HEWLETT PACKARD

This package contains a section of the

CE SERVICE HANDBOOK FOR 79XX SERIES DISC DRIVES

and consists of the following document:

CS/80 DIAGNOSTICS

Part no. 5957-4227

Insert this section into the handbook binder P/N 9282-0683 along with cover and tabset P/N 5957-4228

NOTE

The tabset consists of model numbers for all DMD disc drives to be documented in the CE Service Handbook. Not all of these sections are available at this printing-refer to periodic announcements in the CSD service publication *Support Update* for part numbers and availability.

This handbook is intended as a reference of most-frequently-used material for the trained HP Customer Engineer. The information is condensed from other manuals related to the product and is not intended as a substitute for these manuals (see Related Manuals, page iv).

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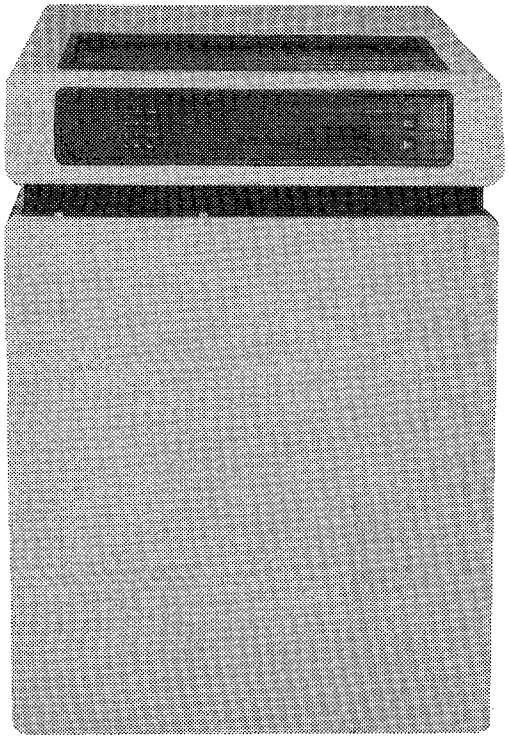
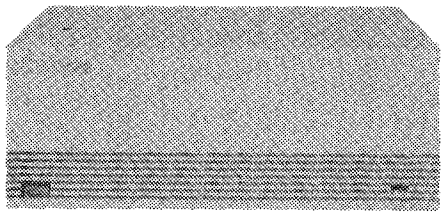
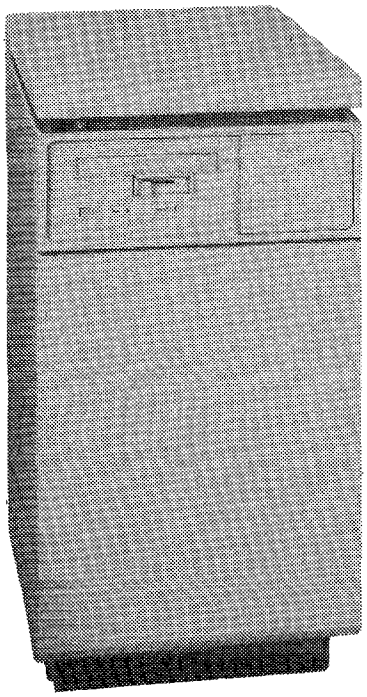
CS/80 FAMILY DISC DRIVES



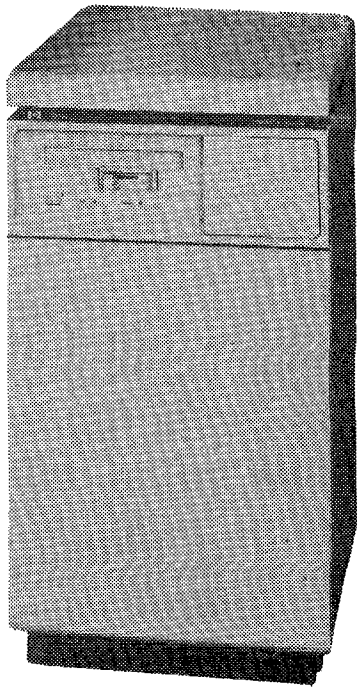
HP 7933/HP7935



HP 7941/HP 7945



HP 7908



HP 7911/HP 7912/
HP 7914

CONTENTS

RELATED MANUALS

5955-3442	CS/80 Instruction Set Programming Manual
5955-3462	CS/80 External Exerciser Reference Manual
07908-90903	Service Manual for 7908 Drives
07912-90903	Service Manual for 791X Drives
07930-90903	Service Manual for 793X Drives
07940-90903	Service Manual for 7941/7945 Drives
CS80 UTIL	Manual for on-line HP 3000 Diagnostic--Obtain programmatically from CS80 MNL file.

CHANNEL INTERFACE - CS/80 AND HP-IB

SECTION I

1-1. SUMMARY

Interface to the disc/tape drive is accomplished through HP-IB hardware and the CS/80 Instruction Set. This interface is managed by the microprocessor-based controller. The controller executes transactions comprising three phases: command, execution (as applicable), and report messages. Each message consists of a header, text, and trailer. The messages are transferred between device and host over 16 HP-IB signal lines: 8 for data, 3 for handshake, and 5 for control as shown in figure 1-1.

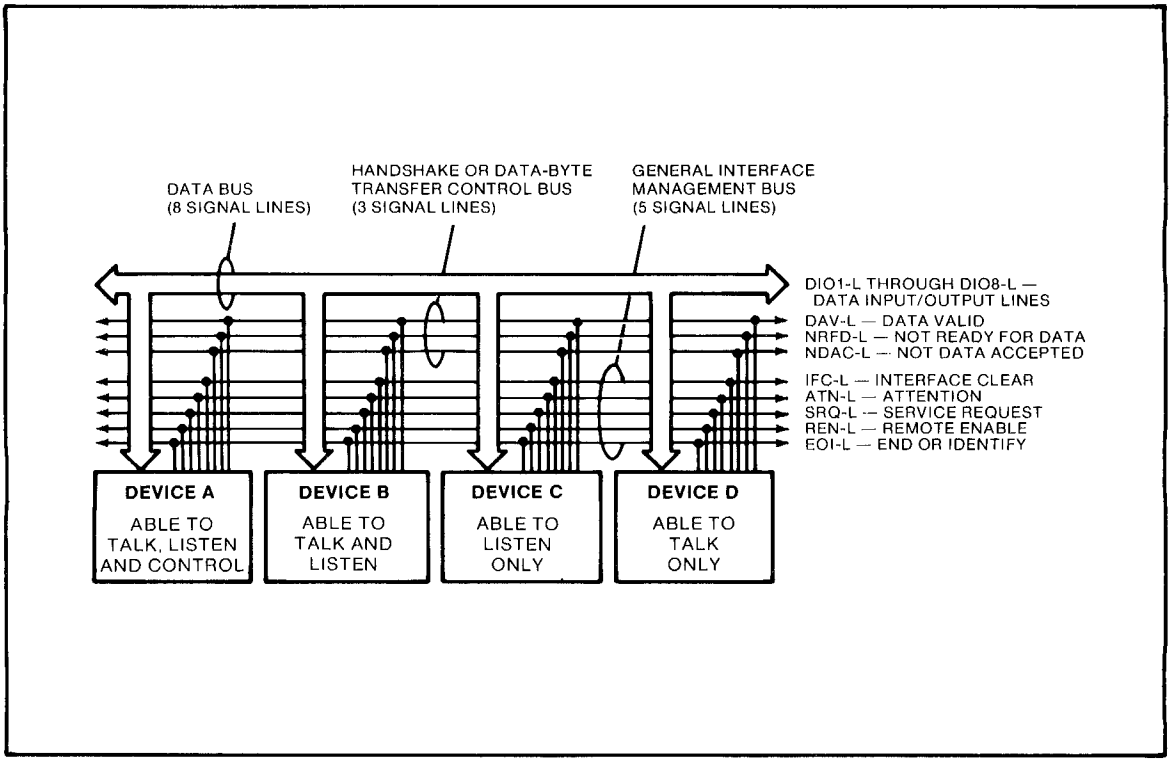


Figure 1-1. HP-IB Signal Lines

The eight Data I/O lines are reserved for the transfer of commands, data, and other messages in a byte-serial, bit-parallel manner. Data and message transfers are asynchronous, coordinated by three handshake lines: Data Valid (DAV-L), Not Ready For Data (NRFD-L), and Not Data Accepted (NDAC-L). The other five lines are for bus management.

Devices connected to the bus may be talkers, listeners, or controllers. The Controller-In-Charge (CIC) dictates the role of each of the other devices by setting the Attention (ATN-L) line low and sending talk or listen addresses on the data lines.

Addresses are set for each device at the time of system configuration. While the ATN-L line is low, all devices must listen to the data lines. When the ATN-L line is high, devices that have been addressed will send or receive data; all others ignore the data lines. Several listeners can be active simultaneously but only one talker can be active at a time. Whenever a talk address is put on the data lines (while ATN-L is low), all other talkers will be automatically unaddressed.

The Interface Clear (IFC-L) line places the interface system in a known quiescent state. The Remote Enable (REN-L) line is used to select between two alternate sources of device programming data such as the front panel or the HP-IB. The End Or Identify (EOI-I) line is used to indicate the end of a multiple-byte transfer sequence. In addition, when a controller-in-charge sets both the ATN-L and EOI-L lines low, each device capable of a parallel poll responds on the DIO line assigned to it.

For complete information on the CS/80 Instruction Set and HP-IB transfer, refer to the CS/80 manuals.

CS/80 Instruction Set Programming Manual	5955-3442
CS/80 External Exerciser Reference Manual	5955-3462

LAYOUT OF THE TAPE

SECTION II

DIAGNOSTIC INFORMATION

ERROR LOG: error rate test log and run log.

USE LOGS: total number of blocks accessed, plus number of times tape was auto-loaded.

SPARE TABLE: see section VI.

INITIALIZING/ CERTIFYING: see section VI.

Figure 2-1 shows numbering of blocks on tape: 61,320 blocks on a long tape, 15,330 on short.

