

Error Summaries

The diagnostic outputs error summaries at the end of each test pass and again at the completion of the entire unit diagnostic test. The summaries at the end of a test pass include only that drive's errors for that one pass. If there are no errors, then no summary is given.

The error summary information can be divided into three sections:

1. Head/Cylinder error table
2. Head/Unit error table
3. Miscellaneous information

An example of an error summary is given. The example is for a 7925 at HP-IB address 6 and a 7906 at address 7. The example starts at the beginning of a test pass for unit 7, the 7906. It is assumed that the 7925 was removed from the test during pass 6 and the test is finishing at pass 10. Several example error messages will be given for the 7906.

Example Test Output

```
UNIT 7

STEP 259 RD ATT FAIL SOFT   300/1/39   TRY=2
ERR AT WRD 6
WRD RD 155533   SHOULD BE 155555
WRD RD 133333   SHOULD BE 133333
WRD RD 066666   SHOULD BE 066666
         SPD   STAT1   E    TYP    STAT2
STATUS IS 0     10     0     00     040
STAT IS DATA ERROR,SHOULD BE NORM COMP

STEP 259 RD ATT FAIL HARD   250/0/35
ERR AT WRD 69
WRD RD 007036   SHOULD BE 007016
WRD RD 007016   SHOULD BE 007016
WRD RD 007016   SHOULD BE 007016
         SPD   STAT1   E    TYP    STAT2
STATUS IS 0     10     0     00     040
STAT IS DATA ERROR,SHOULD BE NORM COM
   RETRY WRITE SUCC

STEP 259 RD ATT FAIL HARD   100/2/40
ERR AT WRD 81
WRD RD 020000   SHOULD BE 000000
WRD RD 000000   SHOULD BE 000000
```

```
 WRD RD 000000   SHOULD BE 000000
          SPD   STAT1   E    TYP    STAT2
 STATUS IS 0     10     0     00     040
 STAT IS DATA ERROR,SHOULD BE NORM COMP

 STEP 259 RD ATT FAIL HARD   100/2/40
 ERR AT WRD 81
 WRD RD 010000   SHOULD BE 000000
 WRD RD 000000   SHOULD BE 000000
 WRD RD 000000   SHOULD BE 000000
          SPD   STAT1   E    TYP    STAT2
 STATUS IS 0     10     0     00     040
 STAT IS DATA ERROR,SHOULD BE NORM COMP

                    UNIT 7 ERROR SUMMARY
CYL  HD0    HD1    HD2    HD3
100   0      0     10RF    0
250   5R     0      0      0
300   0      3      0      0

NO. OF PASSES FOR UNIT 6 IS    6
NO. OF PASSES FOR UNIT 7 IS   10

                    UNIT 6 ERROR SUMMARY
CYL  HD0  HD1    HD2  HD3  HD4  HD5  HD6  HD7  HD8
 30   0    5R     0    0    0    0    0    0    0
 49   0    0      1    0    0    0    3    0    0
100   0    5R     0    0    0    0    0    0    0
400   0    0      0    0    0    0    0    0    0
800   0   10RF    0    0    0    0    0    0    0
804   0   10R     0    0    0    0    0    0    0
809   0   15RF    0    0    0    0    0    0    0
810   0   10RF    0    0    0    0    0    0    0
811   0    0      0    0    3    0    0    0    0

                    UNIT 7 ERROR SUMMARY
CYL  HD0    HD1    HD2    HD3
 50   0      3      0      0
100   0      0     10RF    0
250   5R     0      0      0
300   0      3      0      0
375   0      0      0      2
OVERFLOW =     0 TOT ERRS =     85 SOFT ERRS=    71
UNIT   HD0  HD1  HD2  HD3  HD4  HD5  HD6  HD7  HD8
 6      0   55    1    0    3    0    3    0    0
 7      5    6   10    2    0    0    0    0    0
```

Head/Cylinder Error Table

The Head/Cylinder error table is printed at the end of each drive's pass through the diagnostic and at the end of the entire test. The table printed at the end of a test pass includes only the errors made by that drive during the test pass. If the drive made no errors, then the table is not printed.

The Head/Cylinder table is grouped according to drive HP-IB number. The lines of error information are ordered according to increasing cylinder number. The number of heads shown in this table is dependent on the number of heads in the drive. So for the 7906, only four heads worth of information is shown while the 7925 has nine heads of information.

There are two error flags in the Head/Cylinder error table. These are the "R" and the "F" shown to the right of an entry into the table. The "R" signifies that a write retry was attempted. The "F" indicates a non-recoverable error was detected by the diagnostic. A non-recoverable error is a hard write fail, a data miscompare with no error status, or a hard read error that is not corrected by a write retry.

Looking at the Unit 6 Error Summary in the example above, "5R" means five errors occurred with at least one of them requiring a write retry. "10RF" means ten errors occurred with at least one of them being non-recoverable (F) after a write retry (R). And finally, "3" means three errors occurred that were recovered after simply re-reading them (up to five times per error). Unit 6 seems to have a bad head and Unit 7 could have a marginal spot on its media.

NOTE

In a multiple drive test, if one drive made several errors while the other drive made none, the Head/Cylinder table could have an output for the drive with no errors. This output would be just one line of output with the cylinder equal to the last cylinder output for the previous drive but with all the heads showing 0 errors. If this output is seen, ignore it.

Unit/Head Error Table

The Unit/Head error table is only output at the end of the diagnostic test. It shows the number of errors that occurred for each head in each drive in the test. If a number of errors occur on one head (as for Unit 6 in the example), chances are that the head is marginal.

The number of heads shown in this table is equal to the largest number of heads for the drives in the test. In the example, nine heads are shown for each drive even though Unit 7 only has 4 heads. The extra heads will be shown as having 0 errors.

Miscellaneous Information

If a drive is removed from the test because of too many errors, an error message indicating this is printed. The message is preceded by a string of "*" and followed by another string. The number of passes each drive completed is given at the start of the final error summaries.

There is a line of output showing the total number of errors that could not be put into the Head/Cylinder table (OVERFLOW), the total number of data related errors (TOT ERRS) and the total number of soft errors (SOFT ERRS).

