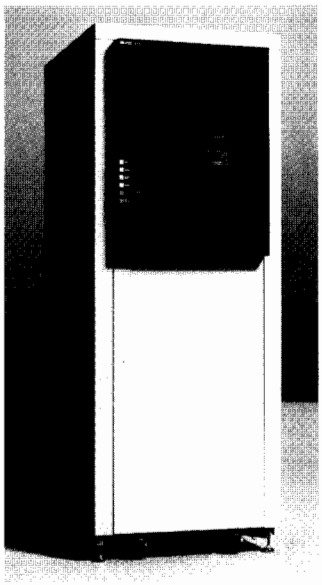
HP 7978A/B



Part No. 07978-90039
For use with binder No. 9282-0683

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NOTICE

This Handbook is intended only for service personnel trained in its use by Hewlett-Packard. It is designed as a quick reference guide to commonly used service information. The information contained here is highly condensed from other manuals and this volume is not intended to be a substitute for, but rather a supplement to those manuals.

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SECTION 1

PRODUCT INFORMATION

[1] INTRODUCTION

The 7978A/B is a streaming 1/2 inch reel to reel, read-after-write magnetic tape drive mounted in a upright cabinet. It is designed to provide high speed data backup in two standard data formats (GCR - 6250 CPI and PE - 1600 CPI). Tape speed is 75 IPS during data transfer and 250 IPS during rewind. The command set used is similar to that used on the 7976A product.

The 7978A/B has No capstan since it is not required to start and stop tape rapidly. A buffer tape tension arm and speed sensor are used to control the two reel motors that maintain tension and speed. A ceramic coated head is used to improve tape head life. The 7978A/B has extensive data error detection/correction circuitry and a built-in retry algorithm which reduces the hard error rate. To decrease back-up time, an "immediate report" host/drive interaction technique is used. A front panel display indicates soft errors, self-tests, and diagnostics information.

[2] OPTIONS

The available options are:

135 Delete cabinet for 7978B only. No hardware for installation is needed. For sale to OEMs only.

[3] SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

LINE VOLTAGE	90-125 VAC	198-250VAC
LINE FREQUENCY	48/66 Hz	

If the line voltage drops below 77/154 VAC for 500 ms or more, the drive will require an operator for recovery.

Current Requirements 6.2 A at 120 VAC, 3.7 A at 208 VAC.

Power Requirements 397 Watts

MECHANICAL SPECIFICATIONS

Cabinet Standard vertical 56-inch EIA cabinet.

Vibration 0.015 inch displacement at 5 to 55 Hz in the vertical plane.

Max Acceleration at 55 HZ = 2.37gs

MEDIA SPECIFICATIONS ANSI standard X3.40-1976, 1.5 mil substrate tape only.

[4] ACCESSORIES

	Customer Order Number	HP Number
- Magnetic Tape, 2400ft (box of 10)	92150F	
- Magnetic Head Cleaner Kit	92193H	
contains:		
- Tape Head Cleaner, 4 oz bottle		8500-1914
- Tape Head Cleaner, 4 oz can		8500-1251
- Foam tipped swabs		9300-0468
- Lint-free paper cloth		9310-4028

SECTION 2

ENVIRONMENTAL/INSTALLATION/PM

[1] ENVIRONMENTAL CONSIDERATIONS

ESD CONSIDERATIONS

5 Kv discharge without any perceived errors
15 Kv discharge without permanent hardware failure.

OPERATING LIMITS

Temperature	16.0 to 32.0 degrees C., 60 to 90 degrees F.(limited by media)
Rate of Change	20°C (36°F)/hr non-condensing
Humidity	20 to 80 percent non-condensing (limited by media)
Altitude	0 to 3.0 kilometers, 0 to 10,000 ft.

NON-OPERATING LIMITS

Temperature	-40°C to +75°C (-40 to 167°F) (storage or shipment)
Humidity	90% at 65°C (149°F) (storage or shipment)
Altitude	15.3 KM (50,000 ft.)
Media	+5 to 48 degrees C 20 To 80% non condensing (storage)

[2] INSTALLATION CONSIDERATIONS

UPGRADE INSTALLATION

The following information pertains to the 88702A Upgrade Kit which converts a 7978A to a 7978B. Installation instructions are provided with every upgrade kit.

NOTE

For billing: Enter '7978A' into the "REPAIRED UNIT" field, enter the serial number of the 7978A into the "SERIAL NUMBER" field, enter '88702A, 7978A to 7978B' into the "COMMENTS" field. Enter 'IN' (for 'installation') into the "REPAIR CLASS" field.

CONTENTS OF THE 88702A UPGRADE KIT

-Master Controller Board	07978-66554
-Supply Reel Motor Assembly	07978-67926
-Sensor Harness	07978-61624
-Servo Controller EPROM	07978-89909
-"B" Label for S/N Plate	07978-84310
-Voltage Label (chassis)	07978-84312
-Voltage Label (rack)	07978-84313
-Cable Ties (3)	1400-0538
-Installation Instructions	88702-90000

REQUIRED TOOLS

-13 mm wrench (box or open-end)
-small Pozidriv screwdriver
-pair of wire cutters
-2.5 mm hex (allen) driver
-3.0 mm hex (allen) driver
-standard screwdriver
(approx. 1/4-inch flatblade)

[3] PREVENTIVE MAINTENANCE

TRANSPORT CARE

After installing the HP 7978A/B, the only maintenance task required is to frequently clean the tape path.

Regular cleaning improves performance and reduces maintenance costs. A clean tape path (and clean tapes) reduces read/write errors and lengthens tape life.

The following definitions are provided to help you identify tape-related transport failures and their causes:

BROWN STAINING: Low humidity levels cause brown deposits of oxide to accumulate on the head. As the stain grows, tape-to-head seperation increases until the head becomes useless. Once ruined, the head must be replaced. Brown staining cannot be removed with ordinary cleaning solvent. Your only defense is to maintain a humidity level greater than 35% and less than 45% in the tape drive and storage areas.

CLEAR FILMING: Every time a tape is used it sheds oxide and binder which forms a clear film upon the head. If not removed with cleaning solvents at frequent intervals, tape-to-head separation errors occur. Clear films can build up until cleaning with solvent is no longer effective and replacement of the head becomes necessary.

POLE TIP EROSION: Improper cleaning of the tapes and tape drive causes premature wearing of the soft metal in the tape head. The failure shows up as a loss of signal amplitude.

DETERMINING A CLEANING SCHEDULE

How often your customers clean their drive depends upon three factors: usage, operating environment, and tape quality. The following should be used as guidelines for developing an appropriate schedule.

MINIMUM: A thorough cleaning of the tape path every shift (eight hours). Minimum cleaning is appropriate under the following conditions:

- less than 10 reels are used per shift (eight hours).
- there is no visible debris on tape head after each reel of tape.

- there is no reason to suspect a high level of dust in the computer center from vacuuming, printers, delivery of supplies, etc.

NORMAL: A thorough cleaning of the tape path after every 10 reels of tape (roughly every 1.5 hours of continuous running). Normal cleaning is appropriate under the following conditions:

- more than 10 reels are used per shift.
- there is no visible debris on the tape head after each reel of tape.
- there is no reason to suspect a high level of dust in the computer center.

HEAVY: A thorough cleaning of the tape path after *each reel* of tape under the following conditions:

- visible debris appears on the tape head after each reel of tape.
- uncleaned interchange tapes from outside your computer center are being used.
- uncleaned new tapes which have been used only once or twice are being used (new tapes usually contain additional debris from the slitting process during manufacture).

SPECIAL: One thorough cleaning of the tape path under the following conditions:

- abnormal dust level in the computer center because of custodial activity, equipment moves, supply delivery, etc.
- extended periods (days) of tape drive inactivity prior to use.

If using a vendor other than HP, make sure that the cleaning fluid is a high quality solution of 80% Freon TF and 20% isopropyl alcohol. Avoid solutions of Freon TF and other solvents.

Do not use soap and water on the tape path. Soap leaves a thick film and water may damage electronic parts.

Do not use standard hub cleaners or strong alcohol solutions (>20%). These solutions damage the tape guides.

Do not use aerosol cleaners; even if they are freon TF. The spray is difficult to control and often contains metallic particles which damage the tape head.

WIPING MATERIALS

Use non-abrasive lint-free cloth and swabs. These *must* be discarded after use.

Do not use facial tissues. Although seemingly effective, they introduce highly abrasive lint into the tape path.

If the head does not wipe clean using a foam tipped swab, you can remove the foam tip and use the the cotton portion for wiping.

If the head still does not wipe clean, try cleaning the head with alcohol followed by an HP cleaner to remove the alcohol residue from the head.

CLEANING PROCEDURE

a) Pour a small amount of solvent into a clean container; such as a small UNWAXED paper cup.

b) Dab all cloths and swabs into the container, as needed.

c) While applying pressure in both directions of the tape path, and perpendicular to the tape path as well, clean the following surfaces:

- read/write head
- fixed guides on the head plate
- cleaner block

d) Inspect the rollers. Clean them ONLY if visibly dirty. Roller bearings are greased, use cleaning fluid sparingly.

e) Discard all used cleaning materials.

SECTION 3

CONFIGURATION

[1] EXTERNAL CONFIGURATION/SWITCHES

The 7978A/B is supported on HP3000 series computers 37,39,40,42,44,48,64,68 and 70;HP1000 series computers A/L; HP9000 series 500 and series 200.

HP3000 Series 37,39,40,42,44,48,64,68 & 70.

7978A/B = Type 24, Subtype 2, Unit 0, Driver HIOTAPE2 (Manual Reply)

7974A = Type 24, Subtype 3, Unit 0, Driver HIOTAPE2
7978A/B = Type 24, Subtype 10,Unit 0, Driver HIOTAPE2 (Auto Reply)

HP1000 A; use Interface Driver ID.37 and Device Driver DD.24 on all RTE-A Operating Systems.

HP-IB loading may be altered on the HP-IB Interface PCA-A6 by placing the appropriate load DIP in the socket provided. No load DIP will result in an HP-IB loading of ONE. Maximum cable length is 6 metres on a dedicated GIC.

[2] SETTING THE HP-IB ADDRESS

The HP-IB address is set using the buttons on the front panel.

Go offline-
If not offline, press the OFFLINE/RESET Button to place the drive offline. The OFFLINE light should be lit.

Set display to addressing-
If the ADDRESS light is not illuminated, press the TEST/ADDRESS Button to toggle the ADDRESS light on.

Select addressing mode-
Press the ENTER Button to select the addressing mode.

Select address-
Each press of the TEST/ADDRESS Button increments the number shown in the display. Holding the button down causes the display to increment about twice a second. Release the button when the desired address is shown.

Enter address into drive-
If the ENTER Button is pressed within 5 seconds after the address you want is shown in the display, the tape drive initializes to that address.

If neither the ENTER Button nor the TEST/ADDRESS Button is pressed within 5 seconds, the drive aborts the addressing mode; shown by the hexadecimal display going OFF. The addressing mode may also be aborted by pressing any other button than the ENTER or TEST/ADDRESS buttons.

[3] VERIFICATION PROCEDURE

A. After the tape drive has been uncrated and positioned in place, open the rear panel to gain access to the power cord. Verify that the voltage selection and fusing are correct for the area.

B. Verify power receptacle polarity and voltage level prior to connecting the drive to the power source.

C. Verify Offline:

1. Apply power to the drive (the power switch is located behind the rear panel). The tape drive should perform the power-on selftest. If the selftest passes, 70% of the drive circuits have been verified - proceed to step 2. If the selftest fails, use the error message and Section 5 of this handbook to determine the cause of the failure.

2. Clean the tape path in accordance with cleaning procedures in Section 2 of this handbook.

3. Mount and load the HP tape that came with the tape drive.

4. Enter diagnostic Test 24 and perform auto gain adjust (see Section 5 for procedure). If test passes, proceed to Step 5. If the test fails, proceed to Section 5 and determine the cause of the malfunction.

5. Enter diagnostic Test 21. If the test passes, proceed to Step 6. If this test fails, use error message and Section 5 to determine the cause of the failure.

6. Enter diagnostic Test 22. If this test passes, proceed to the on-line verification. If this test fails, use error message and Section 5 to determine cause of the failure.

D. Verify Online:

NOTE

The 7978A/B Tape Drive must be properly configured on the HP 3000 system to perform the online verification.

1. Power off the tape drive and perform an orderly shutdown of the HP 3000 computer system.

2. Connect the HP-IB cable to the drive and to the host system. Consider the length of the HP-IB cable and its required loading (the 7978A/B is shipped as a one-load device, it can be increased to a load factor of three; see Section 3 for procedure).

3. Power on the tape drive and set the HP-IB address (see Section 3 for this procedure).

4. Load the Diagnostic Utility System Tape (DUS) and perform IOMAP to see if the CPU can identify the tape drive.

5. Restart the HP 3000 computer system using a coolstart, coldload, or reload.

6. Run Program PD471A. It is recommended, as a minimum, that Sections 3,4,5,20 Steps 40 and 41 be executed to verify the online operational status of the drive.

NOTE

The Update EEPROM is meant to be used by the channel program to update the HP-IB address, the module Compute_EEPROM_CK_SUM, Diagnostic Test 19, and the Firmware Update Module. Any other use is not authorized.

[4] FIRMWARE UPDATE PROCEDURE

1. Mount and load the bug fix tape on 7978A/B.
2. Run Test 30.
3. Enter the firmware update revision number supplied in the bug fix instructions.
4. A successful power-on self test should be performed automatically upon a successful update loaded into EEPROM.

NOTE

The bug fix tape is unloaded as the update is being written into EEPROM.

5. Auto Gains should be recomputed using Test 24.

If the 7978A/B lost power during the update, the EEPROM should be re-initialized and the firmware update procedure be re-executed.

Any error messages resulting from a firmware update should be checked against the explanation of these messages in this handbook. Appropriate corrective action should be taken. Most error messages indicate an operator error. An EEPROM failure, however, indicates the EEPROM is malfunctioning and should be replaced.

Re-initialization of the EEPROM is provided at power-on time before diagnostics are executed. This undocumented feature will occur when the drive is turned on and the following three buttons are pressed at the same time: load, rewind and test/address. Remember, initialization of EEPROM will only occur when the buttons are pressed and the power is simultaneously turned on. No prompt will be given to tell you when the buttons should be pressed.

Finally, whenever a ROM change occurs the EEPROM must be zeroed. This is accomplished, after the new ROMs are loaded, by using the Firmware Update Procedure steps previously described; or a firmware update can be done using the old EEPROMs. If the latter

approach is taken, the RESET Button must be pressed during the update. (The RESET Button must be pressed while the count down from 8 is being displayed.)

The version number stored in EEPROM is an encoded value. It is used as part of the firmware update to determine eligibility for firmware updates and is saved as a reference for service engineers to quickly determine the firmware vintage with Test 27. The version number is decoded as follows:

bit 7 -Indicates whether the update is for the 7978A/B or the 7974A. 7974A = 1.

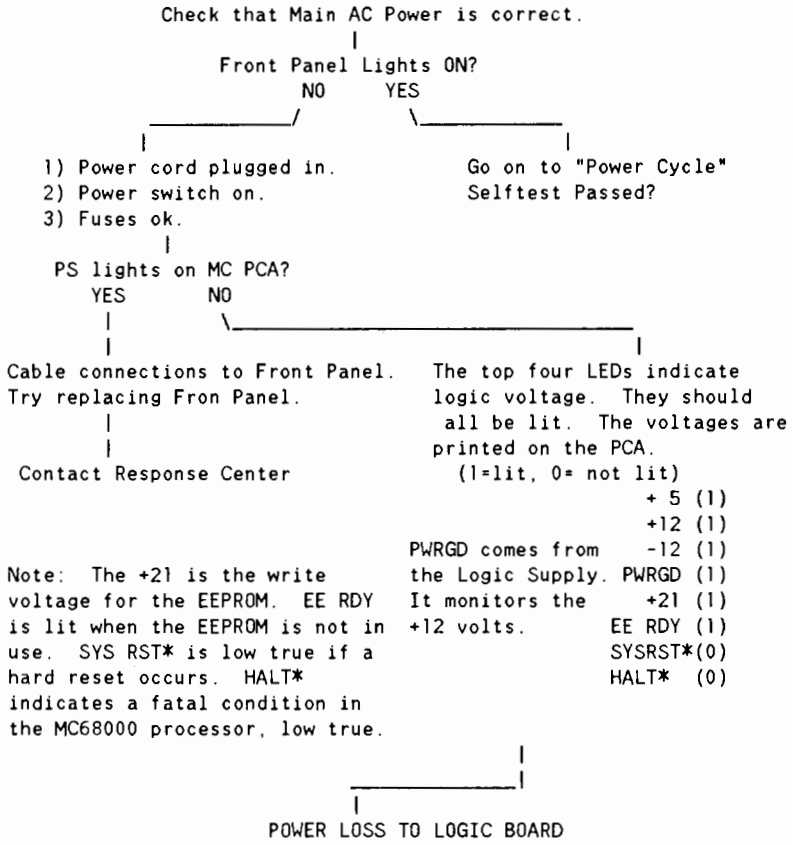
bits 6-0 -The version number of the update. The initial ROM release would always be 0 for bits 6-0.

Notification of downloaded routines developed for the 7978A/B will be through Service Notes. Instructions for the use of a routine will be in the applicable Service Note.