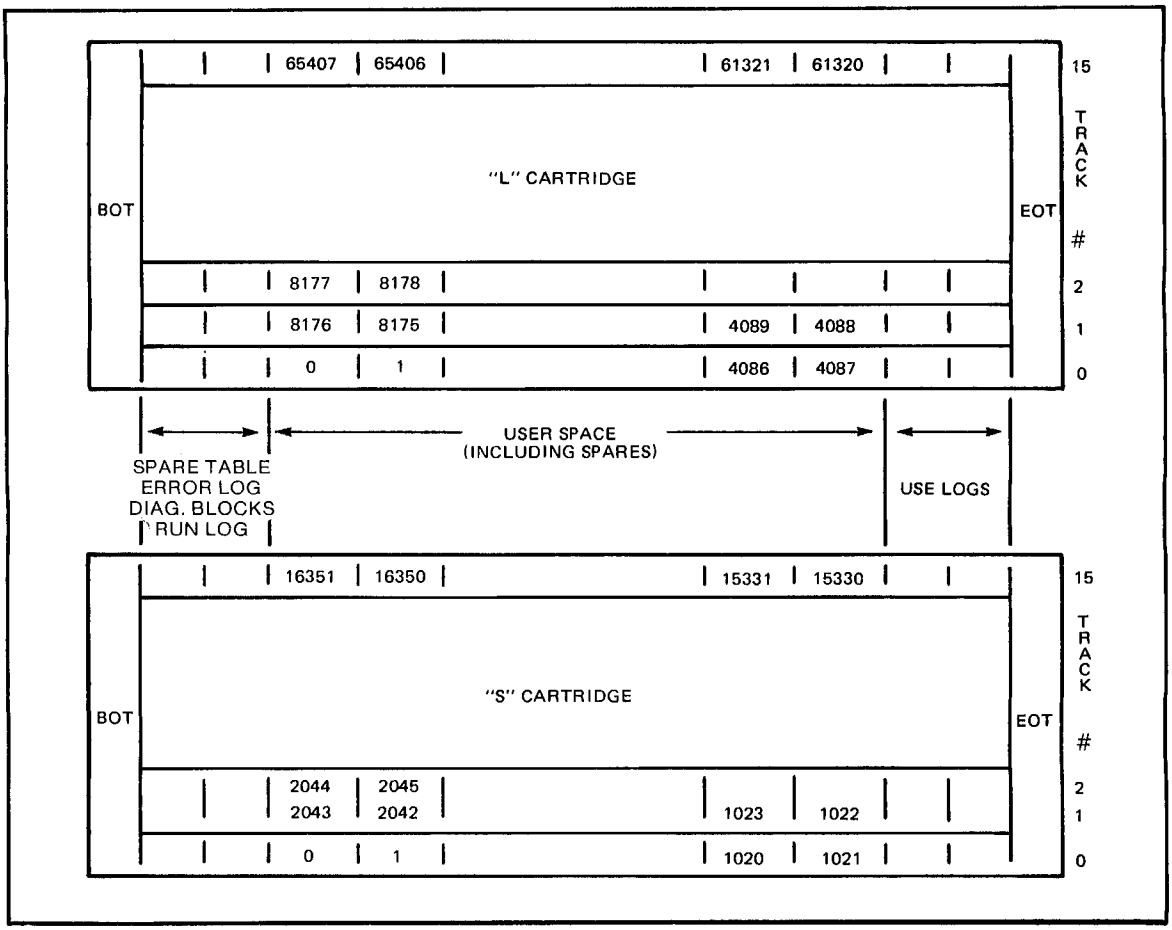


Figure 2-1. Tape Cartridge Format

NOTE: New tapes must be certified before data can be stored, see section VI. Tape head must be cleaned after each certification!

Cartridges for Linus tape drive (7908/791X) and Buffalo (9144A) are interchangeable. The primary difference between the two tape drives is that Buffalo has read-after-write capability.

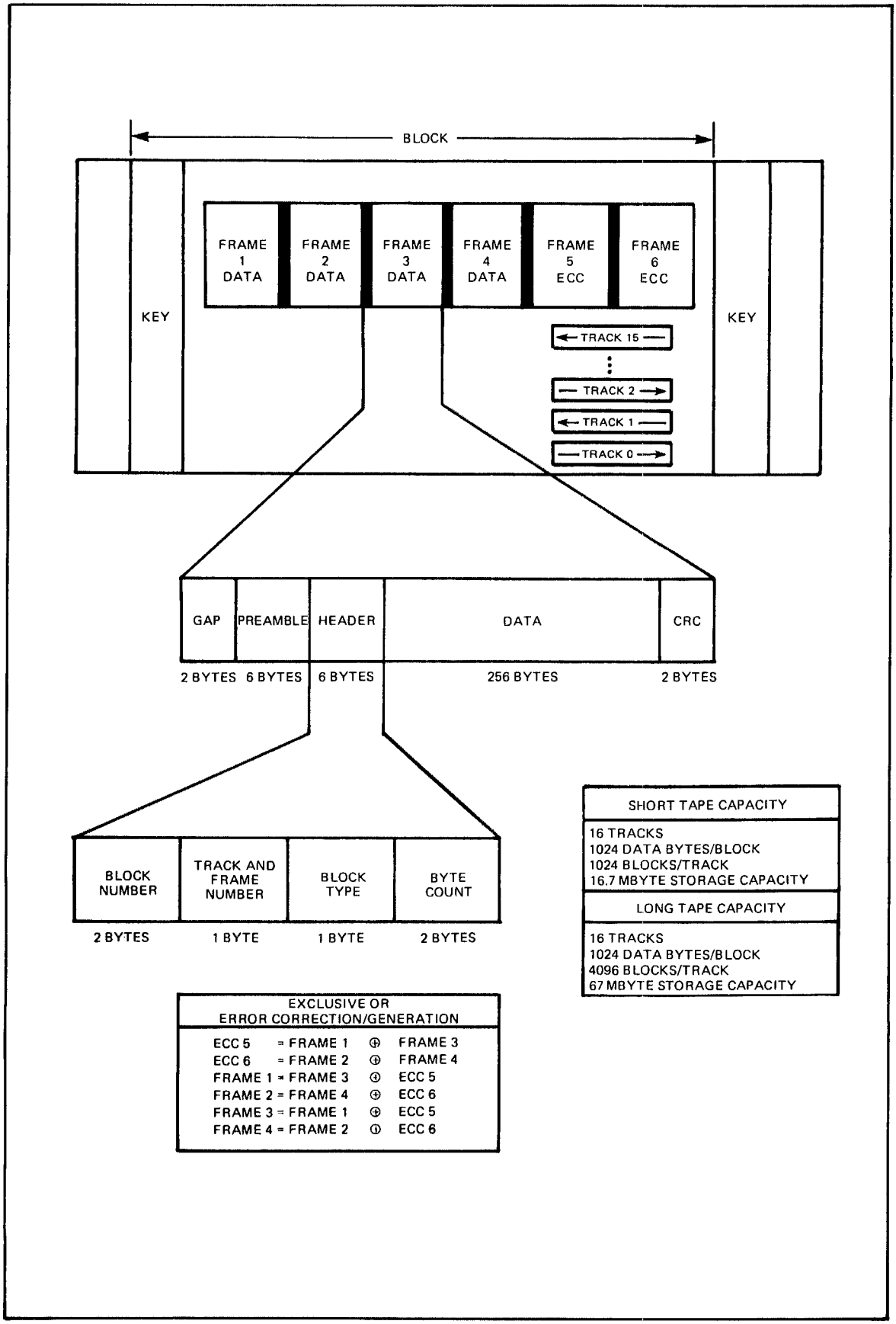
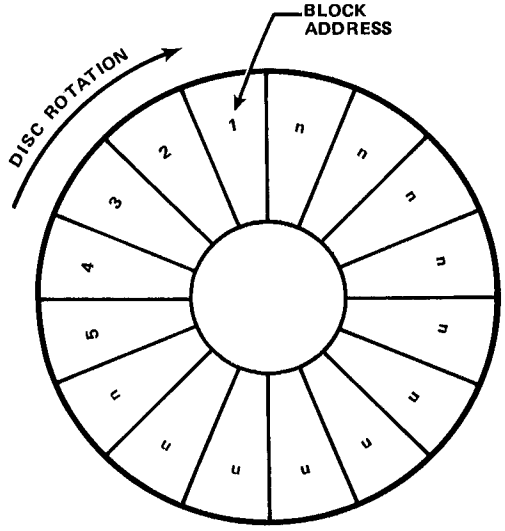


Figure 2-2. Tape Block Format

LAYOUT OF THE DISC

SECTION III

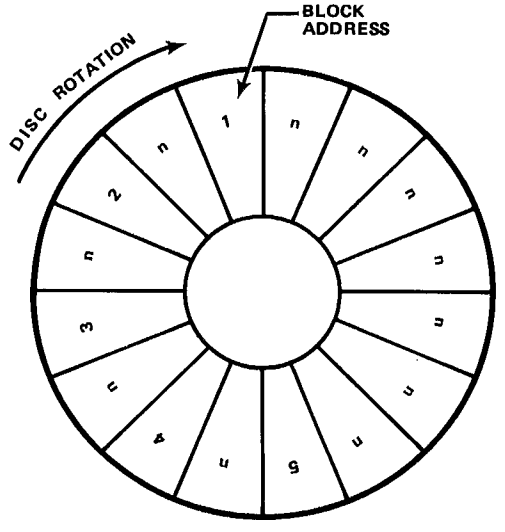
3-1. SECTOR INTERLEAVING - ALL DRIVES



CASE 1

INTERLEAVE = 1

Blocks (i.e., sectors) are transmitted serially. This is the optimum method of data transfer when the host CPU (or controller) has adequate processing speed or buffering to accept each block as it is read. If not, an extra revolution of latency is introduced between each block.



CASE 2

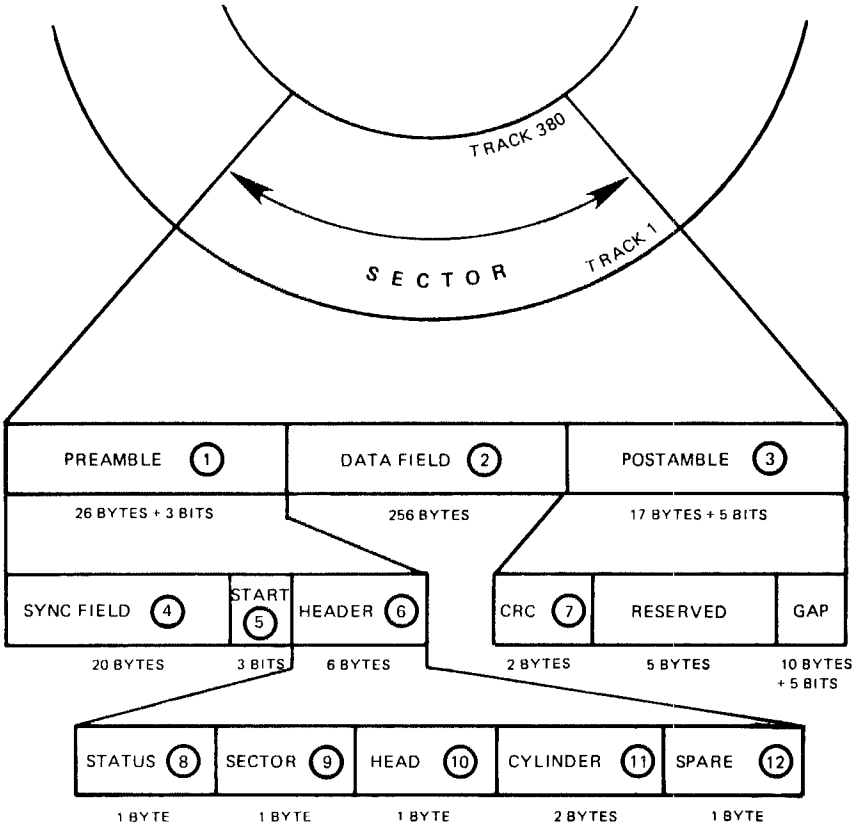
INTERLEAVE = 2

Sectors are transmitted in alternate (interleaved) blocks to allow the CPU time to process before the next block is read. Latency is therefore much less than one revolution but greater than Case 1 above. (Interleave=3 means two blocks/sectors are skipped, interleave=4 means three, etc.

Unless otherwise required by the host, all CS/80 drives use an interleave of 1 (no latency). (HP 794X defaults to 1.)