Quantity Of Data Transferred

The following formulas can be used to calculate the number of sectors of data transferred per pass:

Long Pass:

Number of sectors transferred = 10HCS + 12,288

Short Pass:

Number of sectors transferred = 2HCS + 512

where: H = number of heads accessed

C = number of cylinders accessed

S = number of sectors/track for disc being tested

Chapter 7
Disc Analyzer (DISCZ)

General

The chart introduced in Chapter 1 illustrating supported discs is reproduced below for your convenience:

SUPPORTED DISCS

	7906H ICD	7910H ICD	7920H 7925H ICD	7906M MAC	7920M 7925M MAC
M/E/F	YES	YES	YES	---	---
L-SERIES	YES	YES	YES	---	---
A-SERIES	YES	---	YES	YES	YES

DISCZ provides a capability to string together and loop on any combination of the discrete disc commands that are available. The intent is to provide a minimum but adequate capability to home in on suspected problems.

The A-Series version of DISCZ differs slightly from the M/E/F and L-Series versions. The disc LU prompt has been changed to a SELECT CODE query. The HP-IB address request is followed by a disc UNIT# request. Also, a status check is done following the UNIT# request to insure proper disc type. The DISCZ command LU is changed to SC to indicate select code and the command CU has been changed to CA for changing address numbers. DISCZ buffers are initialized to the number 31415 before any read attempts. This was done to distinguish the case when no data was read.

NOTE

When testing HP-IB MAC type disc drives, the HP-IB address is selected by the thumbwheel switch in the 13037 controller on the 12745 interface board. The unit number is chosen by the front panel select switch and displayed by the LEDs on the front of the drive. On the HP-IB ICD disc drives, the front panel select switch and the display LEDs indicate the HP-IB address. The unit number for the ICD is always 0.

Operator Commands

Operating System Commands

This following commands can be input from the operator's console:

```
RU,DISCZ
BR,DISCZ
OF,DISCZ
```

To start the Disc Analyzer, type RU, DISCZ followed by return. DISCZ will output the following comments:

```
A-Series MAC HP-IB disc diagnostic.
                                    rev. 2401

DISCZ DISC ANALYZER PROGRAM***** TYPE ?? FOR HELP

!!WARNING  SAVE THE DATA OR USE SCRATCH PLATTER!!

ENTER Disc Select Code (21-47)

ENTER Disc HPIB Address (0-7)

ENTER Disc Unit# (0-7)

Checking Disc ID ...
```

If the drive status is good, DISCZ writes:

```
Disc ID Okay!
```

If there is an error, ERT will report "ERROR!" and loop back to the configuration dialogue. There may be situations that will cause this status check to hangup. ERT can be re-run by first using the OFF command (OF,ERT) and then restarting the program (RU,ERT).

DISCZ Commands

DJ get DSJ status byte
DSJ is returned (see DSJ specs).

ST get status byte
STATUS is returned.

SK seek to physical address
SK,cylinder,head,sector
where sectors are 128 word sectors
STATUS is output at completion of the command
(see STATUS specs.)

SM set file mask
SM,mask
where mask is filemask (0 to 7)
DSJ is returned.

RC recalibrate.

RA request address (get address record)
DSJ is returned
ADDRESS is returned (see ADDRESS specs).

AR address record (set address record).

ID get HP-IB identify bytes
ID,unit
where unit is the address.

EN send END command.

RD read data
RD,number of words
data only (not the preambles)
STATUS is returned
DATA is returned (see DATA specs).

RF read full sector
RF,number of words
number of words includes preamble words
STATUS is returned
DATA is returned.

RO read with offset
RO,number of words,offset
words are data only (not the preambles)
offset is in increments -64 to 64
STATUS is returned
DATA is returned.

RW read without verify
RW,number of words
words are for data only (not the preambles)
checksum is not checked
STATUS is returned
DATA is returned.

VF verify sectors
VF,number of sectors
data only, 128 word sectors.

WD write data
WD,number of words,data
data only (not preambles) - data is word pattern.

WF write full sector
WF,number of words
data and preamble is taken from current buffer
preambles from buffer are re-written on disc.

IN initialize (write)
IN,number of words,SPD,data
data is one word pattern.
SPD is 0 to 7 (3 bits are SPD, respectively)
number of words is data only
preambles (generated by controller) re-written
see address record (AR).

Operator Control Commands

?? help command, all commands are listed.
??,xx - where xx is any command listed by ??.
Parameter requirements for command xx are listed
(see HELPXX specs).

LL change list device
LL,lu - where lu is the new list device lu number.
lu=0 for no list device.

CU(CA) change disc unit (address)
CU,xx - where xx is the new disc unit number.
CA,XX - where xx is the new disc address number (A-Series)

LU(SC) change disc lu (select code)
LU,xx - where xx is the new disc LU number.
SC,xx - where xx the new disc select code number (A-Series)

LE lock EQT of disc LU (not supported in RTE-L/XL).

UE unlock EQT of disc (not supported in RTE-L/XL).

SW set display window
SW,first word, number of words - sets the display "window" for the user, gives partial display of the data buffer.

IB initialize buffer
IB,pattern buffer, is initialized before each operation
If no pattern, buffer not initialized.
On startup, it is set to initialize to zeroes.

DB display data buffer
DB,first word,number of words
default is to display the window (SW).

MW modify word(s) in data buffer
MW,first word,number of words, data.

/E terminate (exit) program. EX also supported.

CO send comment to list device
CO (then a carriage return)
input up to 40 characters of comment on the next line, then CR
Typed comment line is printed on the list device for permanent record
(see COPY specs.)

Program Control Commands (Program Mode)

There is a programmable command buffer with space reserved for 99 program lines. Entering a line number anywhere from 1 to 99 preceding the command is interpreted by DISCZ to be put into the command buffer instead of being executed. All the above commands are useable in the program mode.

The commands operate differently only in that the TR (trace) mode has control over the console display and list device outputs. The TR mode defaults to suppression of status and data. The only return is if an error occurs. The command being executed is always echoed in the default mode.

Analyzer Control Commands (Program Mode)

EP erase program.

LP list program.

SP start program.

GO go to
nn, GO, nn
this allows looping within the program.

N= loop counter
N=, nn
this counter is incremented each time this statement is executed, and the program will halt here after nn times.

nn add line to program or replace line
nn, command - where nn is the line number, followed by a program or disc command
nn with no command will delete line.

Output Message Specification

The list output device specified, essentially echoes the terminal output. Therefore, the following specifications apply to both outputs.