SECTION 4

TROUBLESHOOTING

[1] CHECKOUT PROCEDURE



The LEDs show the voltage outputs of the Mother Board to the Master Controller. The top four LEDs are voltage indicators, the

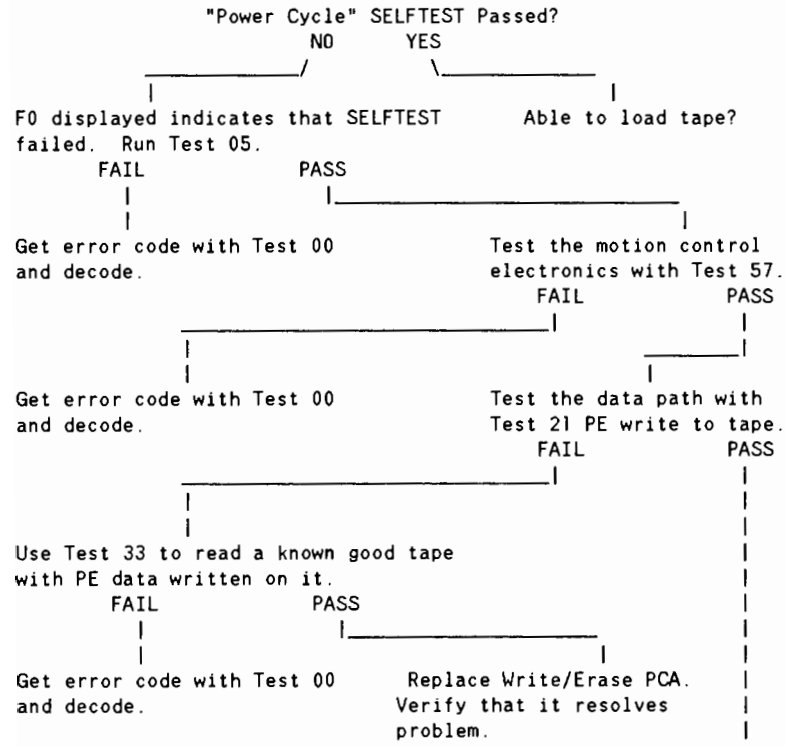
bottom four indicate CPU processing "status". If an LED is off, check the voltage at the test point on the edge of the PCA. IF no LEDs are lit on the Logic board, it does not necessarily mean that the MC PCA is bad.

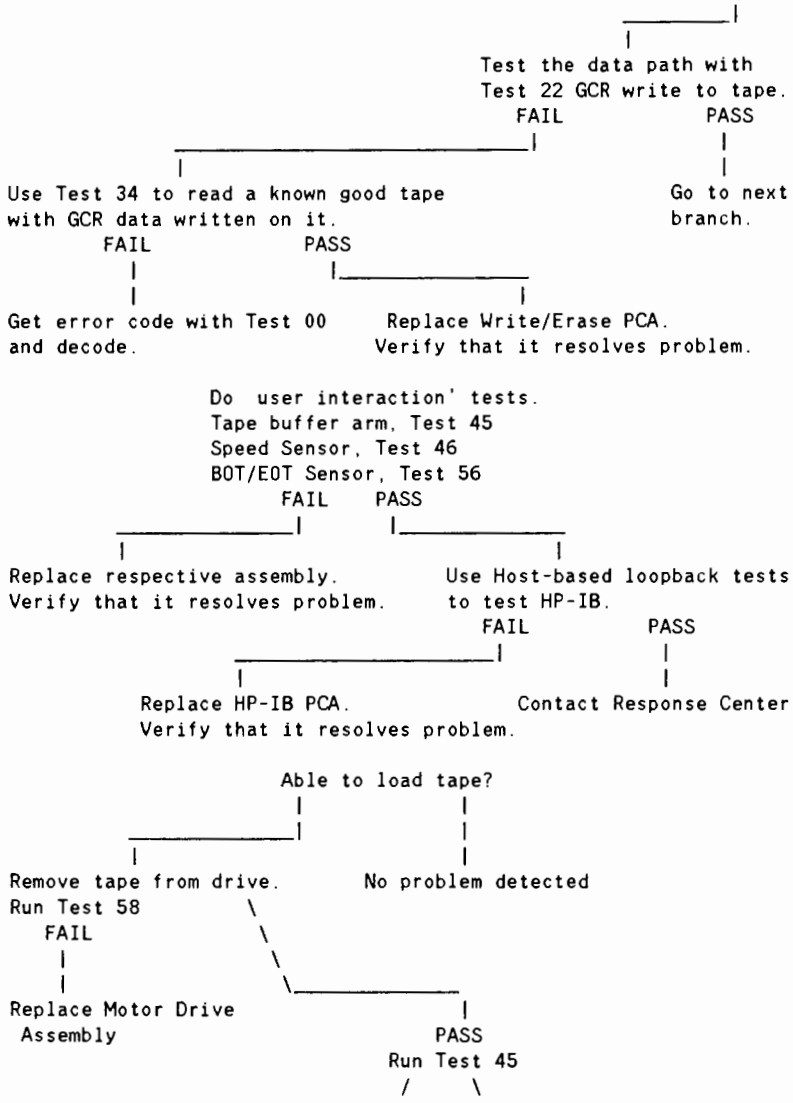
There is a possibility that power is OK to the card cage but it is being lost before it gets to the LEDs. Check the power at other places.

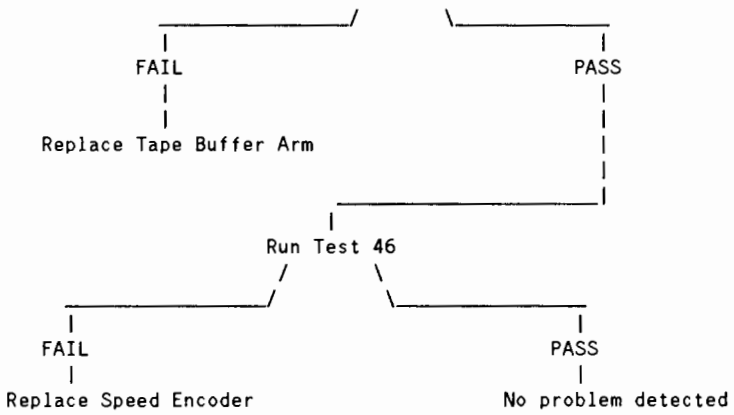
Take a look at the Motor Driver Assembly
Look at the +12 and -12 on the Preamp Board,
the logic supply and the Motor Driver Assembly.

If it doesn't show up one place, but shows up everyplace else, it's probably the Mother Board. If power doesn't appear, it is the Power Supply.

**** TURN POWER OFF BEFORE CHANGING ANY PCA ****




Test the data path with
Test 22 GCR write to tape.
FAIL
PASS
Use Test 34 to read a known good tape
with GCR data written on it.
Go to next
branch.
FAIL
PASS
Get error code with Test 00
and decode.
Replace Write/Erase PCA.
Verify that it resolves problem.
Do user interaction' tests.
Tape buffer arm, Test 45
Speed Sensor, Test 46
BOT/EOT Sensor, Test 56
FAIL
PASS
Replace respective assembly.
Verify that it resolves problem.
Use Host-based loopback tests
to test HP-IB.
FAIL
PASS
Replace HP-IB PCA.
Verify that it resolves problem.
Contact Response Center
Able to load tape?
Remove tape from drive.
Run Test 58
FAIL
No problem detected
Replace Motor Drive
Assembly
PASS
Run Test 45



What is the symptom?

Do you have a focus for your suspicions?

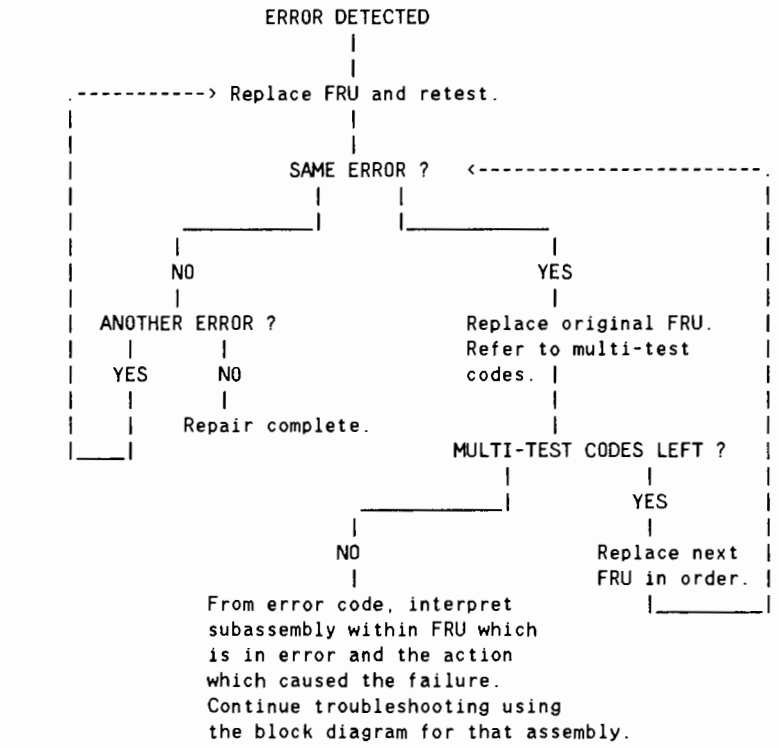
If not, then put the tape drive into a "maximum use" mode that puts the most stress on the electronics. Use the following utilities:

Utility Test 25; sets the drive to NOT loop on test.
Utility Test 26; sets the drive to loop on test.
Utility Test 31; sets the drive to reposition tape on each test.
Utility Test 32; sets the drive to "walk" the tape through the test.
Utility Test 01; Displays the ERROR LOG.
Utility Test 02; Clears the ERROR LOG.

DECODING ERROR CODES (Test 00)

The error code is a FRU number relating to a specific assembly or PCA. A location diagram is on the "plastic shield" that covers the capacitors and motor supply board.

Follow this order of troubleshooting whenever possible:



POWER SUPPLY PCA OUTPUT SPECIFICATIONS

OUTPUT #	PIN #	NOM. VOLT (V)	TOTAL ERROR BAND (25 DEGREES C) (NOM. INPUT) (V)	P-P RIPPLE (mV) (STEADY LOADS) 120 Hz	P-P RIPPLE (mV) (STEADY LOADS) 20 KHz	P-P RIPPLE (mV) (STEADY LOADS) 0-50MHz
1	9-15	+5.1	5.01 - 5.19	70	60	100
2	18	+12	11.6 - 12.4	--	120	240
3	1-8	-12	-11.6 to -12.4	--	120	240

Common Mode Output ripple current (wideband) 600 mA P-P
Overvoltage threshold limits 5.5 to 7.0 volts
Maximum output change; low line to high line @200 watts

OUTPUT #	OUTPUT VOLTAGE
1	10 mV
2	0.10 V
3	0.10 V

[2] POWER-ON SELFTEST RESULTS

(Applicable for firmware Revision Level A3.00. In addition to the results table in this section, see diagram of the Card Cage Locator in Section 8).

INITIAL DRIVE CONFIGURATION:

1. All cables to card cage except Front Panel were disconnected.

2. Reel servo cables disconnected from MD PCA.

3. All PCAs in card cage except MC were removed.

4. Door Open/Closed has no effect on the results. In other words, we are using the backplane logic P/S, MC PCA, and Front Panel only at the start of the tests.

Re-install PCAs/cables in sequence shown on the chart i.e. MC only, MC and HP-IB only, MC, HP-IB, and Write only, etc.

TO COMPLETE CHECKOUT OF THE DRIVE:

A. SERVO SYSTEM

   1. Reconnect cable to J24 on SC PCA.

   2. Reconnect cables from reel motors to MD PCA.

   3. Run Test 58 to verify basic servo system. Reel motor cables can be connected up one at a time if desired; test will not indicate a failure. However, no reel motion will occur if cable is unplugged.

B. READ HEAD AND PREAMP, BASIC READ CHAIN

   1. Reconnect cable to J23 on Read PCA (from Preamp).

   2. Run Test 33, 34, or both to verify basic read functions (this assumes you have available a tape created by Test 21 or Test 22).

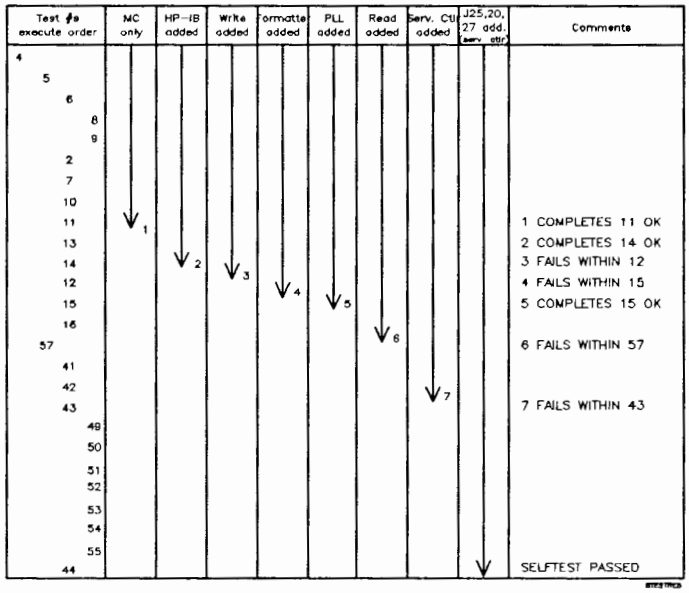
C. WRITE HEAD AND BASIC WRITE CHAIN

   1. Reconnect cable to J22 on Write PCA (from Write Head).

   2. Run Test 21, 22, or both to verify basic write functions.

NOTE

Drive will pass the power-on selftest with any or all of the cables denoted by an asterisk (on the board location diagram) disconnected. The power-on test will also pass if the MD PCA is bad or disconnected.



Power-On Selftest Results

Selftest now says "PASS", however only the logics and some cables have been tested.

[3] POWER-ON TEST SEQUENCE

```
4                   Call Test 5, then Test 57
  5
      6             MC Kernal Test - calls Test 8, then
                    Test 9
          8         MC RAM walking bit test
          9         MC Timers test
      2             Clear Diagnostic Error Log and set
                      default diagnostic environment
      7             Front Panel LED test
      10            MC EEPROM read test
      11            MC Data Buffer RAM test
      13            HP-IB Internal Loopback test
      14            HP-IB/MC Interface test
      12            Write Assembly Write Clock test
      15            MC/FMT/PLL/WRT digital loopback test
      16            Read Assembly test
  57                Servo Contr. Power-on selftest;
                      calls Tests 41,42,43,44
      41            Servo Contlr./MC Interface test
      42            Servo Contlr. power-on selftest;
                      verify 8051,RAM,PROM
      43            Calls Tests 49 to 55
          49        EOT/BOT Write Enable test
          50        Servo. Contlr. connector test
          51        Relay hard shutdown test
          52        Zero crossing test
          53        DAC test
          54        Speed Encoder test
          55        In-position and gap interrupt test
      44            Servo Contlr. gap handling test
```

[4] TAPE CHANNEL MAPPING

PREAMP CHANNEL	PHYSICAL TAPE CHANNEL	PREAMP CHANNEL	PHYSICAL TAPE CHANNEL
1	5	6	1
2	7	8	6
3	3	9	4
4	P	7	8
5	2		

SECTION 5

DIAGNOSTICS

[1] OVERVIEW

INTRODUCTION

The 7978A/B's built-in diagnostics are grouped as Power-on selftest and Operator/Host-requested diagnostics. The power-on selftest covers the Master Controller assembly, HP-IB assembly, digital data path, Servo Controller assembly, partial testing of the BOT/EOT sensor, and speed encoder loop. Power-on selftest covers as much of the drive as possible without tensioning tape and performs the testing in less than 30 seconds. (70-75% of the drive is tested). Operator/Host requested diagnostics are initiated by an Operator from the Front Panel or by a Host from the HP-IB. The diagnostics which are requested from an Operator or Host are grouped into utilities and tests. A utility returns status, performs a function (update EEPROM, set autogain values), or changes the environment in which a diagnostic test is executed. A diagnostic test will perform a set of tasks involving hardware attempting to detect and isolate a failure.

Diagnostics are accessed through the HP-IB and Front Panel. The HP-IB is used by the Host, while the Front Panel is a keyboard used by an Operator. The Host requests a diagnostic by sending a diagnostic test number. The appropriate test is executed and the error message is returned to the Host. The Host may also request some special diagnostics through secondary protocol commands. An Operator requests a diagnostic from the Front Panel. An error message is displayed on the Front Panel upon completion of the diagnostic, if an error exists. When a diagnostic fails, the error message will be displayed on the Front Panel until the RESET Button is pressed. Once the RESET Button has been pressed, the Front Panel will reflect the status prior to execution of the diagnostic.

BUS ERROR

A Bus Error will occur whenever the Master Controller accesses certain subsystems which do not respond within an allowable amount

of time. Since the Bus Error can occur right in the middle of a CPU instruction, it is not possible to return to the correct program location following a Bus Error. Rather than take the chance of allowing the Master Controller to execute unpredictably, the drive will shut down the controller following a Bus Error. An error code will be displayed on the Front Panel indicating the FRU the Master Controller was attempting to access when the Bus Error occurred. The power will have to be cycled in order to restart.

UNEXPECTED EXCEPTION HANDLING

The MC68000 CPU is capable of responding to a number of unexpected conditions which should never occur. Should one of these conditions be detected by the CPU a hardware or firmware failure is indicated. The 7978A/B will respond to these unexpected exceptions by displaying an error code indicating which exception occurred and shutting down as with a Bus Error.

EXCESSIVE SOFT ERROR RATE WARNING

The excessive soft error rate warning is displayed on the Front Panel when the error threshold has been met or surpassed. The error threshold used will be large enough to prevent a warning from occurring for acceptable soft error rates. The soft error rate is computed, using a command count and the retry count for the currently loaded tape, after each command is processed. The warning message is cleared from the Front Panel when the error rate declines below the error threshold, or a load command is executed. If, at the time of unloading the tape, the error rate equals or exceeds the maximum number of errors allowed on a tape the dirty tape path warning message will be displayed. The dirty tape path warning message will be displayed until the RESET Button is pressed or a tape is loaded.