Figure 3-1. Sector Interleaving

3-2. DISC FORMAT - HP 7908



1. PREAMBLE – 26 BYTES + 3 BITS FOR SYNCHRONIZATION AND ADDRESSING
2. DATA FIELD – 256 BYTES OF AVAILABLE USER DATA
3. POSTAMBLE – 17 BYTES + 5 BITS OF DATA CHECKING
4. SYNC FIELD – 20 BYTES TO ACHIEVE PHASE LOCK
5. START – 3 BITS SIGNAL THE START OF INFORMATION TO FOLLOW
6. HEADER – 6 BYTES FOR STATUS AND ADDRESSING INFORMATION
7. CRC – 2 BYTES FOR CYCLIC REDUNDANCY CHECK
8. STATUS – 1 BYTE FOR TRACK STATUS INFORMATION
9. SECTOR – 1 BYTE FOR SECTOR ADDRESS
10. HEAD – 1 BYTE FOR HEAD NUMBER
11. CYLINDER – 2 BYTES FOR CYLINDER ADDRESS
12. SPARE – 1 BYTE FOR LOGICAL SPARE NUMBER

Figure 3-2. HP 7908 Sector Format

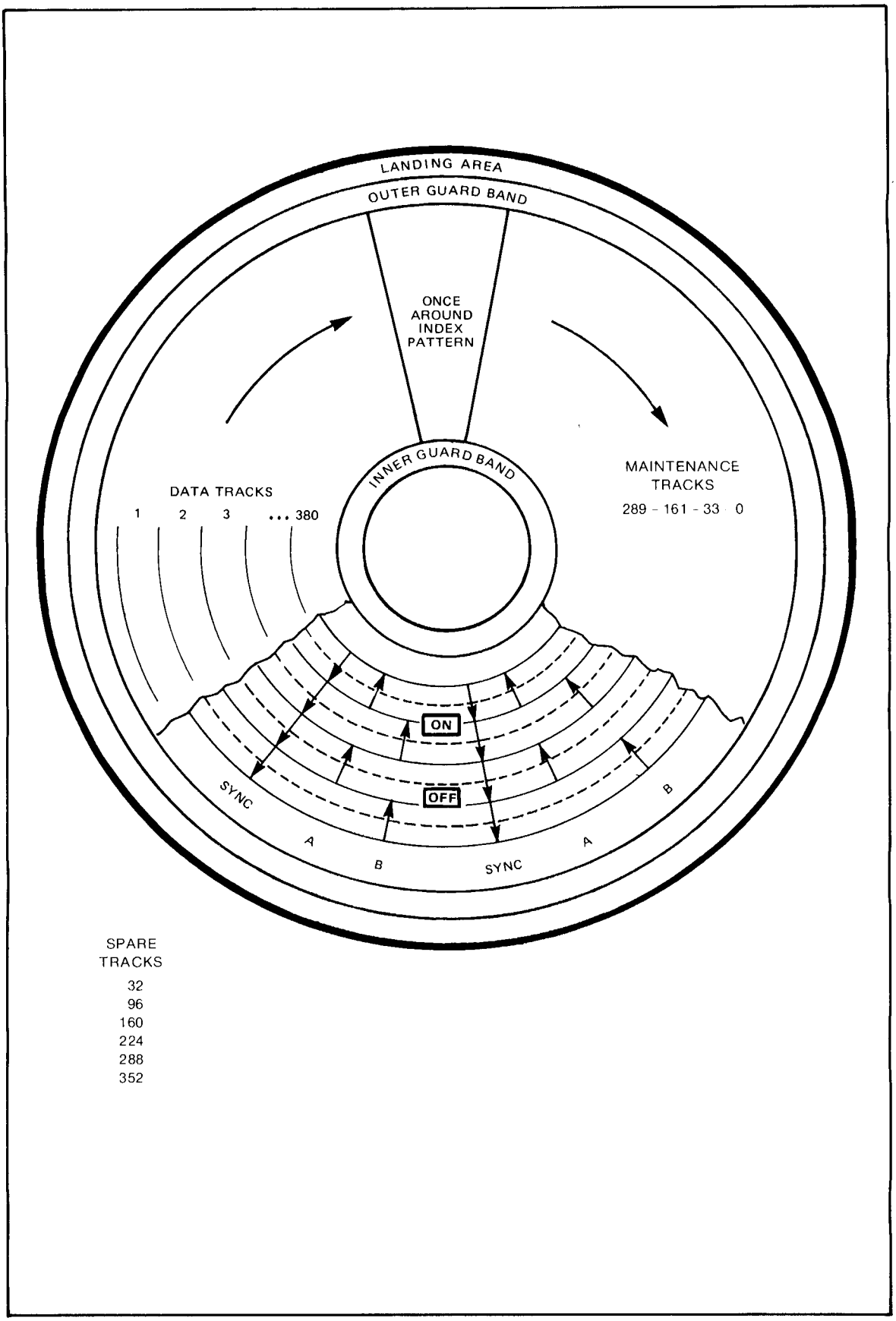
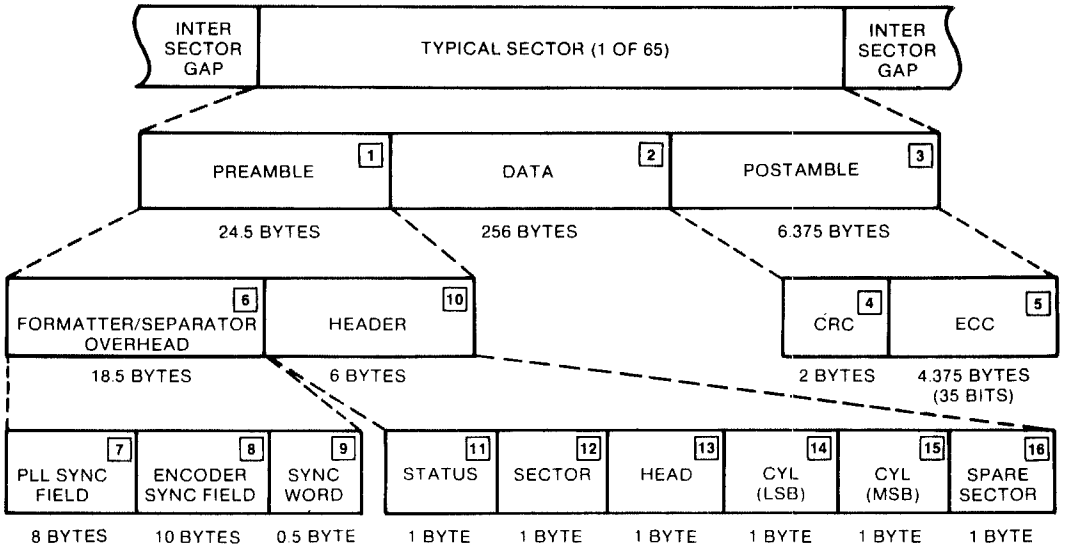


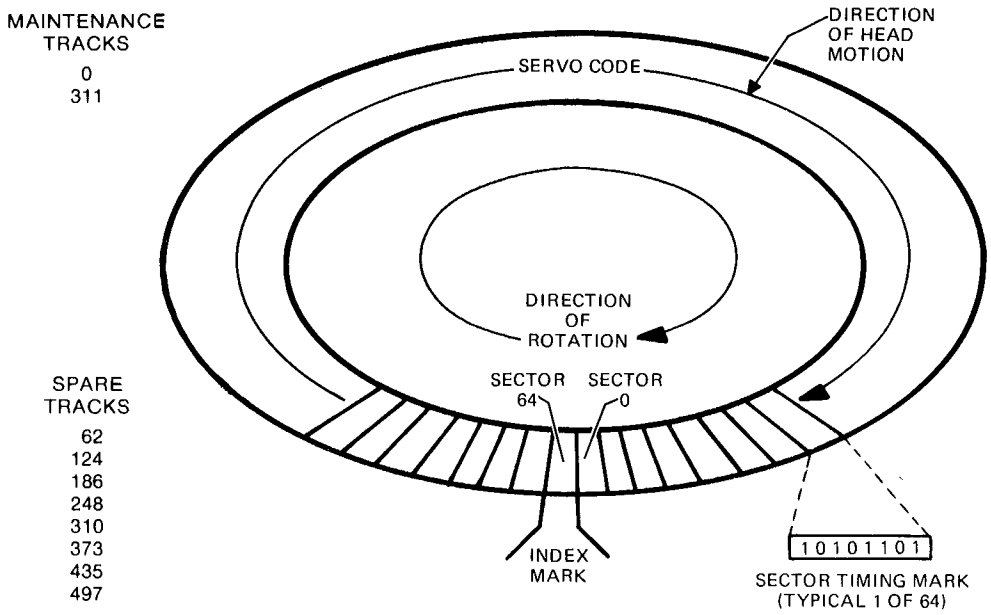
Figure 3-3. HP 7908 Tri-Bit Servo Code

3-3. DISC FORMAT – HP 7911/HP 7912/HP 7914



1	PREAMBLE	— 24.5 bytes for synchronizing and addressing.
2	DATA	— 256 bytes of data.
3	POSTAMBLE	— 6.375 bytes for data checking and error correction.
4	CRC	— Cyclic Redundancy Check. 16 bits for check information.
5	ECC	— Error Correction Code. 35 bits for check and correction information.
6	FORMATTER/SEPARATOR OVERHEAD	— 18.5 bytes to achieve synchronization.
7	PLL SYNC FIELD	— 8 bytes to achieve phase lock.
8	ENCODER SYNC FIELD	— 10 bytes for encode synchronization.
9	SYNC WORD	— 0.5 byte signalling start of data field.
10	HEADER	— 6 bytes for status and addressing information.
11	STATUS	— 1 byte for physical track status, maintenance, data, or spare.
12	SECTOR	— 1 byte for sector address.
13	HEAD	— 1 byte for physical head address.
14	CYL (LSB)	— 1 byte for physical cylinder address (LSB).
15	CYL (MSB)	— 1 byte for physical cylinder address (MSB).
16	SPARE SECTOR	— 1 byte for logical spare address. If spare sector is still available this will be 64. If spare sector has been used this will be the number of the sector mapped out.

Figure 3-4. HP 791X Sector Format



NOTES:

1. **Sector timing mark occurs every 256 microseconds.**
2. **One index mark is generated per revolution.**
3. **Index mark occurs within 163 usec of every 65th sector timing mark.**