Status

If applicable, status is returned on every disc command issued. Refer to command specifications. The STATUS return format is as follows:

```
STAT1:123456  (S1=123456)  STAT2:123456  DSJ:123456
```

where:

STAT1 = status bytes 1 and 2 in octal (16 bits)

STAT2 = status bytes 3 and 4 in octal (16 bits)

DSJ = device specified jump (octal)

S1 = octal conversion of controller status
5 least significant bits of byte 1

DSJ (Device Specified Jump)

The DSJ return format is as follows:

```
DSJ=123456
```

where the value is returned in octal format.

Address

The returned address is in the following format:

```
CYL=123456  HEAD=123456  SEC=123456,
```

where the numbers returned are in decimal, and represent the logical address of the next operation (if previous operation successful) or of the last operation (where an error return occurred).

Data Buffer Window

The data buffer is displayed at the completion of all read commands to the disc. Only that portion of the data buffer specified by the SW (set window) command is displayed.

```
123456 123456 123456 123456 123456 123456 123456 123456
123456 123456 123456 123456 123456 123456 123456 123456
123456 123456 123456 123456 123456 123456 123456 123456
123456 123456 123456 123456 123456 123456 123456 123456
123456 123456 123456 123456 123456 123456 123456 123456
123456 123456 123456 123456 123456 123456 123456 123456
123456 123456 123456 123456 123456 123456 123456 123456
123456 123456 123456 123456 123456 123456 123456 123456
123456 123456 .............etc
```

Normally this is all data - 128 words per sector.

For read full sectors, the words are:

```
word 1              = synch word
word 2              = cylinder address
word 3              = head sector address (with SPD bits)
word 4 to 131       = 128 words of data
word 131            = CRC word
word 132 to 138     = ECC (not used by HP-IB controllers)
.........etc.............
```

COpy Comment Lines

The following prompt is output to the console only. This prompt is not suppressed by the TR (trace) option, because if the CO command was used in the command buffer (execute mode), and the "no trace" option was in effect, the program would stop on the CO command without any indication that it was waiting for an operator input.

```
***SAMPLE COMMENT LINE OF 40 CHARACTERS!!!!***
```

HElp (All Commands)

```
*** DISC COMMANDS ***
DJ  GET DSJ STATUS BYTE
ST  GET STATUS WORDS
SK  SEEK TO PHYSICAL ADDRESS
......etc......
```

until all commands have been displayed, then:

```
*** OPERATOR CONTROL COMMANDS ***
LL  CHANGE LIST DEVICE
CU  CHANGE DISC UNIT
LU  CHANGE DISC LU
......etc......
```

until all commands have been displayed, then:

```
*** PROGRAM CONTROL COMMANDS ***
EP  ERASE PROGRAMS
LP  LIST PROGRAM
SP  START PROGRAM
......etc......
```

until all commands have been displayed.

HELPXX (Specific Command)

The help command for a specific command will give the following message:

```
XX,prm1,prm2,prm3,.....,prmn
```

where:

XX = the specific command in question, and prm1 thru prmn are the necessary parameters to enter.

Program Description

Those commands and operations that are discussed in the specifications section will not be discussed here. A fundamental knowledge of the hardware is required to make use of this program. Hardware manuals for both the discs and their controllers should be available for reference to understand the status returns and affirming appropriate response of the disc to each command.

Command Buffer

The Command Buffer is fixed at 99 lines of 20 words (40 characters) or 990 words. This buffer occupies the area immediately after the program DISCZ.

Data Buffer

The data buffer is the unused, available area beyond the command buffer extending to the end of the partition (or memory). When the data buffer command specifies an area larger than that available, DISCZ provides an error message, which gives the available limits of the data buffer. When the program first runs, it initializes the data buffer to zero before essential commands. Use the IB command to disable this feature when desired. The program runs much faster without the "reset buffer" option enabled.

The data buffer is used for all read or write commands, including the initialize command (IN). Data is first put into the buffer, then to the disc for writes. If a "DSJ not equal to zero" is returned, the buffer will have been updated, but the data will not have been output to the disc. If DSJ not 0 is received on reads, the data buffer is not updated.

On writes, all partial sectors on the disc are filled with 1's. This is a controller function, and is not done by DISCZ.

Status Call

Status call ST will always give zero status, since the disc library calls for each command include a status call. Once the status request is made, the status is reset to 0.

Controller Differences

The 7910H disc controller differs from other "H" controllers, causing the 7910H to respond differently to certain commands. The variations will become apparent with experience, and include the following:

1. The 7910H does not respond to the SM (set mask) command. It is in the cylinder mode, with auto seek, and with auto seek to spare. The SM command will always result in a non-zero DSJ = 1.

2. The 7910H does a cylinder address verification on SK (seek), not on the read. The others do it on RD (read), not on SK.

DISCZ Numeric Inputs

There are two important characteristics about inputs to the DISCZ utility. The plus (+) in front of a number is treated as an ASCII parameter. If a number exceeds 32767, it becomes modulo 32767.

Flexibility

All commands are accepted in the program mode. Certain peculiarities are as follows:

1. A CO command will halt the program and wait for an operator input. It can be used for that purpose only.

2. All non-disc commands that are essentially for output or display will be executed, but the output is suppressed, as with all output in the execute mode (except on error).

Miscellaneous Items

1. All numeric inputs are decimal. Octal inputs can be used for data patterns by using the "B" notation (nnnnB).

2. ALL cylinder, head and sector inputs are decimal:

   7910H cylinders = 0 to 747, heads 0 and 1, sectors 0 to 31
   7906H cylinders = 0 to 410, heads 0 to 3, sectors 0 to 47
   7920H cylinders = 0 to 822, heads 0 to 4, sectors 0 to 47
   7925H cylinders = 0 to 822, heads 0 to 8, sectors 0 to 63

3. One track worth of data

   7910H = 4096 words
   7906H = 6144 words
   7920H = 6144 words
   7925H = 8192 words

4. words per sector is 128 (all discs)
   words per full sector = 138 (all discs)

Appendix A
Non-Zero Controller Status Conditions

For any type of non-zero status condition, such as a defective track, seek retry or a direct seek to a spare track, FORM prints the following message:

```
***** NON-ZERO CONTROLLER STATUS *****
ADDR  TRK   CYL.  HD SPD  CS  DS   DSJ
nn    nnnn  nnnn  nn  nn  nn  nnnn nn
****************************************
```

where:

ADDR
nn is the address number of the H-Series disc.

TRK
nnnn is the logical track number, always zero in physical mode.

CYL
nnnn is the cylinder number.

HD
nnnn is the head number.