TAPE USAGE ODOMETER

The amount of tape that passed over the head is recorded dynamically in RAM and statically in EEPROM. Once the RAM odometer reaches 20,000 feet of tape, which is about four reels of 2400 foot tape, the EEPROM odometer is increased by one. The tape usage odometer was made available for the CE to help monitor head wear.

DIAGNOSTIC LOGS

The built-in diagnostics use two logs: the diagnostic error message log and the data error log. The diagnostic error message

log contains the ten most recent failed diagnostic test error messages.

The data error log is used by diagnostics to compute the excessive error rate warning message. A new entry is used whenever a load command is executed. This is a cyclic log, twenty entries deep, which contains:

- The time that this tape was loaded.
- Hard error count.
- Soft error count.
- Number of reportable commands since the tape was loaded.

This log is only available to the Host via an image dump.

* The time value used is in 54.58 ms increments from when the drive was powered up.

[2] TABLE OF DIAGNOSTICS

DIAGNOSTIC FRU TABLE

Abbreviation	Description	FRU Error Code (MSB, hexadecimal)
SC	Servo Controller Assembly	1x
MDRIVE	Motor Drive Assembly	1x
FP	Front Panel Assembly	3x
MC	Master Controller Assembly	4x
F	Formatter Assembly	5x
HP-IB	HP-IB Assembly	6x
WE	Write Electronics Assembly	7x
RE	Read Electronics Assembly	8x
PLL	Phase-Lock Loop Assembly	9x
	Runtime-Detected Errors	Dx
	Protocol Errors	Ex
	Remote Status	Fx

Assemblies that are not isolated to a FRU are:

P	Preamp Assembly	----
Head	Head Assembly	----
Motors	Two Motors	----

MB	Mother Board	----
Tape	Tape Medium	----

DIAGNOSTIC TESTS

Codes*	Test # (Decimal)	Test	FRUs Tested**
L,U	0	Display Error	N/A
L,U	1	Display Error Log	N/A
R,L,U	2	Clear Error Log	N/A
L,U	3	Power-on selftest failure override.	
R,L,T,I,Off	4	Power-on selftest	MC, HP-IB, F, WE, PLL, SC
R,L,T,I,Off	5	Master Controller power-on test	MC, HP-IB, F, WE, PLL, SC
R,L,T,I	6	Kernal MC Tests	MC
R,L,U	7	Front Panel Display	FP
R,L,T,I	8	Walking RAM Tests	MC
R,L,T,I	9	Timer Tests	MC
R,L,T,I	10	EEPROM Read Test	MC
R,L,T,I	11	Data Buffer Tests	MC
R,L,T,I	12	Write Clock Test	WE
R,L,T,I	13	HP-IB Internal Loopback	HP-IB
R,L,T,I	14	HP-IB DB Loopback	HP-IB, MC
R,L,T,I	15	Digital Loopback	F, PLL, WE, MC
R,L,T,I	16	Read Board Present test	RE
R,L	17	not used	
R,L	18	not used	
R,L,T	19	EEPROM Write Test	MC
L,U	20	Front Panel Confidence Test	FP
R,L,T,I,W,On	21	Write PE Data Block	MC, F, PLL, WE, P, RE, SC, Head, Motors,Tape Medium
R,L,T,I,W,On	22	Write GCR Data Block	Same as Test #21
R,L	23	not used	
R,L,U	24	Auto Gain Value Update	RE
L,U	25	Set To Single Looping	N/A
L,U	26	Set To Infinite Looping	N/A
L,U	27	Display MC Revision	N/A
L,U	28	Display Tape Odometer	N/A
L,U	29	Display Densities Supported	N/A
L,U	30	Local Firmware Update	N/A
R,L,U	31	Set Write Test Reposition	N/A
R,L,U	32	Set Write Test To Walk	N/A
R,L,T,I,W,On	33	Read PE Data Block	MC, F, PLL, WE, P, RE, SC, Head, Motors,Tape Medium

* Reference the Diagnostic Test Code Table.
** Reference the Diagnostic FRU Table.

RB,L,T,I,W,On	34	Read GCR Data Block	Same as Test #33
RB,L,U,On	35	BOT EOT Erase Test	
RB,L,U,On	36	BOT EOT PE Write Test	
RB,L,U,On	37	BOT EOT GCR Write Test	
RB,L,U,On	38	BOT EOT PE Read Test	
Rb,L,U,On	39	BOT EOT GCR Read Test	
L,U	40	Worst Case Servo Reposition	
R,L,T,I,Off	41	SC MC Handshake	SC, MC
R,L,T,I,Off	42	SC Power-on Test	SC
R,L,T,I,Off	43	SC Board Test	SC
R,L,T,I,Off	44	SC Gap Interrupt Test	SC, F, MC
L,T	45	SC Buffer Arm Interactive Test	
L,T	46	SC Speed Encoder Interactive Test	
R,L	47	not used	
L,U	48	Display SC Revision	N/A
R,L,T,I,Off	49	SC Optical Sensor Test	SC
R,L,T,I,Off	50	SC Connector Test	SC
R,L,T,I,Off	51	SC Shutdown Test	SC
R,L,T,I,Off	52	not used	
R,L,T,I,Off	53	SC DAC Test	SC
R,L,T,I,Off	54	SC State Machine Test	SC
R,L,T,I,Off	55	SC Interrupt Test	SC
L,T	56	SC BOT EOT Sensor Test	SC
R,L,T,I,Off	57	SC Power-on Tests	SC
L,T	58	SC Motor Drive Interactive Test	SC,MDRIVE
L,T	59	SC Motor Drive Waveform Test	SC,MDRIVE

The following tests are applicable on the 7978B only.

R,L,T,I	60	General Checkout	MC,HP-IB,F,WE, PLL,SC,HEAD,TDU MDRIVE,F,P
R,L,T,I	61	Tape displacement unit	TDU
	62	not used	
L,U	63	Display autogains	
R,L,U	64	Auto Gain Checkout	RE
R,L,T,I,W	65	Wellness Test	RE,WE,SC,MDRIVE, F,P,HEAD,MC
L,U	66	Display error rate	
L,U	67	Display buffer usage	
L,U	68	Display Queue usage	
L,U	69	Turn display usage off	
	70-99	not used	

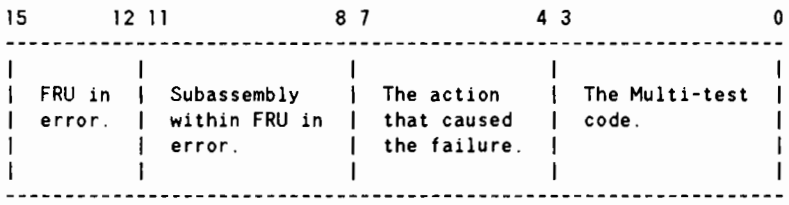
* Reference Diagnostic Test Code Table.
** Reference the Diagnostic FRU Table.

DIAGNOSTIC TEST CODE TABLE

R -- Remote access is from the Host via the HP-IB. (7978A and B)
RB-- Remote access is from the Host via the HP-IB. (7978B only)
L -- Local access is by user input from the Front Panel.
U -- The diagnostic is a utility.
T -- The diagnostic is a test.
I -- A diagnostic test may also be executed in an infinite loop, rather than the default of single execution.
W -- A read or write tape test may be "walked" down the tape, rather than the default of repositioning after each data block.
On - Remote access to diagnostics only when drive is online.
Off- Remote access to diagnostics only when drive is offline.

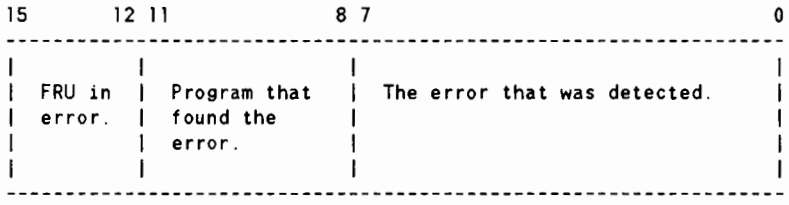
ERROR FORMATTING

GRAPHICAL BREAKOUT OF THE DIAGNOSTIC ERROR MESSAGE



OR

Protocol and Firmware Generated Error Message.



[3] INDIVIDUAL DIAGNOSTIC DESCRIPTIONS

Following is a list of each diagnostic and what it does. The term "local access" will be used when the Front Panel interface is used to access a diagnostic, while the term "remote access" will be used to designate Host access to the diagnostic via the HP-IB interface. If neither of these terms are used, the diagnostic is available from both interfaces. The term "secondary" will mean that a secondary interface protocol command is needed to request the diagnostic. If a diagnostic can be executed multiple times before returning the result, the term "looping" will be used. The tape tests will reposition after each data block unless the diagnostic environment is set to "walk" down the tape. The term "Walking" will be used to indicate the walking capability. Tape position is considered lost after leaving diagnostics.

NOTE

All numbers in this section are in hexadecimal format unless otherwise noted.

Test 0 -- Display the most recent diagnostic error message. Local access, Utility.

Test 1 -- Display diagnostic error message log. The most recently logged error will be displayed first. Subsequent entries will be displayed each time the ENTER Button is pressed until all errors in the log have been displayed.(10 max.) Local access, Utility.

Test 2 -- Clear the diagnostic error log and set the diagnostic environment to the default values of single execution and reposition of tape tests. Resets RAM based odometer to zero. Utility.

Test 3 -- Power-on selftest failure override. This utility will clear the command rejected status after power-on selftest failure. Utility.

Test 4 -- Run complete 7978A Power-on selftest. Calls tests 5 and 57. Test time = 40s. Test,Looping

Test 5 -- Power-on selftest, which is always performed at power-on, calls tests 6, 2, 7, 10, 11, 13, 14, 12, 15 and 16. Note: Tests 41 through 44 are

Short Power on

performed at power-on but not as part of this power-on selftest. Test, Looping. Test time = 31s.

Test 6 -- Tests verify the MC68000 CPU registers, addressing modes, and that the checksum for the Master Controller ROM is correct. It also calls tests 8 and 9 to check the RAM and timers. This test will not affect current status. Test, Looping. Test time = 7s.

Test 7 -- The Front Panel LEDs are lit and extinguished one at a time, followed by rotating 00, 11, ..., FF on the two-digit hexadecimal display. Local access; however the Host has indirect access to this utility by requesting the Power-on selftest. Utility. Test time = 4s.

Test 8 -- The RAM walking bit tests will cover the entire Master Controller RAM. A walking one test is performed on a pattern of zeroes followed by a walking zero on a pattern of ones. The RAM will be tested a single byte at a time. The data in the byte being tested is saved prior to testing and is restored upon completion of the test. Test, Looping. Test time = 2s.

Test 9 -- The three timers in the MC6840 PTM chip on the Master Controller are verified that they count down to zero and provide the correct status. Test, Looping. Test time = 2s.

Test 10 -- The EEPROM chips on the Master Controller are verified to be correct by reading some predefined addresses containing constant values, and performing a checksum. Test, Looping. Test Time = 2s.

Test 11 -- This test will verify the Data Buffer's functionality and perform a marching RAM test on the Data Buffer's static RAM. A background pattern of 000 is written with verify from the lowest Data Buffer address to the highest Data Buffer address. The marching RAM test will then write with verify 3FF from the lowest Data Buffer address to the highest Data Buffer address. Once at the highest address, the pattern is changed to 000 and descends

to the lower address verifying what was written as it descends. Test, Looping. Test time = 5s.

Test 12 -- The Write Clock on the Write Electronics assembly is verified by setting it to run at PE and GCR frequencies. The Write Clock will be returned to the data rate of the currently loaded tape's density upon completion of this test. A status bit is checked to see if the R/W Head is plugged in and responsive. Test, Looping. Test time = 1s.

Test 13 -- The HP-IB internal loopback verifies that the FIFOs and the statuses are correct. Host commands will be ignored during testing. Test, Looping. Test time = 1s.

Test 14 -- Data is looped from the HP-IB to the Data Buffer and back to the HP-IB. This test will verify the HP-IB/Master Controller interface. Host commands will be ignored during testing. Test, Looping. Test time = 15s.

Test 15 -- The digital loopback will test the Master Controller, Formatter, Phase-Locked Loop and the Write Electronic assemblies. GCR and PE IDs, gaps, tape marks and data records are written (digitally) and verified. This test will create its own data 0, 1, ..., FF, 0, ... The loopback data is sent from the Data Buffer through the Write Formatter to the Phase-Locked Loop, through Data Detect and Deskew, into the Read Formatter and back into the Data Buffer. The data is checked for correctness upon re-entry into the Data Buffer. Several tests are run to verify that each density operates properly and that track errors and Data Buffer error conditions can be detected. Whenever a failure is detected, a loopback is performed without the Phase-Locked Loop assembly. If this test passes, the Phase-Locked Loop is reported to be the failure. Test, Looping. Test time = 15s.

Test 16 -- The Read board test will toggle a bit on the Read board to determine if it is present. Test, Looping. Test time = 2s.

Test 17 -- Not used.

Test 18 -- Not used.

Test 19 -- The worst case data patterns are written into a test word in EEPROM. By writing these patterns, a stuck bit (having a value of zero) will be found indicating the cells are saturated (worn), an internal address line is not working, or +21 volts is not available to the EEPROM chips. This test can be executed approximately 20,000 times, using two words for testing, before EEPROM cell wearout may occur. Test. Test time = 1s.

Test 20 -- This test will allow the user to press any button and have a code from 1-7 displayed on the Front Panel display. The uppermost button when pressed will display a '1', while the lowest button will display a '6' when pressed. When the door is opened a '7' will be displayed. This test requires pressing more than two buttons at once to exit. Local access, Test.

Test 21 -- A single PE data record is written. A fixed data record will be created using binary data from 0 to 255. The data will be written with verify. This test will be considered 'failed' if any retries are necessary to write the data record or a hard error occurs. If this test is looped, the Front Panel will indicate the total number of times the test was executed; not the number of times the test failed or passed. A scratch tape must be used for this test, otherwise any and all data may be unrecoverable on an application tape. If the loaded tape is not identified as PE, a PE tape ID will be written. The drive must be online for remote access. Test, Looping, Walking. Test time = 7s.

Test 22 -- A single GCR data record is written. This test is identical to Test 21, except the test pattern is the seven-byte worst case pattern: 4, 32, 152, 188, 32, 4, 188, 0 and a GCR ID is written if the tape loaded is not identified as GCR. Test, Looping, Walking. Test time = 12s.

Test 23 -- Not used.

Test 24 -- The default autogain values are recomputed by creating a gains tape by writing to the loaded scratch tape and reading the tape to adjust the gain values. The following procedure is required

to run the test: press the REWIND Button, press the RESET Button, finally press the ADDRESS Button. After the gain values for a density are computed, the tape will stop for a short time and the display will show the gain average. The range of acceptable values for average gain is E0 hex (high) to 60 hex (low). If any track has a gain value less than 60 hex, the status LED will be red, otherwise the LED will be amber. Local access,Utility. Test time = 30s

Test 25 -- This utility will set the local looping environment to single test execution. Remotely-requested diagnostic tests and utility diagnostics are defaulted to single execution. Local access, Utility.

Test 26 -- This utility will set the local looping environment to infinite execution. The RESET Button must be pressed and held to exit a test in the looping environment. The display will indicate the number of times (in hex) a test has been run. When the executing test first fails, the red pass/fail LED is lit and remains lit until the test is terminated. Local access, Utility.

Test 27 -- This utility displays the current Master Controller firmware ID and revision number on the Front Panel display. It will remain on the display for five seconds. Local access, Utility. Test time = 5s.

Test 28 -- This utility displays the static portion of the Tape Usage Odometer. The most significant word of the odometer is displayed first by alternating the two bytes in the display. The least significant word can be viewed in the same manner by pressing the ENTER Button. Local access, Utility.

Test 29 -- This utility will light the density LEDs for five seconds. Local access, Utility. Test time = 7s.

Test 30 -- The firmware may be updated in EEPROM using an HP firmware update tape. A Version ID number must be input from the Front Panel by the Operator. The tape will be searched for a record containing valid firmware updates with a Version ID matching the Front Panel entry. If no matching record is found on the tape, an error message will be displayed and

no update will be done. A successful update will automatically run the power-on selftest. An unsuccessful update will generate an error message. When this occurs, repair the drive, initialize the EEPROM, and repeat the update. (The initialization process consists of holding the 3 buttons LOAD, REWIND, and TEST/ADDRESS, and simultaneously restoring power to the drive.) Auto Gains should be recomputed using Test 24. Note: The bug fix tape is unloaded as the update is being written into EEPROM. Local access, Utility.

Test 31 -- This utility will set the diagnostic environment to reposition after Tests 21, 22, 33 and 34. This is the default mode which is set at initialization. Utility.

Test 32 -- This utility will set the diagnostic environment to "walk" Tests 21, 22, 33 and 34 down the tape. Utility.

Test 33 -- A single PE data record is read from a prerecorded tape. If the tape passes EOT, a rewind operation will occur after the data block is read. This test will 'fail' whenever a retry or hardware error occurs. Test, Looping, Walking.

Test 34 -- A single GCR data record is read from a prerecorded tape as in Test 33. Test, Looping, Walking.

Test 35 -- This utility will run the servo at PE speed with the erase head on. Once EOT or the RESET Button is pressed, the tape will be rewound to the BOT marker. Utility.

Test 36 -- This utility will run the servo at PE speed with the write and erase electronics on. A GCR ARA BURST is written, which is an all 1's data pattern. When the tape reaches EOT, or the door is opened, or the RESET Button is pressed, the tape will be rewound. The rewind operation will continue until BOT, the door is opened or the RESET Button is pressed. If the BOT marker is detected, the tape is stopped and positioned below the BOT/EOT sensor. Whenever the RESET Button is pressed the utility is aborted. Note: A mounted tape must be reloaded by pressing the load Button upon completion of the test to bring the drive online. Utility.