Figure 3-5. HP 791X Sector Timing & Index Mark Generation

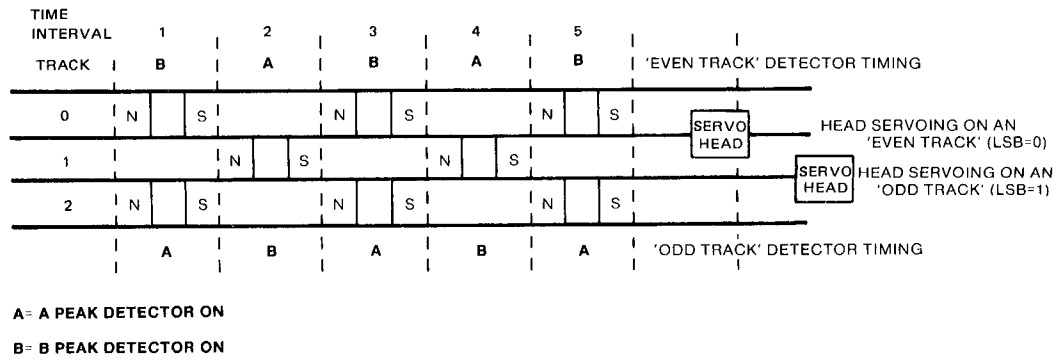
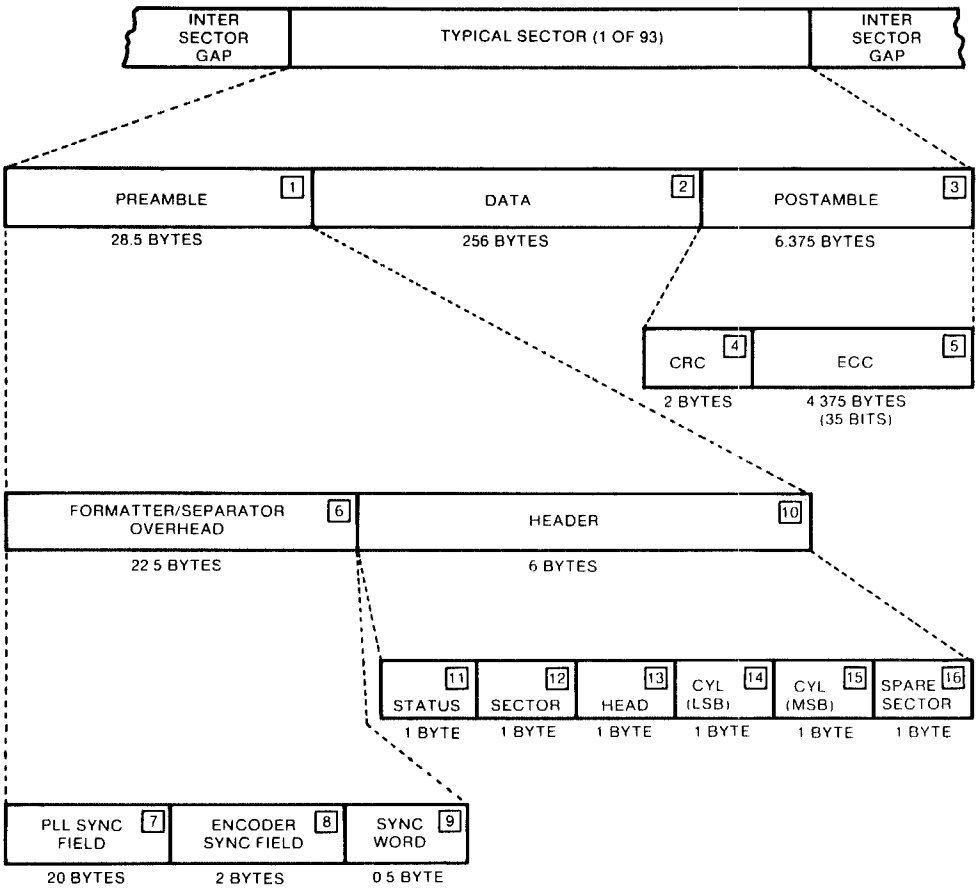


Figure 3-6. HP 791X Track Servoing

3-4. DISC FORMAT – HP 7933/HP 7935



1 PREAMBLE — 28.5 BYTES FOR SYNCHRONIZING AND ADDRESSING

2 DATA — 256 BYTES OF DATA

3 POSTAMBLE — 6.375 BYTES FOR DATA CHECK AND ERROR CORRECTION

4 CRC — CYCLIC REDUNDANCY CHECK 16 BITS FOR CHECK AND CORRECTION INFORMATION

5 ECC — ERROR CORRECTION CODE 35 BITS FOR CHECK AND CORRECTION INFORMATION

6 FORMATTER/SEPARATOR OVERHEAD — 22.5 BYTES TO ACHIEVE SYNCHRONIZATION

7 PLL SYNC FIELD — 20 BYTES TO ACHIEVE PHASE

8 ENCODER SYNC FIELD — 2 BYTES FOR ENCODE SYNCHRONIZATION

9 SYNC WORD — 0 5 BYTE SIGNALLING START OF DATA FIELD

10 HEADER — 6 BYTES FOR STATUS AND ADDRESSING INFORMATION

11 STATUS — 1 BYTE FOR TRACK STATUS

12 SECTOR — 1 BYTE FOR SECTOR ADDRESS

13 HEAD — 1 BYTE FOR PHYSICAL HEAD ADDRESS

14 CYL (LSB) — 1 BYTE FOR CYLINDER ADDRESS (LSB)

15 CYL (MSB) — 1 BYTE FOR CYLINDER ADDRESS (MSB)

16 SPARE SECTOR — 1 BYTE FOR LOGICAL SPARE ADDRESS

Figure 3-7. HP 793X Sector Format

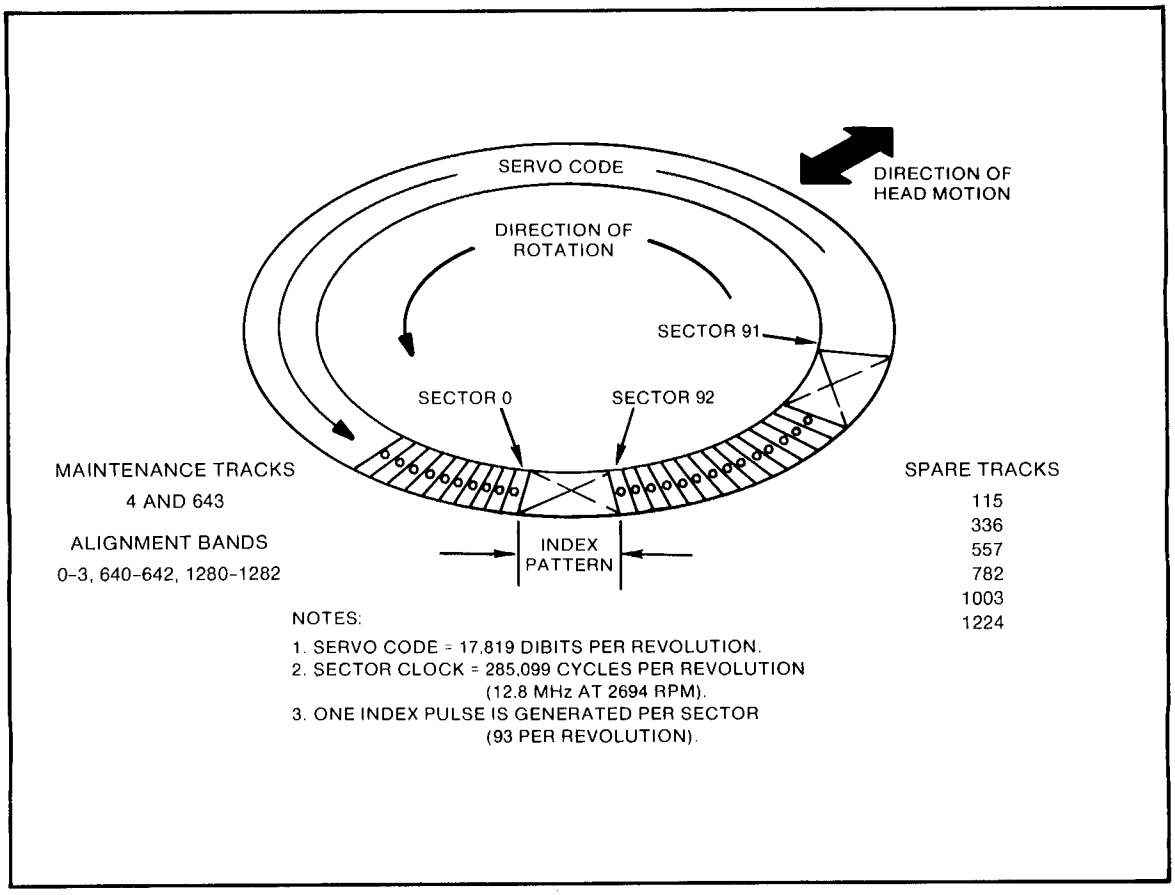


Figure 3-8. HP 793X Sector Clock & Index Generation

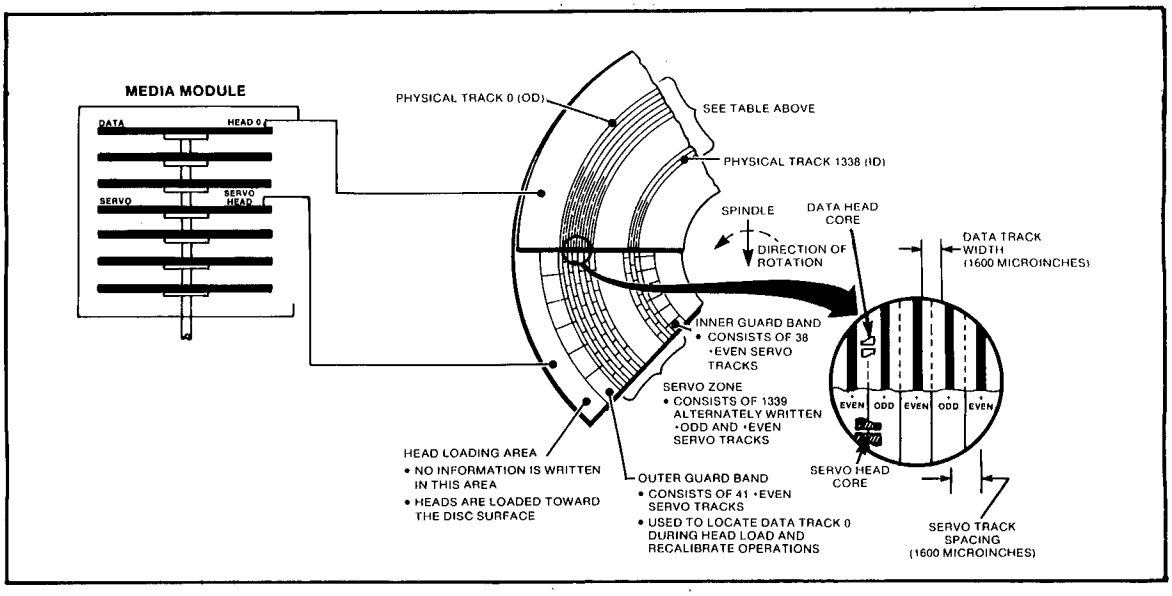


Figure 3-9. HP 793X Data & Servo Track Assignment

3-5. DISC FORMAT - HP 7941/HP 7945

For HP 7941/7945 Disc Format, refer to 7941/45 tab herein, section IX.

EXERCISER INTERFACES

SECTION IV

Table 4-1. CS/80 External Exerciser Commands

HP 85 CS/80 External Exerciser Commands		HP 85 Program Names			
Name	Command Description	EXRSIZ	EXRSI2	TAPE	EX794X
AMCLEAR	AMIGO (794X) DEVICE CLEAR		X	X	X
CANCEL	CANCEL TRANSACTION	X	X	X	X
CERT	PERFORM TAPE CERTIFICATION			X	
CHANNEL	TEST HP-IB CHANNEL		X		
CICLEAR	CHANNEL INDEPENDENT CLEAR	X	X	X	X
CLEAR LOGS	ERASE LOGS	X		X	X
DESCRIBE	DESCRIBE SELECTED UNIT	X	X	X	X
DIAG	PERFORM INTERNAL DIAGNOSTICS		X		
ERRSUM	OUTPUT TEST ERROR SUMMARY	X		X	
ERT LOG	OUTPUT ERROR RATE TEST LOG	X		X	X
EXIT	EXIT PROGRAM OR COMMAND	X	X	X	X
FAULT LOG	OUTPUT FAULT LOG	X			X
HELP	OUTPUT HELP INFORMATION	X	X	X	X
INIT MEDIA	INITIALIZE MEDIA		X	X	
PRESET	UPDATE DEVICE LOGS	X	X	X	X
REQSTAT	REQUEST STATUS	X	X	X	X
REV	OUTPUT FIRMWARE REVISION		X		
RF SECTOR	READ FULL SECTOR		X		
RO ERT	PERFORM READ-ONLY ERT	X		X	X
RUN LOG	OUTPUT RUN LOG	X		X	X
SDCLEAR	CLEAR SELECTED DEVICE	X	X	X	
SENSE	OUTPUT SENSOR DATA		X		
SERVO	794X DEVICE SERVO TEST				X
SPARE	SPARE SECTOR OR BLOCK	X	X	X	X
SPARE TABLE	OUTPUT SPARE TABLE	X	X	X	X
TABLES	OUTPUT DEVICE TABLES		X	X	
UNIT	SET UNIT NUMBER	X	X	X	X
UNLOAD	UNLOAD TAPE CARTRIDGE			X	
USE LOG	OUTPUT TAPE USE LOG			X	
WRITE FM	WRITE FILE MARK			X	
WTR ERT	PERFORM WRITE-THEN-READ ERT	X		X	X