SPD
nn is the octal equivalent of the S, P and D bits, respectively (i.e., nn=04 is binary 100, which means the S bit is set). See the 13365, Integrated Controller Programming Guide for more information.

CS
nn is the controller status. For meanings of this field, see the end of this section. For more information, refer to the 13365 Integrated Controller Programming Guide.

DS
nnnn is the device status. For meanings of this field, see the end of this section. For more information, refer to the 13365 Integrated Controller Programming Guide.

DSJ
nn is the "device specified jump" byte. It is set for any of the controller status or device status conditions above. It means no error if 0; and if 1, an error status exists.

Controller Status Codes (STAT 1)

00 Normal completion, no error. Indicates one of two conditions:

a. Normal completion of the previous command (including the REQUEST STATUS command), no error. The DSJ byte = 0.

b. Condition at power-on or following self test. The DSJ byte = 2.

01 Illegal opcode. Data byte 1 of a secondary GET command sequence contains an illegal opcode (bits 5-1).

03 Illegal drive type. An unknown (unsupported) disc drive type has been set in the drive type field on the disc drive. The DRV TYP field of the SST DATA byte 3 may be examined for the offending drive type.

07 Cylinder miscompare. Generated only during address verification when the cylinder address in the controller register fails to match that in the cylinder address field of the disc sector after two comparisons. The systems should issue a RECALIBRATE command, then retry the data transfer.

10 Data error. May occur for two reasons:

a. The error detection hardware has detected a CRC error while executing a READ, COLD LOAD READ, READ WITH OFFSET, or VERIFY command. A REQUEST DISC ADDRESS command will return the address in which the error occurred.

b. During address verification, it is impossible to read (verify) any sector on the track without a CRC error. A READ command will return the address of the target sector.

11 Head/sector miscompare. Similar to cylinder miscompare. Generated during address verification when the head or sector address in the controller registers fails to match that in the head or sector address field of the disc sector after two comparisons.

Non-Zero Controller Status Conditions

12 I/O program error. May occur for three reasons:

a. An HP-IB byte tagged with ATN (that is, a primary or secondary) was received with incorrect (even) parity. This error will take precedence over all other controller status errors.

b. An unknown (unsupported) secondary was received by the controller.

c. An incorrect HP-IB sequence was detected. For example, during a SEEK command, the controller expects to see one Secondary (GET command), exactly five data bytes not tagged with EOI, and one data byte tagged with EOI, in that order. For a REQUEST STATUS command, the controller expects to see (in order) the secondary send status. Any deviation from the expected order of an HP-IB sequence results in this error status.

13 Sync bit not received in time. Generated during a verify or during any data transfer which performs verification if the sync bit is not found within an appropriate amount of time after the SECTOR COMPARE becomes true.

14 End of cylinder. This may occur for two reasons:

a. A multiple-sector data transfer/VERIFY (new transfer/VERIFY without an intervening SEEK, ADDRESS RECORD or COLD LOAD READ command) must continue beyond the end of logical cylinder, but the filemark will not allow the controller to automatically seek to the next logical cylinder.

b. The file mask allows automatic seeking but the required seek would move the heads beyond the limits of the physical disc.

16 Data overrun. The burst data rate of the controller has exceeded that of the HP-IB causing data to be lost. The overrun is reported at the end of the sector in which it occurred. Data transferred during previous sectors is valid. This error is not reported for normal end of read transfers, although such end of transfers are detected via the controller overrun hardware. A REQUEST DISC ADDRESS command following a data overrun error will return the address in which the error occurred.

20 Illegal access to spare track. During address verification, an address miscompare (cylinder or head/sector) has occurred and the S bit is set in the sector. This usually indicates a direct seek by the user to a spare track in active use, which is forbidden for all commands which use address verification.

21 Defective track. This status is set in two cases:

a. During address verification, the track has been found to be flagged defective (D bit set), but the file mask will not allow the controller to seek an associated spare track.

b. The D bit is set, the file mask will allow the automatic seek but the cylinder and head address of the spare track is the same as that of the defective track.

This condition usually results from flagging (initializing) the track defective without assigning a spare track address. The controller would loop endlessly searching for a spare track if this condition were not tested.

22 Access not ready during data operation. While in the process of transferring data to or from the disc (including VERIFY command), the track center detector in the disc drive detected head motion. If this occurs during a write type command, the drive will fault. The transfer should be retried.

23 Status-2 error (drive status error). The controller is unable to complete a command due to some condition in the disc drive. The drive status byte may be examined for the reason. Examples of Status-2 errors are:

a. An INITIALIZE command is attempted with the FORMAT switch off or the READ ONLY switch on.

b. A command (for example, SEEK) is issued to a disc drive which is not ready (heads unloaded) or for which a drive fault has occurred.

26 Attempt to write on a protected track. A WRITE command has been attempted on a track which has been flagged protected (P bit set) and the FORMAT switch is off. No writing occurs. The check for P bit is not made for the INITIALIZE or WRITE FULL SECTOR command.

37 Drive attention. Generated whenever:

a. A normal SEEK or RECALIBRATE command completes (DSJ byte = 0).

b. The drive unloads and controller is in Idle State 2 or 3.

Device Status Codes (STAT 2)

Bit 0 Access not ready (drive busy). The heads are not positioned over a valid track center as determined by the information on the servo surface of the disc. This could be because of head motion during a seek or because the heads are unloaded. In the latter case, bit 1 is also set.

Bit 1 Drive not ready. The heads are unloaded or a drive fault has occurred. Most drive faults also cause the heads to unload.

Bit 2 Seek check. May be caused by:

a. An illegal cylinder address has been sent to the drive via a SEEK command or during address verification.

b. An illegal head and/or sector address has been sent to the controller via a SEEK, ADDRESS RECORD, or COLD LOAD READ command.

An illegal head or sector is not accepted by the controller, that is the controller retains the previous head and/or sector information. An illegal cylinder is accepted by the controller without error indication and a subsequent REQUEST DISC ADDRESS command will return this address. If the illegal cylinder address is sent to the disc drive, the heads do not move and a Status-2 error (seek check) is generated. The controller uses the DRV TYP field to determine the legality of heads and sectors. The disc drive itself determines whether the cylinder address is legal.

Bit 3 First status. Set when the heads are loaded to identify this event to the user. The controller makes no use of this bit. The controller clears the first status bit after sending it the channel.

Bit 4 Drive fault. One or more conditions in the disc drive which make it logically or physically unsafe to operate. Refer to the appropriate disc drive service manual for a listing of these conditions. Some drive faults cause the heads to unload. These faults require the user to cycle the RUN/STOP switch to restore the disc drive to operation.