Test 37 -- This utility will run the servo at GCR speed with the write and erase electronics on. A GCR ARA BURST is written, which is an all 1's data pattern. Once the tape reaches the EOT marker or the RESET Button is pressed, the tape will rewind. Utility.

Test 38 -- This utility will run the servo at PE speed with the read electronics on. Once the tape reaches the EOT marker or the RESET Button is pressed, the tape will rewind. Utility. This test will not identify bad tape.

Test 39 -- This utility will run the servo at GCR speed with the read electronics on. Once the tape reaches the EOT marker or the RESET Button is pressed, the tape will rewind. Utility.

Test 40 -- This utility will run the servo at PE speed in a worst case reposition pattern. The RESET Button must be pressed to exit this utility. Local access, Utility.

Test 41 -- The Servo Controller interface with the Master Controller is tested by sending a data byte from the Master Controller to the Servo Controller and waiting for the ones complement of the data byte to be returned from the Servo Controller. This handshake sends the data 1, 2, ..., 255, and 0 to the Servo Controller. Test, Looping.

Test 42 -- Servo Controller Power-on selftest, which is always performed at power-on or after a RESET command from the Master Controller. This test will verify the 8051 CPU's internal RAM and PROM. Test, Looping. Test time = 2s.

Test 43 -- The Servo Controller will perform a board test by sequencing through Tests 49 - 55. Test, Looping. Test time = 3s.

Test 44 -- Servo Controller gap handling is verified by simulating gap interrupts. This test will not move tape. The Data Detect and Deskew is put into an idle state upon completion of this test and the Servo Controller will be reset. Test, Looping. Test time = 3s.

Test 45 -- The buffer arm is tested with the aid of an operator. Movement of the buffer arm by the operator is indicated on the Front Panel display. Correct operation is indicated by the numbers in the display changing from 0 to 1 to 3 to 7 as the operator moves the buffer arm down. Local access, Utility. Hold RESET Button for about two seconds to exit test.

Test 46 -- The speed encoder may also be fully tested using an operator to move the speed encoder and to watch the Front Panel display for the correct response of the hardware. Turning the encoder clockwise will cause the numbers in the display to increment, counter-clockwise rotation will cause the numbers to decrement. Local access, Utility counts 00-FF. Hold RESET Button for about two seconds to exit test.

Test 47 -- Not used.

Test 48 -- This utility displays the current Servo Controller firmware revision number on the Front Panel display. The revision number will remain on the display until the RESET Button is pressed or five seconds have elapsed. Local access, Utility.

Test 49 -- This tests the BOT, EOT, and Write Enable circuitry and detects problems in the BOT and EOT parts. The Write Enable signal is checked to verify that it propagates from the Servo Controller to the Write Electronics Board. Test, Looping. Test time = 2s.

Test 50 -- The Servo Controller checks to make sure that connectors J25, J26, J27 on the Servo Controller Board are connected. Test, Looping. Test time = 2s.

Test 51 -- This tests to make sure that the Servo Controller can open the hard shutdown line that controls the relay on the Motor Drive Board. Test, Looping. Test time = 2s.

Test 52 -- This tests the zero-crossing detector by writing minimum and maximum values to the Servo Controller DAC. Test, Looping. Test time = 2s.

Test 53 -- This tests Servo Controller DAC circuitry. Test, Looping. Test time = 2s.

Test 54 -- This tests the Servo Controller speed encoder state machine. Test, Looping. Test tome = 2s.

Test 55 -- This tests the Servo Controller in-position interrupt circuitry by generating one in-position interrupt and checking to see that the interrupt propogates through its latches. Test, Looping.

Test 56 -- This is an interactive BOT/EOT sensor test. The Front Panel display will reflect the current status of the sensor. The RESET Button must be pressed to exit the test. Local access, Utility.

Test 57 -- This is the Servo Controller power-on selftest called by the Channel Program. Tests 41, 42, 43, and 44 are called by this driver. Test, Looping. Test time = 7s.

Test 58 -- This interactive test will provide a sequence of stimuli for the motors and the motor drive assembly. Pressing the ENTER Button will cause the Servo Controller to sequence to the next pattern. This test will continue until the RESET Button is pressed. Local access, Utility. Tape not mounted and door closed.

Test 59 -- This interactive test will provide a sequence of scope loops for the servo system. Pressing the ENTER Button will cause the Servo Controller to sequence to the next pattern. This test will continue until the RESET Button is pressed. The tape drive door must be closed and a tape should not be mounted to run this test. Local access, Utility.

7978 B only

Test 60 -- General checkout - This test is a general checkout test for the entire machine. It requires that a tape be threaded on the machine but not necessarily loaded. The following sequence of tests are then run:

Test 05 - Power-on selftest
Test 57 - Servo power-on selftest. Drive tensions and loads tape

Test 65 - Wellness test
Test 61 - Tape displacement unit

Test, Looping, walking (wellness only), use scratch tape. Test time = 9 min.

7978B only

Test 61 -- Tape displacement unit - This test checks to see if the tape displacement unit (TDU) is engaged while the tape is stopped and at what point on the tape it is retracted when the tape moves. Tape must be loaded to run this test and the test will destroy data beyond the tape position but not before it. Three passes on the tape are used to test the TDU.

Pass 1 Write a section of track 6 and reposition within it.

Pass 2 While stopped, turn on the write head to begin writing track 4. Start the tape and write a fixed distance

Pass 3 Read back over the tape measuring the length of track 4 data. The length indicates the point at which the TDU was retracted.

If looped, the test proceeds slowly down the tape and aborts when EOT is reached. Test, Looping, use scratch tape. Test time = 45s

Test 62 -- Not used

7978B only

Test 63 -- Display autogains - This test displays all of the current auto gain values on the Front Panel. Pressing the ENTER Button scrolls to the next value.

number of values	definition	status light	density light
9	GCR EEPROM gain values	green	6250
1	GCR autogain offset	amber	6250
	(only valid after a GCR load or write GCR command)		
9	PE EEPROM gain values	green	1600

*See note on gain values under Test 64. Local access, Utility.

7978B only

Test 64 -- Local gain check - This test performs the same function as Test 24 (autogain), with the following exceptions.

1) The EEPROM gain values are not affected by the test.
2) The gain values determined by the test are displayed on the Front Panel; GCR values after the GCR test, and PE values after the PE test. The average is displayed first (red STATUS indicates that one or more of the 9 tracks are out of specification). Pressing the ENTER Button steps the display through readouts of the individual track gain values for the 9 tracks (STATUS LED is green). Because individual track gains are displayed, the gain range is not displayed when the ENTER Button is depressed as is the case with Test 24.
3) No password is needed to run the test.
4) At the completion of the test the tape is not unloaded, but a PE ID is written and the tape reloaded.

Local access, Utility, use scratch tape.

NOTE: The autogain values are not directly proportional to the read amplitudes. A value of '00' indicates that the the amplitude is less than 30% of nominal.

7978 Bonly

Test 65 -- Wellness test - This test writes then reads a tape in PE and GCR, storing the error rates for use by Test 66. A tape must be loaded before running the test. The test writes approximately one quarter of the tape in GCR using record sizes increasing from 1K to 32K, then rewinds and reads the tape. A PE ID is then written and the write/read cycle is repeated for PE. If the diagnostic environment is set to "walk", the test will write until EOT (the entire tape), and will also read the same amount. Whenever the drive is performing a retry (reads, writes, or ID), the message "A4" will appear in the display. Pressing the ENTER Button will cause the current pass being written to or read from to be bypassed. The test will continue with the next pass. If a write pass is in process the next read pass will only read as far as the tape was written.

Test, Looping, Walking, use scratch tape. Test time = 8 min.

7978 only

Test 66 -- Display Error rate - This utility displays the error rates obtained from the previous execution of Test 65. Both hard and soft error rates are displayed, "soft" being recovered errors and "hard" being unrecovered errors. The number of hard errors is cumulative for the duration of Test 65. The number of soft errors is the average rate per pass. If a pass is aborted prior to completion, the data is not entered into the rate unless it is the first pass. Eight values are displayed, with the ENTER Button being used to scroll from one to the next.

Error rate value	Lights: density	write	status	Resolution
GCR write soft	6250	on	amber	average
GCR write hard	6250	on	red	
GCR read soft	6250	off	amber	average
GCR read hard	6250	off	red	
PE write soft	1600	on	amber	average
PE write hard	1600	on	red	
PE read soft	1600	off	amber	average
PE read hard	1600	off	red	

Local access, Utility.

7978 B only

Test 67 -- Display buffer usage - This test turns the display usage environment on to display buffer usage. Whenever the drive is online, The amount of data in the buffer will be displayed in the two-digit display as a hexadecimal value indicating the number of kilobytes (1024) in the buffer. Exception: If the buffer is full the display will stay at "FF" and not roll over to 0. Local access, Utility.

7978 B only

Test 68 -- Display queue usage - This test turns the display usage environment on to display command and report queue usage. Whenever the drive is online, and writes are currently being performed, the number of commands in the command queue will be displayed in the two-digit display as a hexadecimal number. When reads, moves, readaheads, backspace moves or backward moveaheads are being performed or the report queue is being purged of readaheads, the display will then be indicating the number of reports in the report queue. Local access, Utility.

7978 B only

Test 69 -- Turn display usage off - This test turns off the display usage environment setting it back to the default power-on state. Only one of the usages, buffer or queue, may be displayed at a time. When one is turned on the other is turned off (if it was on). This test turns both off. Local access, Utility.

[4] DIAGNOSTIC ERROR MESSAGE DESCRIPTIONS

Error messages are generated whenever a problem occurs, either at runtime or when executing a diagnostic test. These error messages are stored in the Error Log. The Log contains the ten most recent error messages.

The error message cannot be written to the Front Panel or returned to the Host in its entirety. For that reason, the error message is divided into two halves. The first half (MSB) of the error message contains the failed FRU and the subsystem, within the failed FRU, which was detected as an error. The second half (LSB) of the error message contains a multi-test code and a code indicating what action was used to cause the failure, or a firmware or Host protocol error. The multi-test code is used when a diagnostic test covers more than one, unique interface or hardware function which may cause the diagnostic isolation to a specific FRU to be incorrect.

When errors occur during execution of diagnostic tests of the Formatter Assembly or the Phase-Lock Loop (clock recovery) Assembly, a second, 16-bit status word is also generated and logged. This second word may also be recalled and viewed.

The Host will request the error message when a diagnostic fails.

Diagnostics requested from the Front Panel call diagnostic Test 0 to display the error message when the test is completed.

NOTE

In the 7978A, any error detected in the Servo Controller is reported as a Master Controller D2xx error. Individual errors that caused the Master Controller D2xx error could be seen, but only by running a selftest. Therefore, these errors could only be seen if there was a failure of the selftests run during power up or if there was a failure after manually running the appropriate selftest from the Front Panel. The error codes could not be read in the Front Panel if the error occurred during normal operation of the drive.

The 7978B makes all error codes available at the Front Panel, even if the error occurred during normal operations. Both the Master Controller D2xx error codes and the specific errors that caused the D2xx code can be seen by executing Test 1. For errors involving the Formatter Assembly or Phase-Lock Loop (Clock recovery), the second, 16 bit error word can be viewed by pressing the ENTER Button after executing Test 1.

NOTE

All numbers in this section are in hexadecimal format unless otherwise noted.

DIAGNOSTIC ERROR CODES

The following categories of errors are covered in the order shown

4-Digit Error Codes

2-Digit Error Codes

4-DIGIT ERROR CODES

REPLACEABLE FRUs

"D" ERROR	Specific Error Codes	Servo	Motor Drive	Front Panel	Master Cntlr	For-matter	HP-IB	Write	Read	PLL
D253	1001-1004	X1								
	1010	X1								
D254	1021	J25 D								
	1022	J26 D								
	1023	J27 D								
	1024-102F	X1								
	1030-103D	X1								
D255	1040-1047	X1			X2					
	1050-1057	X1			X2					
	105D-105F	X1			X2					
D256	1060-1064	X1								
D25C	1070	X1			X2					
D25E	1080-1082	X1								
	1090	X1	X2							
D256	10D1-10D5	*								
	10D2-10D3	X1								
	10DA	X1			X2					
	10E0-10EE	*								
	10F0	X1								
	1210-12F0	X1								

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NOTE

X1 designates an assembly to be replaced first, X2 designates an assembly to be replaced second, and so on.

The "*" means that this error code would not normally be seen and you should call the factory for further information.

The letter "D", in the Servo column, means "disconnected".

REPLACEABLE FRUs

"D" ERROR	Specific Error Codes	Servo	Motor Drive	Front Panel	Master Cntlr	For-matter	HP-IB	Write	Read	PLL
	3F00			X1						
	4110-4160				X1					
	4220-4230				X1					
	4310-4360				X1					
	4370-4380				X1		X2			
	4390-43A0				X1					
	4410-4470				X1					
	4510-4570				X1					
	5111-53A4				X3	X2		X4		X1
	6110-6220						X1			
	7110-7140							X1		
	84XX-8FXX								X1	
	9111-93A4				X3	X2		X4		X1

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NOTE

X1 designates an assembly to be replaced first, X2 designates an assembly to be replaced second, and so on.

The 7978B makes all error codes available at the Front Panel, even if the error occurred during normal operations. All error codes can be seen by executing Test 1. The specific error codes (2nd column in the preceding two tables) apply to the 7978B only. The "D" errors apply to both the 7978A and 7978B.

1xxx Servo Controller Assembly FRU

10xx A general problem was found with the Servo Controller

100x Load errors. (Master Controller Error Code D253)

1000 No error. Load was accomplished successfully.
1001 Can not turn the Motor Drive on.
1002 Over-tension shutdown.
1003 Under-tension shutdown.
1004 Timeout; buffer arm not at midrange point in time.

101x Emergency shutdown errors. (Master Controller Error Code D253)

Catastrophic error--emergency shutdown.

1010 Buffer Arm out of normal operating range.

102x Hardware failures. (Master Controller Error Code D254)

Hardware failures.

1021 Servo Controller detected disconnect on J25.
1022 Servo Controller detected disconnect on J26.
1023 Servo Controller detected disconnect on J27.
1024 Servo Controller detected possible Buffer Arm Assembly failure.

NOTE

The error codes, **1027** to **102A**, apply to the hardware on the Servo Controller PCA that translates the waveform from the speed encoder into information understood by the Servo Controller.

1027 Servo Controller detected a failure in its external counter See previous NOTE.
1028 Servo Controller detected a failure in the forward-direction bit. See previous NOTE.
1029 Servo Controller detected a failure in its internal counter. See previous NOTE.
102A Servo Controller detected a failure in its quadrature circuitry. See previous NOTE.

102D Servo Controller detected a BOT/EOT sensor test failure. Possible problem with comparator level-shifting circuitry.

NOTE

The Servo Controller tests Motor 1 (top motor) on the Servo Controller PCA by sending it known voltages; above and below 0 volts and then above and below -6 volts. Voltages on either side of 0 volts test the DAC for loading voltage. Voltages on either side of -6 volts test the DAC for correct operating voltage. In the process, some other components are checked.

Motor 1 needs an input that is the sum of a) the voltage from the DAC (speed) and b) the voltage from the Buffer Arm corresponding to the position of the arm (tension). During execution of diagnostic Test 53, the Servo Controller blanks out the Buffer Arm input to the summation circuits and applies voltages around 0 and-6 volts, noting its DAC.

If an error between 102F and 1032 occurs, first ensure that the Buffer Arm has not introduced an erroneous value. Execute Test 45. If the Buffer Arm has been checked and the error is either 1031 or 1032, check the power supply. If both the Buffer Arm and power supply are not the problem, or if Buffer Arm is working properly and the error is either 102F or 1030, the problem could be in the DAC, the summation circuitry, or the comparators.

102F The Servo Controller DAC failed under 0 volts. See previous NOTE.

103x Hardware failures. (Master Controller Error Code D254)

These messages indicate failure of selftests.

1030 The Servo Controller DAC failed over 0 volts. See previous NOTE.

1031 The Servo Controller DAC failed under -6 volts. See previous NOTE.

1032 The Servo Controller DAC failed over -6 volts. See previous NOTE.

1033 Over-tension during the drive test (exists as a safeguard; tape must not be mounted and threaded when executing Test 58)

NOTE

Errors **1038** thru **103D** are power-on selftest failures. These are NOT reported to the Master Controller because to do so would interfere with the capabilities of the Servo Controller during the time it is talking to the Master Controller. The least significant byte of these error codes are shown on the LEDs on the Servo Controller PCA (i.e. 38 through 3D). Read the LEDs from the top one downwards.

An amplified discussion of the use of these LEDs is under error code **10F0**.

1038 Hung while resetting the Processor. See previous NOTE.
1039 ROM checksum error. See previous NOTE.
103A Internal (inside 8051) RAM failure. See previous NOTE.
103B External RAM failure (walking ones). See previous NOTE.
103C External RAM failure (walking zeros). See previous NOTE.
103D External RAM failure (marching test). See previous NOTE.

104x **Invalid dual-ported RAM values. (Master Controller Error Code D255)**

There is an emulated 2-port RAM between the Servo Controller and the Master Controller. This simulates a shared-data area. Communications to the Device Program always has two copies; one is kept in the Servo Controller and one in the Master Controller. This error says that the value sent to the Servo Controller has been rejected -- the problem probably lies with the Master Controller.

If these error codes are seen, they are probably indicating an intermittent problem.

NOTE

Error codes **1040** through **105F** mean that the Servo Controller has received an invalid number. The most probable cause is a problem in the Master Controller and Servo Controller interface.

1040 thru **1047** The format 104n is used for NORMAL mode. The n specifies the address in the Dual-Ported RAM which contains an invalid value.

1050 thru 1057 The format 105n is used for DIAGNOSTIC mode. The n specifies the address in the Dual-Ported RAM which contains and invalid value.

105D Invalid value of Sense Select parameter in Sensor Test.
105E Invalid value of Interrupt Select parameter in Interrupt.
105F Invalid value of Load Control parameter in Patch Firmware Diagnostic.

