This package contains a section of the

CE SERVICE HANDBOOK
FOR
79XX SERIES DISC DRIVES

and consists of the following document:

7908
DISC/TAPE DRIVE
Part no. 07908-90905

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

NOTE

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 v).

PRINTING HISTORY

New editions incorporate all update material since the previous edition. Updating Supplements, which are issued between editions, contain additional and revised information to be incorporated into the manual by the user. The date on the title page changes only when a new edition is published.

NOTICE

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SAFETY CONSIDERATIONS

KEEP WITH MANUAL

GENERAL - This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

SAFETY SYMBOLS

⚠ Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the product against damage.

⚡ Indicates hazardous voltages.

⏚ Indicates earth (ground) terminal.

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

SAFETY EARTH GROUND - This is a safety class I product and is provided with a protective earthing terminal. An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER - Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an auto-transformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the main power source.

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by service-trained personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

All products which utilize tape head cleaner are shipped with a Material Safety Data Sheet (MSDS). Follow all applicable precautions when using the tape head cleaner.

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For research and education purposes only.

- **Do not attempt to remove or change printed-circuit assemblies, interconnecting cables, or system cables while ac power is applied to the disc drive.**

CAUTION

- Do not run the disc drive without an absolute filter installed. Severe contamination in the head/disc area may result in damage to the heads and/or disc surfaces.

- Use only the brands of cleaning materials specified.

  Other brands of cleaning materials may contain contaminating oils and/or lint which could leave a harmful residue.

- Use only the type of alcohol specified. Some other types contain inpurities that could cause damage.

- Avoid applying excessive pressure to the gimbal area of a head while cleaning. Excessive pressure may alter or damage the head characteristics which are precision set at the factory.

- Never place an inspection mirror between the heads or allow it to touch the heads. The flying characteristics of the heads may be altered or damaged.

- Do not use oil or other similar lubricants anywhere in the disc drive.

- Do not turn the disc drive power on or off when the system bus is in an active state (activity indicator ON).

- Do not connect or disconnect the HP-IB cable from the disc drive when the system bus is in an active state (activity indicator ON).

- Do not operate the disc drive with the power module cover removed. This will reduce the efficiency of the disc drive RFI shielding.

- Do not attempt to power up the disc drive with the power module cover removed, or the module withdrawn from the enclosure. This will interrupt the flow of cooling air in the enclosure and cause overheating and possible damage to the equipment.

- Do not attempt to manually extend the carriage assembly, unless the head spacer tool (part no. 07930-60154) is installed and there is no media module in the disc drive; otherwise head damage will occur.

- Precautions must be taken during maintenance of the disc drive to avoid accidental erasure of data. Normal writes initiated from the host CPU or the disc drive control panel (diagnostic commands) can overwrite data. Such writes must be restricted to prescripted scratch areas.

- If maintenance of the disc drive requires operation with the card cage cover and/or head contamination shields removed:

  a. Do not unplug or connect any heads while the heads are over the discs.

  b. Do not touch read/write PCA-A10, or the head connectors while the heads are over the discs.

  c. Do not operate the disc drive with the two captive screws at the top of read/write PCA-A10 detached from the adjacent read/write PCA shield.

  d. Do not attempt to remove or install the card cage cover with power applied to the disc drive.

- To avoid accidental erasure of data while performing manual head alignment:

  a. Take precautions to minimize the possibility of electrical discharge. Touch grounded metal on the disc drive before placing the head alignment tool near the carriage assembly.

  b. Do not touch read/write PCA-A10 with the head alignment tool. This could cause a ground path to the head assembly and erase data on the head alignment tracks.

  c. Ensure that the shaft of the head alignment tool has an insulating sheath.

iv
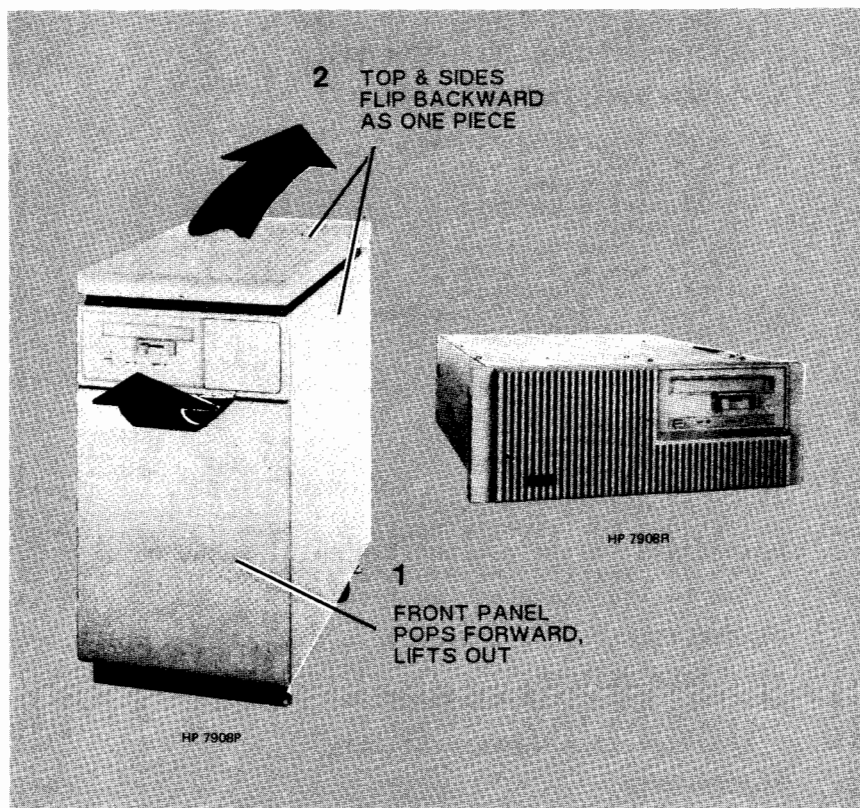
5955-3442   CS/80 Instruction Set Programming Manual

5955-3456   Site Environmental Requirements Manual

5955-3462   CS/80 External Exerciser Reference Manual

5957-4205   HP 7908/11/12 Quick Reference Guide

5957-6471   Cartridge Tape Upgrade Manual

07908-90901 HP 7908 Operator Instructions

07908-90902 HP 7908 Operating and Installation Manual

07908-90903 HP 7908 Service Manual

CONTENTS

1-1. PRODUCT DESCRIPTION

HP 7908 DISC/TAPE DRIVE

16-megabyte fixed disc
3-disc, 6-head Winchester mechanism
Cabinet or rack mount
Built-in cartridge tape
Built-in controller
Self-diagnosis and error logging

PHYSICAL DIMENSIONS

	HP 7908P	HP 7908R
Height:	720 mm (28.4 in.)	177 mm (7 in.)
Width:	354 mm (13.9 in.)	482 mm (19 in.)
Depth:	740 mm (29.1 in.)	689 mm (27.1 in.)
Weight		
Net:	72.5 kg (160 lb.)	37.0 kg (81.6 lb.)
Shipping:	104 kg (230 lb.)	58.9 kg (130 lb.)

1-2. OPTIONS & ACCESSORIES

The following items are included with the standard drive:

9164-0156	16.7 megabyte tape cartridge
8120-3446	2-metre HP-IB cable (Product No. 10833B)
8120-1378	2.3-metre gray power cord (rack)
	OR
8120-2371	2.3-metre black power cord (cabinet)
*	1-ounce bottle of tape cleaner
*	10 tape head cleaning swabs

* Reorder in quantities specified in the list below.

The following options are available:

OPTION 015 - 180 to 255 volt operation

OPTION 140 - Delete cartridge tape drive

The following accessories or consumables are available:

88140S	Package of 5 tape cartridges, 16.7 megabytes, 150 ft.
88140L	Package of 5 tape cartridges, 67.0 megabytes, 600 ft.
8500-1251	Tape head cleaner, 4 ounce can
9300-0767	Lint-free cleaning swabs, box of 50
10833A	RFI shielded HP-IB cable, 1 metre (P/N 8120-3445)
10833B	RFI shielded HP-IB cable, 2 metre (P/N 8120-3446)
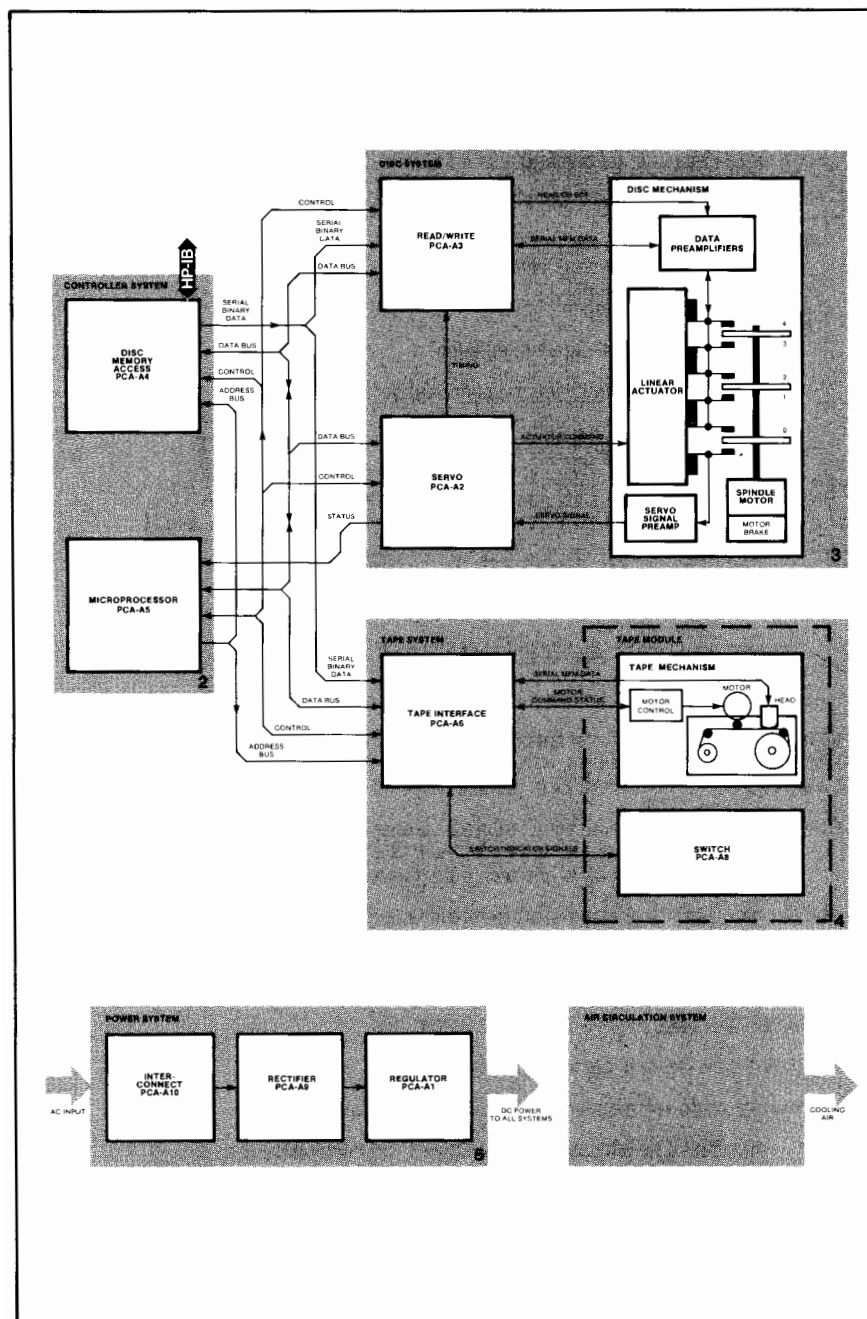
Figure 1-1. Functional Block Diagram

1-3. SERVICE KITS

The following tools and supplies are recommended for servicing the drive.

07908-16001	HP 85 External Exerciser Tape
07908-90903	Service Manual
09815-20602	Motherboard PCA Removal Tool
1535-2653	Torque Driver, 1/4-inch Variable
1540-0724	Transit Case
5955-3462	CS/80 External Exerciser Reference
5957-4205	Quick Reference Guide, HP 7908/791X
8710-1213	IC Inserter
8710-1426	TORX(R) Field Kit
9300-0794	Anti-Static Workstation

NOTE: TORX(R) is a registered trademark of Camcar Division of Textron Inc. The TORX(R) Field Kit consists of the following parts.

8710-1424	Bit T6
8710-1423	Bit T7
8710-1422	Bit T8
8710-1421	Bit T9
8710-1418	Bit T10
8710-1415	Bit T15
8710-1416	Bit T20
8710-1417	Bit T25
8710-1420	Bit T27
8710-1419	Bit T30
8710-1413	Driver Handle
8710-1425	Extension
8710-1412	Pouch

NOTE: See Section VIII, Replaceable Parts, for recommended spares stocking of both the disc and tape portions of the drive.

1-4. OPERATING SPECS & CHARACTERISTICS

Table 1-1. Operating Specifications

DISC DRIVE

Average controller overhead time:	9.4 ms
Average seek time:	41.6 ms
Average rotational delay:	8.3 ms
Average time to transfer 1 kbyte:	1.9 ms
Total average transaction time (excluding system overhead):	61.2 ms

Disc performance index: 16.34*

Maximum disc transactions per second, for 1 kbyte transfers, less system overhead.

Refers to fundamental disc performance; true I/O rates are application dependent and must take into account system overhead, including the individual system configuration specifications.

TAPE DRIVE

Speed

Read/write/verify speed:	152.4 cm/s (60 in./s)
Search speed:	228.6 cm/s (90 in./s)

Data Transfer Rate

System dependent (35 kbytes/s maximum)

Table 1-2. Operating Characteristics

DISC DRIVE DATA CAPACITY

	Data Bits Per	Data Bytes Per	Data Words Per	Sectors Per	Tracks Per
Byte	8	1			
Word	16	2	1		
Sector	2.048	256	128	1	
Track	71.680	8.960	4.480	35†	1
Head	26,521.600	3.315,200	1.675,600	12.950	370‡
Drive	132,608,000	16,576,000	8.288,000	64,750	1,850

†Total number of sectors per track is 36, one of which is utilized as a spare.

‡There are 380 tracks per surface. Six tracks are used as spares for defective tracks and four are used for maintenance tracks.

Acoustic Emissions

Sound Pressure Level per ISO standard 3744
    HP 7908P — 53 dBa   HP 7908R — 59 dBa

Safety

- HP 7908P/R — CSA certified to CSA 22.2 No. 154.
- HP 7908P/R — Meets all applicable safety standards of IEC 380 and IEC 435.
- HP 7908P — UL listed to UL 114 and UL 478.
- HP 7908R — UL recognized to UL 114 and UL 478.

Table 1-2. Operating Characteristics (cont'd)

Power Characteristics

Voltage:	88 to 127V (includes 100, 110, and 120V)
	180 to 255V (includes 208, 220, and 240V)
Frequency:	47.5 to 66 Hz
Phase:	Single
Power:	400 watts
Current:	7 amperes maximum at 120 Vac, 60 Hz
Line Dropout:	No effect on performance; no operator intervention required for dropout equal to or less than one-half cycle of the ac line frequency (10.6 ms, 50 Hz; 8.3 ms, 60 Hz).

Heat Dissipation

400 Watts (1364 Btu/hr)

Electromagnetic Emissions

Radiated and conducted interference:

- HP 7908P — For U.S.A., designed to meet FCC Docket 20780 for Class A computing peripheral devices.
- HP 7908P — For Europe, designed to meet VDE 0871 for Level A computing devices. FTZ licensed on some HP systems. Refer to your local sales representative for more information.
- HP 7908R — The rackmount version is intended for installation in an overall product that will affect the emissions characteristics. It is recommended that end-use products be tested for RFI emissions.

Magnetic nonoperating:	< 2 milligauss at 2 m (7 ft) on all surfaces
Magnetic operating:	< 5 gauss at any surface

TAPE DRIVE DATA CAPACITY (HP 88140S, 150 ft)

	Data Bits Per	Data Bytes Per	Data Words Per	Blocks Per	Tracks Per
Byte	8				
Word	16	2			
Block	8,192	1,024	512		
Track	8,372,224	1,046,528	523,264	1,022	
Cartridge	133,955,584	16,744,448	8,372,224	16,352*	16

* Total number of blocks per 150 ft. cartridge is 16,624, 32 of which are utilized as spares and 240 of which are used as maintenance blocks.

TAPE DRIVE DATA CAPACITY (HP 88140L, 600 ft)

	Data Bits Per	Data Bytes Per	Data Words Per	Blocks Per	Tracks Per
Byte	8				
Word	16	2			
Block	8,192	1,024	512		
Track	33,488,896	4,186,112	2,093,056	4,088	
Cartridge	535,822,336	66,977,792	33,488,896	65,408**	16

** Total number of blocks per 600 ft. cartridge is 65,776, 128 of which are utilized as spares and 240 of which are used as maintenance blocks.

2-1. ENVIRONMENTAL REQUIREMENTS

For complete information, refer to the Site Environmental Requirements manual, P/N 5955-3456.

Table 2-1. HP 7908 Environmental Requirements

Note: The environmental specifications listed herein apply when this device is not connected to a Hewlett-Packard (HP) system. When this device is connected with HP systems, the more stringent environmental specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

Temperature

Operating:	10°C (50°F) to 40°C (104°F)
Non-operating:	-40°C (-40°F) to 60°C (140°F)
Maximum Rate of Change:	Not to exceed 10°C/hr (18°F)

Relative Humidity

Operating: 20% to 90%, noncondensing with a maximum of 0.015 pound of water per pound of dry air. For example, this is equivalent to a maximum of 80% humidity at 24°C (75°F), a maximum of 50% humidity at 32°C (90°F), or a maximum of 30% humidity at 40°C (104°F).

Nonoperating: 10% to 90% noncondensing

Vibration

Operating: 0.1 g rms in direction of actuator
0.25 g rms in any other direction

Nonoperating: 1 g rms in any direction

Shock

Operating: Will withstand 11 ms. half-wave sine shock with a peak amplitude of 2 g's.

Nonoperating (Storage and Transit): Will withstand 11 ms, half-wave sine shock with a peak amplitude of 20 g's.

Altitude

Operating: 100 m below sea level to 4 574 m (330 ft below sea level to 15,000 ft)

Non-operating: 300 m below sea level to 15 000 m (1,000 ft below sea level to 50,000 ft)

Table 2-1. HP 7908 Environmental Requirements (cont'd)

Electromagnetic Susceptibility Operating Range

Radiated: HP 7908R < 3V/m 14 kHz to 1 GHz
                                                 HP 7908P < 1V/m 14 kHz to 1 GHz

Conducted: < 3V rms 30 Hz to 50 kHz
                                                      < 1V p-p 50 kHz to 400 MHz

Electrostatic Discharge: ⩽ 12.5 kV

Magnetic: < 5 gauss 47.5 to 198 Hz

Power line transients (*per IEEE Standard P587.1/F*):
  Oscillatory wave (100 kHz ringing wave):   < 1.5 kV
  Unidirectional wave (one 20 μs wide pulse):   < 1.0 kV

Power Requirements

Voltage: 88 to 127V (includes 100, 110, and 120V)
                                                 180 to 255V (includes 208, 220, and 240V)

Frequency: 47.5 to 66 Hz

Phase: Single

Current: 7 amperes maximum at 120 Vac, 60 Hz

Distortion: 5% peak and flat harmonic distortion

Over/Under Voltage: 25% of typical line voltage for 30 seconds
                                                 30% of typical line voltage for 0.5 second

MAINTAIN AT LEAST 75 MM (3 IN.) CLEARANCE FRONT AND REAR.

HP 7908R

Computer
Museum
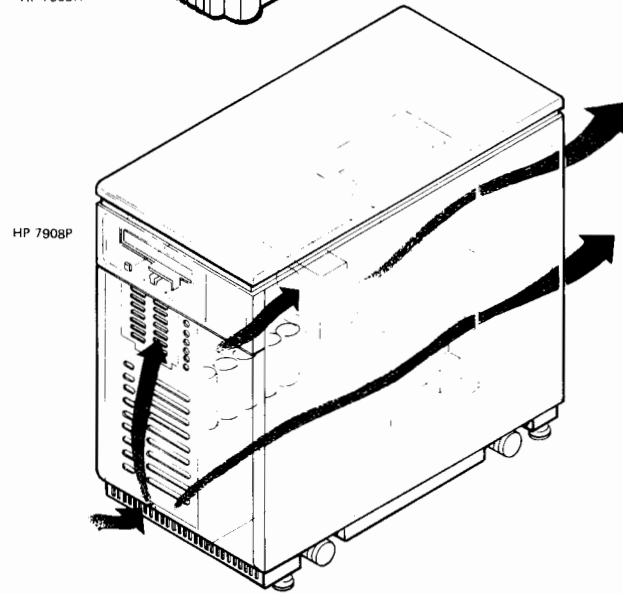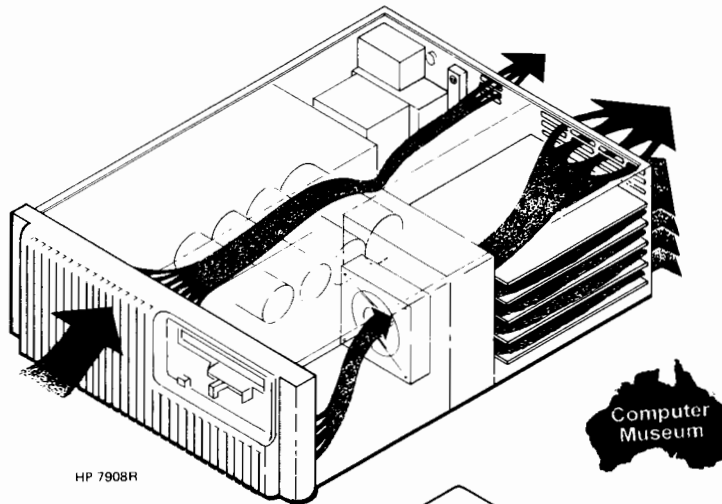
HP 7908P

SEALED DISC MECHANISM – NO AIR FILTERS REQUIRED

Figure 2-1. Cooling Requirements

2-2.   INSTALLATION

First-time installation of the HP 7908 requires use of the following manuals.

Site Environmental Requirements for Disc/Tape Drives, P/N 5955-3456.

HP 7908 Operating and Installation Manual, P/N 07908-90902.

INSTALLATION CHECKLIST

1. HP 7908P – Lower leveling feet after situating drive.
   HP 7908R – Install rackmount ears using bottom hole.

2. Verify input ac voltage and fuse rating.

3. Connect HP-IB cable and set address select switch.

4. Power up and perform self test.

NOTE: To change power cord/fuses/strapping, see later paragraphs in this section.

2-3.   HP-IB INTERCONNECTION

A 2-meter cable is supplied as standard with either drive. Other HP-IB cables available from the Corporate Parts Center are listed below (lengths must be within load limits specified in next paragraph).

CABLE LENGTH	HP PART NUMBER	PRODUCT NUMBER
0.5 metre	8120-3444	10833D
1.0 metre	8120-3445 *	10833A
2.0 metres	8120-3446 *	10833B
4.0 metres	8120-3447	10833C
6.0 metres	8120-3448	Not assigned
8.0 metres	8120-3449	Not assigned

* Prior to AUG 82, P/Ns were 5060-9455 & 5060-9456 respectively. (Supplier change only – no functional difference.)

Cabling is limited to one metre per HP-IB load. Typically, the host system is seven equivalent loads and the disc/tape drive is one equivalent load.
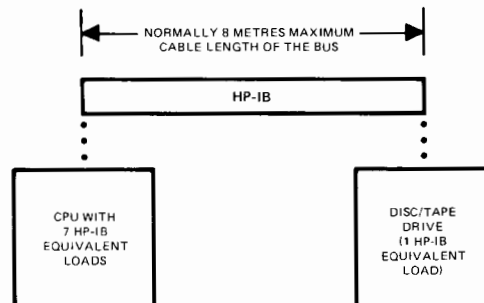
In multi-drive systems, the HP standard allows seven metres of cable between the host and the nearest device, and one metre between each additional device. The maximum configuration is eight devices (not including the CPU) per HP-IB channel or a maximum of 15 metres or 15 equivalent loads.

```
|◄─────── 1 METRE X N LOADS = CABLE LENGTH IN METRES. ───────►|
               UP TO 15 METRES MAXIMUM.

┌──────────────────────────────────────────────────────────────┐
│                           HP-IB                                │
└──────────────────────────────────────────────────────────────┘
    •                         •                         •
    •                         •                         •
    •                         •                         •
┌───────────┐          ┌───────────┐          ┌───────────┐
│ CPU WITH  │          │ DISC/TAPE │          │ DISC/TAPE │
│  7 HP-IB  │          │   DRIVE   │          │   DRIVE   │
│ EQUIVALENT│          │  (1 HP-IB │          │  (1 HP-IB │
│   LOADS   │          │ EQUIVALENT│          │ EQUIVALENT│
│           │          │   LOAD)   │          │   LOAD)   │
└───────────┘          └───────────┘          └───────────┘
```

TO NEXT DRIVE

(DAISY CHAIN)

FROM CPU

HP-IB CONNECTOR ON DMA PCA-A4
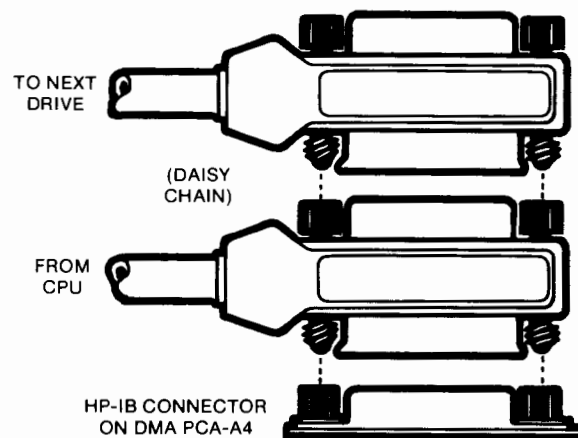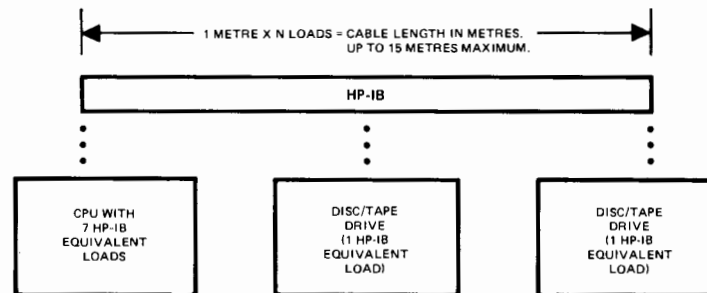
Table 2-2. System Configurations

SYSTEM	MAX DRIVES	HP-IB CABLE	INTERFACE
250	4	2m std	PIC
1000A/L	4	2m (10 max)	12009A-001
1000E/F	8	2m (10 max)	12821A (2)
9845	2	2m max	98034B-045

2-4. HP-IB DEVICE ADDRESS

The device select switch is on the same PCA as the HP-IB connector (DMA) and is accessible through the rear panel. The switch can be reset with a non-metallic pointed tool (such as a pencil or broken-off cleaning swab).
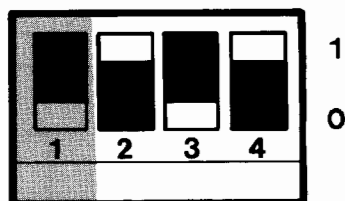
EXAMPLE OF SWITCH
SET FOR ADDRESS 5

Switch Settings *(msb) 1 2 3 4 (lsb)				HP-IB Address
X	0	0	0	0
X	0	0	1	1
X	0	1	0	2
X	0	1	1	3
X	1	0	0	4
X	1	0	1	5
X	1	1	0	6
X	1	1	1	7

* msb = most significant bit
  lsb = least significant bit
  X = don't care

Note: Check the HP-IB device address switch and ensure that no two devices in the system have the same address.