OPER Editing Commands		OPER Executable Commands	
EDIT	EDIT PROGRAM STEP	CLR	CHANNEL INDEPENDENT CLEAR
EXEC	EXECUTE OPER PROGRAM	CMPR	WRITE-THEN-READ AND COMPARE
EXIT	EXIT PROGRAM	COMP	COMPLEMENTARY COMMAND
HELP	OUTPUT HELP LISTING	ENDLP	END LOOP
LIST	LIST PROGRAM	INSK	INCREMENTAL SEEK
NEW	START NEW PROGRAM	LCRD	LOCATE AND READ
NULL	DELETE PROGRAM STEP	LCWR	LOCATE AND WRITE
		LOOP	BEGIN LOOP
		RQST	REQUEST STATUS

COMMANDS BY CATEGORY

Log & Table Interrogation

CLEAR LOGS	REQSTAT
ERRSUM	RQST
ERT LOG	REV
FAULT LOG	SENSE
RUN LOG	USE LOG
TABLES	SPARE TABLE

Media Installation

CERT	INIT MEDIA

Error Rate Testing

CERT	WTR ERT
CRGTST	RO ERT

Channel Verification

CHANNEL	CMPR

Channel/Drive Clearing

CANCEL	PRESET
CICLEAR	UNLOAD
CLR	RELS
	AMCLEAR

Reading/Writing/Seeking

CMPR	LCWR
COMP	RF SECTOR
INSK	WRITE FM
LCRD	CRGTST
	SERVO

Internal Diagnostics

DIAG	CRGTST

Block Sparing

CERT	SPARE
	SPARE TABLE

Miscellaneous

UNIT	LIST
EDIT	LOOP
ENDLP	NEW
EXEC	NULL
EXIT	STOP
HELP	DESCRIBE
	D2D

4-1. USING THE EXERCISER WITH AN HP 85

Note: The following items are required for implementing the CS/80 external exerciser using the HP 85:

Description	HP Order Number
ROM DRAWER	HP 82936A
I/O ROM	00085-15003
16K MEMORY MODULE	HP 82903A
HP-IB INTERFACE	HP 82937A
EXERCISER PROGRAM	07908-16001

Due to HP 85 memory size limitations, the CS/80 external exerciser has been stored as many separate programs on the tape. Some of the commands are repeated in two or more programs where necessary. Since loading another program is time consuming, it is suggested that the user become familar with the commands and the program(s) in which they reside using the HELP command.

To load the exerciser into an HP 85, proceed as follows:

a. Connect the HP-IB cable from the HP 85 to the CS/80 device.

b. Power-on the CS/80 device.

c. Insert the CS/80 external exerciser tape into the HP 85.

d. Power-on the HP 85.

The HP 85 goes through an automatic loading sequence, and lists the programs along with their HELP routines. The program desired is selected by pressing the appropriate "k" key on the HP 85.

If the CS/80 external exerciser tape has been inserted into the HP 85 before power-on, then once power is turned on the tape will automatically enter autoload. During autoload, a help listing is displayed and the "k" keys on the HP 85 are set up with the program names and their associated HELP listings. To load a program, press the appropriate "k" key; for the HELP listing of a program, hold down the shift key and press the appropriate "k" key.

If the tape is inserted after the HP 85 has been powered on, or if another program is desired, loading can be done as follows:

a. Press the [**PAUSE**] key (if a program is already running).

b. Type [**LOAD "NAME"**], where NAME is the desired program.

c. Press the [**END LINE**] key.

The autoload feature within the HP 85 allows the program to start running immediately once it has loaded. If the program was loaded otherwise (such as by typing LOAD "NAME") then the RUN key must be pressed to run the program. RUN always restarts the program from the beginning. To stop and start a program, press PAUSE and CONT respectively. CONT re-enters the program at exactly the same point at which PAUSE caused it to stop.

If a command in another program is entered, the question "Another program will now be loaded from the tape, Do you want the program loaded?" will be asked. If YES is entered, the program in which the command resides will be loaded; if NO is entered, the current program module is re-entered and "Input the TEST name" is displayed again. After typing in a command, press the END LINE key to enter the command.

If any problems are encountered while running a specific program, the program can usually be restarted by pressing the PAUSE key and then the RUN key. If the program does not restart, it is recommended that the power is cycled on the HP 85. This will cause the tape to autoload. If a read error is displayed while loading the tape, it is recommended that the tape head be cleaned.

The CS/80 external exerciser sets up three "k" keys while each test is running. If k1 is pressed (ABORT), the program will ask "Do you wish to ABORT?". If YES is entered, then a CANCEL is issued. Certain tests such as INIT MEDIA or CERT cannot be aborted due to the nature of the test. If k2 is pressed (DISPLA), then all printer output is forced to go to the display screen; conversely, if k3 is pressed (PRINTR), then the output is redirected to the thermal printer.

4-2. USING THE EXERCISER WITH AN HP 64000

The maximum data buffer size while using OPER with an HP 64000 is 2048 bytes. The following items are required for implementing the CS/80 External Exerciser using the HP 64000:

Description	HP Order No.
HP 64000 Computer	
External Exerciser Program: Mini-Cartridge Tape	64932-10002

To load the CS/80 External Exerciser, proceed as follows:

a. Connnect an HP-IB cable from the HP 64000 to the CS/80 device.

b. Set the rear panel switches on the HP 64000 mainframe for local mass storage.

c. Turn on the HP 64000.

d. Insert the CS/80 external exerciser tape into the HP 64000.

CAUTION

When inserting the cartridge into the transport, there is no need to push hard. Use of too much force may result in a "Servo Fail" error message. Also, do not remove the tape cartridge while the "Tape Drive On" indicator is on. This could result in damage to the information stored on the tape.

After initialization the tape goes through an automatic loading sequence. Then the CRT will display the following format:

```
BOOT IN PROGRESS

When the output buffer fills the test will

Continue (The test will continue and the first data received will be lost)
                              OR
Print and Continue (The buffer will be printed and the test continued)
                              OR
Pause (You will then be asked if you want to print the buffer and then
continue or if you just want to Continue, losing
the first data received)

STATUS: Select 'CONTINUE', 'PRINT & CONTINUE' or 'PAUSE'

EXIT   PRINT DSP   CONTINUE PRNT-CONT   PAUSE
```

At this time the user may choose how information is displayed.

After formatting, five levels of softkeys are available (by pressing the ---ETC--- key) for formatting or performing disc diagnostic operations. Furthermore, a brief description of the CS/80 External Exerciser commands are given by pressing the HELP softkey. Since the softkeys only allow 9 characters to be displayed, a few of the command names have been slightly abbreviated. In all cases, however, typing in the entire command as specified in the front part of this manual will invoke that particular operation.

After entering the desired command or string of commands, pressing the RETURN key will begin execution of the functions desired. Should the user require termination of a command operation, press the RESET key twice. This will put the system in the awaiting input level.

The locate and read (LCRD), locate and write (LCWR) and compare (CMPR) commands are limited by memory space. These commands will load a software buffer located in mainframe memory. The buffer can hold only 2048 bytes of information at a time; use beyond these bounds will result in an error indication. Since the screen cannot always display all available information at one time, occasionally the ROLL UP key must be used to scroll the information so it can be seen.

It is not recommended that termination of INIT MEDIA or SPARE commands be done using RESET-RESET as this will cause formatting problems. If any problems are encountered during other command sequences, press the RESET key twice; if the problem still exists after re-entering the command, it is recommended that the exerciser tape be loaded again. If a read error is displayed while loading the tape, it is suggested that the tape head be cleaned.

4-3. USING THE EXERCISER WITH AN HP 9845B/C

The maximum data buffer size while using OPER with an HP 9845B/C is 1024 bytes. The following items are required for implementing the CS/80 External Exerciser using the HP 9845B/C:

Description	HP Order No.
HP 9845B/C Computer	
HP-IB Interface	HP 98034A
External Exerciser Program: Mini-Cartridge Tape	09845-94064

Due to the nature of the programs, the CS/80 External Exerciser has been stored as four separate modules on the tape. Some of the commands are repeated in two or more program modules where necessary. Since loading another program module is time consuming, it is suggested that the user become familar with table A-1 which shows all commands and the module(s) in which they reside.

The modules labeled EXRSIZ and EXRSI2 are disc and controller oriented programs; the module labeled TAPE contains commands to be used specifically for CS/80 devices which have the tape backup feature. The OPER program module contains the Operator Designed CS/80 Program Set.

To load the exerciser into an HP 9845, proceed as follows:

a. Connect the HP-IB interface cable from the HP 9845 to the CS/80 device.

b. Power-on the CS/80 device.

c. Insert the CS/80 external exerciser tape into T-15 (the right tape drive) on the HP 9845.

d. Ensure that the key labeled "AUTO ST" on the HP 9845 is in the down position.

e. Power-on the HP 9845.

The tape goes through an automatic loading sequence, and lists the four programs (EXRSIZ, EXRSI2, TAPE, OPER) along with HELP routines. The program desired is selected by pressing the appropriate "k" key on the HP 9845.

If the CS/80 external exerciser tape has been inserted into the HP 9845 before power-on, then once power is turned on the tape will automatically enter autoload. During autoload, a HELP listing is displayed and the "k" keys on the HP 9845 are set up with the four module names and their associated HELP listings. To load a program module, press the appropriate "k" key; for the HELP listing of a program module, hold down the shift key and press the appropriate "k" key.

If the tape is inserted after the HP 9845 has been powered on, or if another program module is desired, loading can be done as follows:

a. Press the PAUSE key (if a program is already running).

b. Type LOAD "NAME",1 (where NAME is the desired program).

c. Press the EXECUTE key.

The autoload feature within the HP 9845 allows the program to start running immediately once it has loaded. If the program was loaded otherwise (such as by typing LOAD "NAME",1) then the RUN key must be pressed to run the program. RUN always restarts the program module from the beginning. To stop and start a program, press PAUSE and CONT respectively. CONT re-enters the program module at exactly the same point at which PAUSE caused it to stop.

If a command in another program module is entered, the following appears on the screen: "Another program will now be loaded from the tape, Do you want the program loaded?". If YES is entered, the program in which the command resides will be loaded; if NO is entered, the current program module is re-entered and "Input the test name?" is displayed again. After typing in a command, use the CONT key to enter the command.

If any problems are encountered while running a specific program, the program can usually be restarted by pressing the PAUSE key and then the RUN key. If the program does not restart, it is recommended that the power is cycled on the HP 9845. This will cause the tape to autoload. If a read error is displayed while loading the tape, it is recommended that the tape head be cleaned.

The CS/80 External Exerciser sets up three "k" keys while each test is running. If k1 is pressed (ABORT), the program will ask "Do you wish to ABORT?". If YES is entered, then the program will ask whether a CANCEL or CICLEAR should be issued. Certain tests such as INIT MEDIA or CERT cannot be aborted due to the nature of the test. If k2 is pressed (DISPLA), then all printer output is forced to go to the display screen; conversely, if k3 is pressed (PRINTR), then the output is redirected to the thermal printer.