106x Runtime errors. (Master Controller Error Code D256)

Errors detected during runtime (not during a diagnostic).

(Servo Controller errors **10Dx** and **10Ex** are also under Master Controller error code **D256**).

1060 The Servo Controller detected an "in-position" echo failure.
1061 The Servo Controller detected a gap echo failure. Same reason as error 1060 above.
1062 EOT marker too long (or tape is too shiny)--detected while moving forward.
1063 EOT marker too long (or tape is too shiny)--detected while moving in reverse.
1064 No tension loss on Unload. Speed encoder may be developing drag or Buffer Arm may be obstructed or sticking.

107x Command in the wrong context. (Master Controller Error Code D25C)

1070 Rewind requested when servo was not moving at the proper reverse velocity. Probably a problem with the interface between the Servo Controller and Master Controller--if intermittent, could be problem in MC firmware.

108x Positioning errors. (Master Controller Error D25E)

1080 Reposition overflow. Reposition required movement over too long a distance. Possible firmware failure.
1081 An "in-position" interrupt occurred while the drive was not moving. SC problem, tape slip, or "stiction."
1082 Computed and actual direction of the "in-position" point conflict. SC problem, tape slip, or "stiction."

109x Master Controller Error Code D259 -- Safety shutdown errors.

1090 Safety shutdown. Voltage requested from the motor drive was more than it should have been while at stop.

NOTE

If the door is open and a tape is loaded, tapping the Buffer Arm, even lightly, will cause the Motor Drive to initiate a safety shutdown. The Servo Controller will issue a **1090** error code, "Safety Shutdown".

10Dx Firmware error. (Master Controller Error Code D256)

These error codes should never be seen; but if they do appear, they will most likely be followed immediately by a more recognizable failure. If any of these **10Dx** or **10Ex** errors reappear after replacing the Servo Controller PCA, notify the factory.

10Ex Firmware error. (Master Controller Error Code D256)

See explanation under error **10Dx** above.

NOTE

The errors **10E0** through **10EE**, are table lookup errors in the firmware.

10Fx Servo Controller Error (Master Controller Error Code D256)

10F0 The Servo Controller is unresponsive or missing.

If this error is received, check the LEDs on the edge of the Servo Controller PCA (these may not be present on newer PCAs), These LEDs, if lit, should show the hexadecimal numbers 38 through 3D. The specific meanings of these different codes are listed under the 103x errors.

If the LEDs show some other numbers than 38 through 3D, this indicates that the processor on the Servo Controller PCA should be

changed. If NO LEDs are lit, first check the power connections and supply.

If error code:
1038 or 103A----------change the Servo Controller processor
1039----------change the Servo Controller ROM
103B,103C, or 103D-----change the Servo Controller RAM.

The problem could also be with the Master Controller which, in this case, erroneously determines that the Servo Controller is unresponsive. To see if the Master Controller is wrong, toggle power and see if the LEDs change at all. If they do, but then all go off, this indicates that the Servo Controller is operational.

12xx An error related to the Servo Controller was detected by the Master Controller.

This range of errors indicates a problem with the Servo Controller or circuits after the Servo Controller. At power-on, the Servo Controller performs some initial selftests and if a problem is found, one of the following errors will appear.

1210 The Servo Controller found an error in its kernal test.

1220 The Servo Controller failed the interface test with the Master Controller.

1230 The Servo Controller failed the gap interrupt test.

1240 An in-position interrupt was not received.

1250 A gap interrupt was not received.

1260 The write enable signal was not HIGH in the sensor test.

1270 The write enable signal was not LOW in the sensor test.

1280 The write enable sensor harness is not connected.

12F0 The Servo Controller was not present or was not responsive.

3xxx Front Panel Assembly FRU.

3F00 The hardware is not present or responsive.

4xxx Master Controller Assembly FRU.

41xx CPU error on Master Controller Assembly (internal registers).
42xx Master Controller RAM failure.
43xx Master Controller Data Buffer subassembly failure.
44xx Master Controller timer chip subassembly failure.

The programmable timer chip on the Master Controller contains three timers; two run at 75 KHz and the other runs at 600 KHz.

45xx Master Controller EEPROM chip subassembly failure.

4510 The read/write ready status was not present.

This could be an error in the TTL that brings the ready lines out or could be a problem in one or the other EEPROM on the Master Controller PCA.

4520 The computed EEPROM check sum was not the same as the stored check sum.

The check sum, done at power-on, did not check. To determine the EEPROM is bad, change the recomputed check sum by resetting the HP-IB address and then recycling power. If the error reappears, either the EEPROM is bad or something is dynamically changing the EEPROM. Check the write enable/disable circuits to the EEPROM, and if found to be working correctly, replace the EEPROMS.

4530 An EEPROM read value was incorrectly read.

At power-on, factory values inside the EEPROMS are checked against the values stored in the ROM on the Master Controller PCA.

On a 7978A, the 3-button reset only initializes the firmware update area. So if bad values are loaded into the drive from a bad update tape, there is no way to initialize the EEPROMs back to the state they were in before the date was loaded in. The drive can be made inoperable, incapable of even reading another firmware update tape. Two methods are available to bring the tape back up; a firmware update downloaded from the Host or by changing the EEPROMs. On a 7978B, the 3-button reset initializes the entire EEPROM (except the HP-IB address and the odometer value), so this potential problem does not exist.

NOTE

The drive can sense if new EEPROMS are present when the 3-button reset is called. When this reset is done after installing new EEPROMS, the entire EEPROM is initialized, including the HP-IB address and the odometer value.

NOTE

Because odometer values can not be transferred to new EEPROMS, installation of new EEPROMS restarts the count at zero.

4540 A write value into the EEPROM did not verify after write.

Indicates a bad EEPROM.

4550 The computed EEPROM check sum did not verify after being written.

Same problem as for error 4540 above.

4560 The EEPROM is write enabled when it should be disabled.

Firmware problem or failure of "write disable" circuitry. Bad values may have been written into EEPROMS by this time.

4570 The EEPROM is not write enabled when it should be enabled.

See error **4560** above.

5xxx Formatter Assembly FRU

NOTE

In the Formatter Assembly errors, 5xyz, x denotes the subassembly that failed, y denotes the operation in which the error occurred, and z denotes the test that failed. Failed tests and possible cause of the failure, from most likely to least likely, are as follows:

xxx1-Digital loopback with PLL (PE).
Suspect: PLL, Formatter, MC, Write Electronics.
xxx2-Digital loopback with PLL (GCR).
Suspect: PLL, MC, Write Electronics.
xxx3-Digital loopback without PLL (PE).
Suspect: Formatter, MC, Write Electronics.
xxx4-Digital loopback without PLL (GCR).
Suspect: Formatter, MC, Write Electronics.

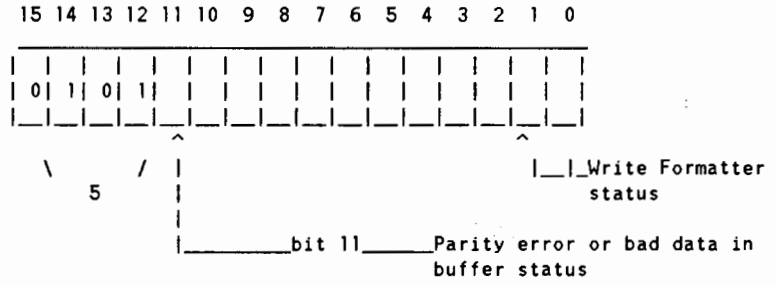
The graphical breakout of the Status Word for each subassembly is after the 51xx errors, the 52xx errors, and the 53xx errors respectively.

51xx Write Formatter Failure.

511x Failure while writing ID.
512x Failure while writing data.
513x Failure while verifying data.
514x Failure while writing a tape mark.
515x Failure while forcing one track in error.
516x Failure while forcing two tracks in error.
517x Failure while forcing unrecoverable data.
518x Failure while forcing a parity error.
519x Failure while forcing data overruns.
51Ax Failure while forcing data underruns.

Status Word for a Write Formatter Failure (second, 16-bit word)

The following is a graphical breakout of the hardware status word for a Write Formatter failure.



For bits 0,1,---'1' = TRUE

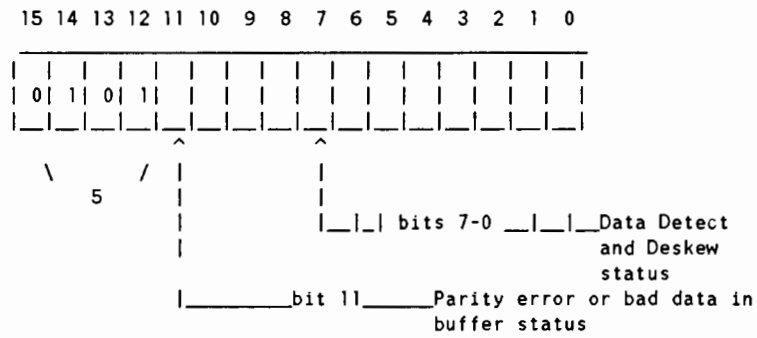
Data bit 0 = data underrun
Data bit 1 = parity error

52xx Data Detect and Deskew Failure

521x Failure while writing ID
522x Failure while writing data
523x Failure while verifying data
525x Failure while forcing one track in error
526x Failure while forcing two tracks in error
527x Failure while forcing unrecoverable data
528x Failure while forcing a parity error
529x Failure while forcing data overruns
52Ax Failure while forcing data underruns

Status Word for a Data Detect and Deskew Failure (second, 16-bit word)

The following is a graphical breakout of the hardware status word for a Data Detect and Deskew failure.



Data bits 0,1,2 = block that is detected

D2	D1	D0	
0	0	0	Reset detected
0	0	1	Tape Mark detected
0	1	0	GCR ARA ID detected
0	1	1	GCR Density ID detected
1	0	0	Data/GCR ARA Burst detected
1	0	1	PE Density ID detected
1	1	0	unused
1	1	1	Data/unknown

For bits 3,4,5,6,7,---- '1'=TRUE

Data bit 3 = gap detected
Data bit 4 = block type verified
Data bit 5 = all tracks synchronized
Data bit 6 = interrupt pending
Data bit 7 = hardware diagnostic error.

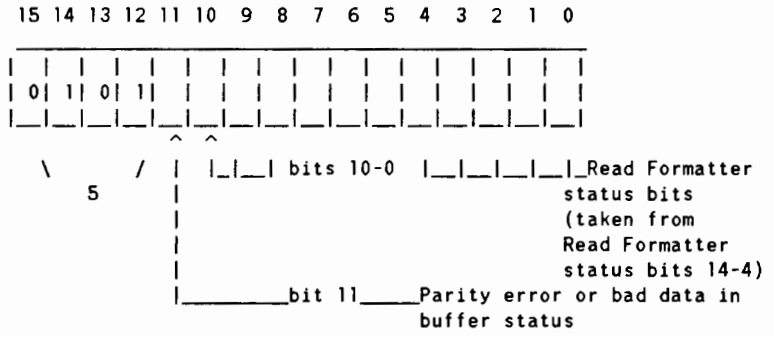
53xx Read Formatter Failure

531x Failure while writing ID
532x Failure while writing data
533x Failure while verifying data
534x Failure while writing a tape mark
535x Failure while forcing one track in error

536x Failure while forcing two tracks in error
537x Failure while forcing unrecoverable data
538x Failure while forcing a parity error
539x Failure while forcing data overruns
53Ax Failure while forcing data underruns

Status Word for a Read Formatter Failure (second, 16-bit word)

The following is a graphical breakout of the hardware status word for a Read Formatter failure.



Accumulated tracks in error count - data bits 0,1,2 (1 = TRUE)

Data bit 0 = one track in error
Data bit 1 = two tracks in error
Data bit 2 = more than two tracks in error

Corrected error flag - data bit 3 (1 = YES, CORRECTIONS)

Data bit 3 = corrected error flag

Immediate errors - data bits 4,5 (1 = YES, ERROR)

Data bit 4 = hardware error -- no interrupt
Data bit 5 = uncorrectable error -- no interrupt

Immediately interrupting errors - data bits 6,7
(1 = YES, ERROR/INTERRUPT OCCURRED)

Data bit 6 = gap before End-of-Data Error and interrupt flag
Data bit 7 = Buffer Overrun Error and interrupt flag

End of Record errors - data bits 8,9,10 (1 = YES, ERROR)

Data bit 8 = CRC error
Data bit 9 = ACRC or LRC error
Data bit 10= residual error

6xxx HP Interface Bus (HP-IB) Assembly FRU.

61xx HP-IB failure.

6110 The inbound FIFO was not empty after an attempt to clear.

6120 The internal HP-IB loopback has failed.
6130 The 'end' bit in the interface is not functional.

When the EOI comes through the interface it sets a bit that is available for the Master Controller to read. This error indicates that the chip that contains the 'end' bit is not functional.

62xx HP-IB/Master Controller interface failure.

The HP-IB can accept data from the Host, Master Controller, or from the Data Buffer. Data can also go out through these paths. Paths are checked by having the Host loop data in, either through the Master Controller or through the Data Buffer. The interface to the Data Buffer can be checked by writing data from the Master Controller to the HP-IB then to the Data Buffer and then reading the data back out of the Data Buffer. The path from the HP-IB to the Master Controller can be checked by reading data into the HP-IB and then reading the data back out. This last path is the the path that has failed, according to this error category.

6210 The data transferred was not received.

Although the Data Buffer is the receiver, the primary search for the problem should still be in the HP-IB electronics at this point. The Data Buffer is checked out during the power-on checks, but there are some portions of the HP-IB to Data Buffer to HP-IB loop that are not checked out during power-on; for example, the HP-IB link.

6220 The data transferred was missing an EOI. Possible Data Buffer problem.

7xxx Write Electronics Assembly FRU.

71xx Write Clock failure.

A value is written to the write clock which uses this value to divide the system clock to the write frequency for GCR or PE. Errors 7110, -20, -30, and -40 indicate that the write clock circuitry is not working properly.

8xxx Read Electronics Assembly FRU.

NOTE

The only error messages for the Read Electronics Assembly come from the execution of the Autogain Diagnostic (Test 24).

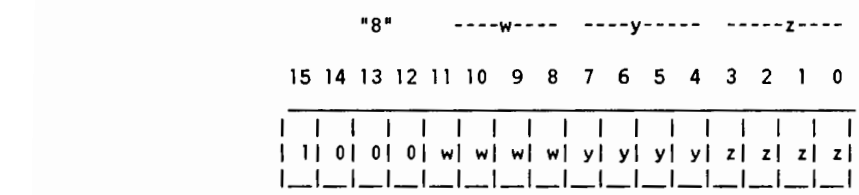
The error log will contain two error messages (16-bit words) after the Auto Gain Diagnostic. The first 16-bit error word indicates which tracks have exceeded the allowable upper or lower limit for acceptable Autogain values. The second 16-bit word shows, for each failed track, whether the failure was because the gain value was too high or too low. Execute Test 1 to display the first message, and then press the ENTER Button to see the second message.

The formatting for this error is different than either diagnostic error messages or protocol/firmware error messages in the 7978A/B.

The Autogain error code, for both the first and second error words takes the form 8wyz.

In the first 16-bit error word:
8 -> denotes the Read Electronics Assembly FRU
w -> set to '0', meaning this is the first word (bit 11),
density is in bits 10 and 9
--if bits 10 and 9 are "1" and "0", mode is PE
--if bits 10 and 9 are "1" and "1", mode is GCR

```
            error data for track 9 is in bit 8. 1=fail,
               0=pass
      y -> error data for tracks 8 to 5 (bits 7-4).
            1=fail, 0=pass.
      z -> error data for tracks 4 to 1 (bits 3 to 0).
            1=fail, 0=pass)
```



In the second 16-bit word (called by pressing the ENTER Button):

8 -> denotes the Read Electronics Assembly FRU

w -> set to '1', meaning that this is the second word (bit 11),
density is in bits 10 and 9
--if bits 10 and 9 are "1" and "0", mode is PE
--if bits 10 and 9 are "1" and "1", mode is GCR
error data for track 9 is in bit 8. 1=too high, 0=too low

y --> error data for tracks 8 to 5 (bits 7-4). 1=too high, 0=too low

z -> error data for tracks 4 to 1 (bits 3-0). 1=too high, 0=too low

First 16-bit word of error message

8 4 x x 1000010[0]-xxxxxxxx	PE density. In addition to errors in (xx), the [0] shows that track 9 does NOT contain an error. See explanation in the previous NOTE.
8 5 x x 1000010[1]-xxxxxxxx	PE density. In addition to errors in (xx), the [1] shows that track 9 contains an error. See explanation in the previous NOTE.

8 6 x x 1000011[0]-xxxxxxxx	GCR density. In addition to errors in (xx), the [0] shows that track 9 does NOT contain an error. See explanation in the previous NOTE.
8 7 x x 1000011[1]-xxxxxxxx	GCR density. In addition to errors in (xx), the [1] shows that track 9 also contains an error. See explanation in the previous NOTE.

Second 16-bit word of error message

8 C x x 1000110[0]-xxxxxxxx	PE density. Track(s) in error contain a '0' for low amplitude or a '1' for high amplitude. All non-error bit positions are '0'.
8 D x x 1000110[1]-xxxxxxxx	PE density. Track(s) in error contain a '0' for low amplitude or a '1' for high amplitude. All non-error bit positions are '0'. In this case, the [1] shows that track 9 has a high-ampltude error.
8 E x x 1000111[0]-xxxxxxxx	GCR density. Track(s) in error contain a '0' for low amplitude or a '1' for high amplitude. All non-error bit positions are '0'.
8 F x x 1000111[1]-xxxxxxxx	GCR density. Track(s) in error contain a '0' for low amplitude or a '1' for high amplitude. All non-error bit positions are '0'. In this case, track 9 has a high-amplitude error.