2-5. PCA LOCATION

PCA	NEW P/N	EXCH. P/N	LOCATION
A1 Regulator	07908-60007	-69007	Card cage slot #1
A2 Servo	07908-60006	-69006	Card cage slot #2
A3 Read/Write	07908-60305	-69305	Card cage slot #3
A4 DMA	07908-60009	-69009	Card cage slot #4
A5 MPU	07908-60002	-69002	Card cage slot #5
A6 TIB	07908-60241	-69241	Card cage slot #6

(See IPB foldout in Section VIII for location:)

A7 Motherboard	07908-60004	------	Bottom of card cage
A8 Switch	07908-60142	------	Front of tape drive
A9 Rectifier	07908-60013	-69013	Rectifier Assembly
A10 Interconn.	07908-60012	------	Rectifier Assembly

Refer to Section IV for PCA testpoints.

Note that A6 and A8 are not included for Option 140 (no tape drive).
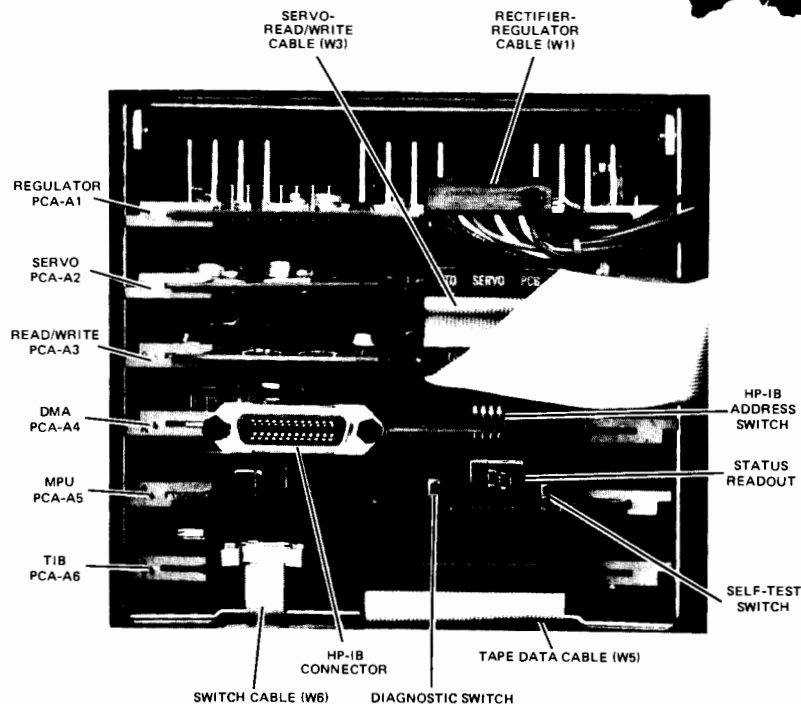
2-6. PCA REVISION HISTORY

PCA	ORIGINAL P/N	UPDATE	EXCHANGE	1st DRIVE PREFIX	SVC NOTE
A1 REG	07908-60007		-69007		
A2 SRVO	07908-60006		-69006		
A3 R/W	07908-60005		-69005		
		-60105	-69105	2209	SN-05
		-60205	-69205	2225	SN-08
		-60305	-69305	2400	none
A4 DMA	07908-60009		-69009		
A5 MPU	07908-60002		-69002		
A6 TIB	07908-60141		-69141		
		-60241	-69241	2206	SN-03
A9 RECT	07908-60013		-69013		

NOTES: A3,-69105 solves WOT-L, -4V oscillation, DWFL problems.
A3,-69205 solves write-off-tracks; also use this update
if Servo -69006 or Disc Mech -69000 is replaced.
A3,-69305 reduces excess read errors caused by increase
in media bandwidth on random drives; replace on failure.
A6,-69241 solves false detection of uncorrectable tape
read errors; must also have MPU firmware -19006 or later.
A6,-69241 date code E-2206 can give T error CO or DA in
rate test or certify, T error 28 in self test, or times
out during tape read (ref SN-04).

2-7. MPU FIRMWARE HISTORY

EPROM updates can be ordered by kits only (e.g., 07908-1XXXX):

Use REV command to identify current ROMs in drive – see paragraph 5-4.

EPROM updates can be ordered by kits only (e.g., 07908-10008):

For ROM physical locations, see section IX, figure 9-1.

KIT P/N	OBSOLETES	DRIVE PREFIX	TIB DATE CODE	REF PCO	MANDA TORY?
07908-1X002:	-1X001	2135	D-2134	48-4336	no
U241 -89045	-89040				
U261 -89046	-89041				
U271 -89047	-89042				
U291 -89048	-89043				
U2101-89049	-89044			(Rev A)	
07908-1X003:	-1X002	2145	2139	48-4480	no
U121 -89050	(new)				
U241 -89051	-89045				
U261 -89052	-89046				
U271 -89053	-89047				
U291 -89054	-89048				
U2101-89055	-89049			(Rev C)	
07908-1X004	Not Released				
07908-1X005	-1X003	2148	no change	48-4617	no
U261 -89056	-89052	--(update 2147 only)		(Rev D)	
07908-1X006	-1X005	2206	2206	48-4692	yes
U121 -89062	-89050				
U241 -89057	-89051				
U261 -89058	-89056				
U271 -89059	-89053				
U291 -89060	-89054				
U2101-89061	-89055			(Rev E)	
U2101-89065	-89061	2207	(Rev E')	48-4908	no
07908-1X007	-1X006	2229	----	48-4939	yes
U121 -89071	-89062				
U241 -89066	-89057				
U261 -89067	-89058				
U271 -89068	-89059				
U291 -89069	-89060				
U2101-89070	-89061			(Rev F)	
07908-1X008	-1X007	2408	----	48-0398	no
U121 -89086	-89071				
U241 -89081	-89066				
U261 -89082	-89067				
U271 -89083	-89068				
U291 -89084	-89069				
U2101-89085	-89070			(Rev G)	

X = 0 (new) or 9 (exchange) parts in ROM kit 07908-1X008, etc.

2-8. CONTROLS & INDICATORS

FRONT PANEL - TAPE DRIVE

BUSY   ON indicates tape being exercised (don't unload or turn off main power). FLASHING indicates tape drive fault or read/write error.

PROTECT   Indicates tape cartridge set to SAFE.

UNLOAD   Push to rewind tape before removing.

Eject Lever   Push firmly to right after UNLOAD (never when BUSY).

SAVE   Push (twice) for full disc to tape transfer.

RESTORE   Push (twice) for full tape to disc transfer.

Status LED's: (to left of SAVE/RESTORE switches) See below.

Left Lamp CARTRIDGE FAILURE	Right Lamp DRIVE FAILURE	CAUSE *
OFF	OFF	Normal
ON	OFF	Bad or wrong cartridge
OFF	ON	Replace tape mechanism
ON	ON	Could be tape mechanism or cartridge

EJECT LEVER

UNLOAD   BUSY INDICATOR   PROTECT INDICATOR

TAPE DRIVE

STATUS LED's   RESTORE   SAVE

TAPE DRIVE WITH FRONT COVER REMOVED
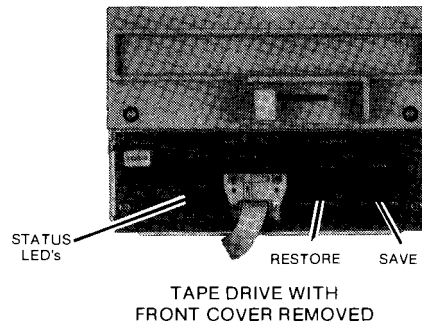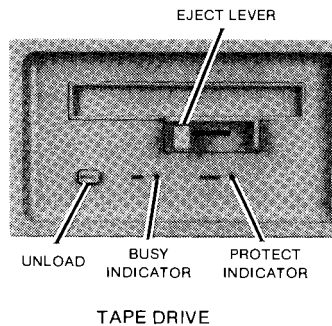
* See paragraph 4-4, step C, for full description of status LED's.

Self test is invoked with each power-up, taking 1 to 3 minutes depending on tape installed. "P." indicates pass, a number indicates suspect PCA. (See figure 2-2 for switch locations.)

SUMMARY OF TEST SWITCH FUNCTIONS

```
To Duplicate Power-On Test:                 ⎫
--------------------------                  ⎪
    Press both switches < 3 sec             ⎪
                                            ⎪    TEST MODE
To Run 15-Second Self Test:                 ⎪    ---------
--------------------------                  ⎬
    Press self test switch < 3 sec          ⎪    RESULTS IN "P."
                                            ⎪    OR PCA DIGIT.
To Run 90-Second Diagnostic Test:           ⎪    ("-" = END)
-------------------------------             ⎪
    Press diagnostic switch < 3 sec         ⎭


To Enter Supplemental Mode:                 ⎫
--------------------------                  ⎪
    Hold either switch until flash          ⎪
                                            ⎪
To Obtain Test Error Code:                  ⎬    DIAGNOSTIC MODE
--------------------------                  ⎪    ---------------
    Press self test switch < 3 sec          ⎪
                                            ⎪    RESULTS IN 2-DIGIT
To Obtain Next Suspect PCA:                 ⎪    HEX CODE (ONE AT A
--------------------------                  ⎪    TIME).   "-" = END.
    Press diagnostic switch < 3 sec         ⎭

To Repeat Test Results (Anytime)
-------------------------------
    Hold either switch until flash

To Return To Normal Mode:
------------------------
    Press both switches < 3 sec
```

NOTE: See Section V DIAGNOSTICS for error code tables.

CAUTION

Do not connect or disconnect the HP-IB
cable with power applied to the HP 7908.

SUSPECT PCA's

DISPLAY   CONDITION

    P.   OK
    1.   A1 REG
    2.   A2 SRVO
    3.   A3 R/W
    4.   A4 DMA
    5.   A5 MPU
    6.   TAPE
    -      END

    ERROR CODES

DISPLAY   LOCATION

01 - 1F   MPU
20 - 3F   TIB & TAPE
40 - 4F   POWER SYSTEM
50 - 6F   DMA
90 - AF   SERVO
CO - dF   R/W
    -       END
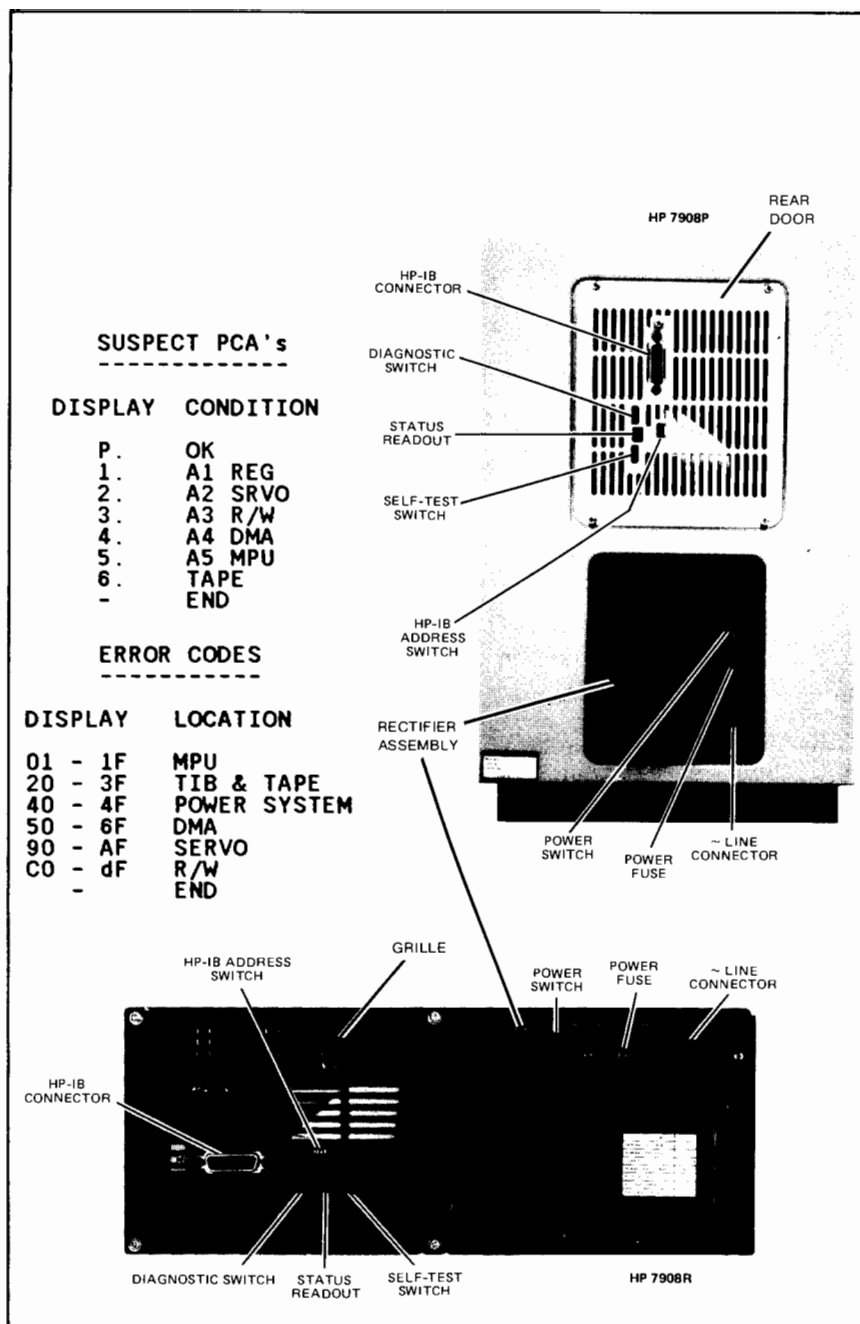
Figure 2-2. Rear Panel Switches and Indicators

2-12

2-9. AC POWER: CORDS/FUSES/STRAPPING

POWER CORDS

See figure 9-2 for alternate power cords. Remember that changing the power cord may require changing fuses and strapping also.

FUSES

DESCRIPTION	I.D.	RATING	HP P/N	LOCATION
120V Fast-blo	Main	8A,250V	2110-0342	Rear panel
220V Fast-blo	Main	4A,250V	2110-0055	Rear panel
-12V Feedback	F194	1A,250V	2110-0001	Rectifier PCA
-12V Unregltd	F195	10A,32V	2110-0523	Rectifier PCA
+12V Unregltd	F290	10A,32V	2110-0523	Rectifier PCA
+5V Unregltd	F291	15A,32V	2110-0048	Rectifier PCA
120V Fan motor	F255	1A,250V	2110-0001	Rectifier PCA
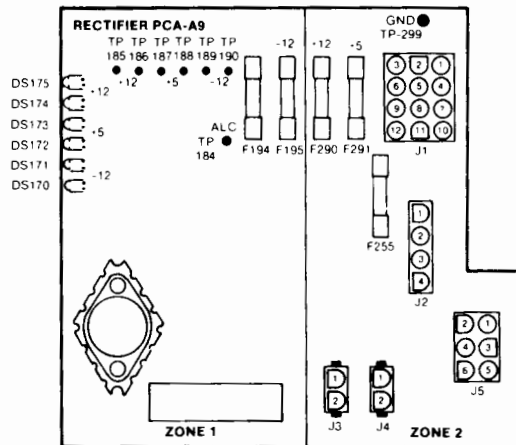
WARNING

To avoid dangerous electrical shock, do not perform any removal/replacement operation until the AC main power is removed from the disc/tape drive.

CAUTION

Do not attempt to operate an HP 7908 configured for 100/120 VAC on 208/220 VAC or vice versa. Damage to the disc/tape drive will result.

NOTE: When restrapping be sure to change main power fuse, power label on rear panel, and power cord as applicable. A spare strapping plug is shipped with each drive.

"LOW" VOLTAGE STRAPPING FOR 100V/120V AC LINE

INSTALL HP P/N 07908-60026 (VOLTAGE STRAP – LO) TO ACHIEVE CONNECTIONS ABOVE, AND ENSURE LINE FUSE IS RATED AT 8AF/250V. AFFIX THE PROPER PORTION OF THE POWER SPECS LABEL (HP P/N 07908-80020) TO THE POWER SUPPLY REAR PANEL. THIS LABEL WAS SHIPPED WITH THE 7908.

"HIGH" VOLTAGE STRAPPING FOR 220V/240V AC LINE

INSTALL HP P/N 07908-60027 (VOLTAGE STRAP – Hi) TO ACHIEVE CONNECTIONS ABOVE, AND ENSURE LINE FUSE IS RATED AT 4AF/250V. AFFIX THE PROPER PORTION OF THE POWER SPECS LABEL (HP P/N 07908-80020) TO THE POWER SUPPLY REAR PANEL. THIS LABEL WAS SHIPPED WITH THE 7908.

100/110/120 VOLTAGE STRAP

208/220/240 VOLTAGE STRAP

Figure 2-3. High/Low Voltage Strapping

2-10. PREVENTIVE MAINTENANCE

NO regularly scheduled PM on HP 7908 drives. EXCEPT operator must:

Clean tape head and capstan once per week and each time a new tape is certified.

Keep the internal areas free of dust, lint, etc.
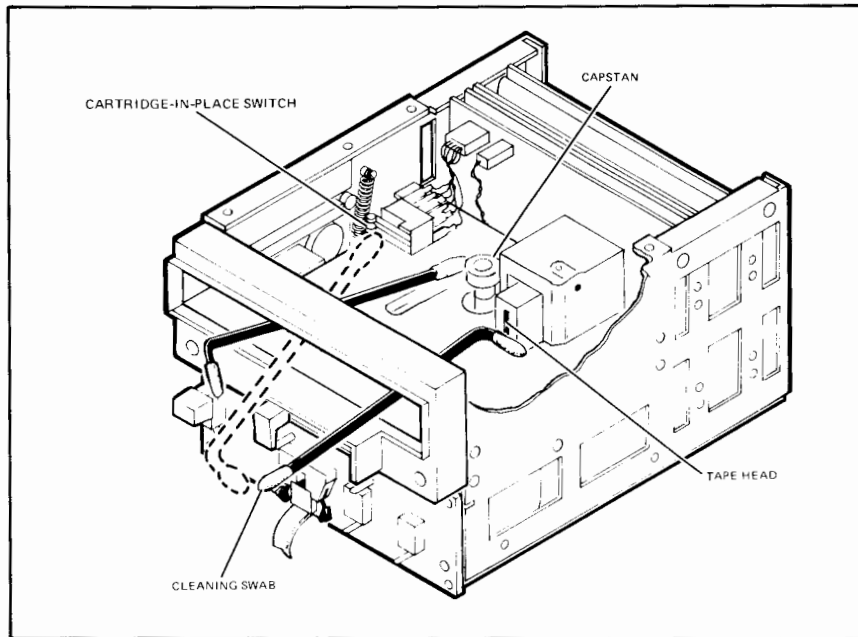
Figure 2-4. Tape Head Cleaning

1. With power ON and cartridge removed, momentarily press lower part of cartridge-in-place switch. Wait for head to raise. (See CAUTIONs.)

2. Dampen swab straight end and clean rotating capstan.

3. Dampen swab bent end and clean head with up and down motion. Press cartridge-in-place switch again to release head and stop capstan. (Ignore buzzing sound.)

CAUTION

Do not press cartridge-in-place switch more than once or hold down longer than 1 second (causes unit fault/system shutdown).

Do not touch the tape. Do not attempt to clean the tape or tape guides within the cartridge. Do not use cleaning materials other than those specified. (See paragraph 1-2.)

For system configuration, see related system manuals/handbooks.

For product configuration, look under Installation in Section II.

For disc and tape configuration, see CS/80 tab in this handbook.

See next section for self test and diagnostic procedures.

See IPB foldout in Section VIII for subassembly location.

4-1. POWER SUPPLY VOLTAGES

Six red and green LED's reflect the presence of secondary power. These are on the rectifier assembly (PCA-A9) and are visible through the rear grille.

In case of power surge/failure or over-temperature shutdown, cycle the power switch before checking fuses.

Table 4-1. Rectifier Assembly LED's

UNREG SUPPLY	LED's EXTINGUISHED	SUSPECT COMPONENT
+5V	DS172 (RED) & DS173 (GREEN)	CR1
+5V	DS173 (GREEN)	F291
+12V	DS174 (RED) & DS175 (GREEN)	CR2
+12V	DS175 (GREEN)	F290
-12V	DS170 (RED) & DS171 (GREEN)	CR2
-12V	DS171 (GREEN)	F195
ALL	All LED's out	Main Fuse

RECTIFIER PCA-A9

LED's

GREEN
RED
GREEN
RED
GREEN
RED

TP TP TP TP TP TP
185 186 187 188 189 190

+12 +12   +5   -12

+5

ALC
TP
184

-12
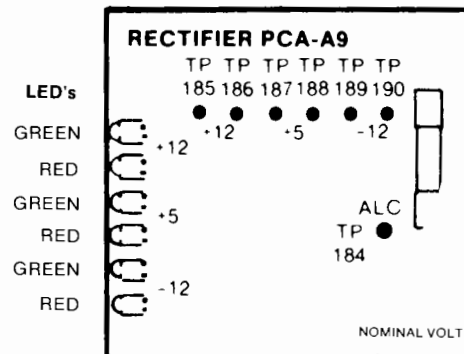
NOMINAL VOLTAGES:

TEST POINT	LOADED		NO LOAD		LOADED
	DC	AC	DC	AC	MINIMUM (DC) OPERATING
TP-187	7V	1V p-p	12V	1.5V p-p	6V
TP-185	16V	2V p-p	22V	3V p-p	13V
TP-189	-16V	2V p-p	-22V	3V p-p	-13V

A1 REG

J1

10 9 8 7 6 5 4 3 2 1

GND
GND
+5V UNRGLTD
+12V UNRGLTD
-12V UNRGLTD
-12V UNRGLTD
+12V UNRGLTD
+5V UNRGLTD
GND
GND

PFAIL (TP-188)
MRST (TP-184)
-12 L RGLTD (TP-188)
-12V RGLTD (TP-176)
+5V RGLTD (TP-180)
+12V RGLTD (TP-164)
+12V RGLTD (TP-158)
+12T RGLTD (TP-156)
+12 L RGLTD (TP-154)

● +5V REF (TP-101)
● +6V REF (TP-102)

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A2 SVO

(ODD NUMBERED PINS 1 – 33 ON OTHER SIDE OF PCA)

2   J2   34

GND
IDX (TP-188)
PMD (TP-187)
TCH (TP-186)
DRV (TP-182)
SD (TP-181)
SNCH (TP-180)
MC (TP-179)
PCK (TP-178)
PES1 (TP-167)
PES2 (TP-166)
CA (TP-165)
AGC (TP-164)
+5V (TP-146)

7908-37

A3 R/W

(ODD NUMBERED PINS 1 – 33 ON OTHER SIDE OF PCA)

2   J2   34

AGND (TP-173)
SIGL
AGC (TP-188)
SIGH (TP-187)
GND
MFM (TP-172)
MODE (TP-171)
TRF (TP-167)
VCOH (TP-163)
CON (TP-161)
+5V (TP-151)

7908-38

A4 DMA

HP-IB

(PINS 13 - 24 ON OTHER SIDE)

13   24
1   J1   12

4 3 2 1
S150

● +5V (TP-170)
■ GND (TP-160)

7908-34

A5 MPU

(ODD NUMBERED PINS 1 – 49 ON OTHER SIDE OF PCA)

49   1

S120   DS129 STATUS READOUT   S140

50   J1   2

SELF TEST   DIAGNOSTICS

● GND (TP-173)
● SYCLK (TP-171)

7908-35

7908CE-3

Figure 4-1. PCA Testpoints

4-2

Table 4-2. PCA Power Distribution

Power Within the Mother PCA-A7

SUPPLY	REGULATOR PCA-A1		SERVO PCA-A2		R/W PCA-A3		DMA PCA-A4		MPU PCA-A5		TIB PCA-A6		MOTHER PCA-A7	
	A1P1	A1P2	A2P1	A2P2	A3P1	A3P2	A4P1	A4P2	A5P1	A5P2	A6P1	A6P2	A7J1 TAPE	A7J2 DISC
+5V Regulated	37 thru 50	1 thru 14	47, 48	3, 4	47, 48	3, 4	47, 48	3, 4	47, 48	3, 4	47, 48	3, 4	·5	
+12V Regulated (Spindle)		19 thru 26		29, 30										·12
+12VL Regulated (Logic)		34		1, 2		1, 2		1, 2		1, 2		1, 2		
+12VT Regulated (Tape)		27 thru 32											·12	
-12V Regulated (Spindle)	19 thru 32		21, 22											-12
-12VL Regulated (Logic)		33	49, 50		49, 50		49, 50		49, 50		49, 50			
Ground	1 thru 18	35 thru 42 / 45 thru 50	1, 2, 25, 26, 45, 46	5, 6, 7, 8, 25, 26, 47, 48, 49, 50	1, 2, 25, 26, 45, 46	7, 8, 25, 26, 47, 48, 49, 50	1, 2, 25, 26, 45, 46	7, 8, 25, 26, 47, 48, 49, 50	1, 2, 25, 26, 45, 46	7, 8, 25, 26, 47, 48, 49, 50	1, 2, 25, 26, 45, 46	7, 8, 25, 26, 49, 50	GND	

▨ Denotes Source

4-2. TAPE STATUS LEDs

```
   Left Lamp          Right Lamp
CARTRIDGE FAILURE    DRIVE FAILURE        CAUSE *
-----------------    --------------       -----
      OFF                 OFF          Normal
      ON                  OFF          Bad or wrong cartridge.
      OFF                 ON           Replace tape mechanism.
      ON                  ON           Could be tape mechanism
                                       or cartridge.
```

* See paragraph 4-4, step C, Auto-Load Failures for full description of Status LED's.

4-3. TROUBLESHOOTING FLOWCHARTS

The following flowcharts are intended for use with the self test switches.