The remaining faults may be cleared programmatically using the disc CLEAR command. Note the warning regarding the use of the CLEAR command given in the command description.

Bit 5 FORMAT switch. The state of the front panel STATUS switch (on/off = 1/0). The switch must be on to allow an INITIALIZE or WRITE FULL SECTOR command to execute, or the controller returns a Status-2 error. If the track has been flag protected, the FORMAT switch must also be on to allow the WRITE command to execute, or the controller returns an attempt to write on protected track error.

Bit 6 READ ONLY (platter protect) switch. The state of the front panel READ ONLY switch (on/off = 1/0). While this switch is on, the disc is hardware protected against writing of any kind. Any of the three write commands attempted while this switch is on will cause the controller to generate a Status-2 error.

Note: In the HP 7906, there are two such switches, one for the removable cartridge and another for the fixed disc. These switches may be set individually to prevent writing on either or both platters.

Bit 7 Drive Attention. Set at the completion of a SEEK, a RECALIBRATE, or when the heads load or unload. Cleared by the controller (not reported to the channel) except when the heads unload due to a drive fault.

Appendix B
Magnetic Tape Loader (MTLDR)

This listing represents the updated MTLDR program. Changes have been made to make this compatible with RTE-IVE.

```
0001                    ASMB,A,B,L          MAG TAPE LOADER
0002  00002                 ORG 2
0003*****************************************************************
0004*
0005*   REV. 2126 810430
0006*
0007*****************************************************************
0008*
0009  00002 124003          JMP *+1,I
0010  00003 077500          DEF START
0011*
0012  77500                 ORG 77500B
0013*
0014  00020           DC    EQU 20B
0015  00021           CC    EQU DC+1
0016  00000           A     EQU 0
0017  00001           B     EQU 1
0018*
0019* SAVE A AND S REGISTERS FOR FILE SEARCH
0020*
0021  77500 073663  START STA ARG        SAVE A REG
0022  77501 102501        LIA 1         GET S REG
0023  77502 073664        STA SRG       SAVE S REG
0024*
0025* CONFIGURATION SECTION
0026*
0027  77503 101046        LSR 6         SHIFT 6 BITS RIGHT
0028  77504 013621        AND B77       MASK OUT LOWER 6 BITS
0029  77505 073617        STA SCODE
0030*
0031  77506 067640        LDB IOTB1     GET TABLE 1 ADDRESS
0032  77507 017624        JSB SETIO     SET IO INSTR
0033  77510 037617        ISZ SCODE
0034  77511 067651        LDB IOTB2     GET TABLE 2 ADDRESS
0035  77512 017624        JSB SETIO
0036*
```

```
0037* STORE INFORMATION FOR MEMORY BASED CONFIGURATOR (RTE-IVE)
0038*
0039  77513 104200        DLD MT        RESTORE FIRST AND SECOND WORD
      77514 077622
0040  77515 104400        DST 77700B     OF MAG TAPE BINARY LOADER
      77516 077700
0041  77517 063605        LDA IOC5      STORE I/O INSTRUCTION
0042  77520 073702        STA 77702B     FOR CONFIGURATOR
0043*
0044* NOW DO FILE SEARCH IF REQUIRED
0045*
0046  77521 067664        LDB SRG       CHECK IF FILE FORWARD WAS
                                        REQUESTED
0047  77522 006011        SLB,RSS       ???
0048  77523 027536        JMP NRD       NO JUST READ A FILE
0049  77524 063663        LDA ARG       GET FILE COUNT
0050  77525 003004        CMA,INA       MAKE REQUEST NEG FOR COUNTER
0051  77526 073663        STA ARG       SAVE NUMBER AS COUNTER
0052  77527 067614        LDB SL0RW     SELECT 0 AND REWIND
0053  77530 017604  FFL   JSB CMD       OUTPUT COMMAND
0054  77531 102321  IOC8  SFS CC        WAIT FOR COMPLETION
0055  77532 027531        JMP *-1
0056  77533 067616        LDB FFC       GET FILE FORWARD COMMAND
0057  77534 037663        ISZ ARG       ANY FILES LEFT?
0058  77535 027530        JMP FFL       YES
0059*
0060* TAPE READ STARTS HERE
0061*
0062  77536 067615  NRD   LDB RDCMD     GET READ COMMAND
0063  77537 017604        JSB CMD       DO IT
0064  77540 103720  IOD1  STC DC,C      START DATA CHANNEL
0065  77541 102221  IOC2  SFC CC
0066  77542 027574        JMP STAT      CHECK STATUS
0067  77543 102320  IOD2  SFS DC        ANY DATA
0068  77544 027541        JMP *-3       NO
0069  77545 107520  IOD3  LIB DC,C      YES GET IT(RECORD COUNT)
0070  77546 005727        BLF,BLF       POSITION COUNT TO LOWER BYTE
0071  77547 007000        CMB           MAKE IT NEGATIVE
0072  77550 077662        STB WCT       SAVE INPUT COUNT
0073  77551 102221  IOC3  SFC CC
0074  77552 027574        JMP STAT      YES EXIT TO STATUS
0075  77553 102320  IOD4  SFS DC        WAIT TO READ NEXT WORD
0076  77554 027551        JMP *-3
0077  77555 107520  IOD5  LIB DC,C      GET LOAD ADDRESS
0078  77556 074000        STB 0         START CHECKSUM
0079  77557 077604        STB CMD       AND ADDRESS POINTER
0080  77560 027564        JMP *+4
0081  77561 177604  NWD   STB CMD,I     PUT WORD IN MEMORY
0082  77562 040001        ADA 1         MOVE
0083  77563 037604        ISZ CMD       MOVE UP ADDRESS
0084  77564 102320  IOD6  SFS DC        WAIT FOR NEXT WORD
```

```
0085  77565 027564         JMP *-1
0086  77566 107520  IOD7   LIB DC,C       GET DATA TO STORE IN MEMORY
0087  77567 037662         ISZ WCT         FINISHED WITH DATA?
0088  77570 027561         JMP NWD         NO READ NEXT WORD
0089  77571 054000         CPB 0           IS CHECK SUM OK?
0090  77572 027541         JMP NRD+3       YES-WAIT FOR COMMAND CHANNEL
                                           STATUS
0091  77573 102011         HLT 11B         NO
0092  77574          IOC4   EQU *
0093  77574 102521  STAT   LIA CC          GET STATUS
0094  77575 001727         ALF,ALF         POSITION EOF BIT
0095  77576 002020         SSA             IS IT EOF?
0096  77577 102077         HLT 77B         HALT HERE IF GOOD READ
0097  77600 001727         ALF,ALF
0098  77601 001310         RAR,SLA
0099  77602 102000         HLT 0           NO-READ ERROR
0100  77603 027536         JMP NRD         READ NEXT RECORD
0101*
0102* OUTPUT COMMAND SUBROUTINE
0103*
0104  77604 000000  CMD    NOP
0105  77605 106621  IOC5   OTB CC
0106  77606 102521  IOC6   LIA CC
0107  77607 001323         RAR,RAR
0108  77610 001310         RAR,SLA
0109  77611 027605         JMP *-4
0110  77612 103721  IOC7   STC CC,C
0111  77613 127604         JMP CMD,I
0112*
0113* CONSTANTS
0114*
0115  77614 001501  SLORW  OCT 1501
0116  77615 001423  RDCMD  OCT 1423
0117  77616 000203  FFC    OCT 203
0118*
0119  77617 000000  SCODE  NOP
0120  77620 177700  BM100  OCT -100
0121  77621 000077  B77    OCT 77
0122  77622 106501  MT     LIB 1
0123  77623 006011         SLB,RSS
0124*
0125* SET IO INSTRUCTION SUBROUTINE
0126*
0127  77624 000000  SETIO  NOP
0128  77625 077637         STB .IOTB
0129  77626 167637  LOOP   LDB .IOTB,I
0130  77627 006003         SZB,RSS
0131  77630 127624         JMP SETIO,I
0132  77631 160001         LDA B,I
0133  77632 013620         AND BM100
0134  77633 043617         ADA SCODE
```

```
0135  77634 170001         STA B,I       RESET IO INSTRUCTION
0136  77635 037637         ISZ .IOTB
0137  77636 027626         JMP LOOP
0138*
0139* MORE CONSTANS AND DEFS
0140*
0141  77637 000000  .IOTB  NOP
0142  77640 077641  IOTB1  DEF *+1
0143  77641 077540         DEF IOD1
0144  77642 077543         DEF IOD2
0145  77643 077545         DEF IOD3
0146  77644 077553         DEF IOD4
0147  77645 077555         DEF IOD5
0148  77646 077564         DEF IOD6
0149  77647 077566         DEF IOD7
0150  77650 000000         NOP
0151*
0152  77651 077652  IOTB2  DEF *+1
0153  77652 077541         DEF IOC2
0154  77653 077551         DEF IOC3
0155  77654 077574         DEF IOC4
0156  77655 077605         DEF IOC5
0157  77656 077606         DEF IOC6
0158  77657 077612         DEF IOC7
0159  77660 077531         DEF IOC8
0160  77661 000000         NOP
0161  77662 000000  WCT    NOP
0162  77663 000000  ARG    NOP
0163  77664 000000  SRG    NOP
0164                       END
**  NO ERRORS *TOTAL **RTE ASMB 92067-16011**
```