9xxx Phase-Locked Loop (Clock Recovery) Assembly FRU

NOTE

In the Phase-Locked Loop Assembly errors, 9xyz, x denotes the subassembly being accessed, y denotes the operation in which the error occurred, and z denotes the test that failed. Failed tests and possible cause of the failure, from most likely to least likely, are as follows:

xxx1-Digital loopback with PLL (PE).
Suspect: PLL, Formatter, MC, Write Electronics.
xxx2-Digital loopback with PLL (GCR).
Suspect: PLL, MC, Write Electronics.
xxx3-Digital loopback without PLL (PE).
Suspect: Formatter, MC, Write Electronics.
xxx4-Digital loopback without PLL (GCR).
Suspect: Formatter, MC, Write Electronics.

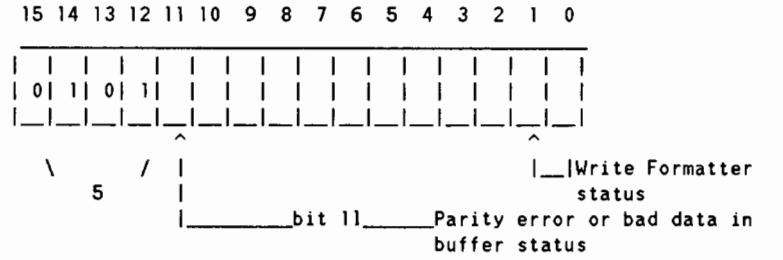
The graphical breakout of the Status Word for each subassembly is after the 91xx errors, the 92xx errors, and the 93xx errors respectively.

91xx Failure while accessing the Write Formatter

911x Failure while writing ID
912x Failure while writing data
913x Failure while verifying data
914x Failure while writing a tape mark
915x Failure while forcing one track in error
916x Failure while forcing two tracks in error
917x Failure while forcing unrecoverable data
918x Failure while forcing a parity error
919x Failure while forcing data overruns
91Ax Failure while forcing data underruns

Status Word for a Write Formatter Failure (second, 16-bit word)

The following is a graphical breakout of the hardware status word for a Write Formatter failure.



For bits 0,1, -- '1' = TRUE

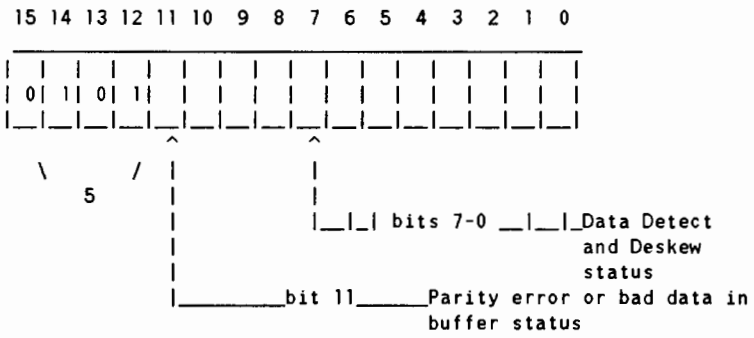
Data bit 0 = data underrun
Data bit 1 = parity error

921x Failure while accessing the Data Detect and Deskew.

921x Failure while writing ID
922x Failure while writing data
923x Failure while verifying data
924x Failure while writing a tape mark
925x Failure while forcing one track in error
926x Failure while forcing two tracks in error
927x Failure while forcing unrecoverable data
928x Failure while forcing a parity error
929x Failure while forcing data overruns
92Ax Failure while forcing data underruns

Status Word for a Data Detect and Deskew Failure (second, 16-bit word)

The following is a graphical breakout of the hardware status word for a Data Detect and Deskew failure.



Data bits 0,1,2 = block that is detected

D2	D1	D0	
0	0	0	Reset detected
0	0	1	Tape Mark detected
0	1	0	GCR ARA ID detected
0	1	1	GCR Density ID detected
1	0	0	Data/GCR ARA Burst detected
1	0	1	PE Density ID detected
1	1	0	unused
1	1	1	Data/unknown

For bits 3,4,5,6,7,--'1' = TRUE

Data bit 3 = gap detected
Data bit 4 = block type verified

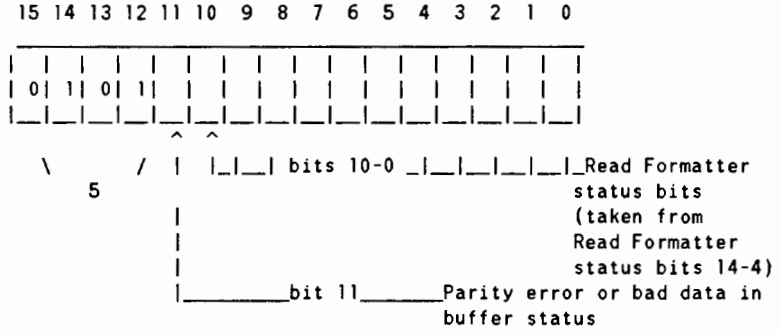
Data bit 5 = all tracks synchronized
Data bit 6 = interrupt pending
Data bit 7 = hardware diagnostic error.

93xx Failure while accessing the Read Formatter.

931x Failure while writing ID
932x Failure while writing data
933x Failure while verifying data
314x Failure while writing a tape mark
935x Failure while forcing one track in error
936x Failure while forcing two tracks in error
937x Failure while forcing unrecoverable data
938x Failure while forcing a parity error
939x Failure while forcing data overruns
93Ax Failure while forcing data underruns

Status Word for a Read Formatter Failure (second, 16-bit word)

The following is a graphical breakout of the hardware status word for a Read Formatter failure.



Accumulated tracks in error count - data bits 0,1,2 (1 = TRUE)

Data bit 0 = one track in error
Data bit 1 = two tracks in error
Data bit 2 = more than two tracks in error

Corrected error flag - data bit 3 (1 = YES, CORRECTIONS)

Data bit 3 = corrected error flag

```
Immediate errors - data bits 4,5  (1 = YES, ERROR)

Data bit 4 =  hardware error -- no interrupt
Data bit 5 =  uncorrectable error -- no interrupt

Immediately interrupting errors - data bits 6,7
    (1 = ERROR/INTERRUPT OCCURRED)

Data bit 6 =  gap before End-of-Data Error and interrupt flag
Data bit 7 =  Buffer Overrun Error and interrupt flag

End of Record errors - data bits 8,9,10  (1 = YES, ERROR)

Data bit 8 =  CRC error
Data bit 9 =  ACRC or LRC error
Data bit 10=  residual error
```

Dxxx Errors detected during runtime.

The first byte, (D1,D2, etc.) tells what detected the error. The second byte tells what the error is. A "D288" error is the same as a "D188" error; however "D1" shows the Channel Program detected the error and "D2" shows that the Device Program detected the error.

D1xx Channel Program detected failure. (Controller errors)

NOTE

Most of the "D1xx" errors come from the Host attempting to do something invalid or there is a problem in either the tape drive Master Controller PCA or firmware.

The first action to take is to replace the Controller PCA. If this does not correct the problem, the problem could be in the firmware. Contact the factory.

D1xx Transaction ID mismatch.

An identification is attached to each command the Channel program receives to help keep track of individual commands during command queueing and reporting. This error indicates a ROM problem; either with the ROM itself or the data contained in the ROM.

Operations can not continue after this error because the channel program and the device program are out of syncronization. The drive must be reset or power cycled.

D179 Transaction ID mismatch (ROM problem). Reset or cycle power.

D17A Missing pending command.

The Channel Program keeps a copy of every command it sends to the Device Program. This enables it to match up the reports of completed commands with its list of pending commands.

D17B Report Queue error.

D17C Report Queue full.

D17D Unknown command to device program.

D17E Full Command Queue.

D17F Unknown non-Host command.

There are times that the Channel Program and the Device Program talk to one another. This error indicates a problem in internal communications and can be considered a firmware error.

D183 Data buffer byte count mismatch. (Test MC)

D184 Bad message type.

The error messages from D185 through D188 indicate a problem in either the hardware of the Master Controller PCA or the HP-IB PCA. If these two boards are replaced and the problem remains, call the factory; there is probably something more wrong than is indicated by one of these error messages.

D185 Processor handshake abort. (Test HP-IB)

D186 Unknown interface exception. (Test HP-IB)

An unknown interrupt was received from the HP-IB PCA.

D187 Outbound data freeze. (Test HP-IB)

The HP-IB PCA says it can not send data out over the HP-IB.

D188 Inbound interface FIFO error. (Test HP-IB)

D189 EEPROM update failure. (Test MC)

D18C Channel Program case error.

This indicates a firmware problem in the Channel Program.

D18E Supply reel tachometer inoperative. (7978B only)

D1FF Device Program is unresponsive to the Channel Program.

This indicates a firmware problem in the Channel Program.

D2xx Device Program detected failure.

D201 A timeout on a Device Program report occurred.

This is set by diagnostics. There are certain diagnositc programs which run in the Channel Program time slice and issue commands for the Device Program to execute. The diagnostics that use this time slice put a time limit on the Device Program. This error indicates that the Device Program took too long to report back and was timed out by the diagnostic.

In addition to this error, the next two error messages are only seen during the execution of diagnostics.

D202 More than seven (7) retries have occurred during a tape diagnostic.

D203 A soft error has occurred during a tape diagnostic.

D204 Tape runaway.

D205 The tape is write protected.

D209 The read record/move command returned an unidentifiable tape.

An attempt was made to execute a read command on a tape that did not have a valid ID on it. The tape could not have the proper ID or it could be blank.

D20A The write gap/tape mark record command returned an unidentifiable tape.

An attempt was made to write a gap or tape mark to a tape which either had an unidentifiable tape ID or the tape was blank.

D210 The tape is not at load point.

This error may be seen if, for example, a request has been made to write a tape ID and the tape is positioned somewhere other than at load point.

D213 Backward move command while tape is at load point.

D225 Tape positioning failure. (Test SC)

This is the same error as D25E. However, this error should never be displayed. It is for internal use by the drive only.

D226 System Reset.

This error is for internal use by the drive only. It should never be displayed.

D227 Readahead Reject.

This error is for internal use by the drive only. It should never be displayed.

D228 The door was open, so reject the command.

This error will appear if the drive is positioned beyond the EOT in a long gap area and the door is then opened. Before the EOT, opening the door is transparent as far as errors are concerned.

D229 Velocity is out of specification. (Test SC)

This error is only set by the Servo Controller if the velocity goes out of the specified allowable range during a write because this means that the data was written incorrectly. If the velocity goes out of specification

during a read and the data is recovered it does not matter if the velocity was not within specifications.

D22D Multiple tracks were in error. (Test F)

D22F Tape mark or ID was not verified. (Test F)

D230 Gap noise was detected. (Test F)

Data was detected when a gap was expected. This could have been caused by a previous incomplete erasure of the tape.

D231 Data format error. (Test F)

D232 Tape Not identifiable on Load or Rewind commands. (Test F)

During a Load operation, a false BOT or some other false data could have prevented a valid tape ID.

The tape is also re-identified during every Rewind operation. A false BOT may also cause an error during this operation. The error could also have been caused by the read head turning OFF but not turning back ON; the drive expects to receive the same identification it holds in memory, but the tape appears to have changed to a blank tape.

D233 Gap before end of data. (Test F)

A data block contains a large dropout or is clipped off before the standard closing blocks (mark II, CRC, etc.) are read from the end of the data block. This might be from tape slippage.

D234 Data block dropout. (Test F)

Occurs when a small, full-width dropout is detected. If the dropout is large enough to approximate the size of a gap, the data block will be interpreted as two separate records.

The cause of this error is more likely from the tape rather than from the drive hardware.

D235 Redundancy error. (Test F) (Read Formatter)

D236 Read parity errors. (Test F)

D23C Data Buffer overrun. (Test MC)

This error message is used internally in the drive and will not be seen in the error log.

D23D Data block timeout. (Test F)

The data block is too long.

D23E Tape mark dropout. (Test F)

Similar to data block dropout but in the tape mark area.

D23F Tape mark unverified. (Test F)

D240 Tape mark timeout. (Test F)

D251 Servo Controller is unresponsive. (Test SC)

As commands are given to the Servo Controller from the Master Controller, a continuing handshake is maintained to make sure that the Servo Controller also puts a copy of this command into its part of the emulated 2-port RAM. If the Master Controller does not receive confirmation that the Servo Controller put a copy of this command in the 2-port RAM, the Servo Controller is considered unresponsive. See next description, "Servo Controller command not complete."

D252 Servo Controller command not complete.

Although a copy of a command from the Master Controller was confirmed to be in the Servo Controller's part of the emulated 2-port RAM, no report that the command was executed was received by the Master Controller.

NOTE

Whenever the errors D253, D254, D256, and D259 are logged, the 7978B will also log a Servo Controller Assembly FRU error (10xx). On a 7978A, the 10xx errors will not be seen.

D253 The Servo Controller shut down. (Test SC)

The Servo Controller detected a loss of tension. Loss of tension is caused in a number of ways. Only when loss of tension is not caused externally does this error indicate a problem.

D254 Servo Controller hardware failure. (Test SC)

This could be a Servo Controller error or a Master Controller firmware error.

D255 Servo Controller protocol error. (Test SC)

D256 Servo Controller runtime error. (Test SC)

The Servo Controller was set up, started reading or writing a data block, but has not come back out of the data block. This is either a Servo Controller problem or a Data Detect and Deskew problem. It could be a Data Detect and Deskew problem because the DDD generates signals that tell the Servo Controller when a data block is being entered and when it is being exited. If the DDD gives the entering signal but fails to give the exiting signal, the Servo Controller can not report back that it has exited the block.

D257 No in-position interrupt. (Test SC)

After the drive is ramped up to speed, the Servo Controller is supposed to report that the tape drive is in position for reading or writing. An interrupt is used for this purpose. This error says that this interrupt was not received. This is usually a Servo Controller hardware failure.

D258 No gap position interrupt. (Test SC)

This error is similar to D257 above but for the gap position interrupt. This error usually indicates a Servo Controller hardware failure.

D259 Safety shutdown. (Test MDRIVE)

This can be caused externally by actions such as opening the door. However, if the shutdown is initiated by the Motor Drive, this indicates a problem with the Motor Drive.

D25A No BOT marker.

The BOT marker was either not present or was mounted incorrectly. This could also be caused by a problem in the Sensor Harness assembly

D25B Speed out of specification. (Test SC)

This is the same as D229 (Velocity is Out of Specification). In fact, the D229 error is fed to this error message, and if it appears, will appear under this message.

D25C Desired state is invalid.

The Servo Controller was asked to do something that it is unable to do. This error indicates a firmware bug in the Master Controller.

D25E Tape position failure. (Test SC)

This is the same error as D225. It is detected by the Servo Controller.

D260 Tape Displacement Unit not engaged. (7978B only)

D261 Tape Displacement Unit not retracted. (7978B only)

D265 Read Formatter unresponsive. (Test F)

D266 Read Formatter hardware error. (Test F)

D267 Bad detect on write. (Test F)

A record was written but when the read head passed over the new record, something different was read back.

D267, D268, and D269 can be caused by a number of things. Problems could be indicated in either the write electronics or the read electronics.

D268 Bad erase. (Test WE)

An attempt was made to erase the tape but the read head detected something left on the tape. The erase head/electronics might not be working correctly or perhaps the tape has slipped and the

read head is reading something previous to a tape mark.

This only occurs on an erase and may, therefore, be seen in a Write Gap or a Write Skip.During retries, this error does not appear until after three retries have been attempted. On the fourth retry the drive attempts to erase a block, do a Write Skip and move on. At that time, the error may appear. This error could also indicate a problem with the Tape Displacement Unit.

D269 No detect on write. (Test F, WE)

This is an indication the the erase head is probably working but the write head is off. As mentioned in D267, these errors may indicate problems in either the read electronics or write electronics.

D26A Track out of syncronization. (Test F)

This may indiate a problem in the Data Detect and Deskew, because that is the function that performs this synchronization. Also, the data on the tape might be so unusual that synchronzation fails. There also might be a hardware problem.

D26E Formatter byte count mismatch. (Test F)

A certain number of bytes are written to tape. When the read-after-write operation is done, the number of bytes read off the tape is compared to the number of bytes the Write Formatter says it has written. This error says there is not a match.

D27C Report Queue overflow.

This indicates a firmware error.

D27D Unknown command.

This indicates a firmware error.

D280 No end of record on a write record. (Test F, MC)

D281 Data Buffer parity error. (7978B only)

D282 Data Buffer underrun. (7978B only)

D283 Data Buffer byte count mismatch. (Test MC)

This is the same as the "D183" error checked by the Channel Program.

D284 Bad message type from device.

D289 Servo register access error.

D28A Device Program case error.

Utility program error.

D28B Device Program hardware utility case error.

Utility program error.

D28E One-line encoder inoperative.

D3x0 Diagnostic Program detected failure.

D310 No tape was loaded when a read or write data block test was called.

An attempt to run Test 21 was made without a tape in the "loaded" state.

D320 A tape with the wrong density ID was loaded for a read data block test (PE Test= #33, GCR Test= #34).

D330 No write ring was installed on the tape loaded for a write date block test.

D340 A tape-related error occurred during a local firmware update.

The firmware update tape could not be read.

D345 EEPROM failure was detected during firmware update.

D350 A valid firmware update record was not found on the loaded tape.

D360 The EEPROM READY signal did not come true during a Tape Usage Odometer update.

D364 Download is too large.

There is a capability to download a maximum of 512 bytes of diagnostic programs from the host.

D366 Invalid download ID.

D367 Incorrect Download checksum.

D368 The firmware update will not fit into EEPROM. Aborted.

D369 Invalid ID for a firmware update.

D36A Version number specified for the firmware update not found on the tape.

D36B Bad firmware update checksum.

D36C Insufficient data for the firmware update.

D36D Odd number of bytes for a firmware update.