KEY TO SYMBOLS

EXIT
from a page

```
   ↓
 ┌───┐
 │ 2 │   Go to sheet 2,
 │ A │   block A.
 └─┬─┘
   ▼
```

ENTRY
from a page

```
    1, 2
 ┌───┐     Continued from
 │ A │     sheet 1 or 2.
 └─┬─┘
   ▼        Block A
```

START

4, 5, 6
A

TURN POWER
SWITCH TO "0"
AND BACK TO
"1" AGAIN

DOES
STATUS READOUT
LIGHT UP IN
ANY WAY
?

STATUS READOUT
SHOULD SEQUENCE
THROUGH ALL
SEGMENTS, DISPLAY
VARIOUS BOARD
NUMBERS, AND THE
PERIOD SHOULD COME
ON TO SIGNAL THE
COMPLETION OF TEST

NO

YES

5
A

OOES
STATUS READOUT
SEQUENCE IMPROPERLY
OR = "8 " OR "=."
?

YES

NO

TURN POWER SWITCH TO "0"
REPLACE MPU PCA-A5
TURN POWER SWITCH TO "1"

DOES
STATUS
READOUT
= "P "
?

NO

DOES
STATUS READOUT
SEQUENCE IMPROPERLY
OR = "8."
?

NO

3
A

YES

2
A

YES

REINSTALL OLD
MPU PCA-A5

5
A

Figure 4-2. Troubleshooting Flowcharts (sheet 1 of 6)

4-5

```
                           1
                           A

                    PRESS DIAGNOSTICS
                        SWITCH

  "U" ON STATUS
  READOUT MEANS
  HOST HAS DENIED  ------
  RELEASE

                        DOES              NO
                       STATUS
                      READOUT
                       = "P."
                         ?
                                                   3
                        YES                         A

                        MORE              YES
                      EXTENSIVE
                    DEVICE CHECK
                      DESIRED
                         ?
                                              SEE THE CS/80
                        NO                    EXTERNAL EXERCISER
                                              REFERENCE MANUAL,
                                              PART NO. 5955-3462
                        END
```
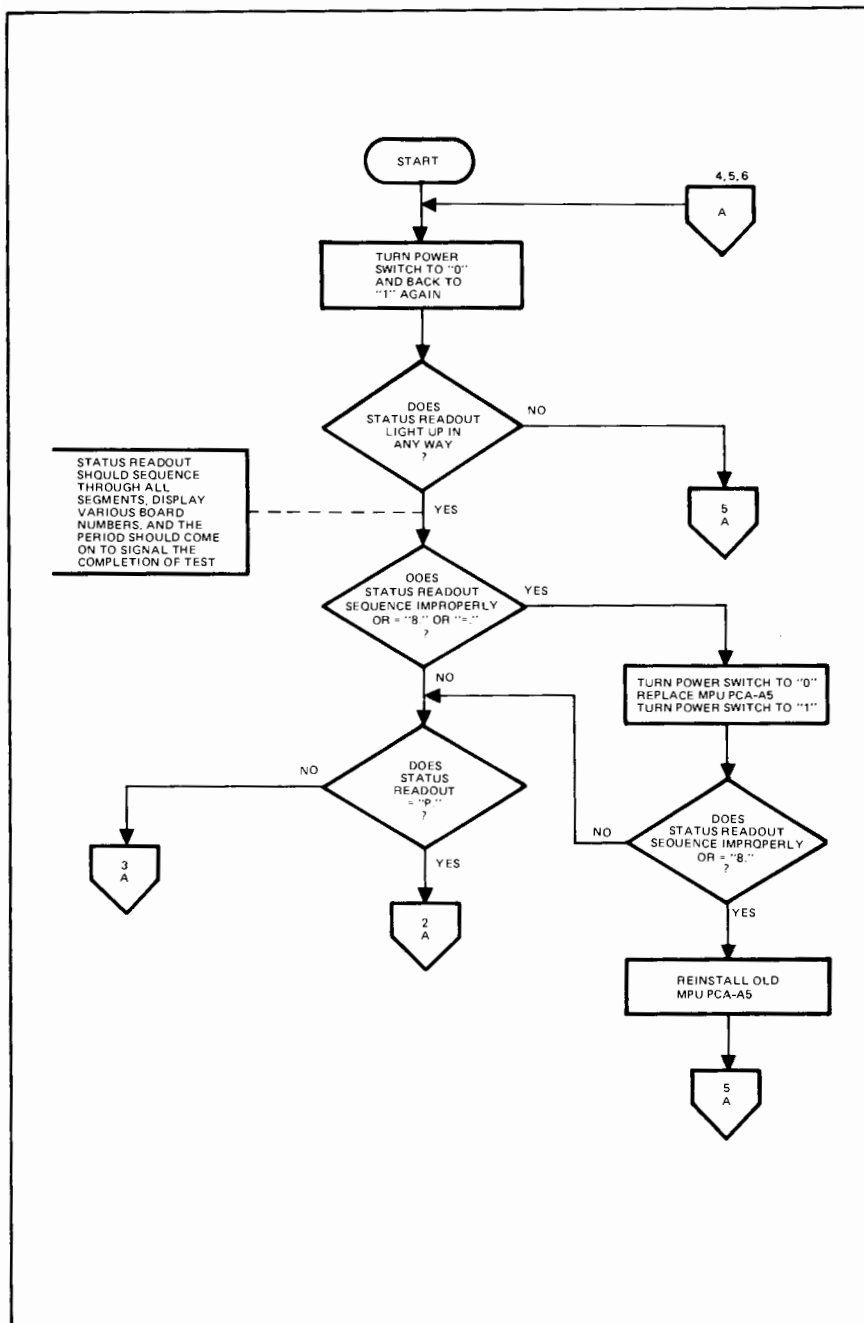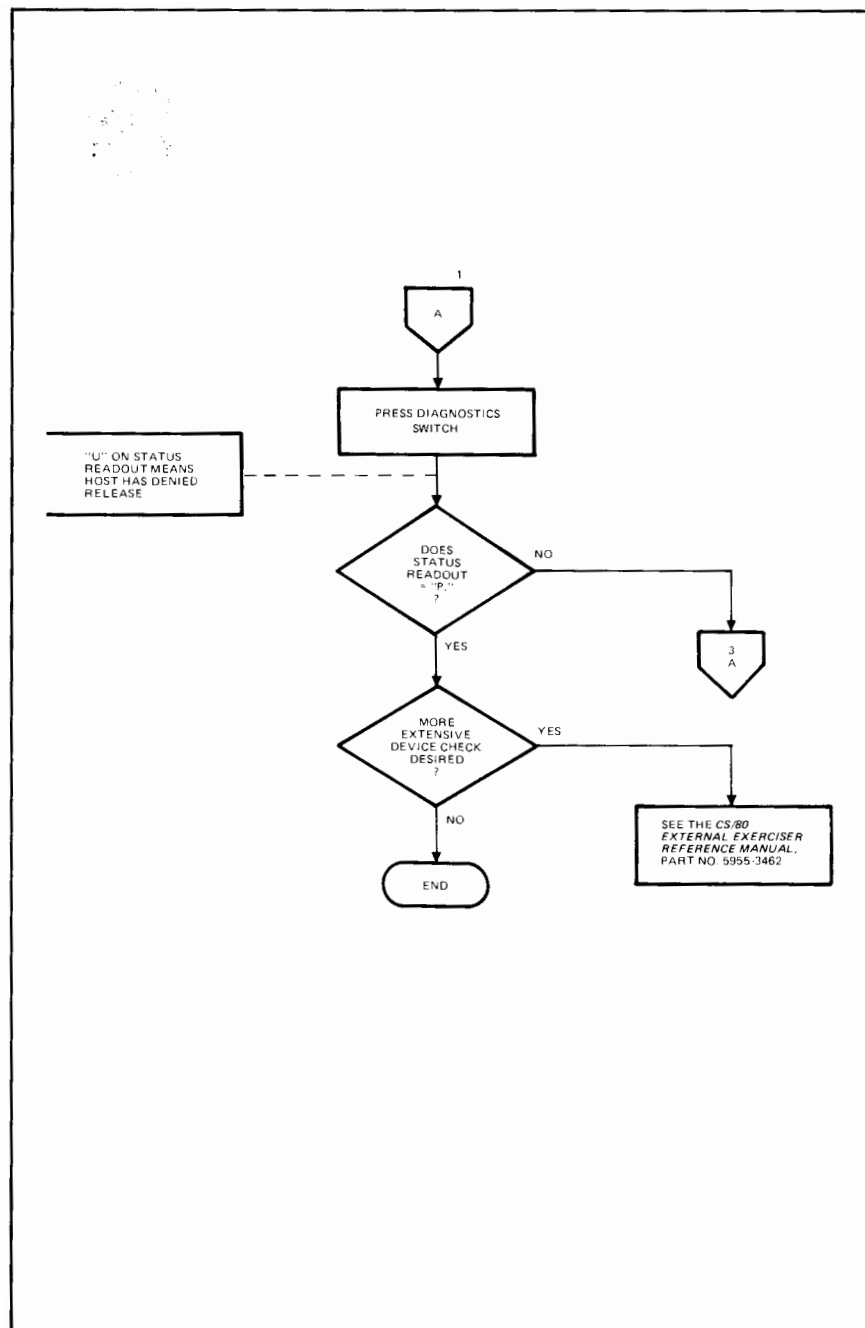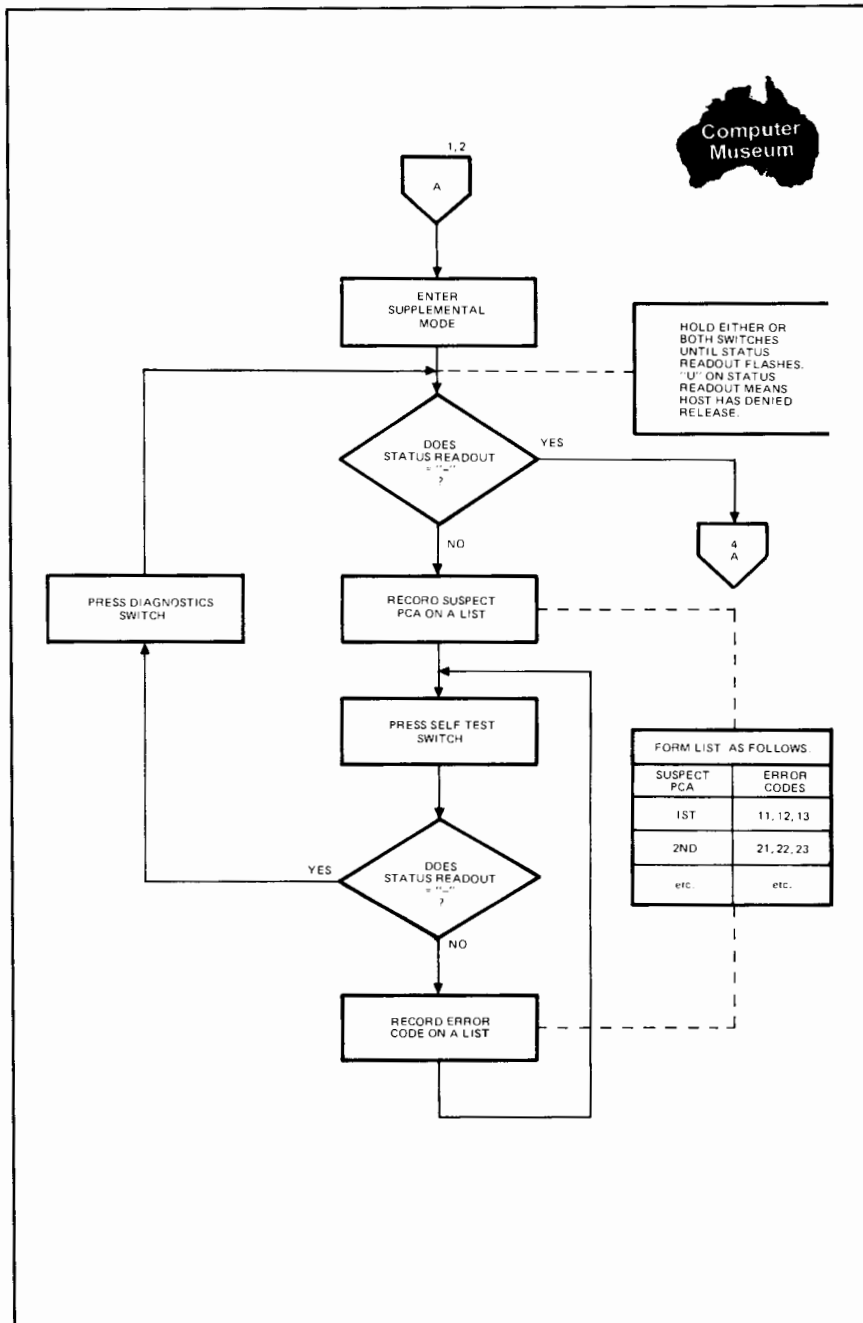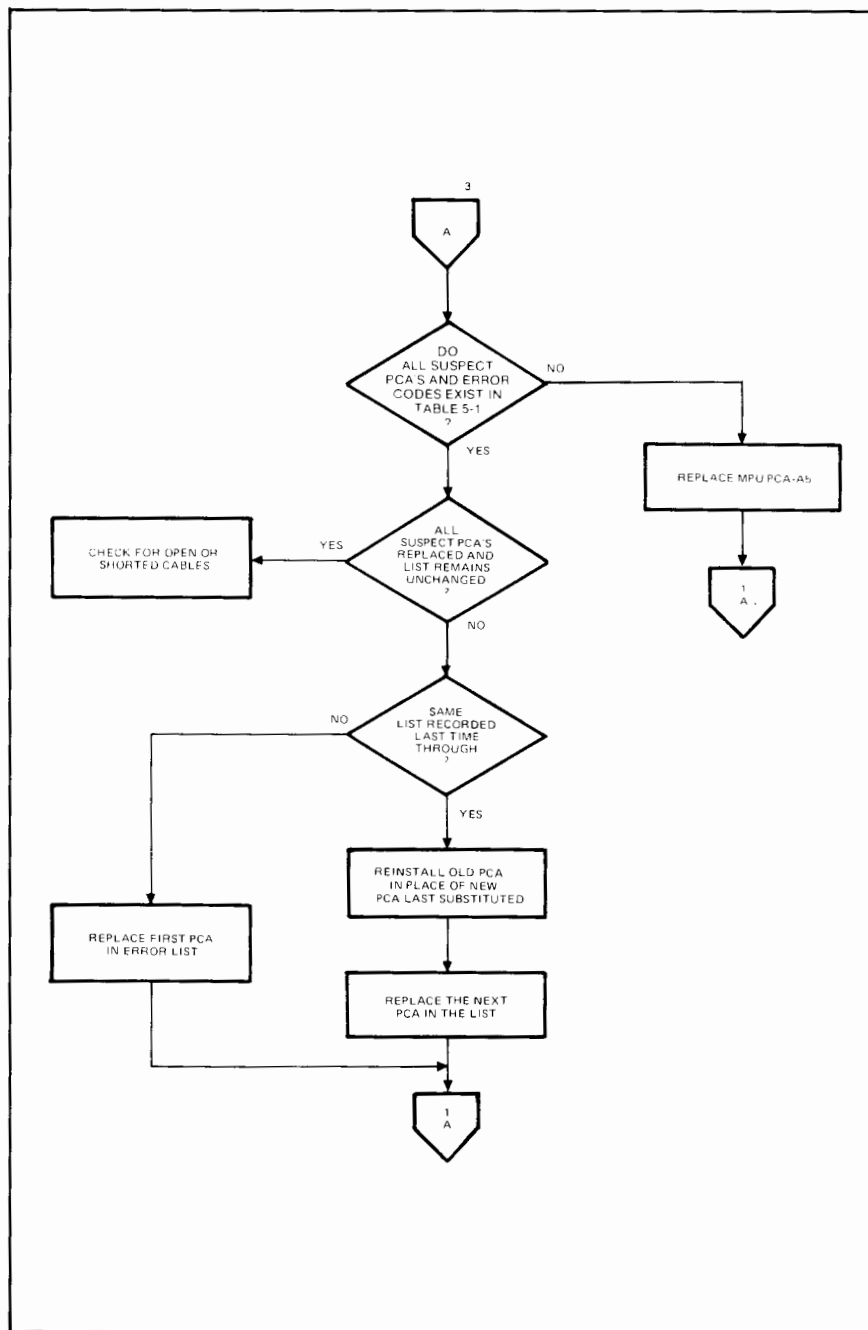
Figure 4-2. Troubleshooting Flowcharts (sheet 2 of 6)

Figure 4-2. Troubleshooting Flowcharts (sheet 3 of 6)

Figure 4-2. Troubleshooting Flowcharts (sheet 4 of 6)

A 1.6

ALL RED LED'S LIT?
NO → 6 A
YES

ALL RED AND GREEN LED'S LIT?
NO → (to ALL RED LED'S LIT)
YES

ALL GREEN LED'S LIT?
YES → (to FAN SPINNING)
NO

CHECK FOR SHORTS ON RECT REG CABLE (W1) OR ON REG PCA-A1

REPLACE F195, F290, OR F291

1 A

FAN SPINNING?
NO → REPLACE F255
YES

ALL REGULATOR PCA-A1 TEST POINTS OK?
NO → REPLACE RECT REG CABLE (W1) OR REG PCA-A1
YES

+12V AND −12V ON PINS 1 AND 2 OF A7J2?
NO → REPLACE MOTHER PCA-A7
YES

RFI MEASURED ON ANY SUPPLY?
YES → FIND SOURCE AND ELIMINATE
NO

END

1 A

Figure 4-2. Troubleshooting Flowcharts (sheet 5 of 6)

```
        5
        A

     ANY              YES      VOLTAGES        YES      CHECK FOR SHORTS
   "REO LEO'S  ─────────────►  ON CR1 & CR2  ─────────► ON RECT PCA-A9
      LIT                         OK                     CHECK DIODE CABLE
       ?                          ?                      (W2). CHECK C320,
                                                         C350, C370, AND
       │NO                        │NO                    C390 FOR SHORTS.
       ▼                          ▼
     MAIN              YES      VOLTAGE         YES      REPLACE CR1 OR
     FUSE   ──────────────►    ON T1         ─────────► CR2 OR DIODE
      OK                       SECONDARY                CABLE (W2).
       ?                         OK
                                 ?
       │NO                       │NO                              │
       ▼                         ▼                                ▼
  CHECK FOR SHORTS        CHECK T1, L1, L2,                       1
  ON INTERCONNECT         INTERCONNECT PCA-A10,                   A
  PCA-A10 OR T1, L1, L2.  VOLTAGE STRAP, POWER
                          SWITCH, MAIN FUSE-
       │                  HOLDER, LINE FILTER
       ▼                  AND PRIMARY WIRING
  REPLACE MAIN FUSE              │
       │                        ▼
       ▼                        1
       5                        A
       A
```
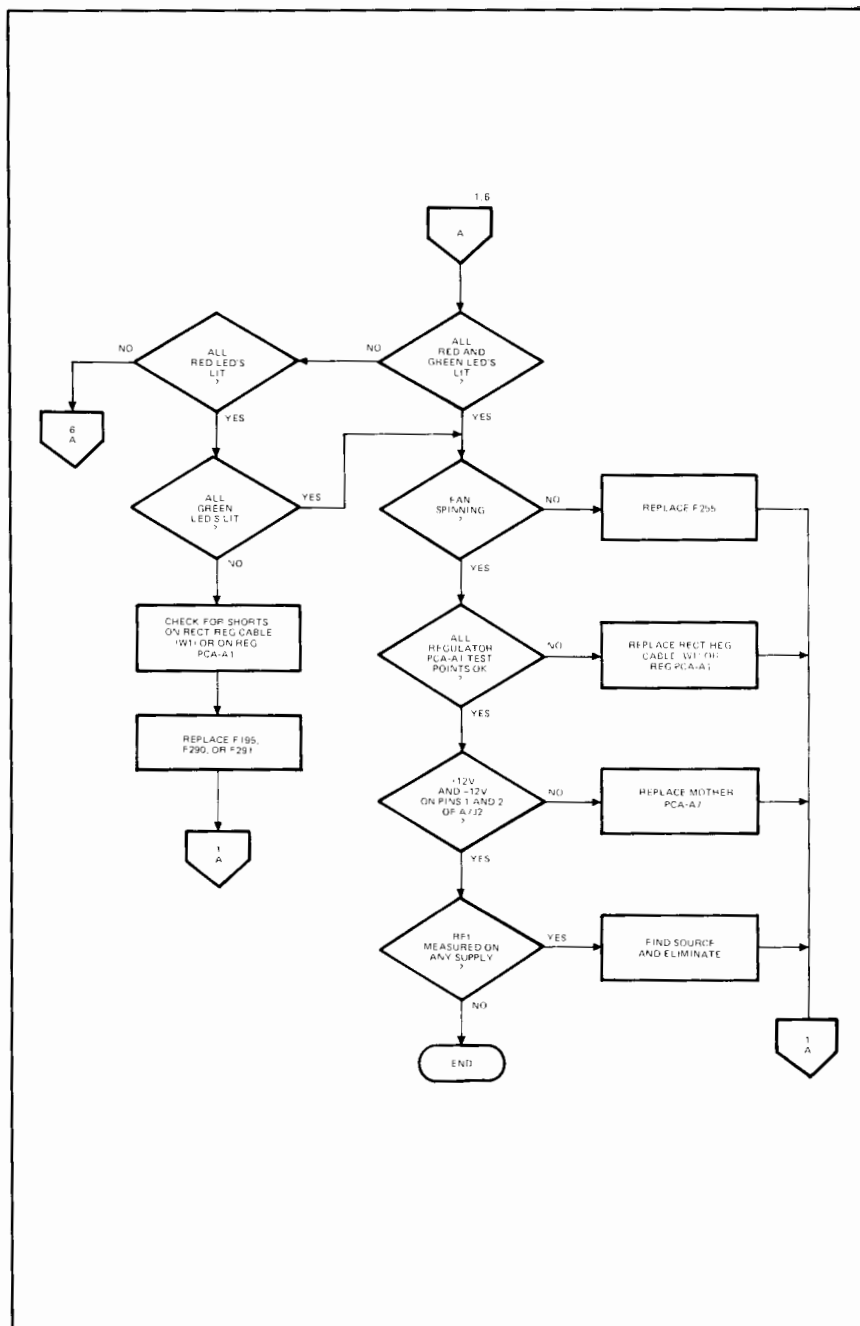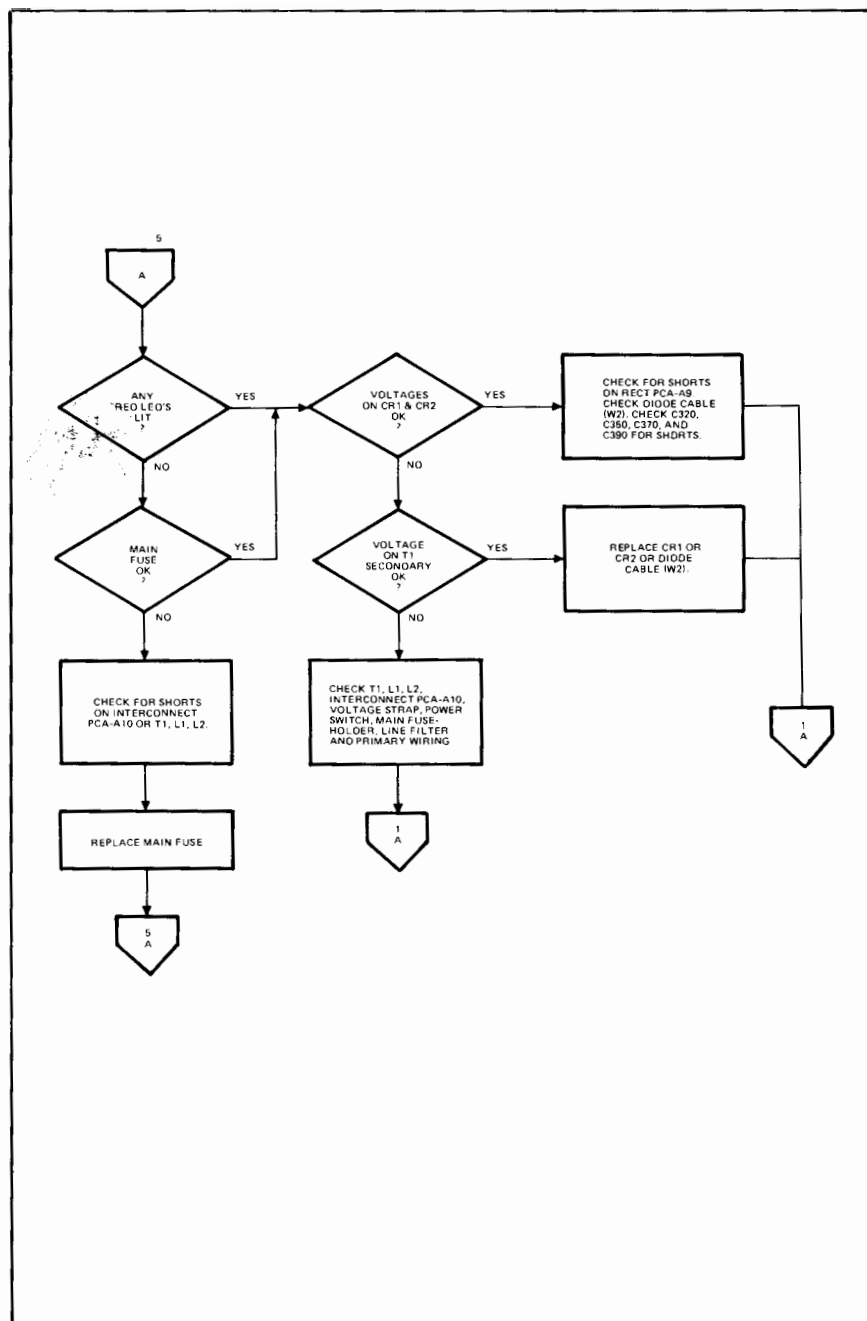
Figure 4-2. Troubleshooting Flowcharts (sheet 6 of 6)

4-4. GUIDELINES FOR TROUBLESHOOTING —
TAPE MODULE

CONTENTS

TROUBLESHOOTING FLOW-CHART

DECODING CS'80 STATUS

READING AND USING TAPE LOGS

AUTO-LOAD FAILURES

FAULT LOG

USE OF TAPE ERT's

FLAG PLOT

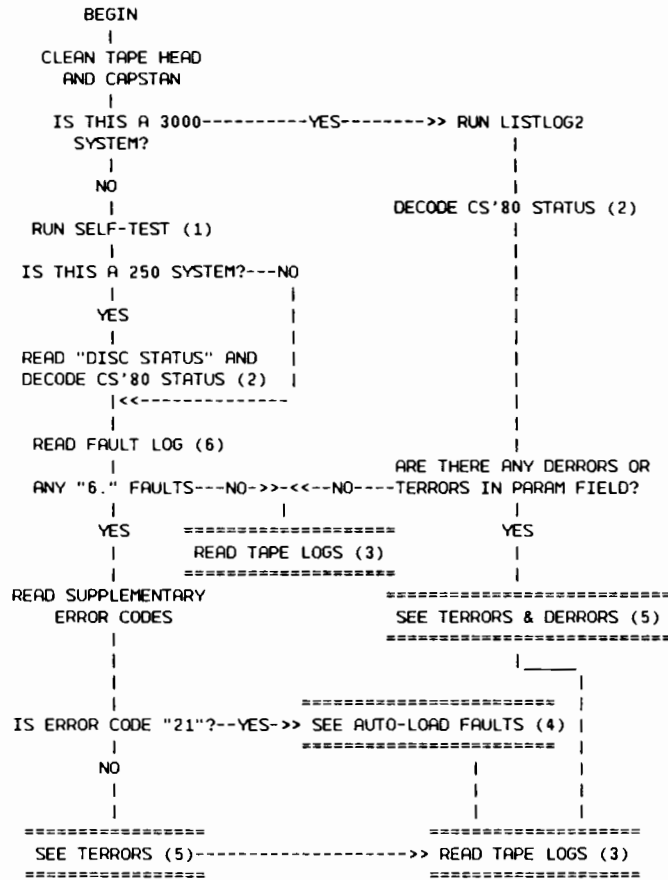TERRORS AND DERRORS

TAPE VERIFICATION

TAPE REPLACEMENT CONDITIONS

INTRODUCTION

This document is in the form of a flowchart. Begin on the next page and follow the chart through.