4-4. USING THE EXERCISER WITH AN HP 250

The maximum data buffer size while using OPER with an HP 250 is 1024 bytes. The following items are required for implementing the CS/80 External Exerciser using the HP 250 system:

Description	HP Order No.
HP 250 Computer	
External Exerciser Program:	
(1) Flexible Disc	45260-18001
or	
(2) DC 600 Cartridge Tape	45260-19001

The HP 250 uses a BASIC version of the CS/80 External Exerciser in a 64k user block. Either a flexible disc drive or a CS/80 tape backup system (DC 600) is required to load the program; it is also necessary to boot a special operating system. The time required to go from one program to another is small when running from disc, but when running from tape, it is recommended that very little program switching be done; the tape was not designed for this use. The exerciser is composed of four programs (EXRSIZ, EXRSI2, TAPE, OPER) with each containing the same functions as the HP 85 version (see table A-1). There is also an AUTOST program which can be configured to begin running at boot-up, or run directly.

To load the exerciser into the HP 250, via flexible disc, proceed as follows:

a. Boot up the system from the CS/80 External Exerciser flexible disc. Ensure that the system configuration is compatible with the particular devices currently connected to the system.

b. Enter the command RUN "AUTOST". This program will list the four programs available and provide a description of the commands available within each. To run any one of the programs, press the appropriate softkey.

To load the exerciser into the HP 250, via DC 600 tape cartridge, proceed as follows:

a. Boot up the system from the DC 600 exerciser tape cartridge.

b. Switching between programs should be kept to a minimum when using the DC 600 tape. Determine which program to use (via table A-1), and explicitly load it by entering the command RUN "programname:K", where programname is one of the following: EXRSIZ, EXRSI2, OPER, or TAPE.

It is possible to have AUTOST load automatically at boot-up. This can be accomplished by using the CONFIG utility to specify AUTOST as the Autostart program. Similarly, it is possible to configure any of the exerciser programs to be automatically loaded.

Exerciser programs may be started by using the RUN command. When one exerciser program cannot load another, it will retain control and signal that the load failed; the message "UNABLE TO LOAD PROGRAM" will appear. The likely causes are: Trying to run in a 32k user block, or the system is searching the wrong mass storage device. If the user block is too small, then attempt to run the exerciser from another larger block (the system may have to be reconfigured to get a larger block). If the wrong storage device is being searched, use the MSI (Mass Storage Is) command to set it to the desired one: 'MSI ":Q"' tells the operating system to search the tape and MSI ":F2 ,6,x" (where x is 0, 1, or 2) tells it to search a flexible disc drive. If an error occurs while attempting to load any of the programs, check to be sure that the HP-IB DROM is configured in the current operating system.

When a function is requested which resides in another program, the command will automatically be performed when that program is loaded; it is not required to repeat the command.

Softkey labels are always visble and the labeled key active. The HALT key has been defined to behave the same as the ABORT softkey. The PRINT softkey will display a label like "Printer is 8". The number (8) is the address of a device which may be used as a printer; 0 and 1 are typically assigned to a printer, 8 is assigned to the work station CRT, and 9 is unassigned. Pressing the PRINTER IS key causes the next functioning printer to be selected. Notice that pressing the DISPLAY key also affects the PRINTER IS key; the label appearing is "Printer is 8".

If the operating system does not boot properly, or the programs cannot be loaded, then there is most likely a problem within the loading device or its controller. If no other loading device is available, then a stand-alone device such as the HP 85 should be used to run the exerciser.

NOTE: Do not run other utility or applications programs while the external exerciser is running.

4-5. USING THE EXERCISER WITH AN HP 1000L

The maximum data buffer size while using OPER with an HP 1000A/L is 4156 words. The following items are required for implementing the CS/80 External Exerciser using the HP 1000A/L:

Description	HP Order No.	
HP 1000A/L (with at lease 128 kbytes of memory)		
Interface Card	HP 12009A	
External Exerciser Program:	HP 1000A	HP 1000L
(1) Mini-Cartridge Tapes	24398-13323/5/6	24398-13306/8/9
or		
(2) Flexible Disc	24398-13407	24398-13401
or		
(3) Mini-Flexible discs	24398-13410/11/13	24398-13403/4/6
or		
(4) DC 600 Cartridge Tape	24398-13318	24398-13301
	or	
	02196-14001	
An Input Device:		
(1) HP 264X Terminal with Mini-Cartridge Tape Drive		
or		
(2) HP Flexible Disc Drive		
or		
(3) HP Mini-Flexible Disc Drive		
or		
(4) HP CS/80 Device with DC 600 Tape System		

To load the CS/80 External Exerciser, proceed as follows:

a. Power-on the HP 1000A/L-Series and the loading device.

b. Insert the disc or tape into the loading device.

c. For 264X, enter [%LCT]. (Enter [%LCT0120] if the right tape drive is used.)

Type [%E] to run the exerciser.

Note: To load and run in one step, enter [%BCT].

d. For flexible disc, enter [%BDCbuscNAME] where "busc" is an octal number defined as:

b — HP-IB address of the flexible disc drive (0 - 7).
u — the flexible disc drive unit number
sc — the octal select code of the HP 12009A HP-IB interface connected to the flexible disc drive (usually set to 27).

NAME is: EXR1 — CS/80 External Exerciser
TAPE — Tape Exerciser
OPER — Operator Designed CS/80 Program Set

e. For DC 600, enter [%BDCxbusc], where "xbusc" is an octal number defined as:

x — file number

HP 1000L file number	HP 1000A file number	program
0	12B	EXR1
4	16B	TAPE
6	20B	OPER

b — the HP-IB address of the CS/80 device
u — the unit number of the tape unit (standard = 1; dual controller = 0)
sc — the octal select code of the HP 12009A HP-IB interface connected to the CS/80 device (usually set to 27).

When the program module has loaded, the following is displayed:

```
BOOT PROCESS COMPLETE
*RTE-L SYSTEM READY*
```

f. To run a program, press any key to get the RTE-L colon prompt (:), then enter the following:

```
RUN,FILENAME,1,1
```

where FILENAME is EXR1, TAPE, or OPER as specified when loaded

```
Input drive LU?
[10] or [11]
Input DRIVE ADDRESS?
[HP-IB address of CS/80 device]
Input the test name?
?
```

4-6. USING THE EXERCISER WITH AN HP 1000M/E/F

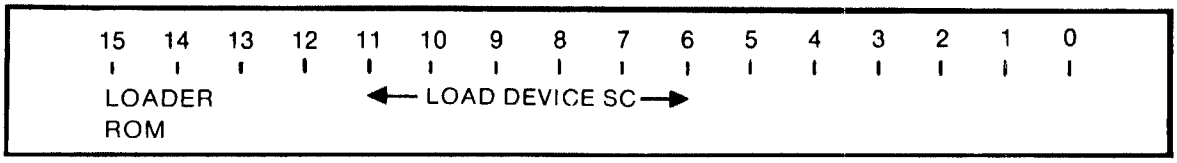
The maximum data buffer size while using OPER with an HP 1000 M, E, or F is 4156 words. The following items are required for implementing the CS/80 External Exerciser using the HP 1000 M, E, or F systems:

Description	HP Order No.
HP 1000 M-, E-, or F-Series Computer (with at least 128 kbytes of memory)	
Buffered Asynchronous Communications Interface with Cable	HP 12966A
HP-IB Disc Interface with HP-IB Cable	HP 12821A
Memory Expansion Module	HP 12731A
Time Base Generator	HP 12539C
Memory Protect	HP 12892B
Dynamic Mapping ROMS	HP 13307A or HP 13307B
Firmware Expansion Module	HP 12791A or HP 13304A FAB
External Exerciser Program:	
(1) Mini-Cartridge Tape	part of system (91711B diagnostic and verification package)
or	
(2) MAG TAPE	optional with system
An Input Device:	
(1) HP 264X Terminal with Mini-Cartridge Tape Drive	
or	
(2) HP 7970B or 7970C Mag Tape Subsystem	

The CS/80 External Exerciser can be loaded from magnetic tape or an HP mini-cartridge. Only the procedure for loading and booting from the mini-cartridge will be discussed here. Loading instructions for magnetic tape is in the 12992 Loader ROM manual (part no. 12992-60001). From there on the procedures are identical for both. The CS/80 External Exerciser is supported through an RTE-4E Operating System Host. The host must be loaded first, then the desired exerciser program module can be loaded. To load the RTE-4E host, insert the tape (provided with the system) into the loading device and perform the following steps:

a. Select the S register.

b. Set the bits as shown below.

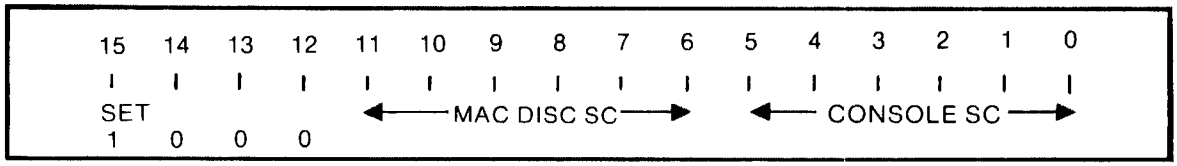


c. Press STORE, PRESET, IBL, PRESET, RUN.

d. The first part of the three-part loading sequence will start now. This takes about five minutes. Normal halt codes are used with 102077 signifying a good load.

e. Select the S register.

f. Set bits as shown below.



g. Press STORE.

h. Select P register.

i. Set bit 1 = 1 (P = 2 octal)

j. Press STORE, RUN.

At this point the operating system will read more data from the tape; the message below will be transmitted to the console when the read has been completed. This takes about five minutes.

CONSOLE RESPONSES

The following is an example of the expected inputs and outputs. Required operator responses are in brackets [ ].

```
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= TBG
SELECT CODE 12= EQT   1,TYPE 32      : 7906 MAC disc
SELECT CODE 15= EQT   2,TYPE  5      : 264x, 262x terminal
SELECT CODE 16= EQT   3,TYPE 12      : Line printer 2631 type
SELECT CODE 17= EQT   4,TYPE 00      : 12531A Compatible terminal
SELECT CODE 20= EQT   5,TYPE 23      : Magtape 1
SELECT CODE 21= EQT   5,TYPE 23      : Magtape 2
SELECT CODE 22= EQT   6,TYPE 33      : CS80 Disc
I/O RECONFIGURATION?(YES/NO)
[YES]
CURRENT SELECT CODE#,NEW SELECT CODE#?(/E TO END)
```

At the I/O reconfiguration stage, the system allows the operator to enter OLD SC,NEW SC to configure the I/O map to match the real I/O structure of the system being used. Terminate the reconfiguration by entering [/E].

Note: The generation for the host operating system has the TBG mapped to select code 11. If the select code for the CS/80 disc is set to 11, it is important to note that the TBG will be overlayed and will not show up in the I/O map. To alleviate this problem move the CS/80 disc to a temporary select code and then move the TBG to the real select code. Then move the CS/80 disc back to select code 11.

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 more data from the loading device.

Press any key and the system will prompt with "*". APLDR can now be used to bring in the exerciser.

The first thing that should be done before loading any program is to run the I/O mapping program. Enter:

```
RU,MAPIO,1
```

Record the lu designations and remove the program so that the other programs can be loaded. Remove MAPIO by entering:

```
OF,MAPIO,8
```

This must always be done whether the I/O map is needed or not.

If unsure of the HP-IB address of the device, a time-out of approximately one second should be set to prevent an infinite loop.

Once the system is loaded and running, the magnetic tape or mini-cartridge must be positioned to the file which contains the desired CS/80 external exerciser program module. A list of the program modules for each type of tape is as follows:

Mag Tape Format

1. Directory
2 - 18. Skip
19 - 32. RTE-4E Host
33. EXR1
34. TAPE
35. OPER

Mini-Cartridge Format (as part of 91711B)

Cartridge 1	Cartridge 2	Cartridge 3
1. Directory	1. Directory	1. Directory
2-15. RTE Host	2. EXR1	2. TAPE
		3. OPER

Positioning can be done using the memory resident program XCNTL or, for the mini-cartridge, positioning is simpler if done with the terminal file search softkeys.