D36E The requested version number is incorrect for your installed ROM (PROM). No update was performed.

D36F Firmware update has been aborted.

This is caused by the operator pressing the RESET Button.

D370 The door was open while attempting to run a Servo Controller test which requires the door to be closed.

D380 Servo handshake/hardware failure during Tests 35 - 40.

D390 A tape is "loaded" while motor drive tests are being executed.

Exxx Protocol errors.

NOTE

The following "E" protocol errors mean that the tape drive and the Host are out of synchronization.

Verify that the drive is cabled correctly (loads are correct). If cabling is correct, replace the HP-IB PCA. If the problem persists, the Host interface should be changed. If the error still remains there might be problems with the Host driver or with the tape drive firmware.

E079 Command Queue not empty.

The host has attempted to send a command without waiting for the report from the drive. This applies to the host-to-interface command queue, which can hold only one command.

E0A2 Request DSJ expected.

E0A3 Request status expected.

E0A5 Unknown unit select.

E0A6 Listen 1 expected.

E0A7 Data byte expected.

E0A8 Missing EOI on data byte.

E0AA Command phase protocol error.

E0AC Read record report phase protocol error.

E0AD Report phase protocol error.

E0AE Cold load protocol error.

E0B0 End "complete" or "Complete - idle" expected.

E0B2 End "Data" expected.

E0B4 Improper secondary.

E0B5 Misplaced data byte.

E0B8 Interface loopback protocol error.

E0B9 Selftest protocol error.

This is a protocol error when the Host is trying to run the tape drive selftest.

E0BC Command parity error.

E0BD Reset by the operator.

This is not an error, it is just logged.

E0BE Device clear received.

This is not an error, it is just logged.

E0BF Internal reset (always after an Image Dump).

FyFy Remote status.

NOTE

The following errors are possible when a diagnostic is run remotely. These errors will be passed back to the host.

For y = C
to
y = F

FCFC Only local access to diagnostic allowed.

FDFD Incorrect Online/Offline mode for a diagnostic.

FEFE Not used.

FFFF Diagnostic passed.

2-DIGIT ERROR CODES

Halted state Error Codes.

These errors are reported to the Front Panel display only.

41 MC68000 CPU error.

42 Master Controller RAM failure.

44 Master Controller Timer Chip failure.

45 The EEPROM failed during a firmware update.

46 Master Controller ROM failure.

Master Controller Assembly Failure.

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45 Master Controller EEPROM failure during a firmware update

This error denotes a catastrophic failure. On catastrophic failures, the processor sends a one-word code to the Front Panel and the drive shuts down immediately. The processor enters a HALT state.

If there is an EEPROM failure during a firmware update, the state of the drive becomes unknown. The drive is immediately shut down and the processor is HALTed. The only input that will be accepted is a 3-finger reset. This reset is accomplished by depressing the LOAD, REWIND, and TEST/ADDRESS Buttons at the same time and then cycling the power with the buttons depressed.

NOTE

A 3-finger reset on the 7978A initializes only the firmware update portion of the EEPROM. This reset

on a 7978B initializes everything in the EEPROM except for the HP-IB address and the odometer.

46 Master Controller ROM checksum failure.

During the power-on selftest a checksum is computed for the Master Controller ROM and this value is checked with the one stored on board the ROM. If these values do not match, the drive is considered inoperable and the one-word catastrophic error above is shown on the Front Panel and the Master Controller is HALTed.

Bus Error Exceptions.

NOTE

These errors are reported to the Front Panel display only.

This category of errors is also of the "fatal" type, similar to the "B" errors above. However, these errors have to do with possible failure of subsystems. The Master Controller writes to a subsystem and each subsystem has a specific amount of time in which it can respond with a DTACK.

The DTACK for some subsystems, such as the Servo Controller, is generated on the Master Controller PCA. The following errors only contain subsystems that generate their own DTACK.

43 The MC Data Buffer subassembly is unresponsive.

51 Write Formatter is unresponsive.

52 Data Detect and Deskew is unresponsive.

53 Read Formatter is unresponsive.

61 The HP-IB is unresponsive.

C1 Bus error exception from an unknown source.

Ax Front Panel Warnings.

A1 Resetting the Device Program.

A2 Drive is active and is offline.

There is a previous action uncompleted (pending) with the host, but the drive has been placed offline.

A3 Dirty tape path warning.

A4 Drive is executing retries during Test 65 (78B only).

A5 Initializing EEPROM.

This can only appear when doing the 3-finger reset.

Bx Unexpected Exceptions.

NOTE

The 'B' errors, like 45 and 46 errors, stop the drive. The 'B' errors are Master Controller errors.

These errors can occur at any time (not just at power-on). There are a number of exceptions that the processor can get; i.e. reading a value out of ROM which is not within its instruction set. The 68000 processor will jump to a specific low-address location to get the pointer to handle a service routine.

In less critical situations, a recovery procedure may be performed. With the following one-word errors, however, no recovery procedure is performed. The error is put in the Front Panel display and then the drive is HALTed.

The Master Controller has three lines in and decodes these lines to one of eight possible error interrupts. The following single-word errors may occur at any time.

B1 Address error exception.

B2 Illegal instruction exception.

B3 Divide by zero exception.

B4 Register bounds violation exception.

B5 Overflow exception.

B6 Privilege violation exception.

The processor is capable of running in two modes; Supervisor Mode and a User Mode, the 7978A/B is always running in Supervisor Mode.

B7 Trace exception.

Trace Mode is never turned on in the 7978A/B. This error means that the error has decoded to Trace "ON".

B8 Emulation of future instruction exception.

The instruction the processor was asked to execute is not implemented, but happens to be in the range of instructions that have been reserved for future use.

B9 Spurious interrupt exception.

The interrupt received was not a valid interrupt code.

BA Unimplemented interrupt exception.

BB Unassigned vector exception.

Fx Front Panel Error Messages.

F0 Power-on Selftest failure.

NOTE

Errors F1 through F5 are are fatal errors detected during normal runtime. The error will be stored in the error log in addition to being shown on the Front Panel.

Test 0 will show the last error logged.

Test 1 will give a breakout of the diagnostic error that caused the runtime "F" error.

F1 The tape is not tensioned.

F2 BOT marker is not present.

F3 Hardware failure.

F4 Firmware error.

F5 Host protocol error.

SECTION 6

ADJUSTMENTS

[1] ELECTRICAL ADJUSTMENTS

The only electrical adjustment for the 7978A/B is the Auto Gain (Test 24). Run this test when the head, read, or preamplifer assemblies are replaced.

[2] MECHANICAL ADJUSTMENTS

The 7978A/B has no mechanical adjustments.

SECTION 7

PERIPHERALS

Intentionally Blank.

SECTION 8

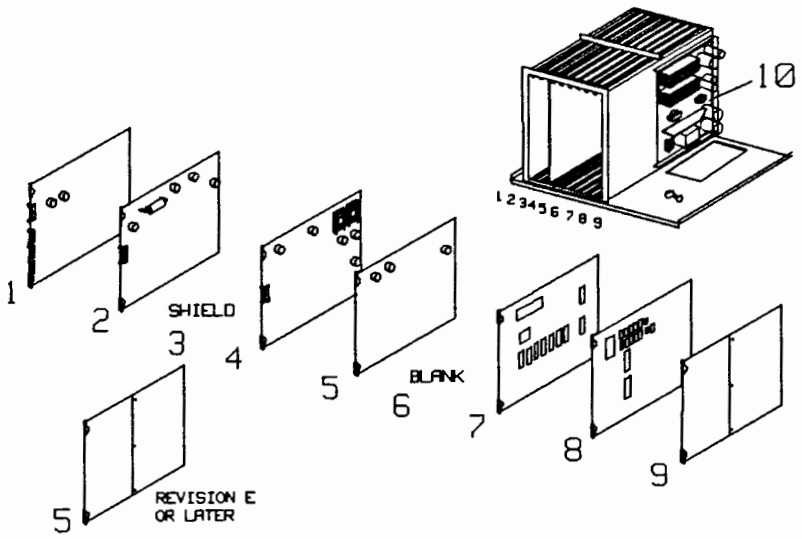
REPLACEABLE PARTS

[1] FIELD REPLACABLE PARTS AND ASSEMBLIES

P/N	DESCRIPTION	USED ON
0180-3391	.02F 100V, Capacitor	7978A/B
0180-3392	.022F 50V, Capacitor	7878A/B
0371-3566	Key cap, Load	7978A/B
0371-3567	Key cap, Online	7978A/B
0371-3568	Key cap, Offline/Reset	7978A/B
0371-3569	Key cap, Rewind	7978A/B
0371-3570	Key cap, Test/Address	7978A/B
0371-3571	Key cap, Enter	7978A/B
0371-3572	Indicator, Status	7978A/B
0371-3573	Indicator, BOT	7978A/B
0371-3574	Key cap, Write Enable/Density	7978A/B
0371-3575	Indicator, Online	7978A/B
0371-3576	Indicator, Offline	7978A/B
0371-3577	Indicator, Rewind	7978A/B
0371-3578	Indicator, Door Open/Busy	7978A/B
0371-3579	Indicator, Test/Address	7978A/B
0403-0481	PC Extractor	7978A/B
0490-0615	Relay	7978A/B
0510-0730	Push-on Rivet	7978A/B
0510-1107	Ball, Stud	7978A/B
07970-00561	Lifter, Pad	7978A/B
07970-20680	Lifter	7978A/B
07978-00103	Card Restraint	7978A/B
07978-01201	Preamp Bracket	7978A/B
07978-01203	Lifter, Restraint	7978A/B
07978-06600	I/O Extender	7978A/B
07978-06601	Power Supply Restraint	7978A/B
07978-20601	Saftey Shield	7978A/B
07978-21200	Cap, Mounting	7978A/B
07978-21701	Roller Bearing	7978A/B
07978-21710	Buffer Arm Assembly	7978A/B
07978-25001	Pivot Hinge Assembly	7978A/B
07978-25004	Swivel Door Assembly-Door	7978A/B
07978-40202	Lower Decorator Panel	7978A/B
07978-48304	Hub, Rubber Band	7978A/B

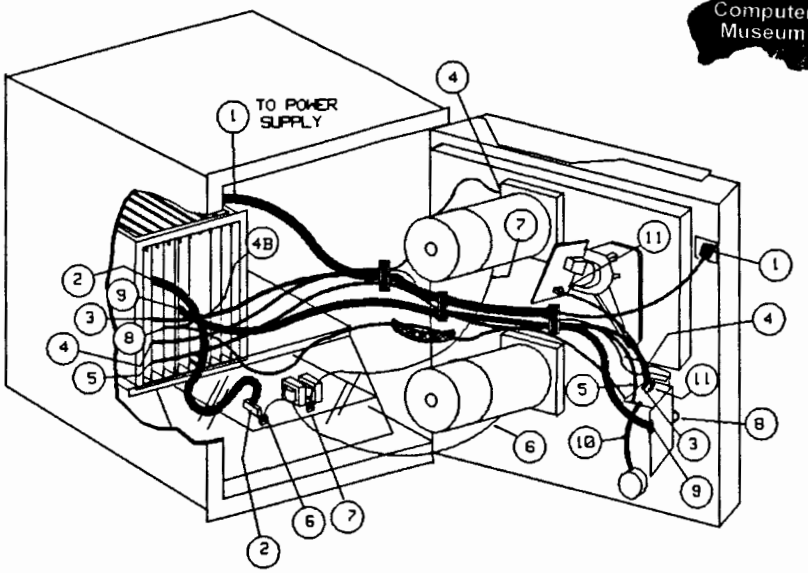
P/N	DESCRIPTION	USED ON
07978-61601	Power Cable- voltage selector	7978A/B
07978-61200	Bracket, Bumper Assembly	7988A/B
07978-61600	Sensor Harness Assembly	7978A
07978-61603	Cable Assembly, Front Panel	7978A/B
07978-61612	Cable, Preamp	7978A/B
07978-61613	Cable Assembly	7978A/B
07978-61614	Cable, Fan	7978A
07978-61624	Sensor Harness Assembly	7978B
07978-64100	Door Cover Assembly	7978A/B
07978-67500	Mother PCA	7978A/B
07978-69505	Formatter D/3 PCA (A5)	7978A/B
07978-67506	HP-IB Interface PCA (A6)	7978A/B
07978-69507	Write PCA (A7)	7978A/B
07978-69508	Read PCA (A8)	7978A/B
07978-69509	Clock Recovery PCA (PLL) (A9)	7978A/B
07978-67512	Preamp Assembly (A12)	7978A/B
07978-69522	Motor Drive PCA (A2)	7978A/B
07978-69551	Servo Controller PCA (A1)	7978A/B
07978-67901	Speed Sensor Assembly	7978A/B
07978-67902	Motor Assembly, Supply	7978A
07978-67903	Motor Assembly, Takeup	7978A/B
07978-67907	Power Module Assembly, USA 115V/903	7978A/B
07978-67908	Front Panel PCA With Switches	7978A/B
07978-67910	Cabinet	7978A/B
07978-67916	Power Modole Assembly UK 220V/900	7978A/B
07978-67917	Power Module Assembly AUS/901	7978A/B
07978-67918	Power Module Assembly EUR 220/902	7978A/B
07978-67919	Power Module Assembly USA 220V/904	7978A/B
07978-67920	Power Module Assembly SWISS 220V/906	7978A/B
07978-67921	Power Module Assembly DENMRK 220V/912	7978A/B
07978-67922	Power Module Assembly AFRICA 220V/917	7978A/B
07978-67923	Power Module Assembly 115V/901	7978A/B
07978-67924	Power Module Assembly 115V/902	7978A/B
07978-67926	Supply Motor	7978B
07978-67935	Buffer Arm Assy.	7978A/B
07978-67950	Tape Displacement Unit	7978A/B
07978-68300	Hub, Shoe Assembly	7978A/B
07978-68301	Hub, Cover Assembly	7978A/B
07978-81600	Cable, Stop	7978A/B
07978-82501	Transformer Assembly	7978A/B
07978-88002	EPROM REV 2.0 U3	7978B
07978-88102	EPROM REV 2.0 U4	7978B
07978-88202	EPROM REV 2.0 U5	7978B
07978-88302	EPROM REV 2.0 U6	7978B
07978-88402	EPROM REV 2.0 U19	7978B
07978-88502	EPROM REV 2.0 U20	7978B

P/N	DESCRIPTION		USED ON
07978-88602	EPROM REV 2.0	U21	7978B
07978-88702	EPROM REV 2.0	U22	7978B
07978-88802	EEPROM REV 2.0	U7	7978B
07978-88902	EEPROM REV 2.0	U23	7978B
07978-69554	Master Controller		7978B
07978-69514	Master Controller		7978A
07978-89103	EPROM, Main Code	U3	7978A
07978-89113	EPROM, Main Code	U4	7978A
07978-89203	EPROM, Main Code	U5	7978A
07978-89213	EPROM, Main Code	U6	7978A
07978-89303	EPROM, Main Code	U19	7978A
07978-89403	EPROM, Main Code	U20	7978A
07978-89503	EPROM, Main Code	U21	7978A
07978-89603	EPROM, Main Code	U22	7978A
07978-89707	EEPROM, Electrical Eraseable	U7	7978A
07978-89807	EEPROM, Electrical Eraseable	U23	7978A
07978-89909	EPROM, Servo Code	U22	7978A/B
0950-0623	O-Ring		7978A/B
0950-0885	Power Supply PCA		7978A/B
0957-0001	Power Supply PCA (A10)		7978A/B
1390-0064	Catch, Spring-Door		7978A/B
1390-0228	Latch, Door Casting		7978A/B
1400-1259	Cable Clamp		7978A/B
1490-0502	Takeup Reel		7978A/B
1535-4913	Leveler		7978A/B
1535-4914	Door, Rear		7978A/B
1535-4915	Bar, Stabilizer		7978A/B
3050-0152	Shoulder Washer		7978A/B
3050-1188	Plastic Washer		7978A/B
3106-2606	Switch, ON/OFF		7978A/B
3160-0311	Fan		7978A/B
8120-1861	Hooded PWR Cable 7978B OPT #905		7978A/B
9164-0189	Magnetic Head Assembly		7978A
2110-0752	Fuse 4A 240VAC		
07978-45001	Door Override Tool		7978A/B



1- Servo Controller Assembly	07978-69551	
2- Write Assembly	07978-69507	
3- Shield	- -	
4- Read Assembly	07978-69508	
5- PLL Assembly	07978-69509	
6- (blank)	- -	
7- Formatter Assembly	07978-69505	
8- Master Controller Assembly	07978-69514	(7978A)
	07978-69554	(7978B)
9- HP-IB Assembly	07978-67506	
10- Power Supply Assembly	0957-0001	

Figure 8-1
7978A/B Card Cage
and Card Placement



1- Front Panel Cbl	6- Takeup Motor Assy
2- Motor Drive Cbl	7- Supply Motor Assy
3- Buffer Cbl (long)	8- Read Cbl
4- Sensor Harness Assy	9- Preamplifier Cbl
4B- 7978B Sensor Harness cbl to Mstr Cntlr PCA	10- Speed Encoder Assy
	11- Tape Buffer Cbl
5- Encoder Cbl	