Each section has either a detailed description of the test conditions and functions or a pointer to where this information can be found.

Where appropriate, at the end of a section there is a pointer to the next applicable section. This has been highlighted using =========.

TROUBLESHOOTING FLOWCHART

```
        BEGIN
          |
   CLEAN TAPE HEAD
     AND CAPSTAN
          |
     IS THIS A 3000----------YES-------->> RUN LISTLOG2
        SYSTEM?                              |
          |                                  |
         NO                                  |
          |                      DECODE CS'80 STATUS (2)
   RUN SELF-TEST (1)                         |
          |                                  |
   IS THIS A 250 SYSTEM?---NO                |
          |               |                  |
         YES              |                  |
          |               |                  |
   READ "DISC STATUS" AND |                  |
   DECODE CS'80 STATUS (2) |                 |
        |<<--------------                    |
          |                                  |
   READ FAULT LOG (6)                        |
          |                      ARE THERE ANY DERRORS OR
   ANY "6." FAULTS---NO->>-<<--NO----TERRORS IN PARAM FIELD?
          |             |                    |
         YES      ===================        YES
          |       READ TAPE LOGS (3)          |
          |       ===================         |
   READ SUPPLEMENTARY          ============================
       ERROR CODES             SEE TERRORS & DERRORS (5)
          |                    ============================
          |                                |____
          |                                |    |
          |             ========================  |
   IS ERROR CODE "21"?--YES->> SEE AUTO-LOAD FAULTS (4) |
          |             ========================  |    |
         NO                             |      |
          |                             |      |
          |                             |      |
   ==================            ====================
   SEE TERRORS (5)--------------------->> READ TAPE LOGS (3)
   ==================            ====================
```

(1) See CE Handbook: 7908, page 5-2 or 7911/12/14, page 5-15
(2) Go to subsection A
(3) Go to subsection B
(4) Go to subsection C
(5) Go to subsection G
(6) Go to subsection D

A. DECODING CS'80 STATUS

1. HP 3000 SYSTEMS

On 3000 systems with CS80UTIL run the CONVERT command to decode the status message, returned by LISTLOG2, to English.

Systems without CS80UTIL will require decoding the status messages in LISTLOG2. These messages will consist of 20 octal bytes and require conversion to binary and hex for analysis.

2. HP 250 SYSTEMS

On 250 systems, use the DISC STATUS command to retrieve the last two status messages. The last 10 words (20 bytes) of the 250's status message are the CS'80 status bytes.

3. DECODING STATUS BITS

Full details are given in the CS'80 Instruction Set Programming manual, HP P/N 5955-3442, page 2-39. (CE Handbook CS/80 tab, chapter VII.)

If bit 24 is set there have been TERRORS; bytes P1 to P4 in the parameter field will be the TERROR field.

```
P1 = most suspect component
P2 = next most suspect component
P3 = TERROR associated with P1
P4 = TERROR associated with P2
```

Any DERRORS will be recorded in the parameter field in bytes P7 to P10.

==
Refer to table 5-1 & 5-2 in section V for decoding TERRORS and DERRORS.

If no TERRORS or DERRORS are logged then refer to subsection B to read the tape logs.
==

B. READING AND USING TAPE LOGS

1. READING LOGS

Use the HP 85 to access the following tape logs. See the CS'80
External Exerciser reference manual appendices for instructions on
loading host diagnostics. (CS/80 tab in CE Handbook.) Before
reading the logs, issue a PRESET command to force the RAM
information to be updated to the Run Log.

2. ERT LOG

Shows the errors recorded since the last CLEAR LOGS instruction.
Generated during Read only or Write then Read ERT tests (including
certification).

If the cartridge is write-protected, the ERT LOGS cannot be updated.

If the number of Permanents or Unlocatables/Uncorrectables exceeds the
values shown in subsection J, step 1, the tapes should be discarded.

```
==============================
```
To run an ERT test, refer to subsection E.
```
==============================
```

3. RUN LOG

Shows the accumulated data errors during user access of the tape
since the last CLEAR LOGS command. Errors encountered during self-
test and error rate tests are logged in the ERT log.

```
=========================================================
```
If there are any uncorrectables or the accumulated errors exceed the
values shown in subsection J, step 2, run an ERT test and flag plot, refer
to subsection E.
```
=========================================================
```

4. USE LOG

Shows the number of blocks accessed during the lifetime of the tape,
and the number of times the tape was loaded into the system. This log
cannot be cleared but also is not updated on write protected tapes.

HP recommended maximum usage is 2500 cycles of BOT to EOT to BOT.
This is equivalent to approximately 277 full volume accesses or
20,480,000 blocks on the 88140L,LC tape and 5,120,000 blocks on the
88140S,SC tape.

C. AUTO-LOAD FAILURES

Symptoms   - One or more of the LED's behind the switch panel board
07908-60142 on the tape drive will be on and the self-
test LED will output "21" as an error code. See note 1.

Debugging   - Use drive LED's as a GUIDELINE only for suspecting
components. Keep accurate records of actions as these
failures tend to be intermittent.

CARTR LED	DRIVE LED	SUSPECT COMPONENT	ACTION
OFF	OFF	NONE	NORMAL CONDITION
OFF	ON	1.DIRTY HEADS 2.WORN CARTRIDGE 3.DEFECTIVE DRIVE	1.CLEAN HEADS 2.TRY NEW CARTRIDGE (4) 3.TRY NEW DRIVE
ON	OFF	1.DIRTY HEADS 2.CARTRIDGE IS NOT AN 88140L,LC or S,SC or HAS BEEN DEGAUSSED 3.DEFECTIVE CARTRIDGE 4.DEFECTIVE DRIVE	1.CLEAN HEADS 2.SEE NOTE (3) 3.IF CORRECT CARTR.(3) MAY BE WORN OUT - REPLACE 4.ON MULTIPLE FAILURES REPLACE THE DRIVE
ON	ON	1.TIB MAY HAVE ERASED TAPE 2.HEAD OFF TAPE	1.CARTRIDGE FORMAT IS RUINED - REPLACE TIB AND TAPE 2.DRIVE

NOTES 1. The LED's only stay lit until a new cartridge is loaded.

2. 3000 systems record the drive failures in the status logs
(LISTLOG2). Look for DERROR 203 dec status in the parameter field
which indicates this fault.

3. Can only use cartridges formatted for use in this drive. If
cartridge becomes degaussed it is ruined.
ROCKING TAPES - cartridge may have tape almost wound off hub.
Rotate the drive wheel so about 4 revolutions of tape wind on
to the small spool and try auto-loading again. This should
occur only with a new tape, if it happens with an old tape
the drive may be defective.

4. If 2 or more tapes show this problem then the tape drive, not the
tape, may be at fault.

==
**If the cartridge is suspect an ERT test can be performed and a resultant
FLAG PLOT obtained to assist in confirmation of diagnosis; refer to
subsection E.**
==

D. FAULT LOG

Accessing the FAULT LOG will give the historical record of faults
occuring since the last time the logs were cleared.
Faults may be lost if the device is powered down or a CLEAR command is
sent to the device controller. This is because faults are collected
in RAM and only written to the disc when the RAM is full i.e., 5 entries.
A PRESET command forces the Fault Log to be updated from the RAM.

The fault log contains tape system errors, only on single controller units.

Using the host resident CS'80 Exerciser program do the FAULT LOG
command. The disc will then return all the accumulated DERRORS
and TERRORS.

```
===================================================
 Refer to table 5-1 & 5-2 (in section V) for DERRORS and TERRORS.
===================================================
```

E. USE OF TAPE ERT'S   _

1. ATTRIBUTES

If the cartridge is suspect, an ERT test can be performed and the
resultant Flag Plot obtained to assist in cartridge and tape drive
diagnosis.

The ERT tests cannot be run if the cartridge is write protected. Before
running ERT tests it can be useful to print out the ERT log contents as
historical data.

Now clear the ERT log (only) using the CLEAR LOGS command.
Clean tape head before running test.

    RO ERT   This is a read only error rate test that can be used when
              data must not be lost--for example, if the data integrity is
              uncertain because the tape may have been written with a dirty
              head causing a low amplitude signal. Takes half as long as
              WTR ERT on full length tape tests.

    WRT ERT   DESTROYS THE DATA ON THE TAPE but does give full control of
              the write and read conditions.

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2. TEST RESPONSES AND DETAILS

To run an ERT test use the TAPE program of the External Exerciser and
run RO ERT or WTR ERT. Respond to the questions as follows.

FULL TEST	RESPONSES RO ERT	RESPONSES WTR ERT
Test name	RO ERT	WTR ERT
Continue	N/A	YES
Loop count	1	1
Addreses, tracks or tape	C	C
New block address	0	0
Tape length	ALL	ALL
Pattern source	N/A	RN

Note: For short tapes RO ERT takes 8 mins., for long tapes 35 mins..
      For short tapes WTR ERT takes 17 mins., for long tapes 70 mins..

PARTIAL TEST	RESPONSES RO ERT	RESPONSES WTR ERT
Test name	RO ERT	WTR ERT
Continue	N/A	YES
Loop count	1	1
Addreses, tracks or tape	C	C
New block address	0	0
Tape length	16000	8000
Pattern source	N/A	RN

Note: All tests take 8 minutes and for a short tape this is a full test.

3. OUTPUT FROM ERT TESTS

Read the ERT log and compare the results with the following table.
This table shows the maximum limits for ERT tests.

ENTRY	88140L,LC FULL TEST		88140S,SC FULL TEST		88140L,LC,S,SC PARTIAL TEST
	WTR	RO	WTR	RO	WTR & RO
# Blocks	130816*	65408*	32704*	16352*	16000
# Permanents	250	250	128	128	64
# Transients	----------------------N/A----------------------				
# Unlocatables	15	N/A	10	N/A	10
# Uncorrectables	0	1	0	1	1

*these values may vary if the cartridge is not certified.

===
When done access the Flag Plot to help determine the cause of failure.
Refer to subsection F.
===

F. FLAG PLOT

A Flag Plot is generated as a result of ERT testing or certifying and is available from the ERT LOG (see CS'80 External Exerciser Reference Manual, P/N 5955-3462). The flag plot gives a visual indication of the positions of various faults on a tape. The following symbols appear on the plot in equivalent positions to the error on the tape.

+	=	a permanent error
U	=	an uncorrectable error
K	=	an unlocatable error

A listing is also available giving the logical addresses of the errors. More errors may appear on the listing of addresses than on the flag plot due to the flag plot's dramatic compression of the X axis resulting in multiple errors in one spot. The bits to the right of the error list indicate in which frame the error occured.

A Flag Plot of the positions of used spares is available after the Read Drive Tables Utility (TABLES). These are indicated with an 'S'.

INTERPRETING FLAG PLOTS

The flag plot descriptions listed below can be used to determine tape quality. See subsection J for the appropriate actions.

1. Permanent errors grouped at BOT (0000) on odd tracks only, usually with the number of errors per track increasing with track number. This indicates ISV (instantaneous speed variation)

2. As above but also grouped at EOT (1021 or 4087) on the even tracks is also ISV.

3. Permanent error clumping (horizontal). Causes a) Dirty tape head b) Tape drive is not 07908-6X340. c) Media defect, if error occurs on tracks 0 and 1 or 14 and 15 only it is edge damage and the tape should be discarded.

4. Permanent and or Unlocatable clumping (vertical). This is typical of contamination. Look for evidence of white powder on the tape friction pins and on the cartridge drive belt.

5. Excessive spares, vertical clumping (usually on alternating tracks) indicates poor formatting of the tape by the manufacturer. This is not a problem unless the spares are all used.

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G. TERRORS AND DERRORS

Refer to tables 5-1 and 5-2 in Section V, Diagnostics.

H. TAPE VERIFICATION

Tapes which have been saved from disc are not verified due to the nature of the tape module, i.e., no read-after-write.

To perform a backup and verification on a tape use the following verification options or utilities.

```
SYSTEM TYPE              VERIFY UTILITY
=====================================================
   250        "FVBACK" with softkey "VERIFY ON"

   1000       In RTE-6, "PSAVE" with "VE" option

              In RTE-A/XL, "PVB" utility

   9845       "TAPE VERIFY" utility

   9836       "TAPE BACKUP" utility with verify option

   9000       "DISC BACKUP" utility with verify

   3000       "VINIT", use "VERIFY" command
```

J. TAPE REPLACEMENT CONDITIONS

Any tape fullfilling the following conditions will be replaced by HP-DMK.

1. Any tape exceeding the certify limits. Note that # of blocks tested must equal the certify value to qualify.

ENTRY	88140L,LC	88140S,SC	COMMENTS
# Blocks	131072	32768	= certify value
# Permanents	250*	128	
# Transients	N/A	N/A	does not affect tape/drive perf.
# Uncor/Unloc	32	8	unlocatables should predominate

*Reduced to 250 from 256 following agreement with tape manufacturer

2. Any tape exceeding the Run log limits (assumes a certified tape).

ENTRY	88140L,LC	88140S,SC	CSO REPLACEMENT
# Unlocatables	128	32	in the 90 day warranty
# Uncorrectables	1	1	in the 90 day warranty
# Uncorrectables	5	2	in 1 year and the Use log is less than the max specified below

Maximum Use = 20480000 blocks = 2500 cycles on 88140L,LC
Maximum Use = 5120000 blocks = 2500 cycles on 88140S,SC

3. Any tape having used all spares within the warranty period.

   i.e., Short tapes = 32 entries
        Long tapes = 128 entries

4. Any tape showing signs of ISV on the flag plot.

5. Any tape showing signs of edge damage.

6. Any tape showing signs of white contamination.

7. All tapes returned to DMK must include failure information.

4-5. GUIDELINES FOR TROUBLESHOOTING —
DISC MECHANISM

The failure/replacement rate of the 7908 disc mechanism (07908-6X100) has
been high. Here are some guidelines to help troubleshoot a disc
mechanism problem. Also review "7908 Disc Mechanism Replacement" in
Issue #264 of Support Update.

4-6. HOW TO CLASSIFY THE PROBLEM

A. Retrieve all self test/ diagnostic errors by using the self
test and diagnostic switches on the back of the drive. Write
down the Suspect Conditions and TERRORS.

B. Read all the system and disc logs. On the 1000, loading
CSERR at generation will enable the system to report the
CS/80 status words in the event of an error or fault. (See
"RTE-VI/VM CS/80 Disc I/O Errors and the CSERR Program" in
Support Update, issue #261--Nov 12, 1982. On the 250, use
the Disc Status command to obtain the CS/80 status.

If the system does not have the diagnostic software to read the
disc logs, or you cannot get the system running, use the
External Exeriser program (07908-1600X) on the HP 85. Read the
disc RUN LOG, FAULT LOG, ERT LOG, and ERRSUM.

C. If you suspect a disc mechanism problem, try to classify the
problem as

1. an internal disc system problem (read/ write, servo,
or data problem), or
2. a disc mechanical problem (loose hardware, spindle
motor related, noise), or
3. a system/ disc related problem.

4-7. HOW TO TROUBLESHOOT THE PROBLEM

A. <u>Internal Disc System Problems</u>

1. <u>Compatibility Problems</u>

Review all service notes. Some highlights are:

a. 7908P/R-05 and -08 describe destructive write faults and
other errors which require updating to the newest Read/
Write PCA **(07908-6X305)**.

b. 7908P/R-09 calls for an MPU firmware update. Besides
helping some tape problems, the new firmware cures one
specific HP 250 system hang. (Call your TSE if you
need information.)

2. Data Errors/ Read/ Write System

   a. Symptoms

      Excessive errors on one or more heads may be due to many
      assemblies or combinations of assemblies.

   b. Guidelines

      Troubleshoot the whole read/write system. Before
      making a decision to replace the disc mechanism,
      investigate the Read/ Write PCA, the DMA PCA, the Servo
      PCA, all disc system related cables, the MPU PCA, and
      the Mother PCA.

      Looping on the External Exerciser DIAG programs and RO
      ERT can be helpful in isolating even intermittent
      problems. If you are absolutely sure you have a good
      disc backup, or if data can be destroyed, the WTR ERT
      program can be used.

      Using the INIT MEDIA program with option P--retain only
      primary spares, or option B--retain primary and
      secondary spares, is an allowable operation. But
      remember, this will destroy data.

      Once the drive is performing acceptably, if you replaced
      several PCA's in your attempt to solve the problem, you
      should now work backwards to determine which of the PCA's
      you replaced were good.

      Once you have isolated and replaced the faulty
      component, CLEAR LOGS, and run at least 4 full volume
      passes of the Read Only Error Rate Test (RO ERT) to
      insure the problem has been fixed. Since the WTR ERT
      is a more critical test, it may be used if the data
      can be destroyed.

3. Maintenance Track Problems

   a. Symptoms

      A full spare table will result in a maintenance track
      overflow. Maintenance track TERRORS you might see are
      (hex) C4--cannot seek to or read maintenance track,
      dA--cannot read spares table on maintenance track, or
      dE--cannot read interleave table.

b. Guidelines

Inability to read maintenance tracks may be indicative
of a Read /Write system problem. First approach the
problem as such. If you find and fix a Read /Write
problem and you still cannot read the maintenance
tracks, a complete initialization of the disc mechanism
will be required. This is the only clear situation
where a complete reformat is required. Improper use of
the initialization routine can be very dangerous to
customer data because the initialization, retaining no
spares, wipes out the results of 48 hours of factory
testing! Follow these instructions very carefully.

1) Using the External Exerciser Program, run INIT
MEDIA on the disc and specify option I--initialize
the spare table. Use an interleave value of 1.
This process will take about 1 1/2 minutes.
Warning: This destroys data and factory spares!

2) Run 5 full volume passes of random pattern WTR ERT.
Select the Pattern Test (PT). Use the Random
Pattern Table (RN) as the bit pattern source. This
will take about 12 minutes.

3) Read the ERT LOG.

4) Use the SPARE program to spare out any uncorrectable
sector with an occurrence count of one or more. Be
sure to spare the logical address. You don't need
to retain data. Note that the terminology of the
External Exerciser will say that the length of the
spare operation was 35 sectors because the whole
track was rewritten. Only the sector specified was
really spared. Also note that the address pointer
is returned to sector 0 of the head and cylinder
specified.

5) Clear the ERT LOG using CLEAR LOGS.

6) Run 24 full volume passes of the pattern test WTR
ERT. Select the Pattern Test ERT (PT), and use the
Pattern Table (PT) as the source of the bit
pattern. This will take about 55 minutes.

7) Read the ERT LOG.

8) Use the SPARE program to spare out any sector with
an occurrence count of one or more.

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9) Clear the ERT LOG.

10) Run 4 full volume passes of the pattern test WTR ERT.

11) Read the ERT LOG. If any new errors are listed, use the spare program to spare them.

12) Repeat steps above until no errors are logged in the ERT LOG.

If more than 24 sectors have been spared and you have not found a Servo or Read/ Write problem, you should replace the disc mechanism.

If the maintenance tracks can still not be read, call your TSE.

4. Seek/ Servo Problems

    a. Symptoms

        A seek problem could be indicated by one of the following errors in the FAULT LOG.
          DERROR 64 (decimal), Bit 4--Off track during write
          DERROR 64, Bit 3--Not on track
          DERROR 05--CRC data error and off track
          DERROR 17--Format-Header Cylinder Compare Error
          DERROR 74--Outer guard band detected
          DEROOR 14--Format-Header Status Byte Error

    b. Guidelines

        Troubleshoot all PCA's involved in the servo system. Evaluate the Servo, Read/ Write, and MPU PCA's before replacing the disc mechanism. Possible causes of servoing problems are: Servo PCA faults, random shock, servo code defects, weak drive motor constant, MPU track crossing miscount, Read/ Write PCA or DMA PCA error, or Read/ Write--Servo crosstalk.

        Looping on a Read Only Error Rate Test (RO ERT) could reveal repeatable errors on the same cylinder but different heads. When running the RO ERT, the servo electronics should be able to pass with a plus or minus 8 offset. Difficulty in reading with offset could indicate a disc servo code problem, or (less likely) a Servo PCA problem.

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c. Servo, Spindle, and Actuator Problems

Another servo related error you might encounter is
TERROR A9--unable to lock on disc signal. This problem
could be caused by the disc mechanism's actuator not
allowing the heads to move, or the sindle not spinning
up, a mechanism cable problem, or a Servo PCA problem.

Power up the mechanism. Check to see if the spindle
spins up. If the spindle does not spin up, check the
plus and minus 12 volt supplies on the Regulator PCA.
They should be within 5% for the spindle to function
properly. If the voltages are low, power down the
drive and disconnect the spindle motor cable from the
Mother PCA. Power up the drive and remeasure the
regulated voltages. This should tell if the disc
mechanism is pulling down the power supply, or if the
power supply is causing the problem. A spindle
motor problem, that is caused within the disc
mechanism, would require replacement of the mechanism.

If the spindle spins up, observe the power on sequence
of the disc mechanism's actuator assembly through the
translucent mechanism cover. Check to see that
the carriage lock solenoid (actuator lock) releases when
powered on. Then check to see if the heads move out
over the discs. If the actuator does not release or
move the heads, the problem may be in the Servo PCA, the
ribbon cable, or the disc mechanism.

If the problem appears intermittently and cannot be
isolated to the Servo PCA or ribbon cable, replace
the disc mechanism.

5. Save/ Restore Related Problems

a. Symptoms

If an uncorrectable error is encountered during a
pushbutton (from the switches) save or restore operation,
the tape busy light flashes after the operation has
completed. This could be a tape or disc problem.

b. Guidelines

Read the disc and tape RUN LOGs and the disc FAULT LOG.
An uncorrectable error on the disc will be logged in
the disc RUN LOG. Proceed by troubleshooting as a
disc system related problem.

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B. Disc Mechanical Problems

A mechanical disc problem may go undetected as it may not affect drive performance. Be aware of these problems.

1. Loose Hardware

If you can see or hear any loose hardware rolling around inside the disc mechanism, it will have to be replaced, regardless of performance. Such an occurrence should be rare. Call your TSE.

2. Noise

a. Symptoms

The 7908 is a quiet disc drive; acoustic emmissions are 53 dBa for the Pod version and 59 dBa for the Rack version. Customer complaints of noise should be investigated.

b. Guidelines

1) Spindle Ground Strap
A customer complaint of noise has almost always been due to a vibrating spindle ground strap. Apply damping material to this ground strap as explained in service note 7908P/R-07.

2) Spindle Brake
If the spindle brake does not retract on power up, a "screeching" sound would be produced. Call your TSE for advice. The spindle brake is not a replaceable part, but the TSE may be able to help you solve it without replacing the mechanism.

3) Spindle Bearings
Bad spindle bearings could generate noise. If you encounter this very rare problem, replace the disc mechanism.

4) Spindle Fan Rubbing
The spindle fan could rub on the bottom cover rivets. If this happens, remove the bottom cover and bend it slightly to eliminate the interference.

C. System/ Disc Related Problems

As you all know, it is sometimes difficult to distinguish between a disc and system related problem, especially during a system load and while running disc related utilities. Here are some very flexible guidelines.

1. Read all the disc and system logs. See paragraph B. in section I. Match the system errors to the disc status obtained from the logs. This information may prove valuable in determining if the problem is disc or system software.

2. If you think you have a system/ disc problem, call in the SE. Find out if there have been any recently discovered anomalies in the operating system or utilities. See if he has any information that may help you isolate the problem.

3. Call the disc TSE to see if any new drive problems have been discovered which may apply to your situation.

4. Make sure the customer has a good backup of his system before proceeding.

5. Try to reproduce the problem, and read the system and disc logs again.

6. Check cabling and configuration.

7. Determine whether the operating system or files on the disc have been corrupted. The methods of doing this vary for each system. Generally, you should run read only error rate tests (RO ERT) on the drive to see if errors are occurring. Or you could try booting from a different device or drive. Or you could try loading a known "good" version of the operating system. The SE should be heavily involved at this point.

8. If disc data has been corrupted, you will have to troubleshoot the Read/ Write and Servo systems. (See sections II.A.2, II.A.3, and II.A.4 of this guideline.)

9. If you're having a hard time diagnosing the problem, don't hesitate to call for help from the SEO, TSO, or appropriate Product Divisions.