Appendix C
Series M/E/F Sample Answer File

```
LIST::MF              * LIST FILE
*                  ************************************
*                  *      ====> REV 2126 <====         *
*                  * ** RTE-IVE **   ** NON SESSION ** *
*                  *       7906H SYSTEM DISC           *
*                  *  FOR 91711B HP-IB DISC SUPPORT    *
*                  *           29 APRIL, 1981          *
*                  ************************************
*
*
YES                     * ECHO ON
SYSTEM::MF::2500        * ABSOLUTE FILE
7906H                   * TARGET DISC
11                      * DISC CHANNEL
*
*MOD#  TRKS  CYL HEAD #SRF ADDR #SP UNIT#
*
7906H,  256,   0,  0,   2,   0,   6         * SUBCHANNEL  0  (LU2)
7906H,  203, 131,  0,   2,   0,   3         * SUBCHANNEL  1  (LU10)
/E
0                    * SYSTEM SUBCHANNEL
NO                   * NO AUX DISK
13                   * TBG
0                    * NO PRIV. INT.
YES                  * MR ACCESS TA II
YES                  * RT MEMORY LOCK
YES                  * BG MEMORY LOCK
50                   * SWAP DELAY
64                   * MEM SIZE
0                    * NO BOOT FILE
LINKS IN CURRENT
MAP ALL
*
*                 RTE-IV SYSTEM
*
REL,%CR4S1::E4           * MERGED OP SYSTEM
REL,%CR4S2::E4
*
*                 RTE-IVE CONFIGURATOR
*
REL,%CNF4E::E4           * RTE-IVE CONFIGURATOR
*
```

```
*                   DRIVERS
*
REL,%DVR00::E4            * TTY OR 2600 CRT
REL,%4DV05::E4            * 264X TERMINAL
REL,%DVA12::E4            * 2631A LINE PRINTER
REL,%DVR23::E4            * 7970 MAGTAPE
REL,%DVA32::E4            * 7906H/20H/25H/9895 SYSTEM DISC
*
*                   SPECIAL SYSTEM SOFTWARE
*
REL,%APL4E::E4            * RTE-IVE APLDR
*
*                   USER PROGRAMS
*
REL,%WHZAT::E4            * RTE-IVB WHZAT
REL,%MAPIO::E4            * MAPIO PROGRAM
REL,%XCNTL::E4            * FOR FILE CONTROL
REL,%DBUGR::E4            * DEBUG (USER VERSION)
*
*                   LIBRARIES
*
REL,%4SYLB::E4            * RTE-IVB SYSTEM LIBRARY
REL,%NSESN::E4            * NON-SESSION LIBRARY
REL,$MLIB1::E4            * MATH LIBRARY PART 1
REL,$MLIB2::E4            * MATH LIBRARY PART 2
REL,$MLIB3::E4            * MATH LIBRARY PART 3
REL,$FNDLB::E4            * MATH LIBRARY NON-DS
*
*                   RTE-IVB FILE MANAGER FMGR
************ NOTE: NEEDED TO BUILD FMP LIBRARY **************
*
REL,%BMPG1::E4            * RTE-IVB FMGR PROGRAM
REL,%BMPG3::E4            * FMP LIBRARY
*
*                   REQUIRED RTE-IVE LIBRARY $LIB4E
*
*** NOTE: $LIB4E IS RELOCATED AFTER %BMPG1 AND %BMPG3 ***
*
REL,$LIB4E::E4            * RTE-IVE LIBRARY
*
*
*** NOTE: %FST4E WILL CAUSE GEN ERR 08 AND GEN ERR 05 ******
*         RTE-IVE FSTAT ROUTINE REPLACES THE RTE-IVB FSTAT
*
*
```

```
*** NOTE: %SGL4E WILL CAUSE GEN ERR 08 AND GEN ERR 05 ******
*         RTE-IVE SEGLD ROUTINE REPLACES THE RTE-IVB SEGLD
*
*
*** NOTE: %REIO WILL CAUSE GEN ERR 08 AND GEN ERR 05 ******
*         RTE-IVE REIO ROUTINE REPLACES THE RTE-IVB REIO
*
*
*
DISPLAY UNDEFS
/E
*
*
********** NOTE: RTE-IVB FMGR AND ALL FMGR SEGMENTS **********
*            *** CAN NOW BE CHANGED TO TYPE 8 ***
*
*
FMGR,8
FMGR0,8
FMGR1,8
FMGR2,8
FMGR3,8
FMGR4,8
FMGR5,8
FMGR6,8
FMGR7,8
FMGR8,8
FMGR9,8
FMGRA,8
FMGRB,8
/E
*
***** NOTE: NO RPL'S ***** USE RPLIB IN %4SYLB *****
*
/E
*
*                 EQUIPMENT TABLE ENTRIES
*
11,DVA32,D,T=200            * EQT1: 7906H SYSTEM DISC
20,DVR05,B,T=32767,X=13     * EQT2: 2645A SYSTEM CONSOLE
23,DVA12,B,T=300            * EQT3: 2631A LINE PRINTER
16,DVR23,D,T=20000          * EQT4: 7970B MAGNETIC TAPE UNIT
22,DVR00,B,T=32767          * EQT5: 2600A OR ASR-33 TELETYPE
/E
*
```

```
*               DEVICE REFERENCE TABLE ENTRIES
*
2,0                 * LU1 - 2645A SYSTEM CONSOLE
1,0                 * LU2 - 7906H DISC - SUBCHANNEL 0
0                   * LU3 - SPARE
2,1                 * LU4 - 2645A SYSTEM CONSOLE - LEFT CTU
2,2                 * LU5 - 2645A SYSTEM CONSOLE - RIGHT CTU
3                   * LU6 - 2631A LINE PRINTER
0                   * LU7 - SPARE
4                   * LU8 - 7970B MAGNETIC TAPE UNIT
5                   * LU9 - 2600A OR ASR-33 TELETYPE
1,1                 * LU10 - 7906H DISC - SUBCHANNEL 1
/E
*
*                 INTERRUPT TABLE ENTRIES
*
11,EQT,1            * 7906H SYSTEM DISC
16,EQT,4            * 7970B MAGNETIC TAPE
17,EQT,4            * 7970B MAGNETIC TAPE
20,EQT,2            * 2645A SYSTEM CONSOLE
22,EQT,5            * 2600A OR ASR-33 TELETYPE
23,EQT,3            * 2631A LINE PRINTER
/E
*
2                    * CHANGE DP SIZE (DEFAULT=2)
0                    * RT COMMON CHANGE
0                    * BG COMMON CHANGE
0                    * # OF I/O CLASSES
0                    * # OF LU MAPPINGS
0                    * # OF RESOURCE NUMBERS
100,400              * BUFFER LIMITS
4                    * # OF BLANK ID SEGMENTS
0                    * # OF BLANK SHORT ID SEGMENTS
0                    * # OF BLANK ID EXTENSIONS
10                   * MAX NUMBER OF PARTITIONS
*
*                      PARTITION DEFINITION
*
0                     * FIRST PARTITION PAGE (0=DEFAULT)
06,BG                 * PARTITION#1
24,BG                * PARTITION#2
E
/E
/E
```