USING XCNTL

The XCNTL program is provided in the RTE-4E system, and is executed as follows:

RU,XCNTL,<lu>,<function>

Where: lu = 8 for magnetic tape, 4 for mini-cartridge

Function = 13B file forward
04B rewind
02B record backward
14B file backward
03B forward space

Each of the functions allows the tape to move one program unit. It is important to note when using the file backward command (14B) that the tape is left in front of the last End-Of-File mark. In order to move to the next file, enter RU,APLDR,<lu> twice or RU,XCNTL,<lu>,03B and RU,APLDR,<lu>. This moves the tape past the end of file mark and loads in the next program.

Note: Although XCNTL can be used with the mini-cartridge, it is recommended that the tape control softkeys be used instead.

USING APLDR

Once the tape is positioned, APLDR is used to load the appropriate program module as follows:

Enter: RU,APLDR,<lu> (lu = 8 for mag tape, 4 for mini-cartridge)

Refer to table F-1 for a list of the command names and the program modules in which they reside. The program modules take a maximum of three minutes to load from the mini-cartridge. The program module will now be loaded and the message "EXR1 READY, TAPE READY, or OPER READY" will be displayed on the terminal.

To run the current program, enter:

RU,<NAME>,<input lu>,<output lu>

NAME = EXR1, TAPE or OPER

input lu = 1; in all cases the console is the input lu

output lu = 1; in most cases the console will be the output lu, although the line printer can be used instead. The only problem with using the line printer is that no output will be seen at the console.

Note: This will only work if the line printer was set up during reconfiguration.

SWITCHING BETWEEN PROGRAMS

To execute a different module, the old module must be cleared from memory to allow the new program to be loaded. Enter:

OF,<program name>,8

Note that if this is not done the message NO PARTITION BIG ENOUGH will appear when the load is attempted. In this case the first record was read in and the system attempted to load it into the only partition. Even after removing the old program the tape must be repositioned in order to avoid the message CHECKSUM ERROR. Enter the following to do this:

[RU,XCNTL,<lu>,14B] [RU,XCNTL,<lu>,03B]

BREAKMODE

Breakmode is supported in this diagnostic and may be entered during a loop by pressing any key and then entering *[BR,<program>]. The exerciser can also be stopped by entering *[OF,<program>,1] for example.

PROBLEMS WITH RUNNING THE EXERCISER

There are some particular situations which require special attention in order to avoid complications when attempting to run the exerciser.

1. The lu for the disc drive is requested and is only used to link up with the select code of the controller. It will always be 10 or 11. This can be verified when running MAPIO in the initialization stage. Range checking is employed in the program to insure that the input is 10 or 11.

2. If an invalid drive address is input or if the CS/80 drive is powered down, the program will hang without a message. The reason for this is that the timeout for the drive is set to zero. This is necessary due to some of the waiting periods in the programs, but it can be temporarily changed for set up purposes. Press any key to get the prompt "*" and enter:

   [OF,<program name>,1]

   The timeout can now be changed to 200 ms by entering:

   [TO,6,20]

   The program can now be run. If an invalid address is entered or the CS/80 device is powered down, the following message appears:

   "Continual QSTAT error of -1 being reported please check drive PASCAL halt -1"

   Once the correct address has been determined, the timeout should be reset to 0 by entering:

   [TO,6,0]

   The program can be run again.

3. If an invalid device address is input and the time is still set to zero, the program will hang without a message. At this point the RTE-4E host must be restarted.

4. If at any time the system status is desired, the program WHZAT can be executed by entering:

   [RU,WHZAT]

NAME	COMMAND DESCRIPTION	PROGRAM NAMES		
		EXR1	TAPE	OPER
CANCEL	CANCEL PREVIOUS COMMAND	X	X	
CERT	CERTIFY TAPE CARTRIDGE		X	
CHANNEL	HP-IB CHANNEL TEST UTILITY	X		
CICLEAR	CHANNEL INDEPENDENT CLEAR	X	X	
CLEAR LOGS	CLEAR DRIVE LOGS UTILITY	X	X	
CLR	CHANNEL INDEPENDENT CLEAR			X
CMPR	WRITE-THEN-READ AND COMPARE			X
COMP	COMPLEMENTARY COMMAND			X
DIAG	EXECUTE INTERNAL DIAGNOSTIC	X		
EDIT	REPLACE AN OPER PROGRAM STEP			X
ENDLP	END LOOP			X
ERRSUM	READ ERROR SUMMARY UTILITY	X	X	
ERT LOG	READ ERROR RATE LOG UTILITY	X	X	
EXEC	EXECUTE OPER PROGRAM STEPS			X
EXIT	EXIT THE CURRENT PROGRAM	X	X	X
FAULT LOG	READ FAULT LOG UTILITY	X		
HELP	PRINT LIST OF COMMANDS	X	X	X
INIT MEDIA	INITIALIZE DISC OR TAPE	X	X	
INSK	INCREMENTAL SEEK			X
LCRD	LOCATE AND READ			X
LCWR	LOCATE AND WRITE			X
LIST	LIST OPER PROGRAM STEPS			X
LOOP	LOOP			X
NEW	CLEAR CURRENT OPER PROGRAM			X
NULL	DELETE OPER PROGRAM STEP			X
PRESET	PRESET DRIVE UTILITY	X	X	
REQSTAT	REQUEST STATUS	X	X	
REV	READ FIRMWARE REVISION	X		
RF SECTOR	READ FULL SECTOR	X		
RO ERT	READ ONLY ERROR RATE TEST	X	X	
RQST	REQUEST STATUS			X
RUN LOG	READ RUN TIME LOG UTILITY	X	X	
SDCLEAR	SELECTED DEVICE CLEAR	X	X	
SENSE	READ SENSORS UTILITY	X		
SPARE	SPARE BLOCK UTILITY	X	X	
TABLES	READ DRIVE TABLES UTILITY	X	X	
UNIT	SET UNIT NUMBER UTILITY	X	X	
UNLOAD	UNLOAD THE TAPE		X	
USE LOG	DISPLAY TAPE USE LOG		X	
WRITE FM	WRITE FILEMARK ON TAPE		X	
WTR ERT	WRITE THEN READ ERT	X	X	

4-7. USING THE EXERCISER WITH AN HP 3000

CS80 DIAG

Use CS80 DIAG to gain access to the HP 3000 External Exerciser.

CAUTION

TESTS 1, 2, 3 do not destroy data.
TESTS 4 & 5 destroy data.
TEST 6 is the External Exerciser without OPER commands.

Once "CS80DIAG" program is loaded, type >TEST 6 and >GO.

IMPORTANT: Typing only "GO" will run tests 1 thru 4. **The MPE operating system will be destroyed.** To bypass test 4, type: >TEST 1, >TEST 2, >TEST 3, >GO.

CS80 UTIL

Use CS80 UTIL to read the disc logs and do sparing on-line.

Log on to the TELE-SUPPORT account and type "RUN CS80UTIL". CS80 UTIL requires a message file "CS80MSG"; both "CS80UTIL" and "CS80MSG" are in the HP 32340 group of the TELESUP account.

READING MAINTENANCE TRACKS

SECTION V

HP 7908/791X DISCS

Load "EXERSIZ"
REQSTAT
PRESET
ERT LOG
RUN LOG
FAULT LOG
ERRSUM (P)
Load "EXERSI2"
REV
TABLES (SPARE)

HP 793X DISCS

Load "EXERSIZ"
REQSTAT
PRESET
ERT LOG
RUN LOG
FAULT LOG
Load "EXERSI2"
REV
SENSE
TABLES (SPARE)
TABLES (HEAD V)
TABLES (CONFIG)
TABLES (RUNOUT)

TAPE (LINUS/BUFFALO)

Load "TAPE"
UNIT
REQSTAT
PRESET
ERT LOG
RUN LOG
TABLES (MANUF.)
TABLES (SPARE)
USE LOG

DRIVE STATUS LOGS

LOGS	ERROR TABLE
ERT LOG	\ Data transfer
RUN LOG	/ errors, no decoding
FAULT LOG	TERRORS & DERRORS *
ERRSUM	TERRORS *
USE LOG	No errors

*To decode errors, refer to tab for specific drive herein (section V).

MEDIA PREPARATION

SECTION VI

6-1. CERTIFYING NEW TAPES

The following command steps are suggested to initialize an uncertified tape cartridge.

COMMAND	DESCRIPTION
UNIT	Enter 1 for single controller, 0 for dual
CERT	1 loop PT, see ERT LOG
	Print error limits (see 6-3)
TABLES (S)	Print spare block table

NOTE: Tape exerciser INIT MEDIA command will certify tapes automatically if non-certified. (See CAUTION below.)

CAUTION

Do NOT use INIT MEDIA command unless exerciser tape is prefix 2424, or later.

6-2. TAPE CERTIFICATION LIMITS

LONG TAPE	FUNCTION	SHORT TAPE
131,072	Blocks accessed	32,768
250	Maximimum permanent errors	128 (<32 typ)
2048	Transient errors	N/A
32	Spared blocks	8
32	Unlocatables & uncorrectables (unlocatables should predominate)	8

NOTES:

1. If the acceptable error limits in the table are exceeded, the system should be evaluated. For example, excessive transient errors indicate the head is dirty or connectors are loose; excessive unlocatables indicate a defective tape cartridge.

2. Error rate tests on a single track should have specs approximately one-eighth of the certify specs.

3. Certification is performed on different systems as follows.

System 250	INIT
System 1000	FORMC - FORMAT
System 3000	VINIT - FORMAT

STATUS WORDS

SECTION VII

A 20-byte status report is returned with the Request Status command and contains a summary of all transactions since the last report was cleared.

Refer to table 7-1 for decoding the status bytes. The left column decodes the first 2 bytes (identification field); the next 4 columns decode the 8 bytes of the error reporting field; the last column describes the final 10 bytes of the parameter field.

The 8-byte error reporting field contains Reject Errors, Fault Errors, Access Errors, and Information Errors as shown in table 7-2.

NOTES:

1. Use Set Status Mask command to prevent setting hard errors - insert one's in the bit positions corresponding to errors in the Request Status report. (Fault errors cannot be masked.)

2. Status can also be returned with LISTLOG2 (HP 3000) AND DISC STATUS (HP 250). FORMC (HP 1000) will decode and report status at any failure.