See CS/80 tab for external exerciser and HP–IB information.
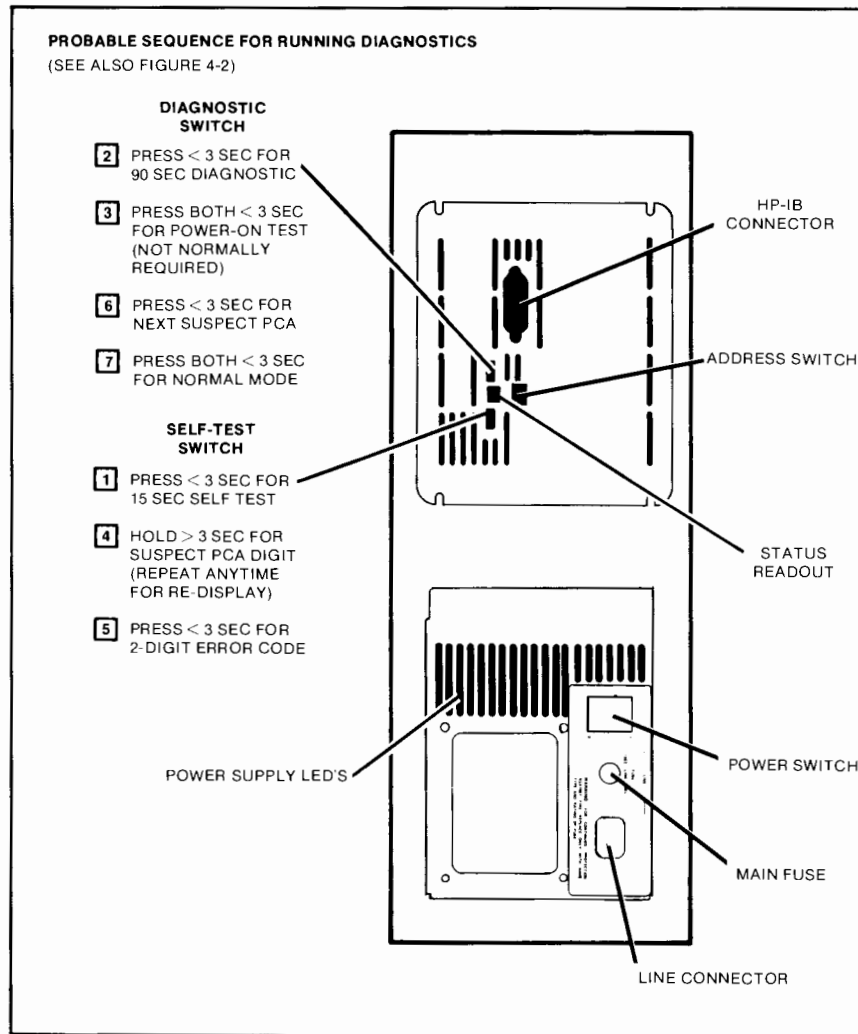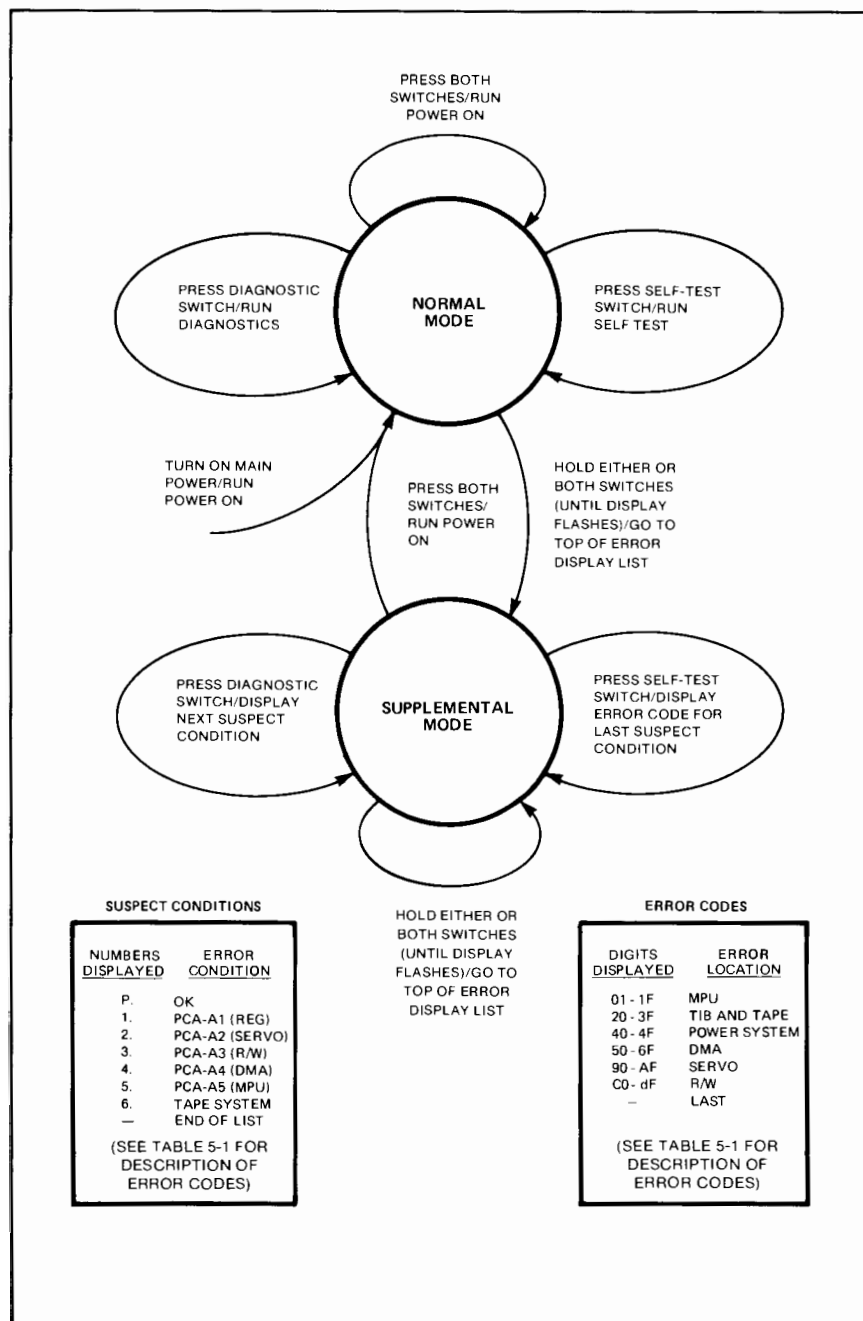
5-1. SELF TEST SWITCHES

PROBABLE SEQUENCE FOR RUNNING DIAGNOSTICS
(SEE ALSO FIGURE 4-2)

DIAGNOSTIC SWITCH

[2] PRESS < 3 SEC FOR 90 SEC DIAGNOSTIC

[3] PRESS BOTH < 3 SEC FOR POWER-ON TEST (NOT NORMALLY REQUIRED)

[6] PRESS < 3 SEC FOR NEXT SUSPECT PCA

[7] PRESS BOTH < 3 SEC FOR NORMAL MODE

SELF-TEST SWITCH

[1] PRESS < 3 SEC FOR 15 SEC SELF TEST

[4] HOLD > 3 SEC FOR SUSPECT PCA DIGIT (REPEAT ANYTIME FOR RE-DISPLAY)

[5] PRESS < 3 SEC FOR 2-DIGIT ERROR CODE

HP-IB CONNECTOR

ADDRESS SWITCH

STATUS READOUT

POWER SUPPLY LED'S

POWER SWITCH

MAIN FUSE

LINE CONNECTOR

Figure 5-1. Rear Panel Switches

PRESS BOTH
SWITCHES/RUN
POWER ON

PRESS DIAGNOSTIC
SWITCH/RUN
DIAGNOSTICS

**NORMAL
MODE**

PRESS SELF-TEST
SWITCH/RUN
SELF TEST

TURN ON MAIN
POWER/RUN
POWER ON

PRESS BOTH
SWITCHES/
RUN POWER
ON

HOLD EITHER OR
BOTH SWITCHES
(UNTIL DISPLAY
FLASHES)/GO TO
TOP OF ERROR
DISPLAY LIST

PRESS DIAGNOSTIC
SWITCH/DISPLAY
NEXT SUSPECT
CONDITION

**SUPPLEMENTAL
MODE**

PRESS SELF-TEST
SWITCH/DISPLAY
ERROR CODE FOR
LAST SUSPECT
CONDITION

HOLD EITHER OR
BOTH SWITCHES
(UNTIL DISPLAY
FLASHES)/GO TO
TOP OF ERROR
DISPLAY LIST

SUSPECT CONDITIONS

NUMBERS DISPLAYED	ERROR CONDITION
P.	OK
1.	PCA-A1 (REG)
2.	PCA-A2 (SERVO)
3.	PCA-A3 (R/W)
4.	PCA-A4 (DMA)
5.	PCA-A5 (MPU)
6.	TAPE SYSTEM
—	END OF LIST

(SEE TABLE 5-1 FOR
DESCRIPTION OF
ERROR CODES)

ERROR CODES

DIGITS DISPLAYED	ERROR LOCATION
01 - 1F	MPU
20 - 3F	TIB AND TAPE
40 - 4F	POWER SYSTEM
50 - 6F	DMA
90 - AF	SERVO
C0 - dF	R/W
—	LAST

(SEE TABLE 5-1 FOR
DESCRIPTION OF
ERROR CODES)

Figure 5-2. Internal Diagnostic States

TERRORS

Table 5-1. Test Error Codes

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
1	01	MPU RAM data miscompare error during self-test.	1) MPU PCA (RAM, Z-80, or Data/Address bus)
2	02	Incorrect MPU ROM checksum found during self-test.	1) MPU PCA (EPROM, ROM, Data/Address bus or Z-80) 2) Another PCA is corrupting the common data bus
3	03	CTC self-test or diagnostic failure of any of 5 diagnostic tests for the counter timer circuit.	1) MPU PCA (CTC, Z-80 interrupt circuit, or data/address bus)
4	04	Cannot write to the 4-bit tape counter during a diagnostic. A write/read check of the tape 4-bit counter failed.	1) MPU PCA (tape counter) 2) TIB PCA (tape counter control circuitry CTCT-H)
5	05	Addressing problems found during self-test. Any of the controller or interface PCAs may be responding to an illegal address.	1) MPU PCA (addressing circuits) 2) Any PCA which shares the address bus (DMA, read/write, servo)
6	06	Bus corruption found during self test. Data bus failure on the common MPU bus.	1) MPU PCA (data bus latches) 2) Any PCA which shares the common data bus (DMA, read/write, servo)
7	07	Bad response to bus select during self-test. DMA, read/write, or servo PCA decode failure.	1) MPU PCA 2) Any of the selected PCAs (DMA, read/write, servo)
8	08	MPU RAM failure found during self-test or background tests.	1) MPU PCA (RAM) 2) Data or address bus

TERRORS

Table 5-1. Test Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
9	09	The Z-80 did not respond to the NMI-L generated by the PHI during a self-test. NMI-L circuitry is not operational.	1) MPU PCA (NMI-L to Z-80 circuit) 2) DMA PCA (PHI interrupt circuit)
10	0A	The controller did not detect either a disc or tape unit. The TIB, read/write, and/or servo PCA is not connected to the MPU bus.	1) Read/write, servo, or TIB not plugged into motherboard
11	0b	Either or both of the MPU self-test switches is continuously active for more than 30 seconds. MPU switches register active for too long.	1) MPU PCA (self-test switches may be stuck in the active state)
12	0C	The CPU trapped an illegal opcode. An illegal instruction was encountered.	1) MPU PCA (Z-80 or ROM)
15	0F	One of the previously mentioned errors has occurred (01-0C hex). This error is an "or" of the RAM, ROM, CTC, and tape counter errors, and is used by the isolation routine as one place to look for general MPU health. See the descriptions for the TERRORS "01-0C" hex.	1) MPU PCA
16	10	The sector pulse is not incrementing the CTC circuit during a read/write self-test. The counter timer circuit is not operational.	1) MPU PCA (CTC or Z-80 interrupt) 2) Disc or read/write PCA not providing sector pulse
32	20	Cartridge not inserted.	1) No tape cartridge present 2) Tape mechanism (does not see the tape)
33	21	Tape did not meet the requirements for loading (tension, key readability, etc.).	1) Tape media (cartridge) 2) Tape mechanism

TERRORS

Table 5-1. Test Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
34	22	Upon completion of reset or autoload of tape, a register shows bad status with TIB connected.	1) TIB PCA 2) Tape mechanism 3) MPU PCA (TIB interface)
35	23	CRC circuitry on the TIB is not correcting errors.	1) TIB PCA (buffers/state machine)
37	25	The first frame (manufacturer's block) of the first block is both unreadable and uncorrectable. The tape may be of the wrong type.	1) Tape media (cartridge) 2) Tape mechanism 3) TIB PCA
38	26	The sector toggle flip-flop cannot be made to function from the TIB PCA. Tape/DMA interface circuits are not functioning properly.	1) TIB PCA 2) DMA PCA
39	27	The DMA to TIB loopback failed, and the TIB's ability to source a known pattern failed. Therefore, read and write to the TIB buffers has failed.	1) TIB PCA 2) DMA PCA (SERDES I/O)
40	28	The DMA-TIB loopback test failed but the test where the TIB sources a pattern to the DMA has passed (can't write, but can read).	1) TIB PCA 2) DMA PCA (SERDES I/O)
41	29	The address counter did not increment by four sectors when the TIB sent one block (1k) to the DMA. TIB/DMA interface circuits failed.	1) TIB PCA 2) DMA PCA (address-increment hardware, state machine)
42	2A	The TIB is failing to sequence the four frames within the 1k block.	1) TIB PCA (state machine)
43	2b	Timeout error for TIB sourcing the known pattern to the DMA. The TIB is not responding to self-test mode control, by sending a known buffer of data.	1) TIB PCA 2) DMA PCA

TERRORS

Table 5-1. Test Error Codes (continued)

NUMBER DEC	NUMBER HEX	CAUSE	SUSPECT HARDWARE
44	2C	Unable to write to self-test system blocks and cannot read keys.	1) Tape media (cartridge) 2) Tape mechanism 3) TIB PCA
45	2d	Could not read from the system test blocks during self-test. Tape unreadable at the system block area. Could not read keys or frame headers.	1) Tape media (cartridge) 2) Tape mechanism 3) TIB PCA
46	2E	In the loopback test (DMA-TIB), the data written was not the data read.	1) TIB PCA 2) Tape mechanism
64	40	The fault latch bit which indicates a possible power fail is set. This bit is tested during the read/write diagnostic. If the fault register is bad. TERROR "db" hex (fault latch shows conflicting results) should also be reported.	1) Rectifier PCA 2) Regulator PCA 2) Read/write PCA (Drive fault register)
80	50	DMA self-test control and status registers cannot be properly read.	1) DMA or MPU PCA (DMA/MPU interface)
81	51	During DMA self-test, the MPU could not read and write to every location in the 16-byte header.	1) DMA PCA (header RAM) 2) MPU PCA (interface/data bus)
82	52	The MPU can't read and write to every location in the 4k DMA data RAM.	1) DMA PCA (data RAM) 2) MPU (interface/data bus)
83	53	The data field bit is incorrect or the disc address counter points to the wrong area.	1) DMA PCA (disc interface) 2) Read/write PCA
84	54	Data compare error during a disc read (occurs if header, data. CRC, byte is wrong).	1) DMA PCA (disc interface) 2) Read/write PCA

TERRORS

Table 5-1. Test Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
85	55	The CRC error bit is set during a read of a good sector. or is not set during a read of a bad sector.	1) DMA PCA (CRC circuit)
86	56	The sector counter did not increment after the read of a good sector or the sector counter did not decrement after a sector had been written to the disc.	1) DMA PCA (sector counter circuits)
87	57	DMA self-test data compare error of any sector byte during a disc write.	1) DMA PCA (disc interface) 2) Read/write PCA
88	58	Unused signal line(s) are being pulled low by another PCA.	1) Read/write PCA (DMA interface)
89	59	The disc address counter didn't increment after a sector was read from the disc.	1) DMA PCA (disc address counter) 2) Read/write to DMA interface
96	60	Improper PHI interrupt bits are set during the PHI diagnostic.	1) DMA PCA (PHI) 2) MPU PCA (PHI to Z-80 interface)
97	61	The PHI self-test microdiagnostic had a FIFO wrap-around data miscompare.	1) DMA PCA (PHI)
98	62	PHI self-test identify bytes were not the same as those loaded.	1) DMA PCA (PHI) 2) MPU PCA
99	63	The byte counter failed during a write operation.	1) DMA PCA (security circuit)
100	64	No EOI was received during a write operation.	1) DMA PCA (PHI) 2) MPU PCA

TERRORS

Table 5-1. Test Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
101	65	A secondary command was not detected during a disc write.	1) DMA PCA (PHI) 2) MPU PCA
102	66	PHI to data RAM data miscompare or data over-run has occurred.	1) DMA PCA (I/O circuits)
103	67	Left-over bytes were not in the inbound FIFO after the buffer became full or the byte count expired during an I/O write (possible overrun).	1) DMA PCA (I/O circuits)
104	68	Transfer stopped in the wrong place during an I/O read (possibly did not stop after sending EOI).	1) DMA PCA (I/O circuits)
105	69	The sector didn't increment at the sector boundary on an I/O write.	1) DMA PCA (sector or I/O ad-dress counter)
106	6A	The sector counter didn't decrement at the sector boundary during an I/O read.	1) DMA PCA (sector counter or I/O address counter)
107	6b	Sector overrun or security circuit malfunction has occurred.	1) DMA PCA (security circuit)
108	6C	A data compare error occurred after an I/O read.	1) DMA PCA (I/O circuits)
109	6d	The DMA I/O counter stopped early.	1) DMA PCA (I/O circuits)
110	6E	The status register bits on the DMA PCA make no sense.	1) DMA PCA
111	6F	The DMA RAM failed the nondestructive RAM test during either the power-on or background test.	1) DMA PCA (RAM)

TERRORS

Table 5-1. Test Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
144	90	The fault register bit which indicates a servo phaselock fault was set when read. If the fault register on the read/write PCA is bad, then TERROR "db" hex (fault latch has conflicting results) should also have been logged.	1) Servo PCA (servo phaselock hardware) 2) Read/write PCA (fault register)
145	91	The offtrack bit of the fault register indicated a servo offtrack condition when read. The fault register may be bad. A "db" hex (fault register indicates conflicting results) should also be logged if the fault register is bad.	1) Servo PCA (track-following hardware) 2) Read/write PCA (fault register)
146	92	A track compare error has occurred during a read/write diagnostic. A header may be incorrect or unreadable, or the servo may have "jumped the track".	1) Servo PCA (track-following hardware) 2) Read/write PCA
147	93	The servo PROM diagnostic did not give the expected results. The Servo PROM may be defective. or the data and/or address lines used to read its contents may be bad.	1) Servo PCA (Servo PROM) 2) Data and/or address lines used to read PROM
149	95	The servo linear motor voltage indicator bit disagrees with the expected value during the servo diagnostic. The linear motor voltage is not responding to current commands. or the linear motor voltage indicator is bad.	1) Servo PCA (linear motor control circuitry) 2) Servo-Read/write cable 3) Disc mechanism (linear motor)
150	96	Track crossings are not indicated when expected. Track crossing detection is faulty or the device is not crossing tracks. Servo head may be in a zone where servo code is invalid or missing.	1) Servo PCA 2) Servo-Read/write cable 3) Disc mechanism 4) MPU (counter timer chip)
151	97	The disc doesn't reach or maintain its minimum specified speed within a reasonable interval.	1) Servo PCA (control circuits) 2) Read/write PCA (fault register) 4) Servo-Read/write cable

TERRORS

Table 5-1. Test Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
154	9A	The number of allowable offtracks was exceeded during a verify operation. Too many offtracks occurred.	1) Servo PCA 2) Disc mechanism (motor constant too weak or servo resonance)
155	9b	Too many verifies during a verify operation. Verify operation is failing.	1) Read/write PCA 2) Servo PCA 3) Disc mechanism (motor constant too weak or servo resonance)
157	9d	Servo ontrack indicator disagrees with expected state. Inability to lock on servo test signal or ontrack indicator is faulty.	1) Servo PCA (phase-locked loop, AGC circuitry, test signal generator, or track crossing and offtrack detection)
160	A0	A bit set on a servo PCA register is clear on the microprocessor register used to read that bit. The servo-microprocessor interface is bad.	1) Servo PCA 2) MPU PCA 3) Motherboard
162	A2	The servo phase-locked loop is unable to lock up on the servo-generated test signal. The servo PCA phase-locked loop, AGC, or test-signal generation is defective.	1) Servo PCA (phase-locked loop, AGC or test signal circuitry)
168	A8	The servo diagnostic does not detect a guard band signal when it expects to. Servo pattern detection or the servo phase-lock function are suspect.	1) Servo PCA (servo PROM for tri-bit pattern decoding) 2) Disc mechanism (servo information incorrectly encoded)
169	A9	Servo phase-locked loop is unable to attain phaselock on the disc signal during the servo diagnostic.	1) Disc mechanism (servo code or disc velocity) 2) Servo-Read/write cable 3) Servo PCA (phase-locked loop)

TERRORS

Table 5-1. Test Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
170	AA	The servo adaptation routine failed due to a dc force problem -e.g., too much drive tilt, the servo gain can't make up for weak motor constant, or the track spacing irregularities are too great.	1) Servo PCA (current drivers) 2) Disc mechanism
171	Ab	The recalibrate terminated with an error.	1) Servo PCA 2) Disc mechanism
172	AC	The device has attempted to force an offtrack condition by sending a very large offset command to the servo. No offtrack was indicated on the servo PCA. The device may not be over servo code, the servo offset circuitry may be defective, or the offset detection circuitry may be failing.	1) Servo PCA (track follower offtrack detection)
173	Ad	The interval between index pulses detected was too long or too short, or no pulse was detected. The servo head may not be over a zone where index pulse code exists, the index detection circuitry (e.g. the servo PROM) may be bad, or the index pulse code may be missing or incorrectly written on the disc.	1) Servo PCA (index detection circuitry) 2) MPU PCA (seek electronics - ROM) 3) Disc mechanism (index pulse code) 4) Servo PCA (data or address lines)
192	C0	The DWF-L (Destructive Write Fault) bit of the fault register indicated a fault when the fault register was read. A destructive write fault may have occurred. If the fault register is defective, TERROR "db" hex should also have been logged.	1) Read/write PCA (fault register) 2) Disc mechanism (preamplifier)
193	C1	The WOT-L (Write-and-Offtrack) bit of the fault register indicated a fault when read. An offtrack may have occurred during a write. If the fault register is bad, TERROR "db" hex should also have been logged.	1) Read/write PCA (write control circuits or fault register) 2) Servo PCA (track-follower)

TERRORS

Table 5-1. Test Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
194	C2	The bit indicating a read/write PCA phase-locked loop error (real-time) was set when the fault register was read. The read/write PCA phase-locked loop is out-of-lock, or the fault register is defective (look for TERROR "db" hex).	1) Read/write PCA (phase-locked loop or fault register)
195	C3	DPO-L (read/write phase-locked loop dropped out of lock) bit of the fault register indicated a fault. The read/write phase-locked loop dropped out of lock since the last time the fault latch was cleared. This is a latched, not a real-time, signal. Look for TERROR "db" hex to see whether the fault register is healthy.	1) Read/write PCA (phase-locked loop or fault register)
196	C4	No useable maintenance track could be found for the head indicated. This TERROR should always be accompanied by the head that was used to look for a good maintenance track. Possibly could not read even one of the the maintenance track sectors, using the head specified. Look at the head numbers (TERRORS "d0" to "d4" hex) that were also logged. TERRORS logged by servo tests will prevent the read/write diagnostic from running. If all the heads are included, then the hardware to suspect is most likely common to all the heads, such as the read/write PCA or the disc media. If only some of the heads were logged, most likely causes include the read/write select circuitry or the disc mechanism preamplifier(s).	1) Read/write PCA (read chain, control or select circuitry) 2) Disc media 3) Disc mechanism (preamplifier)
197	C5	When the correctable sector of the maintenance track was read, no CRC error was rereported. May have read the wrong sector, error detection may be defective, or reads are marginal. The DMA PCA is listed as second most suspect because any serious DMA errors would have blocked the execution of the read/write diagnostic.	1) Read/write PCA (sector counters, formatter/separator, and analog read chain) 2) DMA PCA (CRC circuitry)

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TERRORS

Table 5-1. Test Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
198	C6	Write/read tests on maintenance track write test areas failed for the head(s) indicated by TERRORS "d0" to "d4" hex. Read or write faults, or sector addressing problems. Error detection circuitry (CRC, ECC) could be reporting problems where none exist, but since this circuitry has been tested prior to the read/write diagnostic, this is less likely.	1) Read/write PCA (formatter/separator read chain, read/write control) 2) DMA PCA (CRC circuitry)
199	C7	The data that was read from a write test sector of the maintenance track differs from the data that should have been written to that sector. This error implies a data miscompare between a disc write to and a disc read from the same sector. This could mean that that the ability to write to the disc media has been lost, although reads can still be performed. Such an error would not be detected by the CRC, as long as the last write to that sector left a CRC consistent with the rest of the sector data. Normally, this error will occur with a write/read TERROR "C6" hex. Look at the pattern of head failures for this error for clues to the problem.	1) Read/write PCA (write control and write path) 2) DMA PCA 3) Disc mechanism (preamplifier) 4) Disc media
201	C9	A sector compare error was detected after a disc read operation. This error is detected exactly as it would be during run-time reads. If no other read errors were reported, then this error probably points to sector counting problems rather than problems reading/writing sector headers. Three PCAs are involved in sector counting: the servo, read/write, and MPU PCAs. The servo PCA generates a byte clock, which the read/write PCA uses to produce sector pulses. The CTC (counter timer chip) on the MPU PCA counts sector pulses to determine which sector is currently addressed. At this point, the CTC and servo have passed their crucial diagnostic tests (or the read/write test would have been blocked).	1) Read/write PCA (sector timing and counting) 2) MPU PCA (counter timer chip) 3) Servo PCA (byte clock generation)
202	CA	The read/write-to-DMA tri-state buffer did not tri-state when commanded to do so. The control circuitry for the read/write-DMA buffer failed.	1) Read/write PCA (DMA tri-state buffer control)

TERRORS

Table 5-1. Test Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
204	CC	During the servo adaptation test, no index was detected by the MPU, although the servo PROM that detects disc index pulse code appears to be good. The MPU did not see an index pulse within a reasonable interval. The index pulse is detected by the servo PCA, passed to the read/write PCA for processing, and then sent to the MPU's CTC (counter timer chip). If the servo PROM passed self-test and correctly decoded inner or outer guardbands, then the index signal was probably good as it left the servo PCA. Since the CTC likely also passed self-test, the diagnostic finger points to the read/write PCA.	1) Read/write PCA (index pulse circuitry and sector timing) 2) Servo PCA (index pulse detection) 3) MPU PCA (CTC) 4) Disc media (index pulse locations)
208- 212	d0- d4	Whenever TERRORS "C4", "C5", "C6", or "C7" hex are logged, the heads on which they occurred are also logged. The head(s) reported were being used when one of the above-mentioned errors occurred. The number which follows the "d" is the number of the head involved. Refer to TERRORS C4-C7 hex for the hardware to suspect. The pattern of head errors should provide additional clues to the problem. For example, heads 0 and 1 are o one preamplifier chip, while heads 2, 3 and 4 are on another. Select circuitry problems may result in only one head or chip being selected. If all heads are reported, the problem is probably common to all the heads.	1) Disc mechanism (preamplifier) 2) Read/write PCA (head select)
216	d8	No sector timing pulse was detected by the MPU CTC (counter timer chip) within a reasonable period. The sector timing pulse is either not being generated by the servo and read/write PCAs, or it is not being detected by the MPU CTC.	1) Read/write PCA (check for other TERRORS) 2) Servo PCA (check for other TERRORS) 3) MPU PCA (counter timer chip)
217	d9	The DMA detected the wrong level for the Start-Of-Data (SOD-L) signal from the read/write PCA during a sector read. The read/write PCA is not generating Start-Of-Data (SOD-L) signals, or the DMA is not detecting them.	1) Read/write PCA (SOD-L circuitry) 2) DMA PCA (disc interface)