Appendix D
L-Series Sample Answer File

```
*
* PRIMARY SYSTEM GENERATION ANSWER FILE
* DIAG SYSTEM  (ONLY 1 ID SEGMENT) APRIL 23, 1981
* 02142-18004   REV 2112   810319 (MODIFIED FOR 24398A USE)
*
LINK,CPAGE,          OPTION CURRENT- PAGE
*
MSIZ,32,             L SYSTEM
*
BLOCC,1677B,         XL COMPATIBILITY
*
REL,%EXEC::32762
*
REL,%SAM::32762
*
REL,TIME::32762
*

REL,%SCHED::32762
*
REL,%STRNG::32762
*
REL,%LOCK::32762
*
REL,%ERLOG::32762
*
REL,%OPMSG::32762
*
REL,%XCMND::32762
*
REL,%SYCOM::32762
*
REL,%STAT::32762
*
REL,%LOAD::32762
*
REL,%ID.50::32762
*
REL,%RTIOL::32762
*
REL,%CLASS::32762
*
```

```
REL,%ID.00::32762
*
REL,%DD.00::32762
*
REL,%SWAP::32762
*
REL,%ID.37::32762
*
REL,%DD.30::32762
*
REL,%DD.20::32762
*
*
REL,%DD.12::32762
*
REL,%ID.43::32762
*
MS,$SYS.. ::32762
*
MS,$MXLB::32762
*
MS,$MLIB2::32762
*
MS,$MLIB1::32762
*
MS,$MLIB3::32762
*
MS,$FNDLB::32762
*
*
END
*
*
CLAS,10
*
RESN,10
*
*
* ASIC FOR 2621A/P SYSTEM CONSOLE WITH VCP
*
IFT,%ID.00,SC:20B
*
DVT,%DD.00,M2621,LU:1
*
* ASIC FOR 2635A AUXILIARY CONSOLE/PRINTER
*
*IFT,%ID.00,SC:21B
*DVT,%DD.00,M2635:0,LU:2
*DVT,%DD.00,M2635:1,LU:7
*
```

```
* ASIC FOR 2645A AUXILIARY CONSOLE WITH DUAL MINICARTRIDGES
*
*IFT,%ID.00,SC:22B
*DVT,%DD.00,M2645,LU:3
*DVT,%DD.20,M2645:1,LU:4
*DVT,%DD.20,M2645:2,LU:5
*
*
*HP-IB  1
*
IFT,%ID.37,SC:27B
*
*HP-IB  1 DISC CONTROLLER
*
DVT,,,LU:9,TO:250,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
*
*
* 8-INCH FLEXIBLE DISC
*
*DVT,%DD.30,M7902:0,LU:10,DP:1:5
*DVT,%DD.30,M7902:1,LU:11,DP:1:5
*
* 7906H HARD DISC
*
DVT,%DD.30,M7906:0,LU:12,DP:1:1
DVT,%DD.30,M7906:1,LU:13,DP:1:1
DVT,%DD.30,M7906:2,LU:14,DP:1:1
DVT,%DD.30,M7906:3,LU:15,DP:1:1
*
* 7910H FIXED DISC
*
DVT,%DD.30,M7910:0,LU:16,DP:1:3
DVT,%DD.30,M7910:1,LU:17,DP:1:3
DVT,%DD.30,M7910:2,LU:18,DP:1:3
DVT,%DD.30,M7910:3,LU:19,DP:1:3
*
* HP-IB LINE PRINTER
*
DVT,%DD.12,,LU:6,DT:12B,DP:1:6
*
*
* DUAL 5.25-INCH FLEXIBLE DISCS
*
*DVT,%DD.30,M7902:0,LU:32,DP:1:2:0:0:0:0,DP:6:66:16:2,TO:1500
*DVT,%DD.30,M7902:0,LU:33,DP:1:2:1:0:0:0,DP:6:66:16:2,TO:1500
*
```

```
* PARALLEL INTERFACE CARDS
*
*IFT,%ID.50,SC:24B
*DVT,,,LU:20,TO:5000,DX:2,DP:1:0:2,DT:45B
*
*
* HP-IB  2:   INSTRUMENT BUS
*
*IFT,%ID.37,SC:25B
*
* HP-IB  2 CONTROLLER
*
*DVT,,,LU:21,TO:50,DT:77B,DX:1,DP:1:36B
*
* EIGHT DEVICES
*
*DVT,,,LU:22,TO:500,DT:77B,DX:1,DP:1:1
*DVT,,,LU:23,TO:500,DT:77B,DX:1,DP:1:2
*DVT,,,LU:24,TO:500,DT:77B,DX:1,DP:1:3
*DVT,,,LU:25,TO:500,DT:77B,DX:1,DP:1:4
*DVT,,,LU:26,TO:500,DT:77B,DX:1,DP:1:5
*DVT,,,LU:27,TO:500,DT:77B,DX:1,DP:1:6
*DVT,,,LU:28,TO:500,DT:77B,DX:1,DP:1:7
*DVT,,,LU:29,TO:500,DT:77B,DX:1,DP:1:8
*
*
*
END
*
END
*
*NODE,3,4,5
*
*NODE,2,7
*
*NODE,10,11
*
*NODE,12,13,14,15
*
*NODE,16,17,18,19
*
*NODE,32,33
*
END
*
*
END
```

```
*
ID,1
*
SA,1200
*
CD,10
*
MC,33
*
SS,0
*
RE,%D.RTR
*
* BASIC TRAP LIBRARY. USED FOR HP-IB INTERRUPT PROCESSING
*
*RE,$ABLIB
*
*MS,$MXLB
*MS,$SYSLB
*MS,$MLIB2
*MS,$MLIB1
*MS,$MLIB3
*MS,$FNDLB
*
END
*
END
*
COM,30
*
LIB,$MLIB1::32762
LIB,$MLIB2::32762
LIB,$MLIB3::32762
LIB,$FNDLB::32762
LIB,$FMP  ::32762
LIB,$SYSLB::32762
LIB,$MXLB ::32762
END
*
END
*
STARTUP
*
REL,%DIAG::KB
SE,$DKLIB::32762
*
END
```