3. For more information on commands, see CS/80 Instruction Set Programmming Manual, P/N 5955-3442.

Table 7-1. Request Status Summary

ERROR REPORTING FIELDS[1]

IDENTIFICATION ERRORS FIELD	REJECT ERRORS FIELD	FAULT ERRORS FIELD[2]
<VVVVUUUU> <SS SS SS SS>	0 7 8 15 <0 0 2 0 0 5 6 7> <8 9 10 0 12 0 0 0>	16 23 24 31 <0 17 0 19 0 0 22 0> <24 0 26 27 28 0 30 31>
VVVV = Volume number **UUUU** = Unit number **SSSSSSSS** = Value of the lowest numbered unit with status pending (all ones if no units have status pending).	**2** = **CHANNEL PARITY ERROR** A channel command was received without odd parity. **5** = **ILLEGAL OPCODE** An unrecognizable opcode was received. **6** = **MODULE ADDRESSING** An illegal volume or unit number was specified for this device. **7** = **ADDRESS BOUNDS** The target address has exceeded the bounds for this device. **8** = **PARAMETER BOUNDS** A parameter (other than unit, volume, or target address) is not allowed for this device. **9** = **ILLEGAL PARAMETER** A parameter field was the wrong length for the opcode preceding it. **10** = **MESSAGE SEQUENCE** The message sequence has been violated. (Error suppressed if any reject or fault errors have occurred prior to sequence error.) **12** = **MESSAGE LENGTH** The total length of the execution message differs from the current default value.	**17** = **CROSS-UNIT[3]** An error has occurred during a Copy Data operation. **19** = **CONTROLLER FAULT** A hardware fault occurred in the controller. **22** = **UNIT FAULT** A hardware fault has occurred in the unit addressed. **24** = **DIAGNOSTIC RESULT[3]** The hardware failed the diagnostic indicated in the parameter field. **26 - 28** = **RELEASE REQUIRED** This command cannot be executed until after release is granted to the device. Device requires release for indicated reason: **26** = **OPERATOR REQUEST** Release required for operator request (e.g., load/unload, restore). **27** = **DIAGNOSTIC REQUEST** Release required for diagnostics initiated from control panel (e.g., HIO, self test). **28** = **INTERNAL MAINTENANCE** Release required for internal maintenance (e.g., head alignment, error log). **30** = **POWER FAIL** The power to the unit failed, a diagnostic destroyed configuration, or a pack was loaded. Device should be reconfigured. **31** = **RETRANSMIT** The preceding transaction should be retried.

Notes:

1. Error bit positions correspond to bit positions in Set Status Mask command. A "1" indicates presence of an error. Unused bit positions musta be zeroes.
2. All Fault Errors are unmaskable.
3. Error uses parameter field.
4. • Parameter field configuration is dependent on reported errors.
   • Highest priority is given to lowest numbered errors.
   • Masked errors relinquish their priority.

Table 7-1. Request Status Summary (cont'd)

ERROR REPORTING FIELDS[1]

ACCESS ERRORS FIELD 32 39 40 47 <32 33 34 35 36 37 0 0><40 41 0 43 44 0 0 0>	INFORMATION ERRORS FIELD 48 55 56 63 <48 49 50 51 52 0 0 55><0 57 58 59 0 61 0 0>	PARAMETER FIELD[4] < P1 > - - - - - - - - - - < P10 >
32 = ILLEGAL PARALLEL OPERATION The requested operation cannot be executed in parallel with some other operation(s) currently in progress. **33 = UNINITIALIZED MEDIA** The host attempted to access unformatted media, or unusable media has been loaded. **34 = NO SPARES AVAILABLE** Spare Block cannot be executed due to lack of spare media. **35 = NOT READY** The selected unit is not ready for access at this time (e.g., heads or media not yet fully loaded). **36 = WRITE PROTECT** The selected volume is write protected. **37 = NO DATA FOUND** A block accessed during a read has not been written. **40 = UNRECOVERABLE DATA OVERFLOW** The previous transaction generated more than 1 unrecoverable data error. The entire transfer should be considered in error. **41 = UNRECOVERABLE DATA[3]** Unrecoverable data at indicated block(s). **43 = END OF FILE** End of file encountered on file structured device. **44 = END OF VOLUME** The host attempted to access across a volume boundary.	**48 - 50 = REQUEST RELEASE[3]** Device requests release for indicated reason: **48 = OPERATOR REQUEST[3]** Release requested for operator request (e.g., load/unload, restore). **49 = DIAGNOSTIC REQUEST[3]** Release request initiated from diagnostic control panel (e.g., HIO, self test). **50 = INTERNAL MAINTENANCE[3]** Release requested for internal maintenance (e.g., head alignment, error log). **51 = MEDIA WEAR** Only one spare track (disc) or one spare block (tape) remaining. **52 = LATENCY INDUCED** A latency was induced during the transfer due to slow transfer rate or seek retry. **55 = AUTO SPARING INVOKED** A defective block has been automatically spared by the device. **57 = RECOVERABLE DATA OVERFLOW** The previous transaction generaged more than 1 recoverable data error. **58 = MARGINAL DATA[3]** Data was recovered, but with difficulty. **59 = RECOVERABLE DATA[3]** A latency was introduced in order to correct a data error. **61 = MAINTENANCE TRACK OVERFLOW[3]** Error and fault log area is full.	No Errors: P1 through P6 indicate new Target Address. The address format, which is used any time P1 through P6 contain address information, is defined by the Set Return Addressing command (refer to paragraph 2-24). No Errors: P7 through P10 contain runtime drive error codes (DERRORS), except after a Spare Block command. The errors are arranged chronologically: P7 contains the most recent of the four errors recorded; P10 contains the oldest of the four recorded. Note: Error codes 40H and CBH will always be followed by a single byte containing fault latch information. After a **Spare Block** command, P1 through P6 contain the beginning address of the reformatted area. (Disc operation only.) After **Spare Block** command, P7 through P10 indicate the length - in blocks - of the reformatted area. The length is a four-byte, unsigned binary number. (Disc operation only.) Error Bit No. 17 **Cross-unit:** P1 through P6 contain the encoded values of each unit which has experienced an error. A byte of all ones indicates no additional units. Error Bit No. 24 **Diagnostic Results:** P1 through P6 * contain the following information: P1 = most suspect component P2 = next most suspect component P3 = test error (TERROR) associated with P1 P4 = test error (TERROR) associated with P2 P5 - P6 = not used P7 - P10 contain DERROR information (format described above). Error Bit No. 41 **Unrecoverable Data:** P1 through P6 indicate address of bad block. Error Bit No. 48 - No. 50 **Request Release:** P1 through P6 contain the encoded values of each unit requesting release. A byte of all ones indicates no additional units. Error Bit No. 58 **Marginal Data:** P1 through P6 indicate address of the marginal block. Error Bit No. 59 **Recoverable Data:** P1 through P6 indicate address of recoverable block.

* EXCEPTIONS FOR HP 794X: See section V under 7941/45 tab herein.

Table 7-2. Possible Errors Summary

COMMAND	REJECT ERRORS							FAULT ERRORS								
	CHANNEL PARITY	ILLEGAL OPCODE	MODULE ADDRESSING	ADDRESS BOUNDS	PARAMETER BOUNDS	ILLEGAL PARAMETER	MESSAGE SEQUENCE	MESSAGE LENGTH	CROSS-UNIT	CONTROLLER FAULT	UNIT FAULT	DIAGNOSTIC RESULT	RELEASE REQUIRED	• OPERATOR REQUEST	• DIAGNOSTIC REQUEST	• INTERNAL MAINTENANCE	POWER FAIL	RETRANSMIT
REAL TIME																		
LOCATE AND READ	X	X			X	X	X		X	X		X	X	X	X	X	X	
COLD LOAD READ	X	X			X	X	X		X	X		X	X	X	X	X	X	
LOCATE AND WRITE	X	X			X	X	X		X	X		X	X	X	X	X	X	
WRITE FILE MARK[1]	X	X			X	X	X		X	X		X	X	X	X	X	X	
COMPLEMENTARY																		
SET UNIT	X	X	X		X	X	X		X	X		X	X	X	X	X	X	
SET VOLUME	X	X	X		X	X	X		X	X		X	X	X	X	X	X	
SET ADDRESS	X	X		X	X	X	X		X	X		X	X	X	X	X	X	
SET BLOCK DISPLACEMENT	X	X		X	X	X	X		X	X		X	X	X	X	X	X	
SET LENGTH	X	X			X	X	X		X	X		X	X	X	X	X	X	
SET BURST	X	X			X	X	X		X	X		X	X	X	X	X	X	
SET RPS	X	X			X	X	X		X	X		X	X	X	X	X	X	
SET RETRY TIME	X	X			X	X	X		X	X		X	X	X	X	X	X	
SET STATUS MASK	X	X			X	X	X		X	X		X	X	X	X	X	X	
NO OP	X	X			X	X	X		X	X		X	X	X	X	X	X	
SET RELEASE	X	X		X	X	X	X		X	X		X	X	X	X	X	X	
SET OPTIONS[1]	X	X		X	X	X	X		X	X		X	X	X	X	X	X	
SET RETURN ADDRESSING MODE	X	X		X	X	X	X		X	X		X	X	X	X	X	X	
GENERAL PURPOSE																		
DESCRIBE	X	X			X	X	X		X	X		X	X	X	X	X	X	
INITIALIZE MEDIA	X	X		X	X	X	X		X	X		X	X	X	X	X	X	
SPARE BLOCK	X	X			X	X	X		X	X		X	X	X	X	X	X	
LOCATE AND VERIFY	X	X			X	X	X		X	X		X	X	X	X	X	X	
COPY DATA	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	
RELEASE	X	X			X	X	X			X	X	X	X	X	X	X	X	
RELEASE DENIED	X	X			X	X	X			X	X		X	X	X	X	X	
UNLOAD[1]	X	X			X	X	X			X			X	X	X	X	X	
DIAGNOSTIC																		
INITIATE UTILITY	X	X		X	X	X	X			X	X		X	X	X	X	X	
INITIATE DIAGNOSTIC	X	X		X	X	X	X			X	X	X	X	X	X	X	X	
REQUEST STATUS	X	X			X	X	X			X	X		X	X	X	X	X	

NOTE 1 APPLIES TO TAPE DRIVE OPERATIONS ONLY

Table 7-2. Possible Errors Summary (cont'd)

COMMAND	ACCESS ERRORS									REQUEST RELEASE:			INFORMATION ERRORS					
	ILLEGAL PARALLEL OPERATION	UNINITIALIZED MEDIA[1]	NO SPARES AVAILABLE	NOT READY	WRITE PROTECT	NO DATA FOUND[1]	UNRECOVERABLE DATA OVERFLOW	UNRECOVERABLE DATA	END OF FILE	END OF VOLUME	• OPERATOR REQUEST	• DIAGNOSTIC REQUEST	• INTERNAL MAINTENANCE	MEDIA WEAR	LATENCY INDUCED	AUTO SPARING INVOKED[1]	RECOVERABLE DATA OVERFLOW	MARGINAL DATA	RECOVERABLE DATA	MAINTENANCE TRACK OVERFLOW
REAL TIME																				
LOCATE AND READ	X		X		X	X	X	X	X		X	X	X		X		X	X	X	X
COLD LOAD READ	X		X		X	X	X	X	X		X	X	X		X		X	X	X	X
LOCATE AND WRITE	X		X	X		X[1]	X		X		X	X	X		X					X
WRITE FILE MARK[1]				X	X		X	X		X	X	X	X			X			X	
COMPLEMENTARY																				
SET UNIT											X	X	X							X
SET VOLUME											X	X	X							X
SET ADDRESS											X	X	X							X
SET BLOCK DISPLACEMENT											X	X	X							X
SET LENGTH											X	X	X							X
SET BURST											X	X	X							X
SET RPS											X	X	X							X
SET RETRY TIME											X	X	X							X
SET STATUS MASK											X	X	X							X
NO OP											X	X	X							X
SET RELEASE											X	X	X							X
SET OPTIONS[1]											X	X	X							X
SET RETURN ADDRESSING MODE											X	X	X							X
GENERAL PURPOSE																				
DESCRIBE											X	X	X							X
INITIALIZE MEDIA	X		X	X							X	X	X							X
SPARE BLOCK	X	X	X	X		X	X				X	X	X					X		X
LOCATE AND VERIFY	X		X				X		X		X	X	X							X
COPY DATA	X		X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X
RELEASE											X	X	X							X
RELEASE DENIED											X	X	X							X
UNLOAD[1]											X	X	X							X
DIAGNOSTIC																				
INITIATE UTILITY	X		X	X	X						X	X	X							X
INITIATE DIAGNOSTIC	X				X						X	X	X							X
REQUEST STATUS											X	X	X							X

NOTE 1 APPLIES TO TAPE DRIVE OPERATIONS ONLY