TERRORS

Table 5-1. Test Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
218	dA	The device was unable to read the spare table on the maintenance track. Reads from or writes to the maintenance track are failing or inconsistent, or the maintenance track spare table cannot be located.	1) Read/write PCA 2) DMA PCA 3) Servo PCA 4) Disc media (data surface and mechanism interface)
219	db	The fault register does not report a fault when a fault condition is generated. The fault register is defective, or the fault condition (an off-track) was not successfully generated. The device may be in a disc area (park zone) where offtracks will not be detected.	1) Read/write PCA (fault register) 2) Servo PCA (track-following and offtrack detection circuitry)
220	dC	A logical seek failed during a verify operation. The device cannot read/write well enough to verify, or the seek failed.	1) Read/write PCA 2) DMA PCA 3) Servo PCA
221	dd	The diagnostic error-rate test found an unreadable sector. Reads/writes are marginal or inconsistent, or the media is defective. ·	1) Read/write PCA 2) DMA PCA 3) Disc Media
222	dE	Can't read interleave table on maintenance track. Reads are not working, previous write to interleave table was bad, or we cannot locate the interleave table (track or sector).	1) Read/write PCA 2) DMA PCA 3) Servo PCA 4) Disc media

DERRORS

Table 5-2. Drive Error Codes

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
4	04	During a read operation, the DMA hardware reported a data CRC error. This is the standard reporting error for a data CRC error.	None
5	05	The CRC caught a read data error and the fault register indicates off-track status. The off-track condition might easily have caused the read data error. Therefore, the servo system is more suspect than the read/write chain. A full test of the servo system should be performed. If that is successful, then a read/write test should be performed.	1) Servo PCA 2) Read/write PCA
6	06	During a drive operation that was receiving data from the host, the drive received an end of transfer before the number of bytes expected to be sent to the drive were received. In some cases (receiving a command) the early EOI status is expected and is not an error.	The internal diagnostic should be able to find any errors associated with the EOI status. The DMA PCA controls this status message.
7	07	During a receive or a receive and write operation, the number of bytes expected from the host was received but the last byte was not tagged with EOI. Under normal conditions, this is a reporting error.	If this error is associated with some possible hardware problem, the DMA PCA is suspect.
8	08	During a receive or receive and write operation, a secondary was received while expecting data or commands. If this error is associated with a drive problem, the DMA PCA could have problems. This error is a reporting error and does not mean that there are any hardware problems.	If a drive problem seems to exist, the DMA PCA is suspect.
9	09	An incremental seek was requested that would extend beyond the last track of the device. RAM/ROM failure or a request by the host for a transfer that would extend past the end of the volume.	1) MPU PCA

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DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
14	0E	When a check was made of the header read from the disc, the first byte (status) had the most significant bit clear. This bit should always be set. The read/write PCA is suspect. A full self-test should be performed on the read/write chain.	1) Read/write PCA 2) DMA PCA
15	0F	When a check was made of the sector header read from the disc, the head number was not the one expected. The read/write chain is suspect. A full self-test on the read/write chain should be performed.	1) Read/write PCA (head select) 2) DMA PCA
16	10	When a check was made of the sector header read from the disc, the sector number was not a legal one for this device. The read/write chain is suspect. A full self-test on the read/write chain should be performed.	1) Read/write PCA 2) DMA PCA
17	11	When a check was made of the sector header read from the disc, the cylinder number was not the one expected. The read/write chain and the servo system are suspect. A full self-test should be performed on both the read/write chain and the servo system.	1) Read/write PCA 2) DMA PCA 3) Servo PCA 4) Disc media
18	12	DMA status indicates that the DMA buffer is full of data. The DMA buffer is held clear during this operation, so the DMA should not report a full buffer. The firmware holds the buffer not full on internal disc read operations (buffer reads).	1) DMA PCA
21	15	During a DMA buffer write to the disc DMA a rotational latency was incurred. During a buffered write, all the data is already in the DMA RAM so this error would indicate that the DMA PCA is faulty.	1) DMA PCA

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DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
23	17	All maintenance copies were searched without finding a valid one during an access of the system maintenance area. Note that this error will require either new media or a primary initialization of current media if the error was caused by a read/write problem but that it is possibly recoverable if caused by a servo system failure. The drive has been unable to access a valid copy of a system maintenance file. This could be because seeks to the various copies were unable to be completed or that the read/write chain encountered errors that caused the drive to spare out all its possible copies of the maintenance file. Note that maintenance track sparing is not related to the CS/80 spare command and proceeds without host intervention. A full self-test should be performed on the read/write system and then the servo system.	1) Read/write PCA 2) DMA PCA 3) Servo PCA 4) MPU PCA 5) Disc media
24	18	During an access to a system maintenance area, a maintenance file was read that had an invalid checkword. Note that this error can occur during an access to the spare track table file; the spare table will be zero'ed and the drive will seek to the original physical track on an access to a previously spared track. The drive read in a file that had an invalid checkword at the end of a maintenance file. This had to be caused by a read/write failure or an uncorrectable failure or an uncorrectable read error or bad media. A full self-test should be performed on the read/write chain. If the read/write chain is found to be satisfactory, it must be assumed that a faulty write occurred and the current media must have a primary initialization or be replaced.	1) Read/write PCA 2) DMA PCA 3) Disc media 4) MPU PCA
25	19	An access of the system maintenance area was made and all the copies of the files contained the pattern of an unitialized disc. The disc media has not been properly initialized for use.	1) The disc media needs initializing

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
27	1B	A seek was unable to successfully reach the target track. The actual reason for the failure will be recorded in immediately previous logged DERRORs if logging is enabled (other than a drive system seek). Note: If this error has occurred, then the heads are currently over physical cylinder zero. Since an inability to successfully read from the target track in order to verify position can also trigger this fault, both the servo system and the read/write chain are suspect. A full self-test should be performed on both the servo system and the read/write chain.	1) Servo PCA (track follower or actuator driver) 2) Read/write PCA 3) DMA PCA
28	1C	The sector interleave value could not be read from the disc. This means that the firmware will default to an interleave of one (no interleave).	None
29	1D	A physical head position recalibration operation was unable to successfully attain the normal recal position. This error will prompt a head unload operation. Immediately prior DERRORs will elaborate on the cause of the failure if fault logging is enabled (if the recalibration is not part of a internal drive system operation). The servo system is suspect. A full self-test should be performed on the servo system.	1) Servo PCA
30	1E	A head unload operation failed to detect that the heads were retracted and the drive was forced to perform an emergency retract (if the drive has that ability). The servo system is suspect. A full servo system test should be performed.	1) Servo PCA 2) Disc mechanism 3) Disc media
32	20	At the end of a read operation, no data errors were indicated by the hardware, but at some time since the last seek operation, the drive has gone off track. The data read is considered to be valid. This error is an information error only.	If there are hardware problems associated with this error, the servo electronics should be checked out.

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
33	21	During a disc read or write operation, the target sector was passed because there was either no room in the DMA buffer for the sector to be read or there was not a sector's worth of information in the DMA buffer to be written to the disc. With RPS enabled on a write operation, the error could mean that the RPS window was missed. Otherwise, during a write operation, at least one sector was written to the disc and the latency was induced by a subsequent sector write.	None
35	23	The error log on the disc is full (it contains 101 entries). This may be an indication of an increasing error rate.	1) Read/write PCA 2) Disc media
36	24	The disc fault log is full (contains 65 entries). This might be an indication of degrading drive performance. A full internal diagnostic should be performed as the state of the drive is perhaps suspect. The severity of the impact of this error bears on the length of time since the fault log was last cleared.	None

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
64	40	During a disc read or write operation the drive detected an unexpected hardware fault register bit set. This means that some hardware was indicating to the MPU that a hardware fault had occurred. After this entry in the fault log, the contents of the fault register that prompted this error is recorded. The contents of that byte should indicate which assembly is in error. The fault register in the following parameter byte of the status message as well as in the fault log will have all negative true (negative fault) signals complemented. This means the condition causing the fault to be reported will be set high true in the information byte regardless of the logic level of that bit. Suspected hardware is indicated in the contents of the hardware fault register.	1) Indicated assembly due to the hardware fault register 2) MPU PCA Bit 0 = DWF-L Destructive Write Fault Bit 1 = PLE-L Servo PLL lost lock Bit 2 = PFAIL-L Power fail warning Bit 3 = ONT-H On Track Bit 4 = WOT-L Off Track during write Bit 5 = SOK-L Speed OK (always high) Bit 6 = OTL-L Out Of Lock Bit 7 = WAB-L Out of lock latched
65	41	Servo PCA is/was not phase-locked to the disc servo code.	1) Servo PCA 2) Disc mechanism
66	42	Timeout while waiting for an event that doesn't involve the CTC. Seek failure caused by servo electronics, disc mechanism or shock.	1) Servo PCA 2) Disc Mechanism
67	43	Timeout while waiting for a track crossing interrupt from the CTC. The CTC messed up, the servo PLL out of lock or a seek failure occurred.	1) MPU PCA (CTC chip) 2) Servo PCA 3) Disc mechanism
68	44	Timeout while waiting for ON-H (ontrack) at target track.	1) Servo PCA 2) Disc mechanism

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DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
69	45	Illegal head selected by software.	1) MPU PCA (EPROM or RAM)
70	46	Recalibrate failed because the heads failed to settle. This error is logged after 2 retries of the recalibrate failed.	1) Servo PCA 2) Disc media 3) Disc mechanism
71	47	Timeout occurred while waiting for an offtrack at the beginning of a seek.	1) Servo PCA 2) Disc mechanism 3) MPU PCA (EPROM)
72	48	Timed out waiting for index after a recalibrate. Recalibrate would have failed 2 retries already. Servo can't detect index pulses; read/write sector timer is bad.	1) Servo PCA 2) Read/write PCA 3) Disc mechanism 4) MPU PCA
73	49	The inner guard band was detected after a seek completed. Seek or servo pattern detection failed.	1) Servo PCA 2) Disc mechanism
74	4A	Outer guard band detected after seek complete. Seek failure or servo pattern detection failed.	1) Servo PCA 2) Disc mechanism
75	4B	Outer guard band wasn't detected during a recalibrate. No retries were attempted. Servo pattern detection failed; carriage lock is engaged.	1) Servo PCA 2) Disc mechanism
78	4E	Seek aborted due to servo PLL out of lock or because seek-blocking bit set. Recalibrate aborted due to seek-blocking bit set.	1) Servo PCA 2) Disc mechanism

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DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
80	50	The DMA electronics will indicate to the firmware that the header information in the DMA header buffer was transfered to the disc (disc write operation) and the data in the DMA data buffer is now being transfered. This status bit will remain set for a long enough period for the firmware to test its validity and expect it to be set (if tested at the correct time). If this bit is not set when the firmware expects it to be set, this error is reported. This is an indication that maybe the DMA electronics is not transfering data to the read/write PCA because the DMA is not receiving the control signals from the read/write electronics or there is a component failure on the DMA PCA.	1) Read write PCA 2) DMA PCA
90	5A	A spare operation retaining data was unable to seek to the target track. It is advised that a full internal diagnostic be performed before any sparing operation to ensure that we haven't lost our ability to seek and read/write. This er- ror may be the reason why sparing was in- voked originally.	1) Servo PCA 2) Read/write PCA
91	5B	A spare operation retaining data was unable to read all of the data from the target track. It is advised that a full internal diagnostic be per- formed before any sparing operation to ensure that we haven't lost our ability to read/write. This error may be the reason the sparing operation was invoked originally.	1) Read/write PCA
92	5C	A sparing operation was unable to seek to either of the two closest available spare tracks to be used in that operation. A full internal diagnostic is recommended before any sparing operation. This error would seem to indicate that perhaps a full cylinder of available spare tracks are defective or that the drive can no longer seek.	1) Servo PCA 2) Read/write PCA

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER DEC	NUMBER HEX	CAUSE	SUSPECT HARDWARE
93	5D	A sparing operation was unable to write the available spare track and successfully verify it. A full internal diagnostic is recommended before any sparing operation. This error would seem to indicate that either a full cylinder of available spare tracks were defective or that the drive can no longer read/write.	1) Read/write PCA
94	5E	An error was detected in the logical head load routine from the physical head load driver. The specific DERROR from the physical driver should be the next DERROR.	1) Servo PCA
96	60	The CTC did not decrement or reload after the time for one sector. This problem can originate anywhere along the sector timing pulse data path.	1) MPU PCA
97	61	When the firmware has decided that a non-burst disc write operation is complete, it checks the DMA as it should stop in parallel with the firmware. This error is declared if the firmware and the DMA do not agree. This error is not possible in a burst mode write since the DMA is not currently receiving data from the channel during such a write.	1) DMA (channel circuitry)
98	62	A fault bit was detected on the DMA that should never be set for this device. The DMA PCA is highly suspect and the DMA internal diagnostic should be performed.	1) DMA PCA 2) MPU PCA
102	66	The DMA electronics set a bit that indicates the end of a transfer before the expected termination of the transfer. Either the DMA PCA's circuitry that monitors for the end of a transfer is faulty or the MPU's ability to sense these bits is faulty. A full internal diagnostic should be performed.	1) DMA PCA 2) MPU PCA

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
103	67	During a disc read or write, the target sector for an operation is determined by comparing the controller's target sector number and the sector counter found in the MPU PCA counter-timer chip (CTC). This error indicates that the desired sector number did not appear from the CTC within a full disc rotation. Either the CTC isn't counting (perhaps due to either the CTC circuitry being in fault or the sector timing circuitry that generates the sector pulses is failing) or that has been a controller fault that caused us to be looking for an illegal sector number. A full internal diagnostic of the drive should be performed.	1) MPU PCA 2) Servo PCA (sector timing circuitry)
107	6B	Inconsistent internal error code(s) encountered by error reporting routine.	1) MPU PCA
108	6C	While waiting for the sector counter (STP register) to reach an expected value, it was noted that the STP was counting at a faster rate than is legally possible. The STP circuitry (it is a channel of the counter-timer chip (CTC) on the MPU PCA) or the circuitry generating sector timing pulses (track follower) is bad. A full self test should be performed on the servo system and the MPU PCA.	1) MPU PCA 2) Servo PCA (STP pulse generating circuitry)
111	6F	A microdiagnostic failed that refers to the controller unit as opposed as to one of the mass storage units.	As the associated TERROR desribes
114	72	A channel parity error has been detected by the channel interface or an illegal channel interface state (caused by receiving bus control, DMA handshake error with channel) or channel loopback failure has occurred. The error could be caused by a faulty channel or a fault in the DMA channel interface. This error could also be caused by faulty system configuration or operation.	1) DMA PCA 2) Host system channel cabling, configuration, or interface

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
115	73	The device received a message type which conflicted with its current state. Assuming host computer is operational, there could be a problem with the DMA hardware.	1) HP-IB cable(s) 2) DMA PCA
118	76	Channel activity has placed the device interface in an illegal state. Host software placed the device in an illegal state, or DMA hardware is improperly communicating with the interface chip (PHI).	1) DMA PCA 2) System configuration
119	77	The received length (in bytes) of an HP-IB message conflicted with the expected length. This is an internal error or possibly an interface problem.	1) HP-IB configuration 2) DMA PCA
121	79	An HP-IB message was abnormally terminated. This is an internal error or possibly an interface problem.	1) DMA PCA 2) Channel configuration
128	80	The CPU sent an illegal opcode to the device. This is an internal error or possibly a transmission problem.	1) HP-IB cables 2) DMA PCA
129	81	The CPU sent a unit or volume number which was out of bounds for this device. This is an internal error or possibly a transmission problem.	1) HP-IB cable 2) DMA PCA
130	82	The CPU sent a command which did not have the correct number of parameter bytes for the opcode(s) included. This is an internal error or possibly a transmission problem.	1) HP-IB cables 2) DMA PCA
136	88	An internal diagnostic failed. Look at TERROR to ascertain which one failed.	Determined by TERROR
139	8B	PHI parallel poll synchronization problem was experienced by the CPU or the CPU tried to talk to the drive while it was automatically released.	1) DMA PCA

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
146	92	No more spares are available for a requested sparing operation. Disc media is getting too old, has been damaged, or read/write electronics has problems.	1) Disc media 2) Read/write PCA
148	94	Retry attempts have failed to rectify a data error during a read operation.	1) Read/write PCA
177	B1	One of the first four data frames in a block had a CRC error. The TIB PCA performed a correction and the data was recovered.	None
178	B2	A CRC error was detected in one of the ECC frames (frame 5 or 6).	None
179	B3	Two nonadjacent frames on the tape had CRC errors. This combination of frames with CRC errors makes the block uncorrectable.	None
180	B4	The frame number returned in the DMA buffer after a transfer of data from the TIB PCA to the DMA buffer is not one of the expected values. This error is usually an indication that the TIB PCA skipped a frame while reading the data from a block into its internal buffer. If the TIB PCA appears free of any hardware problems, there could be a media defect at that block which forces the skew error on the tape. If it appears to be related to a particular address on the tape, that address should be spared.	1) Disc media
182	B6	When attempting to write a block of data to the tape, the key which the firmware believes to be the target key is unreadable. When attempting to read a block of data from the tape, the target key and the first 3 frames within that block have CRC errors (the TIB PCA will attempt to retreive the key address from the first three data frames of the block).	None

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DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
183	B7	During a tape verify operation where the TIB PCA is performing an 'n' block verify operation, a key with a CRC error was encountered. This part of the hardware verify operation will be implemented only for products which support parallel operations.	None
184	B8	Too many blocks in a row with a key CRC error (see DERROR "B6" hex). The count is set to 20 keys in a row with CRC errors.	1) Tape media (cartridge)
185	B9	This error is set after multiple attempts to seek and locate the target key. If auto sparing is on and this is a write operation, the block will be automatically spared.	None
186	BA	Eight-tenths of a second passed and the TIB PCA did not report finding a key. The tape has an area in which the keys have been destroyed. Use caution in putting tapes with valuable data in this mechanism until the problem is found. Possibly some keys could be erased.	1) Tape media (erasure) 2) TIB PCA 3) Tape mechanism
188	BC	If during a tape read and transmit operation, the host computer is slow receiving the data being sent to it, the tape may need to stop to allow the host to catch up. If the TIB PCA has data to be transfered to the DMA and a key is read on the tape, the TIB will stop the tape and report the situation to the firmware. The firmware will reposition the tape for the next data block. The tape mechanism is not designed to tollerate an excessive amount of stopping and starting. Any use of the tape which might cause the tape to stop and start an excessive amount should be avoided.	None

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
189	BD	This error is the same as the "BC" hex except that a key was read on the tape before a block of data was received from the host computer to be written to the tape. Another case where this error may appear is when a copy data from the disc to the tape is being performed and disc read retries are necessary, which forces a data overrun on the tape.	None
191	BF	This error indicates that the target block is behind the current block or the target block is too far in front of the current block to attempt to get there from here at 60 inches per second. If retries are allowed and not exhausted, a 90 inch-per-second seek be performed, otherwise, the user will get an unrecoverable data error. This error is also generated when the tape encounters a jump spare on the tape since the new block is too far away from the spared block. In most cases, this error is just information for the user indicating more than one seek was necessary in order to locate the target block. If an excessive number of these errors appear, the TIB PCA could be in error or the tape could have some defected areas causing the hardware to missposition.	1) TIB PCA 2) Tape media (cartridge)
192	CO	During any tape operation (seek, read, verify or write), the TIB PCA indicates that it has useful information in the completion code register by setting a bit in another status register. Upon reading the completion code register, the drive firmware can't find any bits set which mean anything for the operation which the TIB PCA should be performing.	1) TIB PCA 2) MPU PCA
194	C2	A command was strobed to the tape device and the tape drive did not acknowledge the command within two seconds.	1) TIB PCA 2) Tape mechanism 3) Tape data cable

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
196	C4	The command strobe procedure was called to strobe a command to the tape drive. This procedure will wait two seconds for the tape to go "not busy" in the case where the tape drive was busy before the procedure strobed the command. If the tape drive is busy and stays busy for the time limit, this error is reported.	1) TIB PCA 2) Tape mechanism
197	C5	A stop command was strobed to the tape drive. The tape drive set busy status indicating it is busy stopping the tape but the busy status does not go away.	1) Tape mechanism 2) TIB PCA
200	C8	A motion command was strobed to the tape drive. The line indicating the drive is busy is asserted by the tape drive but this line never goes false.	1) Tape mechanism 2) TIB PCA
201	C9	A command was sent to the tape tape drive to start the tape in motion. The tape drive acknowledged the command and supposedly started the tape without any problems, but when the tape status register was read, the "at speed" bit was not set.	1) TIB PCA 2) Tape mechanism
202	CA	Since there is no sector signal when transfer-ring data between the TIB and DMA, the TIB toggles a flip flop for each block (256 bytes) transfered between the DMA and TIB. If the TIB does not toggle the flip flop, this error is reported.	1) TIB PCA

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DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
203	CB	Status byte from tape drive has most sig-nificant bit (bit 7) set which indicates secon-dary status. This secondary status byte from the tape is also reported in the byte following the error byte. This error signals problems in the tape drive. These problems may be related to the tape cartridge or the tape mechanism. If the secondary is persistent and points to the tape mechanism, the tape drive may have problems. If the problem is an off-tape error, the tape may have passed beyond the BOT/EOT field on the tape and need to be respooled. Otherwise, the tape may have a damaged area.	(High true) Bit 0 = Read amplifier or electronics Bit 1 = Off tape Bit 2 = Stepper motor error Bit 3 = ROM checksum or RAM error Bit 4 = Abnormal tachometer feedback Bit 5 = Abnormal drive motor load Bit 6 = Illegal command Bit 7 = Always high (1)
204	CC	This error will occur if, during a write operation, the TIB PCA does not pulse the four-bit down counter on the MPU PCA in 23 milliseconds. Or, if during a read operation, the TIB PCA does not indicate the completion of the operation in ap-proximately the same time.	1) TIB PCA
205	CD	This error is set when the host attempts to perform a tape operation before the tape has completed the autoload, read the spare table and manufacturer's block on the tape. If the "not ready" status is reported even after the tape has completed the autoload and the autoload did not fail.	1) TIB PCA 2) Tape mechanism
207	CF	After reseting the tape drive or after acknowledging the secondary status sent from the tape drive, the most significant bit of the tape drive status register did not return to zero after a specified time.	1) Tape mechanism (controller) 2) TIB PCA

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
208	D0	When the data is transfered to the TIB PCA from the DMA PCA or to the DMA PCA from the TIB PCA, the upper nibble of the disc address counter (on the DMA PCA) will increment by one for each 256 bytes transfered. Since 1k bytes are transfered on tape transfers, this register is a good indication of whether 4 times 256 bytes transfered between the DMA and TIB. If this value does not change by 4, this error is reported.	1) TIB PCA 2) DMA PCA
209	D1	In a tape certification or a write-then-read error rate test, the firmware compares the data read with what it wrote. If they don't compare this error is reported.	1) TIB PCA 2) DMA PCA
211	D3	The firmware was waiting for the CTC to interrupt which indicates that the CTC pulsed the TIB PCA. The CTC interrupt never came.	1) MPU PCA
212	D4	When the target key is located, the TIB PCA puises the counter timer chip on the MPU. This timer will time the delay to the initial erase and time the length of the initial erase (erase before first trame). If the CTC does not start counting after the target key is located during a write operation, this error is reported.	1) TIB PCA 2) MPU PCA

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
203	CB	Status byte from tape drive has most significant bit (bit 7) set which indicates secondary status. This secondary status byte from the tape is also reported in the byte following the error byte. This error signals problems in the tape drive. These problems may be related to the tape cartridge or the tape mechanism. If the secondary is persistent and points to the tape mechanism, the tape drive may have problems. If the problem is an off-tape error, the tape may have passed beyond the BOT/EOT field on the tape and need to be respooled. Otherwise, the tape may have a damaged area.	(High true) Bit 0 = Read amplifier or electronics Bit 1 = Off tape Bit 2 = Stepper motor error Bit 3 = ROM checksum or RAM error Bit 4 = Abnormal tachometer feedback Bit 5 = Abnormal drive motor load Bit 6 = Illegal command Bit 7 = Always high (1)
204	CC	This error will occur if, during a write operation, the TIB PCA does not pulse the four-bit down counter on the MPU PCA in 23 milliseconds. Or, if during a read operation, the TIB PCA does not indicate the completion of the operation in approximately the same time.	1) TIB PCA
205	CD	This error is set when the host attempts to perform a tape operation before the tape has completed the autoload, read the spare table and manufacturer's block on the tape. If the "not ready" status is reported even after the tape has completed the autoload and the autoload did not fail.	1) TIB PCA 2) Tape mechanism
207	CF	After reseting the tape drive or after acknowledging the secondary status sent from the tape drive, the most significant bit of the tape drive status register did not return to zero after a specified time.	1) Tape mechanism (controller) 2) TIB PCA

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
208	D0	When the data is transfered to the TIB PCA from the DMA PCA or to the DMA PCA from the TIB PCA, the upper nibble of the disc address counter (on the DMA PCA) will increment by one for each 256 bytes transfered. Since 1k bytes are transfered on tape transfers, this register is a good indication of whether 4 times 256 bytes transferred between the DMA and TIB. If this value does not change by 4, this error is reported.	1) TIB PCA 2) DMA PCA
209	D1	In a tape certification or a write–then–read error rate test, the firmware compares the data read with what it wrote. If they don't compare this error is reported.	1) TIB PCA 2) DMA PCA
211	D3	The firmware was waiting for the CTC to interrupt which indicates that the CTC pulsed the TIB PCA. The CTC interrupt never came.	1) MPU PCA
212	D4	When the target key is located, the TIB PCA pulses the counter timer chip on the MPU. This timer will time the delay to the initial erase and time the length of the initial erase (erase before first frame). If the CTC does not start counting after the target key is located during a write operation, this error is reported.	1) TIB PCA 2) MPU PCA