Appendix E
A-Series Sample Answer File

```
* RTE-A ANSWER FILE FOR 24398B ICD/MAC DIAGNOSTICS (ASIC)
*
LINKS,CP
RE,%VCTR::11
RE,%EXEC::11
RE,%RPL60::11
RE,%SAM::11
RE,%TIME::11
RE,%SCHED::11
RE,%STRNG::11
RE,%LOCK::11
RE,%ERLOG::11
RE,%OPMSG::11
RE,%XCMND::11
RE,%SYCOM::11
RE,%STAT::11
RE,%RTIOA::11
RE,%IOMOD::11
RE,%PERR::11
RE,%CLASS::11
*
RE,%DD.00::11
RE,%ID.00::11
RE,%IDM37::11
*
MS,$SYSA::11
SE,$SYSLB::11
END
*
END
*
*  BEGIN TABLE GENERATION
*  CONFIGURE LU TABLES
*
* ASIC FOR 2621A/P SYSTEM CONSOLE WITH VCP
*
IFT,%ID.00::11,SC:20B
*
DVT,%DD.00::11,M26XX,LU:1,QU:FI,-
   DP:5:CI:20040B:20040B:0,DP:9:CM:20040B:20040B:CM
*
* HP-IB FOR A-SERIES DISC DIAGNOSTIC
*
IFT,%IDM37::11,SC:21B
DVT,,,LU:21,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
```

```
IFT,%IDM37::11,SC:22B
DVT,,,LU:22,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:23B
DVT,,,LU:23,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:24B
DVT,,,LU:24,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:25B
DVT,,,LU:25,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:26B
DVT,,,LU:26,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:27B
DVT,,,LU:27,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:30B
DVT,,,LU:30,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:31B
DVT,,,LU:31,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:32B
DVT,,,LU:32,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:33B
DVT,,,LU:33,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:34B
DVT,,,LU:34,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:35B
DVT,,,LU:35,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:36B
DVT,,,LU:36,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:37B
DVT,,,LU:37,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:40B
DVT,,,LU:40,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:41B
DVT,,,LU:41,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:42B
DVT,,,LU:42,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:43B
DVT,,,LU:43,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:44B
DVT,,,LU:44,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:45B
DVT,,,LU:45,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:46B
DVT,,,LU:46,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
IFT,%IDM37::11,SC:47B
DVT,,,LU:47,TO:100,DT:77B,TX:0,DX:1,DP:1:36B,PR:0
*
*
END
*
END
*
*
```

```
END,,,,NODE LIST
*
*
END,,,,INTERRUPT TABLE
*
*
CLAS,10
RESN,10
ID,12
RS,0
SAM,1023
SL,0,0
BG,30
QU,300,50
SP,0
MB,0
US,0
*
*
END,,,,LABELED SYSTEM COMMON RELOCATION
COM,10
*
END
*
*
END
```

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READER COMMENT SHEET

HP 1000 ICD/MAC DISC DIAGNOSTIC
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