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
213	D5	The firmware controls the gathering of a block of data from the host computer and then starts a write of that data to a block on the tape. While the TIB PCA is sequencing through the write operation, the firmware gathers another block from the host computer. Once the data for the next block is received from the host, the firmware will "hold hands" with the TIB as a form of redundant protection against writing over keys on the tape. This is done by allowing 23 msec for the TIB to indicate that the six frames were written on the tape (4-bit counter on MPU is pulsed). Once the 4-bit counter is pulsed, the counter is tested to be sure it decremented by only one count. The 4 bit counter decrementing is an indication that the TIB is in final erase (erase frame). This final erase will not last more than about 3.4 milliseconds at which time the TIB will indicate successful completion.	1) TIB PCA 2) MPU PCA (4-bit tape counter)
216	D8	The tape drive reported that a tape was in the mechanism, there was no autoload in progress and the not ready staus bit indicated that the tape was ready for use. This indicates to the firmware that the tape is ready for use. Some time later, the firmware wanted to strobe a command byte to the tape drive but the status now indicates it is not ready for use.	1) TIB PCA 2) Tape mechanism 3) MPU PCA
217	D9	This error is used by the firmware to force the unrecoverable error bit to be set in the staus field returned to the host computer. It means retries expired for a media related error.	1) Tape media (cartridge)
218	DA	The firmware was unable to recover from a non media related problem (possibly through retries). When doing an internal tape write/read test, the firmware will use this error to report that a situation encountered could not be recovered through retries or could not recover and retries are not allowed.	1) Tape media (cartridge)

DERRORS

Table 5-2. Drive Error Codes (continued)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
219	DB	An attempt was made to read from a tape which was never written to.	1) TIB PCA 2) Tape mechanism
220	DC	The host attempted to access beyond the logical end of volume.	Host computer addressing
222	DE	During an internal tape error rate test (ERT), the ERT log overflowed. This means that the ERT test needs to log a new block with a permanent error but the log currently has the maxumum number of entries in it (255 entries). If this error occurs during a tape certify operation, and the firmware is able to update the ERT log on the tape, any blocks that need to be spared on the tape that are in the ERT log will be spared. This does not mean that the tape is safe to use since the certify did not complete.	1) Tape media (cartridge) 2) Dirty tape head
223	DF	An attempt was made to write to a tape which is write protected.	None
225	E1	A parameter bounds error occurred in a set address command.	1) HP-IB cables 2) DMA PCA
226	E2	A parameter bounds error occurred in a command other than unit, volume, or address.	1) HP-IB cables 2) DMA PCA
228	E4	At the end of any disc disc read operation, the firmware will compare the header information that was read from the last sector of the disc to the expected values for that sector address. If this address is incorrect, this error is reported. This fault is an indication of a possible DMA data RAM failure.	1) DMA PCA

DERRORS

Table 5-2. Drive Error Codes (continued)

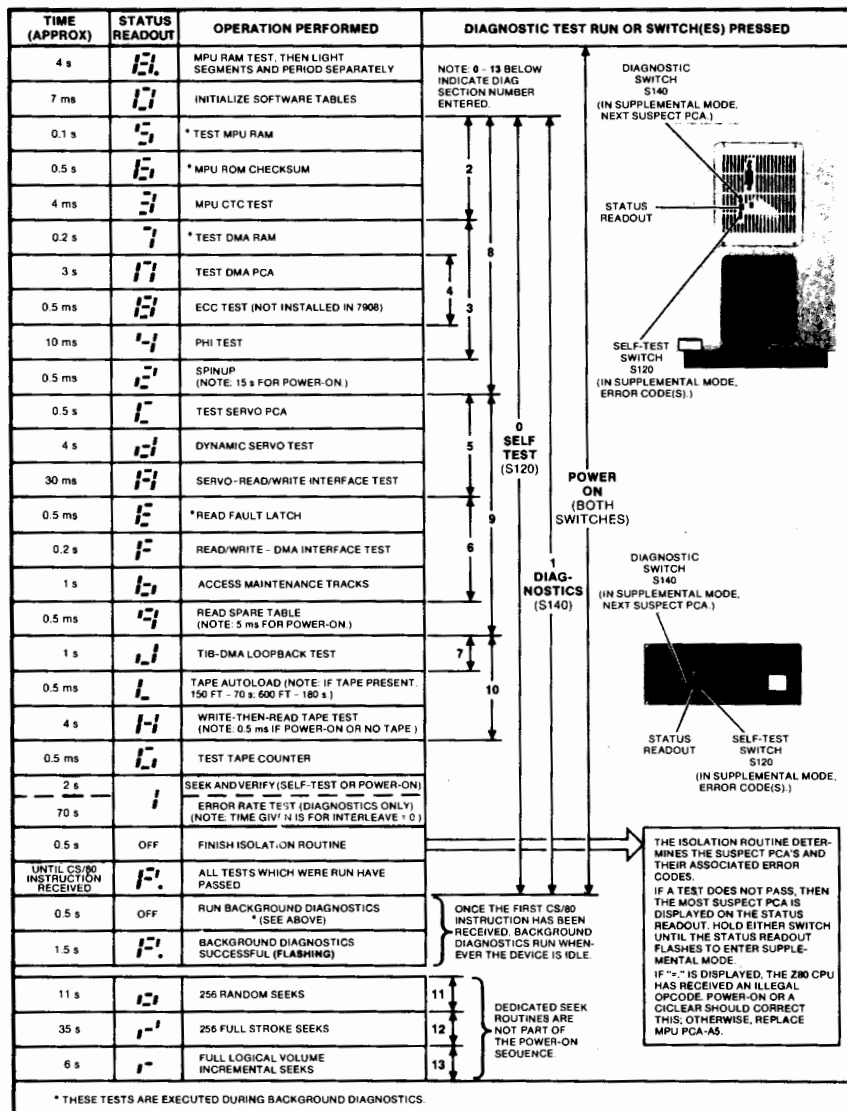| NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
229	E5	At the end of any disc read operation, the header information from the last sector read is compared to the expected sector number. If the values differ, this error is reported. There are a number of possible reasons why this situation could occur. The DMA header RAM could be failing, the CTC could be failing, the read/write electronics could have problems or the servo electronics could be dropping sector timing pulses which go to the CTC on the MPU PCA. Also, if the media has a defect which causes the servo PCA to miss a start of sector signal in the servo code this error could be reported.	1) DMA PCA 2) Read/write PCA 3) Servo PCA 4) MPU PCA 5) Disc mechanism
230	E6	The device was not in proper position to access the media when the CPU commanded a media access. Media not inserted, head loading or diagnostic failure, or a drive fault during real time access may have occurred.	1) Servo PCA 2) Read/write PCA

TIME (APPROX)	STATUS READOUT	OPERATION PERFORMED	DIAGNOSTIC TEST RUN OR SWITCH(ES) PRESSED
4 s	E.	MPU RAM TEST, THEN LIGHT SEGMENTS AND PERIOD SEPARATELY	
7 ms	O	INITIALIZE SOFTWARE TABLES	
0.1 s	S	* TEST MPU RAM	
0.5 s	E	* MPU ROM CHECKSUM	
4 ms	3	MPU CTC TEST	
0.2 s	7	* TEST DMA RAM	
3 s	n	TEST DMA PCA	
0.5 ms	8	ECC TEST (NOT INSTALLED IN 7908)	
10 ms	4	PHI TEST	
0.5 ms	2	SPINUP (NOTE: 15 s FOR POWER-ON.)	
0.5 s	C	TEST SERVO PCA	
4 s	d	DYNAMIC SERVO TEST	
30 ms	A	SERVO-READ/WRITE INTERFACE TEST	
0.5 ms	E	*READ FAULT LATCH	
0.2 s	F	READ/WRITE - DMA INTERFACE TEST	
1 s	b	ACCESS MAINTENANCE TRACKS	
0.5 ms	9	READ SPARE TABLE (NOTE: 5 ms FOR POWER-ON.)	
1 s	J	TIB-DMA LOOPBACK TEST	
0.5 ms	L	TAPE AUTOLOAD (NOTE: IF TAPE PRESENT. 150 FT - 70 s: 600 FT - 180 s.)	
4 s	H	WRITE-THEN-READ TAPE TEST (NOTE: 0.5 ms IF POWER-ON OR NO TAPE.)	
0.5 ms	U	TEST TAPE COUNTER	
2 s	I	SEEK AND VERIFY (SELF-TEST OR POWER-ON)	
70 s	I	ERROR RATE TEST (DIAGNOSTICS ONLY) (NOTE: TIME GIVEN IS FOR INTERLEAVE = 0.)	
0.5 s	OFF	FINISH ISOLATION ROUTINE	
UNTIL CS/80 INSTRUCTION RECEIVED	P.	ALL TESTS WHICH WERE RUN HAVE PASSED	
0.5 s	OFF	RUN BACKGROUND DIAGNOSTICS * (SEE ABOVE)	
1.5 s	P.	BACKGROUND DIAGNOSTICS SUCCESSFUL (FLASHING)	
11 s	c	256 RANDOM SEEKS	
35 s	r'	256 FULL STROKE SEEKS	
6 s	r	FULL LOGICAL VOLUME INCREMENTAL SEEKS	

* THESE TESTS ARE EXECUTED DURING BACKGROUND DIAGNOSTICS.

Right column text:

NOTE: 0 - 13 BELOW INDICATE DIAG SECTION NUMBER ENTERED.

0 SELF TEST (S120)

1 DIAGNOSTICS (S140)

POWER ON (BOTH SWITCHES)

DIAGNOSTIC SWITCH S140 (IN SUPPLEMENTAL MODE, NEXT SUSPECT PCA.)

STATUS READOUT

SELF-TEST SWITCH S120 (IN SUPPLEMENTAL MODE, ERROR CODE(S).)

DIAGNOSTIC SWITCH S140 (IN SUPPLEMENTAL MODE, NEXT SUSPECT PCA.)

STATUS READOUT

SELF-TEST SWITCH S120 (IN SUPPLEMENTAL MODE, ERROR CODE(S).)

ONCE THE FIRST CS/80 INSTRUCTION HAS BEEN RECEIVED, BACKGROUND DIAGNOSTICS RUN WHENEVER THE DEVICE IS IDLE.

DEDICATED SEEK ROUTINES ARE NOT PART OF THE POWER-ON SEQUENCE.

THE ISOLATION ROUTINE DETERMINES THE SUSPECT PCA'S AND THEIR ASSOCIATED ERROR CODES.

IF A TEST DOES NOT PASS, THEN THE MOST SUSPECT PCA IS DISPLAYED ON THE STATUS READOUT. HOLD EITHER SWITCH UNTIL THE STATUS READOUT FLASHES TO ENTER SUPPLEMENTAL MODE.

IF "=" IS DISPLAYED, THE Z80 CPU HAS RECEIVED AN ILLEGAL OPCODE. POWER-ON OR A CICLEAR SHOULD CORRECT THIS; OTHERWISE, REPLACE MPU PCA-A5.

Figure 5-3. Micro and Macro Diagnostics

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5-2.   EXTERNAL EXERCISER DIAGNOSTICS

Table 5-3. External Exerciser Commands

COMMAND*	OPERATION PERFORMED	COMMAND*	OPERATION PERFORMED
DIAG	Internal Diagnostic Test	SPARE	Spare Block Utility
REV	Read Revision Number Utility	INIT MEDIA	Initialize Selected Media
TABLES	Read Drive Table Utility	EXIT	Exit External Exerciser
RUN LOG	Read Run Log Utility	OPER	Enter CS/80 Operations Routine
ERT LOG	Read Error Rate Log Utility	HELP	Display Help Information
FAULT LOG	Read Fault Log Utility	CICLEAR	Channel Independent Clear
ERRSUM	Read Error Summary Utility	SDCLEAR	Selected Device Clear
RO ERT	Read Only Error Rate Test	REQSTAT	Request Status
WTR ERT	Write-Then-Read Error Rate Test	CERT	Certify Tape Cartridge
PRESET	Preset Drive Utility	CANCEL	Cancel Transaction Sequence
CLEAR LOGS	Clear Logs Utility	USE LOG	Read Tape Use Log
CHANNEL	Channel Test Utility	WRITE FM	Write File Mark On Tape
UNIT	Set Unit Number Utility	UNLOAD	Unload Tape

*Some commands must be followed by an address; valid logical addresses in the HP 7908 are as follows:

HEAD   0 - 4   CYLINDER   0 - 369   SECTOR   0 - 34

Refer to CS/80 External Exerciser Reference Manual, P/N 5955-3462, Section 2, for examples

Table 5-4. Operator Designed Commands (OPER)

```
COMMAND                DESCRIPTION
-------                -----------
 CLR           Channel Independent Clear
 CMPR          Write-Then-Read and Compare
 COMP          Complementary Command
 EDIT          Replace an OPER Program Step
 ENDLP         End Loop
 EXEC          Execute OPER Program Steps
 EXIT          Exit the Current Program
 HELP          Print List of Commands
 INSK          Incremental Seek
 LCRD          Locate and Read
 LCWR          Locate and Write
 LIST          List OPER Program Steps
 LOOP          Loop
 NEW           Clear Current OPER Program
 NULL          Delete OPER Program Step
 RQST          Request Status
```

NOTE: Refer to CS/80 External Exerciser Reference Manual, Section 4, for examples.

Table 5-5. TAPE Commands

```
COMMAND            DESCRIPTION
-------            -----------
CANCEL             Cancel Previous Command
CERT               Certify Tape Cartridge
CICLEAR            Channel Independent Clear
CLEAR LOGS         Clear Drive Logs Utility
ERRSUM             Read Error Summary Utility
ERT LOG            Read Error Rate Log Utility
EXIT               Exit the Current Program
HELP               Print List of Commands
INIT MEDIA         Initialize Tape
PRESET             Preset Drive Utility
REQSTAT            Request Status
RO ERT             Read Only Error Rate Test
RUN LOG            Read Run Time Log Utility
SDCLEAR            Selected Device Clear
SPARE              Spare Block Utility
TABLES             Read Drive Tables Utility
UNIT               Set Unit Number Utility
UNLOAD             Unload the Tape
USE LOG            Display Tape Use Log
WRITE FM           Write Filemark on Tape
WTR ERT            Write-Then-Read ERT
```

NOTE: Refer to CS/80 External Exerciser Reference Manual,
Section 3, for examples.

Table 5-6. DIAG Test Entries

DIAGNOSTIC NUMBER	DIAGNOSTIC TEST RUN IN THE HP 7908
0	Complete internal diagnostics: including micro-diagnostics and write/read test. (Equivalent to pressing selftest switch.)
1	Complete internal diagnostics as above followed by complete verify of entire disc. (Equivalent to pressing diagnostic switch.)
2	MPU PCA-A5 micro-diagnostic.
3	DMA PCA-A4 micro-diagnostic.
4	Read/Write-DMA interface macro-diagnostic.
5	Servo PCA-A2 micro-diagnostic.
6	Read/Write PCA-A3 micro-diagnostic.
7	TIB PCA-A6 micro-diagnostic.
8	Data path macro-diagnostic: DMA to Read/Write.
9	Disc system macro-diagnostic: Read/Write to Servo, Read/Write to disc mechanism, Servo to disc mechanism.
10	Tape system macro-diagnostic: DMA to TIB, TIB to tape mechanism, tape mechanism auto test.
11	Random seek test: 256 seeks with verify.
12	Maximum seek test: 256 seeks from physical cylinder 0 to 379 and back (512 seeks total).
13	Incremental seek test: all logical cylinders from 0 to 369 accessed and verified.

5-3. READ DRIVE TABLES UTILITY

The TABLES command listed in table 5-3 returns values stored in the following disc/tape drive tables.

Table Number	Description
1	Disc Spare Track Table
5	Servo Adaptation Table
10	Manufacturer's Tape Block Table
11	Tape Spare Block Table

The disc spare track table lists the logical tracks which have been spared for each head, and which sequential spare (scalar) was used to replace the defective track. The corresponding physical cylinder address for each scalar is as follows:

Scalar Number	Physical Cylinder Address
0 - 4	32
5 - 9	96
10 - 14	160
15 - 19	224
20 - 24	288
25 - 29	352

The manufacturer's tape block table identifies the tape origin and size of the tape cartridge. The tape spare block table contains the physical addresses of tape blocks which are spared.

NOTE: Refer to CS/80 tab for more information.

5-4. READ REVISION NUMBERS UTILITY

The REV command listed in table 5-3 allows the external exerciser to receive a list of ROM revision and rework numbers. The most current printout is shown below. (See CS/80 tab for more data.)

EPROM IDENTIFIER	07908-1X007	07908-1X008
U121	1-4	2-0
U241	1-4	2-0
U261	1-10	2-0
U271	1-10	2-0
U291	1-8	2-0
U2101	1-7	2-0

NOTE: A printout with any codes lower than shown indicates obsolete firmware.

There are NO operating or maintenance adjustments in the HP 7908.

The disc mechanism and tape module are replaceable as assemblies only.

Refer to the service manual for removal/replacement of faulty components.

PERIPHERALS

This section is intended for system-related information not documented in the product manuals.

A complete list of replaceable parts is contained in the service manual. This section covers only major assemblies and spares.

See Section I for service kit, accessories, and consumables.

8-1. RECOMMENDED FIELD STOCKING INVENTORY — DISC DRIVE

```
NUMBER        QTY        DESCRIPTION
------        ---        -----------
0180-3095                27,000uF Capacitor
0180-3096                58,000uF Capacitor
1906-0205      2         Bridge Rectifier Diode 200V
2110-0001      5         Fuse, 1A, 250V
2110-0048      5         Fuse, 15A, 32V
2110-0055      5         Fuse, 4A, NB
2110-0342      5         Fuse, 8A, NB
2110-0523      5         Fuse, 10A, 32V
8120-3446                Cable, HP-IB, 2-metre
07908-00056    5         Foam-Ground Strap
07908-19008              Firmware Kit  (order sep. from MPU)
07908-60004              Mother PCA-A7
07908-60012              Interconnect PCA-A10
07908-60020              Cable, Servo-Read/Write
07908-60024              Cable, Rectifier-Regulator
07908-60026              Voltage Strap - Low
07908-60027              Voltage Strap - High
07908-69002              Exch.PCA-A5 MPU  (without ROMs)
07908-69006              Exch.PCA-A2 Servo
07908-69007              Exch.PCA-A1 Regulator
07908-69009              Exch.PCA-A4 DMA
07908-69013              Exch.PCA-A9 Rectifier
07908-69100              Exch.Disc Mechanism
07908-69305              Exch.PCA-A3 Read/Write
```

8-2. RECOMMENDED FIELD STOCKING INVENTORY — TAPE MODULE

NUMBER	DESCRIPTION
2360-0464	Screw, Mounting, T15
8500-1251	Head Cleaner, 4-oz. can
9164-0127	Cartridge Tape - 600 ft.
9164-0156	Cartridge Tape - 150 ft.
9300-0767	Cleaning Swabs, 10-pack
07908-00047	Shield, ESD
07908-60142	Switch PCA-A8
07908-60143	Cable Assy, Data
07908-60144	Cable Assy, Switch
07908-60145	Cable, Tape Power
07908-69340	Exch.Tape Mechanism
07908-69241	Exch.PCA-A6 TIB

8-3. SPECIAL PARTS

1906-0205	Thermal grease for replacing bridge recti-fier diode. (Not included in service kit.)
8710-1426	TORX driver with interchangeable bits for disassembly of drive parts.
09815-20602	Paper spindle for disengaging Motherboard grommets.

Figure 8-1. Subassembly IPB

CABINET

○ = SEQUENCE OF COVER REMOVAL

① REAR DOOR (5 SCREWS)

HP-IB CABLE

④ FLIP TOP (4 SCREWS IN FRONT)

DISC MODULE

FILLER PANEL (1 SCREW ON BOTTOM)

3

OPT. 140

W5 TAPE DATA CABLE

W4

PCA-A8 SWITCH

W6 SWITCH CABLE

③ UPPER FRONT PANEL (PULL FORWARD)

② LOWER FRONT PANEL (PULL TOP FORWARD THEN LIFT OUT)

CABLE (W3)

CABLE (W1)

Ⓑ

TAPE I/B PCA-A6

MICROPROCESSOR PCA-A5

DISC MEMORY ACCESS PCA-A4

R/W PCA-A3

SERVO PCA-A2

REGULATOR PCA-A1

MOTHERBOARD PCA-A7

NOTE: See reverse side for rectifier detail.

RECTIFIER ASSY

Ⓐ

Ⓑ

Ⓐ

DISC MODULE

RACKMOUNT

8-3

RECTIFIER ASSEMBLY

FUSES (Ref.
Section II)

RECTIFIER PCA-A9

CABLE (W2)

FUSES (Ref.
Section II)

INDUCTOR (L1, L2)

CABLE (W7)

VOLTAGE SELECT PLUG
(Ref. Section II)

INTERCONNECT
PCA-A10

BRIDGE
RECTIFIER
DIODE

TRANSFORMER ASSY

T1

Figure 8-1. Subassembly IPB (cont'd)

8-4

8-4. DISASSEMBLY PROCEDURE

To use the following flowcharts, locate the desired assembly and trace upwards to identify which other assemblies to remove first. (Note that the paragraph numbers refer to the service manual.)
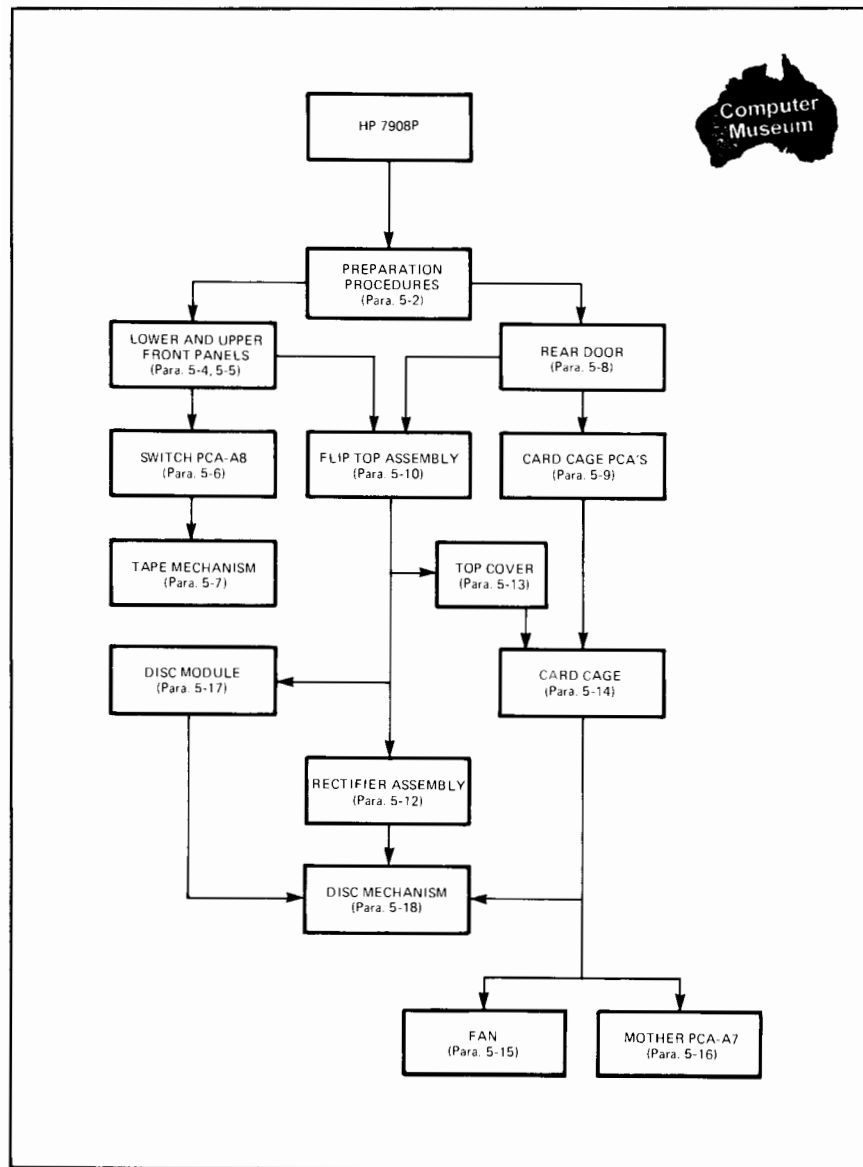
Figure 8-2. Disassembly Aid – Cabinet Model

```
                    ┌──────────────┐
                    │   HP 7908R   │
                    └──────┬───────┘
                           │
                           ▼
                    ┌──────────────┐
                    │ PREPARATION  │
         ┌──────────│ PROCEDURES   │──────────────┐
         │          │ (Para. 5-2)  │              │
         │          └──────┬───────┘              │
         ▼                 │                      │
  ┌──────────────┐         │                      │
  │ FRONT PANEL  │         │                      │
  │ (Para. 5-20) │         │                      │
  └──────┬───────┘         │                      │
         │                 │                      │
         ▼                 │                      ▼
  ┌──────────────┐         │               ┌──────────────┐
  │SWITCH PCA-A8 │         │               │  TOP COVER   │
  │ (Para. 5-21) │         │               │ (Para. 5-26) │
  └──────┬───────┘         │               └──────────────┘
         │                 │
         ▼                 ▼
  ┌──────────────┐  ┌──────────────┐
  │TAPE MECHANISM│  │ REAR GRILLE  │
  │ (Para. 5-22) │  │ (Para. 5-23) │
  └──────────────┘  └──────┬───────┘
                           │
                  ┌────────┴────────┐
                  ▼                 ▼
          ┌──────────────┐  ┌──────────────┐
          │  RECTIFIER   │  │ CARD CAGE    │
          │  ASSEMBLY    │  │ PCA'S        │
          │ (Para. 5-25) │  │ (Para. 5-24) │
          └──────┬───────┘  └──────┬───────┘
                 │                 │
                 ▼                 ▼
          ┌──────────────┐  ┌──────────────┐
          │DISC MECHANISM│◄─│  CARD CAGE   │◄────────┐
          │ (Para. 5-30) │  │ (Para. 5-27) │
          └──────────────┘  └──────┬───────┘
                          ┌────────┴────────┐
                          ▼                 ▼
                   ┌──────────────┐  ┌──────────────┐
                   │     FAN      │  │MOTHER PCA-A7 │
                   │ (Para. 5-28) │  │ (Para. 5-29) │
                   └──────────────┘  └──────────────┘
```
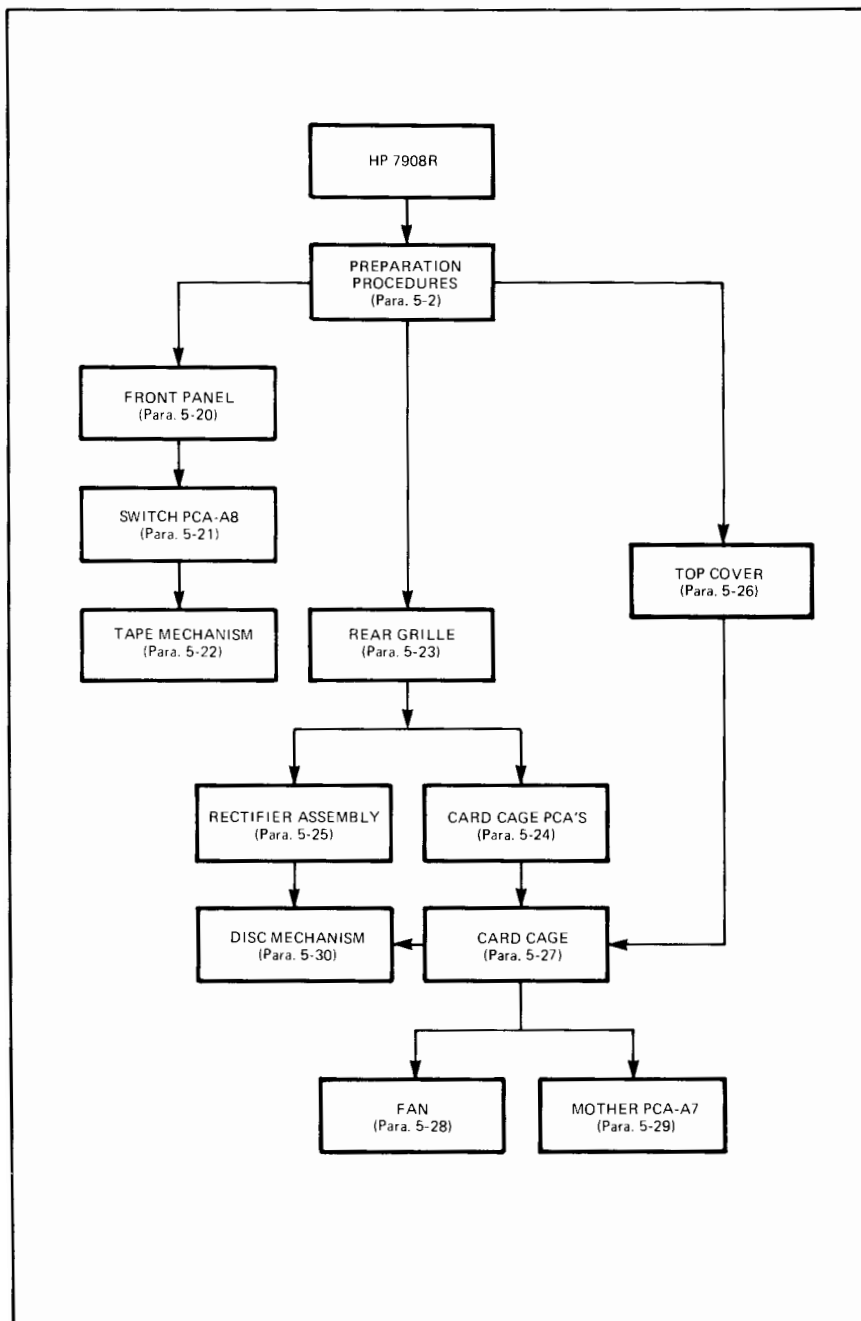
Figure 8-3. Disassembly Aid – Rack Model
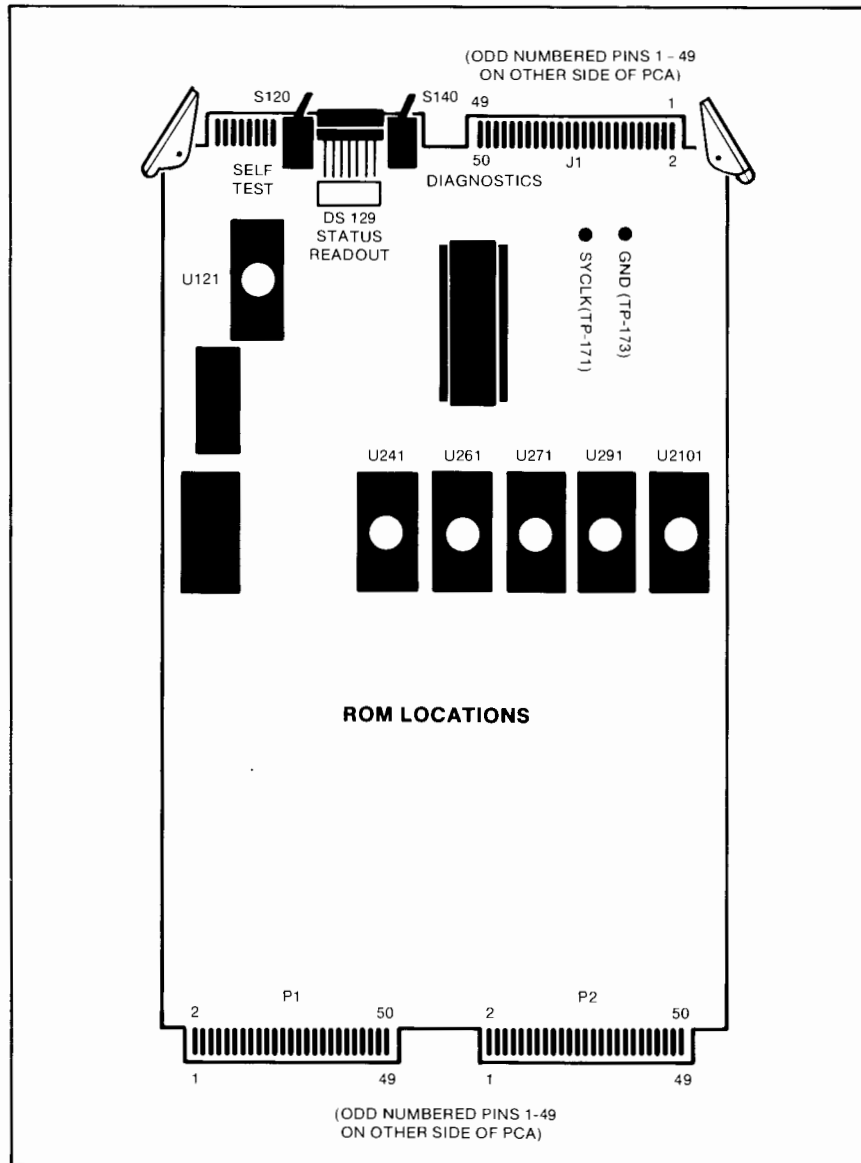
REF 7908CE-8

Figure 9-1. Microprocessor PCA-A5 Layout

HP PART NO.	PRODUCT OPTION # PLUG RATING SPECIFICATION
8120-1351	900 250V BS 1363A
8120-1369	901 250V NZSS 198/AS C112
8120-1689 8120-2857	902 250V CEE7-VII
8120-1378 8120-2371	903 125V NEMA 5-15P
8120-4065	904 250V NEMA 6-15P
8120-1860	905 250V CEE22-VI
8120-2104	906 250V SEV 1011.1959 24507,Type 12
8120-2956	912 220V DHCK 107

Ctry. Codes	Country	HP Opt	Mains V	Hz
531	Afghanistan	902	220	50
481	Albania	902	220	50
721	Algeria	902	220	50
951	American Samoa	903	120	50
762	Angola	902	220	50
357	Argentina	901	220	50
602	Australia	901	240	50
433	Austria	902	220	50
467	Azores	902	220	50
236	Bahamas	903	120	60
525	Bahrain	900	240	50
538	Bangladesh	902	240	50
272	Barbados	900	240	50
423	Belgium	902	220	50
208	Belize (Br. Honduras)	903	120	60
761	Benin (Dahomey)	902	220	50
232	Bermuda	903	120	60
335	Bolivia	902	220	50
793	Botswana	900	240	50
351	Brazil	903	120	60
781	Br. Indian Ocean Terr.	900	240	50
561	Brunei	900	240	50
487	Bulgaria	902	220	50
546	Burma	902	240	50
767	Burundi	902	220	50
243	Caicos	903	120	60
742	Cameroon	902	220	50
122	Canada	903	120	60
733	Canary Islands	902	220	50
941	Canton	900	240	50
244	Cayman Island	903	120	60
754	Central African Republic	902	220	50
756	Chad	902	220	50
337	Chile	902	220	50
570	China (Mainland)	901	220	50
583	China (Taiwan)	903	120	60
301	Columbia	903	120	60
789	Comoros	902	220	50
763	Congo (Brazzaville)	902	220	50
223	Costa Rica	903	120	60
239	Cuba	903	120	60
491	Cyprus	900	240	50
435	Czechoslovakia	902	220	50
409	Denmark	912	220	50
777	Djibouti	902	220	50
247	Dominican Republic	903	120	60
331	Ecuador	9u3	120	60
729	Egypt	902	220	50
211	El Salvador	903	120	60
941	Enderbury Island	900	240	50
738	Equatorial Guinea	900	240	50
447	Estonia	902	220	50
774	Ethiopia	902	220	50
372	Falkland Is. (Is. Malvinas)	900	240	50
405	Finland	902	220	50
427	France	902	220	50
317	French Guiana	902	220	50
790	French Indian Ocean Areas	902	220	50
641	French Pacific Islands	902	220	50
283	French West Indies	903	120	50
755	Gabon	902	220	50
750	The Gambia	900	240	50
512	Gaza Strip	902	220	50

▓ STANDARD

Figure 9-2. Power Cordset Options

Ctry. Codes	Country	HP Opt	Mains V	Hz	Ctry. Codes	Country	HP Opt	Mains V	Hz
429	Germany, Demo. Rep. (E)	902	220	50					
428	Germany, Fed. Rep. (W)	902	220	50	523	Oman	902	240	50
749	Ghana	900	240	50	686	Other Pacific Islands	903	120	60
472	Gibraltar	900	240	50	535	Pakistan	902	240	50
473	Gozo	902	220	50	225	Panama	903	120	60
484	Greece	902	220	50	604	Papua New Guinea	901	220	50
101	Greenland	912	220	50	353	Paraguay	902	220	50
935	Guam	903	120	60	333	Peru	903	220	60
205	Guatemala	903	120	60	565	Philippines	903	120	60
746	Guinea	900	240	50	455	Poland	902	220	50
312	Guyana	903	120	60	471	Portugal	902	220	50
245	Haiti	903	120	60	903	Puerto Rico	903	120	60
215	Honduras	903	120	60	518	Qatar	900	240	50
582	Hong Kong	900	220	50	791	Republic of So. Africa	902	240	50
437	Hungary	902	220	50	485	Romania	902	220	50
400	Iceland	902	220	50	769	Rwanda	902	220	50
533	India	902	240	50	758	St. Helena	900	240	50
560	Indonesia	902	220	50	161	St. Pierre Islands	902	220	60
507	Iran	902	220	50	517	Saudi Arabia	902	220	50
505	Iraq	902	220	50	744	Senegal	902	220	50
419	Ireland	900	240	50	780	Seychelles	900	240	50
508	Israel	903	220	50	747	Sierra Leone	900	240	50
475	Italy	902	220	50	559	Singapore	900	240	50
748	Ivory Coast	902	220	50	770	Somalia	902	220	50
241	Jamaica	903	120	50	568	Southern Asia	900	240	50
588	Japan	903	100	50	622	Southern Pacific Islands	900	240	50
511	Jordan	902	220	50	469	Spain	902	220	50
555	Kampuchea	903	120	50	735	Spanish Africa	902	220	50
779	Kenya	900	240	50	542	Sri Lanka (Ceylon)	902	240	50
580	Korea, Republic of	903	100	60	732	Sudan	900	240	50
513	Kuwait	902	240	50	315	Suriname	903	120	60
553	Laos	903	220	50	795	Swaziland	900	240	50
449	Latvia	902	220	50	401	Sweden	902	220	50
504	Lebanon	902	240	50	441	Switzerland	906	220	50
248	Leeward & Windward Islands	903	120	50	502	Syria	902	220	50
799	Lesotho	900	240	50	783	Tanzania	900	240	50
765	Liberia	903	120	60	549	Thailand	903	220	50
725	Libya	902	240	50	274	Tobago	903	120	60
451	Lithuania	902	220	50	752	Togo	902	220	50
423	Luxembourg	902	220	50	274	Trinidad	903	120	60
566	Macao	900	240	50	684	Trust Terr. of Pacific Is.	903	120	60
759	Madeira Islands	902	220	50	723	Tunisia	902	220	50
788	Malagasy Republic	902	220	50	489	Turkey	902	220	50
797	Malawi	900	240	50	243	Turks Is.	903	120	60
557	Malaysia	900	240	50	778	Uganda	900	240	50
745	Mali	902	220	50	520	United Arab Emirates	900	240	50
473	Malta	902	220	50	412	United Kingdom	900	240	50
741	Mauritania	902	220	50	760	Upper Volta	902	220	50
785	Mauritius	900	240	50	355	Uruguay	901	220	50
201	Mexico	903	120	60	000	U.S.A.	903	120	60
931	Midway Islands	903	120	60	461	USSR	902	220	50
161	Miquelon	902	220	60	307	Venezuela	903	120	60
574	Mongolia	902	220	50	552	Vietnam	903	120	50
714	Morocco	902	220	50	911	Virgin Islands	903	120	60
787	Mozambique	902	220	50	933	Wake Island	903	120	60
792	Namibia	902	240	50	764	Western Africa	902	220	50
536	Nepal	902	240	50	737	Western Sahara	902	220	50
277	Netherlands Antilles	902	220	50	615	Western Samoa	901	240	50
421	Netherlands (Holland)	902	220	50	522	Yemen (Aden)	900	240	50
614	New Zealand	901	220	50	521	Yemen (Sana)	900	240	50
219	Nicaragua	903	220	50	479	Yugoslavia	902	220	50
751	Niger	902	240	50	766	Zaire	902	220	50
753	Nigeria	900	240	50	794	Zambia	900	240	50
579	North Korea	902	100	60	796	Zimbabwe	900	240	50
403	Norway	902	220	50					

1982-01-08

Figure 9-2. Power Cordset Options (cont'd)

		SECTION
REFERENCE		**X**

10-1. ILLUSTRATIONS USED IN THIS HANDBOOK

The following list is an index of the figures and sketches used throughout this handbook.

10-2. TABLES USED IN THIS HANDBOOK

The following list is an index of the tables used in this handbook.

Table 11-1. Service Note Summary

7908-	IMPACT	PREFIX AFFECTED
01A	Disc Backup Tape Cartridges	See Note 1
02	MPU Firmware Update "E"	< = 2205A
03	Tape Read or Certify Errors	< = 2205A
04	Special TIB PCA-A6 Update	2206 thru 2208
05	Write-Off-Track/DWFL Errors	< = 2208A
06	Strain Relief for Cables	All
07	Noisy Disc Mechanism	See Note 2
08	Destructive Write Faults	< = 2224A
09	MPU Firmware Update "F"	< = 2228
10	Tape Mechanism Failures	< = 2241
11	Spindle Ground Strap	All
12	Fan Grounding Update	See Note 3
13	Tape Despooling	2301 to 2310
14	Fuse Update-Rectifier PCA	2331 thru 2333
15	Sticky Spindle Brake	All
16	Tape Cartridge-White Dust Contam.	See Note 4
17	Firmware Upgrade-Rev F to Rev G	All

NOTES:

1. Involves Tape Serials for 88140S: 2XX41 thru 2XX49, and 88140L: 5XX41 thru 5XX48.

2. HP 7908P = Serial No. XXXXA01999
   HP 7908R = Serial No. XXXXA00299

3. Prefixes above 2205 and below 2243.

4. Tapes older than Oct.'83 or with revision number X0XXX-XXXX thru X4XXX-XXXX.

S E R V I C E   N O T E

Supersedes: None

Serial Prefixes affected: A11

Part numbers affected: 07908-6X100

TITLE: Sticky Spindle Brake

APPLIES TO:	All Units ☒		Only Units on Agreement ☐
PERFORM:	Immediately ☐		At PM/Normal Call ☐
	On Failure ☒		Information Only ☐

WARRANTY:	EXTENDED	NORMAL	NONE
LABOR:			X
PARTS:			X
TRAVEL:			X

SERVICE	Return for update ☐	Use as is ☐
INVENTORY	Return for salvage ☐	See text ☒

WARRANTY EXTENDED UNTIL:	N/A

SYMPTOM: A few cases have been seen where the disc mechanism spindle brake did not operate properly. This may be indicated by excessive wear on the brake pad, a screeching sound caused by brake and spindle contact, or possibly a 3. (A9) TERR -- unable to phase lock on disc signal.

Note: The spindle brake is located on the underside of the .7908 disc mechanism. It can be observed after removing the bottom plate.

CAUSE: Improper alignment of the brake plunger and solenoid can restrict the brake from retracting. Improper brake alignment may be due to in-adequate tightening of the screws by the manufacturer.

SOLUTION: Although we cannot set up the brake solenoid as a replaceable part, an adjustment may be made.

The brake operates correctly when it disengages immediately after power on and engages, with an audible click, about 20 seconds after power off. If the brake does not operate as described, follow this procedure.

1. Remove the bottom plate to gain access to the brake assembly. If the brake is engaged onto the spindle, push back the plastic yoke which holds the brake pad to insure that it can retract into the shaft.

If the brake doesn't retract freely, the bracket that the brake is mounted on may need to be bent up/down to let it move freely. Note: the brake may need to be removed to bend the bracket.

2. The thickness of a new brake pad is about 6 mm 3/16th). Attempt to adjust the brake only if there is at least 2 mm (1/16th) of material left. If there is not enough brake material left, contact a mass storage TSE or DMD to see if there are any other solutions available.

22/su   1/84-48

HEWLETT PACKARD

3. Loosen the screws which hold the brake assembly in place. Slide the assembly forward about 1 mm (1/32th"). Tighten the screws.

4. With the disc mechanism out and the bottom plate still off, power up the drive. Check for proper operation of the brake. It should retract on power on and engage about 20 seconds after power off.

5. If the brake still doesn't engage and retract properly, move it forward a little more and try again.

6. If all attempts to adjust the brake fail, replace the mechanism.

S E R V I C E   N O T E

Supersedes: None

Serial Prefixes affected: All

Part numbers affected: 07908-6X100

TITLE: Sticky Spindle Brake

APPLIES TO:	All Units ☒		Only Units on Agreement ☐
PERFORM:	Immediately ☐		At PM/Normal Call ☐
	On Failure ☒		Information Only ☐

WARRANTY:	EXTENDED	NORMAL	NONE
LABOR:			X
PARTS:			X
TRAVEL:			X

SERVICE	Return for update ☐	Use as is ☐
INVENTORY	Return for salvage ☐	See text ☒

WARRANTY EXTENDED UNTIL:	N/A

SYMPTOM: A few cases have been seen where the disc mechanism spindle brake did not operate properly. This may be indicated by excessive wear on the brake pad, a screeching sound caused by brake and spindle contact, or possibly a 3. (A9) TERR -- unable to phase lock on disc signal.

Note: The spindle brake is located on the underside of the .7908 disc mechanism. It can be observed after removing the bottom plate.

CAUSE: Improper alignment of the brake plunger and solenoid can restrict the brake from retracting. Improper brake alignment may be due to inadequate tightening of the screws by the manufacturer.

SOLUTION: Although we cannot set up the brake solenoid as a replaceable part, an adjustment may be made.

The brake operates correctly when it disengages immediately after power on and engages, with an audible click, about 20 seconds after power off. If the brake does not operate as described, follow this procedure.

1. Remove the bottom plate to gain access to the brake assembly. If the brake is engaged onto the spindle, push back the plastic yoke which holds the brake pad to insure that it can retract into the shaft.

If the brake doesn't retract freely, the bracket that the brake is mounted on may need to be bent up/down to let it move freely. Note: the brake may need to be removed to bend the bracket.

2. The thickness of a new brake pad is about 6 mm 3/16th). Attempt to adjust the brake only if there is at least 2 mm (1/16th) of material left. If there is not enough brake material left, contact a mass storage TSE or DMD to see if there are any other solutions available.

22/se

1/84-48

9320-4766 (1/83)

HEWLETT PACKARD

3. Loosen the screws which hold the brake assembly in place. Slide the assembly forward about 1 mm (1/32th"). Tighten the screws.

4. With the disc mechanism out and the bottom plate still off, power up the drive. Check for proper operation of the brake. It should retract on power on and engage about 20 seconds after power off.

5. If the brake still doesn't engage and retract properly, move it forward a little more and try again.

6. If all attempts to adjust the brake fail, replace the mechanism.

S E R V I C E   N O T E

Supersedes:

APPLIES TO:	All Units ☒	Only Units on Agreement ☐
PERFORM:	Immediately ☐	At PM/Normal Call ☐
	On Failure ☐	Information Only ☒

WARRANTY:	EXTENDED	NORMAL	NONE
LABOR:			X
PARTS:			X
TRAVEL:			X

SERVICE	Return for update ☐	Use as is ☐
INVENTORY	Return for salvage ☐	See text ☒

WARRANTY EXTENDED UNTIL:	N/A

Model Numbers: 7908, 7911,
                7912, 7914

Parts Involved: Boxes of five tapes;
                88140L, 88140LC, 88140S, 88140SC

                Individual tapes; P/N 9164-0156, 9164-0127,
                                       9164-0211, 9164-0212

Revision Numbers involved: X0XXX-XXXX through X4XXX-XXXX

TITLE: TAPE CARTRIDGE REPLACEMENT

SYMPTOM: Tape cartridges purchased prior to October 1, 1983, or
          cartridges having a revision number with a second digit
          of "4" or lower stamped on the metal back plate (for ex-
          ample, X4XXX-XXXX) are subject to the following failures.

          . Data loss, may result in auto sparing or verify failures.
          . Shortened tape life.
          . Autoload failures, cartridge fail LED may be on.
          . Cartridge may unload during a read or write with a
            possible off tape status.

          These failures are caused by a white dust that can be
          released from the tape. This dust collects on the cart-
          ridge guide pins, tensioning belt, and the recording sur-
          face of the tape and can cause both read and write errors.
          The contamination can also collect on the tape drive heads.

LR/sg   48/1-84

9320-4766 (1/83)

HEWLETT PACKARD

1 of 2

SOLUTION: All tapes prior to revision "5" should be returned by the
         customer to HP for replacement. The method of replace-
         ment is:

         . UNITED STATES -
           Return tapes to:
               Hewlett Packard Company
               Computer Supplies Operation
               1326 Kifer Road
               Sunnyvale, CA 94086
           Contact CSO sales development (408 720-2343) for details
           and to request a pre-authorized return form. Any questions
           should be directed to Mark Manqueros at CSO, (408) 720-2433,
           COMSYS A500.

         . HPSA -
           Tape replacement will be handled by the sales force 09 group
           in each European country, with the SF09 managers acting as
           the contact person for questions. Replacements will be
           supplied to customers immediately following the return of
           defective cartridges. Dieter Heck, BBN x 2118, COMSYS 6017,
           will be coordinating the program and any questions that
           cannot be answered locally should be addressed to him.

         . ICON -
           The replacement will be handled locally by the Country Support
           Administration Manager and the ACEM's, with the ACEM's coordi-
           nating the replacement to distributors. Please contact them
           for details. If questions cannot be answered by the local
           contacts, please direct them to Joyce Smith, ICON (Div. 18),
           (415) 857-3707.

         . CANADA -
           Canadian customers received the same packet of information and
           preauthorization as United States customers, and certainly that
           replacement procedure will be supported by CSO. But due to
           customs regulations, shipping tapes to CSO across an inter-
           national boundary is slow and complex. For these reasons,
           Canada will set up their own replacement program through the
           Canadian Parts Distribution Center, 2050. Customers should
           call one of the following numbers:
                         Manitoba and West   1-800-387-3154
                         Toronto   671-8383
                         Ontairo   1-800-268-6982
                         Quebec and East   1-800-387-3417
           Any questions should be directed to Rob Young, COMSYS 2050.

HEAD
CLEANING: Please encourage all customers to clean the head and
            capstan regularly; a minimum of once a week. Also,
            the cleaning procedure should be the first step in tape
            drive troubleshooting. For head/capstan cleaning pro-
            cedures, refer to the Operating and Installation Manual
            (07908-90902 or 07912-90902), or the Operator Instructions
            (07908-90901 or 07912-90901) for details.

WARRANTY: . Tape replacement through CSO.
          . Only revision "5", or greater tapes, will be supported by
            DMD. Warranty will not apply to failures caused by use
            of old revision (0 - 4) tapes after July, 1984.

S E R V I C E   N O T E

Supersedes: none

7908 Disc/Tape Drive

Units Affected: 7908P/R
disc drives with serial
prefix less than 2408A.

TITLE: Nonmandatory Firmware
Upgrade From Rev. F
(07908-1X007) to
Rev. G (07908-1X008)
on the 7908 Disc
Drive.

APPLIES TO:	All Units ☒	Only Units on Agreement ☐
PERFORM:	Immediately ☐	At PM/Normal Call ☐
	On Failure ☐	Information Only☒

WARRANTY:	EXTENDED	NORMAL	NONE
LABOR:			X
PARTS:			X
TRAVEL:			X

SERVICE INVENTORY	Return for update ☐	Use as is ☐
	Return for salvage ☐	See text ☒

WARRANTY EXTENDED UNTIL:	none	

SYMPTOM: The new firmware is being implemented to correct the
following problems and inconveniences:

1) DERROR 14 (decimal) or 0E (hex) incorrectly reported
because of a potential, but rare, seek timing problem.
2) No indication of unrecoverable data on a push button
restore operation. (The LED on the Linus will now flash
when unrecoverable data is detected on a restore.)
3) Improper handling of UNLOAD-CLEAR-UNLOAD command sequence
sent from some old 1000 FCOPY routines that would cause
a "write protect" error to be reported even if the tape
wasn't really write protected.
4) The loss of End-of-File marks when the drive attempts to
correct a bad frame.
5) The reporting that the diagnostic test has passed (P.)
when a potentially unrecoverable disc sector is read
during the diagnostic test run from the switches (or
DIAG 1) when a tape is installed. (A 3. dd error will
now be reported.)

PP/sg

48/4-84

9320-4766 (1/83)

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FOR MORE INFORMATION, CALL YOUR LOCAL HP SALES OR SERVICE OFFICE or East (201) 265-5000 ● Midwest (312) 255-9800 ● South (404) 955-1500 ● West (213) 970-7500 or (415) 968-9200 OR WRITE, Hewlett-Packard, 1820 Embarcadero, Palo Alto, California 94303. IN EUROPE, CALL YOUR LOCAL HP SALES or SERVICE OFFICE OR WRITE, Hewlett-Packard S.A., 7, rue du Bois-du-Lan, P.O. Box, CH-1217 Meyrin 2 - Geneva, Switzerland. IN JAPAN, Yokogawa-Hewlett-Packard Ltd., 1-27-15, Yabe Sagamihara City, Kanagawa Prefacture, Japan 229.

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ACTION: This is a nonmandatory change, however, kits
are available if the customer chooses to upgrade
his drive at his own expense. There will be no
FSI update required (use existing Rev. F until
gone). New and exchange parts are available from
CPC under the following part numbers:

New EPROM Kit 07908-10008

Exchange EPROM Kit 07908-19008

07908-89081	U241
07908-89082	U261
07908-89083	U271
07908-89084	U291
07908-89085	U2101
07908-89086	U121

Using the CS/80 REV command, the numbers returned
are 2-0 for all for all EPROMs.