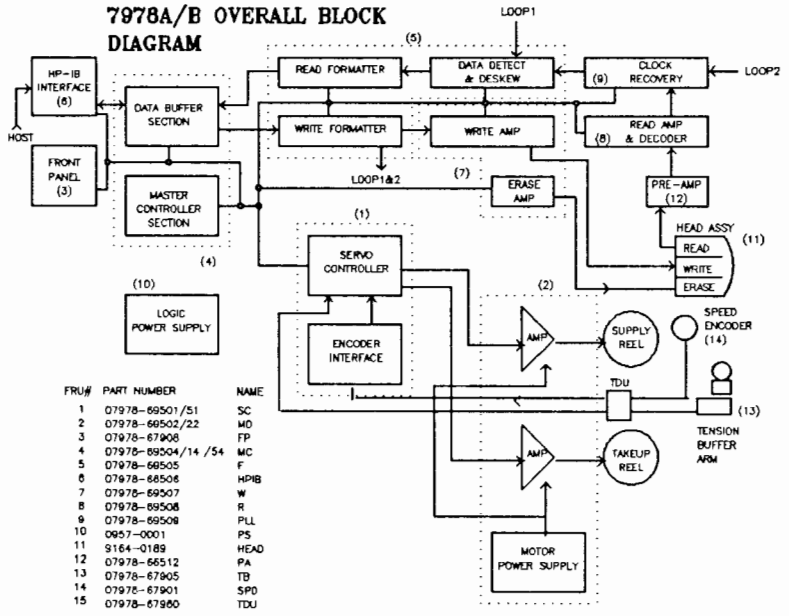
Figure 8-2
7978A/B Cable Interconnect

SECTION 9

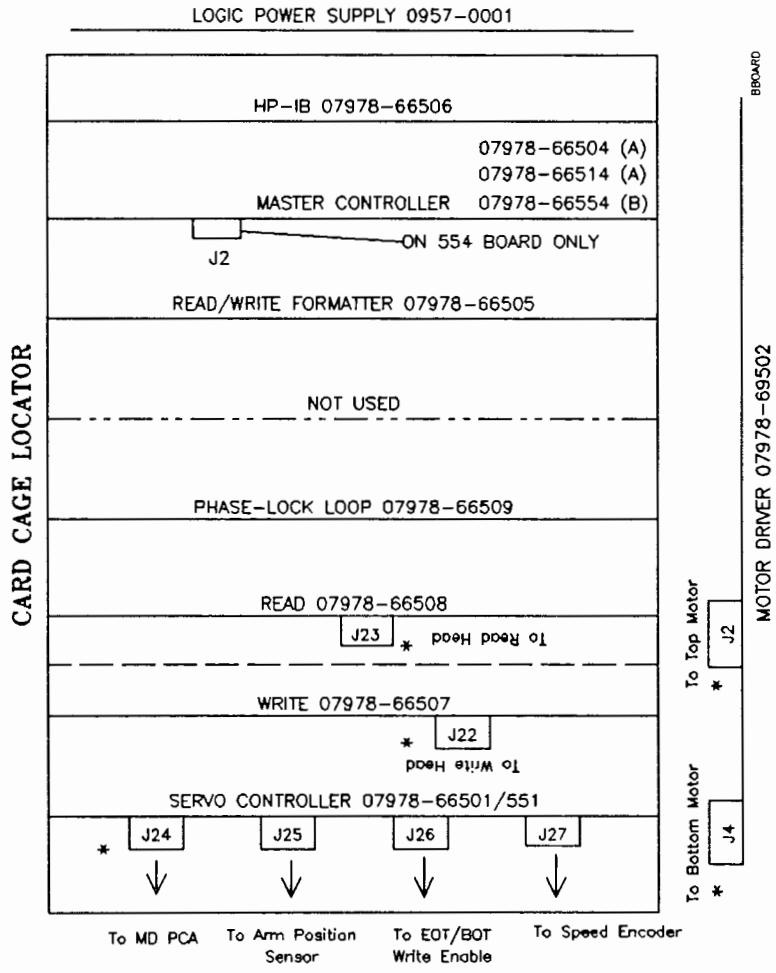
DIAGRAMS

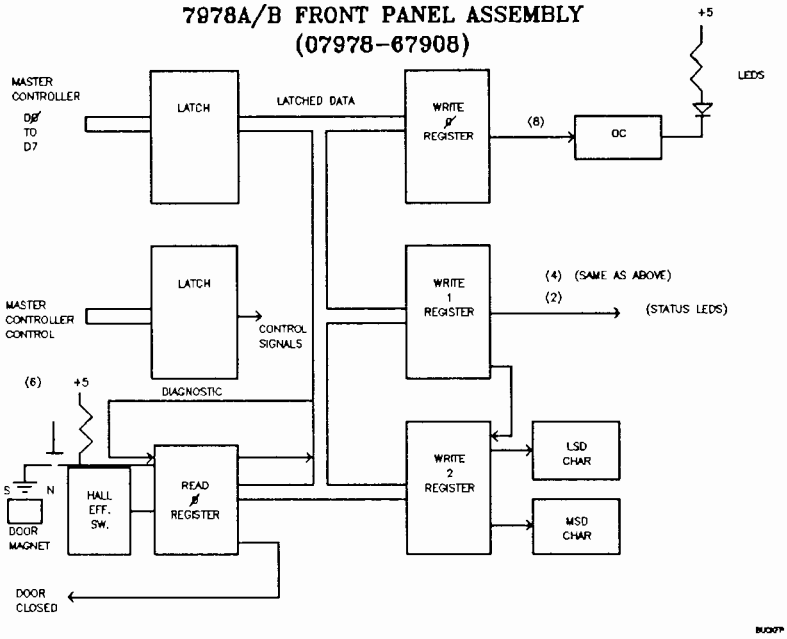
[1] TROUBLESHOOTING DIAGRAMS

7978A/B OVERALL BLOCK DIAGRAM

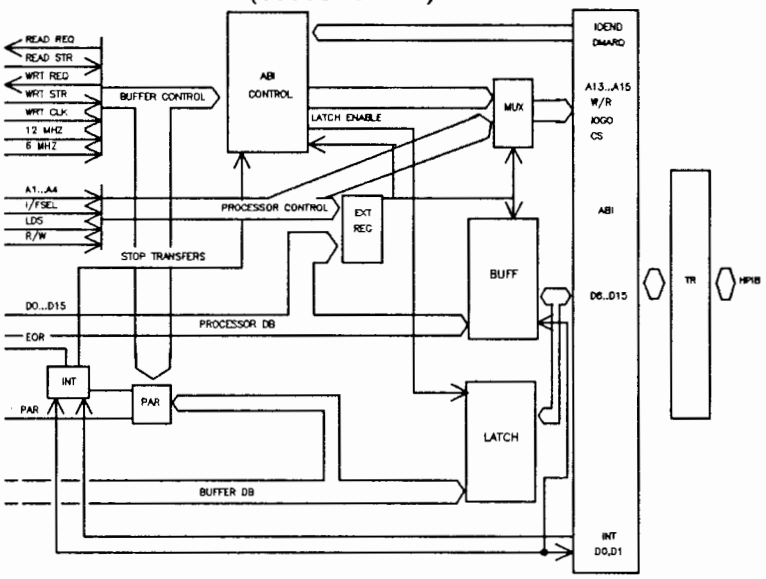


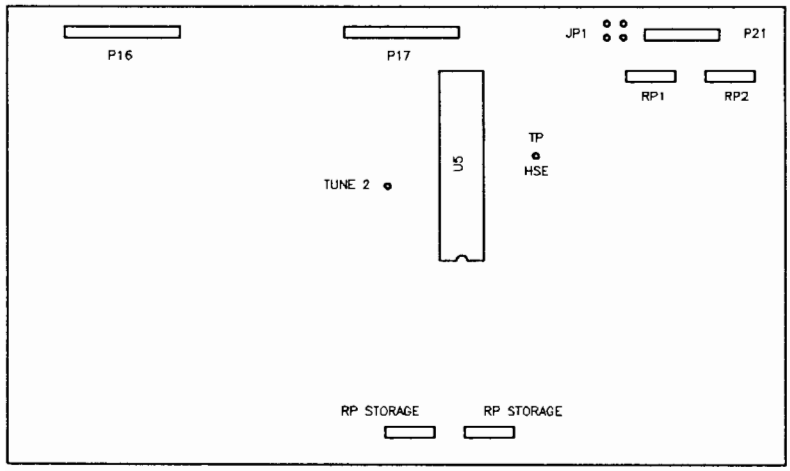
FRU#	PART NUMBER	NAME
1	07978-69501/51	SC
2	07978-69502/22	MD
3	07978-67908	FP
4	07978-69504/14 /54	MC
5	07978-69505	F
6	07978-69506	HPIB
7	07978-69507	W
8	07978-69508	R
9	07978-69509	PLL
10	0957-0001	PS
11	9164-0189	HEAD
12	07978-66512	PA
13	07978-67905	TB
14	07978-67901	SPD
15	07978-67950	TDU


LOGIC POWER SUPPLY 0957-0001
CARD CAGE LOCATOR
HP-IB 07978-66506
07978-66504 (A)
07978-66514 (A)
MASTER CONTROLLER 07978-66554 (B)
J2
ON 554 BOARD ONLY
READ/WRITE FORMATTER 07978-66505
NOT USED
PHASE-LOCK LOOP 07978-66509
READ 07978-66508
J23
To Read Head
WRITE 07978-66507
J22
To Write Head
SERVO CONTROLLER 07978-66501/551
J24
J25
J26
J27
To MD PCA
To Arm Position Sensor
To EOT/BOT Write Enable
To Speed Encoder
MOTOR DRIVER 07978-69502
BBOARD
To Top Motor
J2
To Bottom Motor
J4


7978A/B FRONT PANEL ASSEMBLY
(07978-67908)
+5
LEDS
MASTER CONTROLLER
Dø TO D7
LATCH
LATCHED DATA
WRITE ø REGISTER
(8)
OC
LATCH
MASTER CONTROLLER CONTROL
CONTROL SIGNALS
WRITE 1 REGISTER
(4) (SAME AS ABOVE)
(2)
(STATUS LEDS)
(6)
+5
DIAGNOSTIC
WRITE 2 REGISTER
LSD CHAR
MSD CHAR
S
N
DOOR MAGNET
HALL EFF. SW.
READ ø REGISTER
DOOR CLOSED

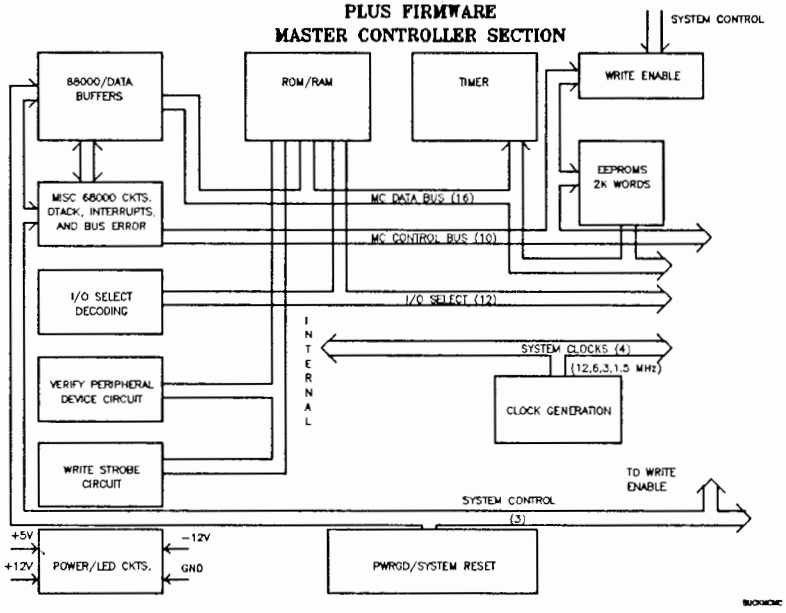
7978A/B HP-IB ASSEMBLY (07978-66506)



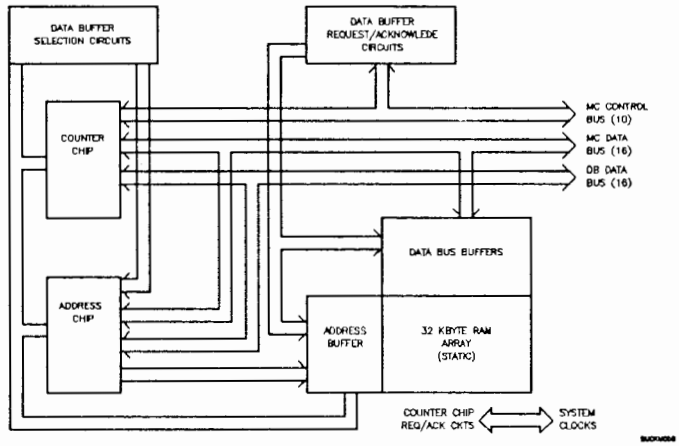


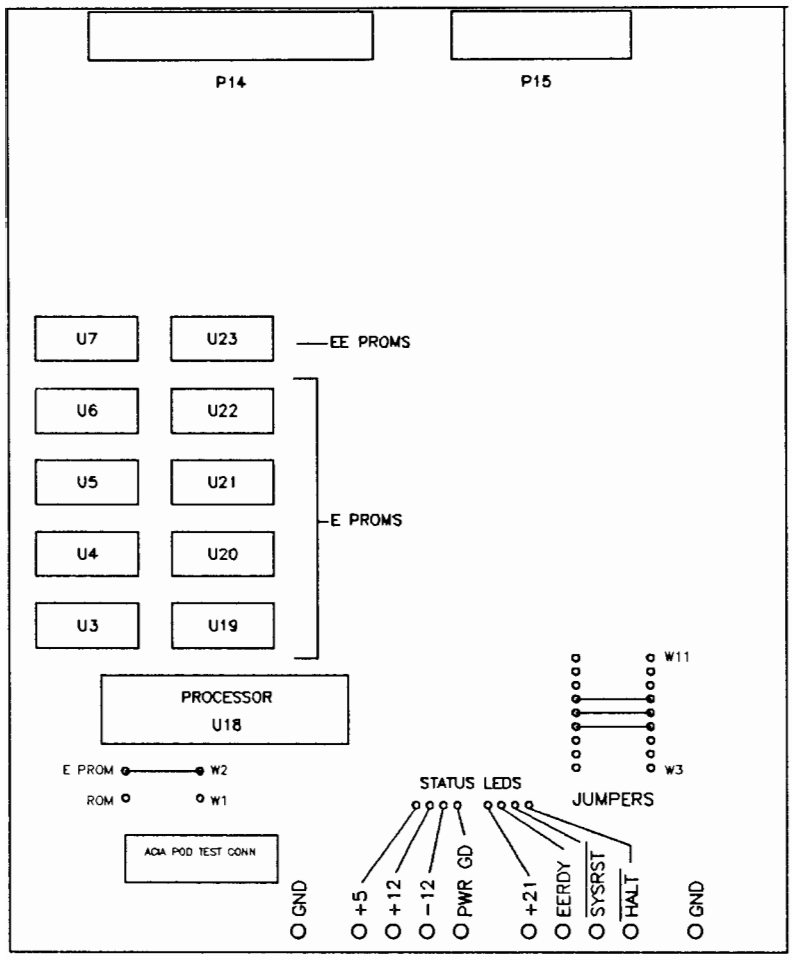
HP-IB ASSEMBLY PCA 07978-66506

7978A/B MASTER CONTROLLER ASSEMBLY
PLUS FIRMWARE
MASTER CONTROLLER SECTION



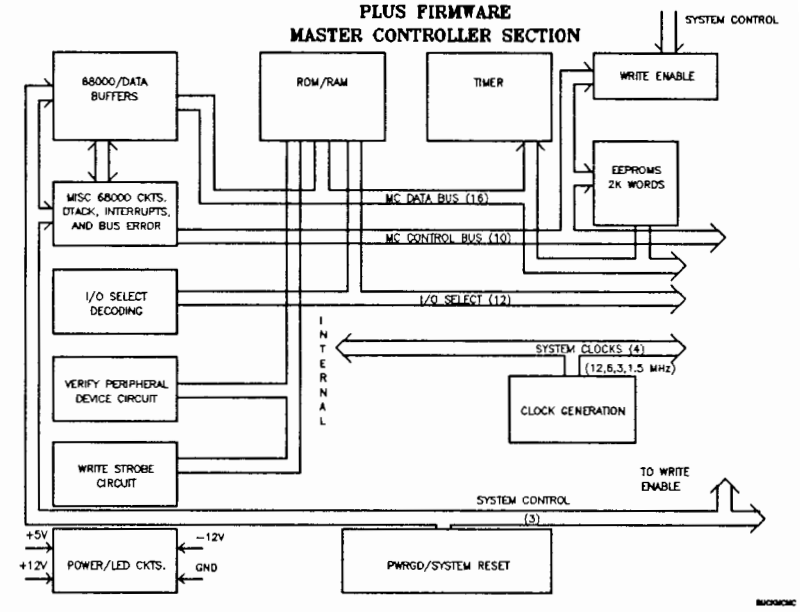
DATA BUFFER SECTION



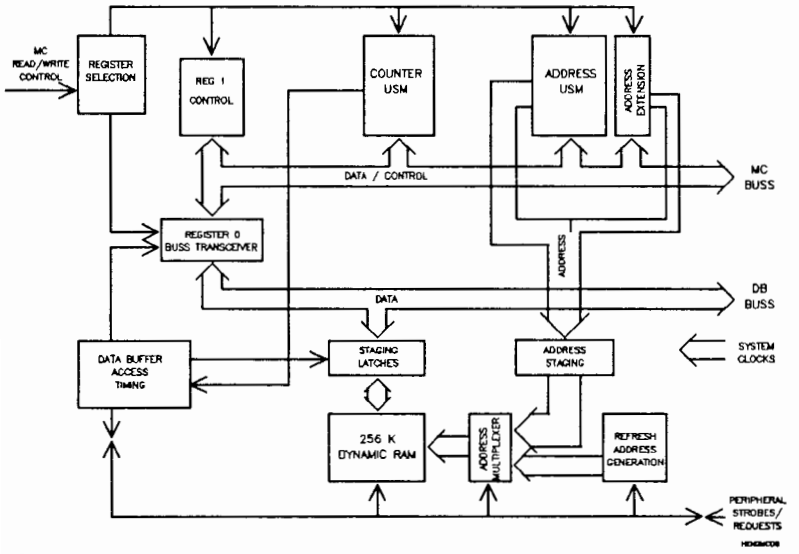


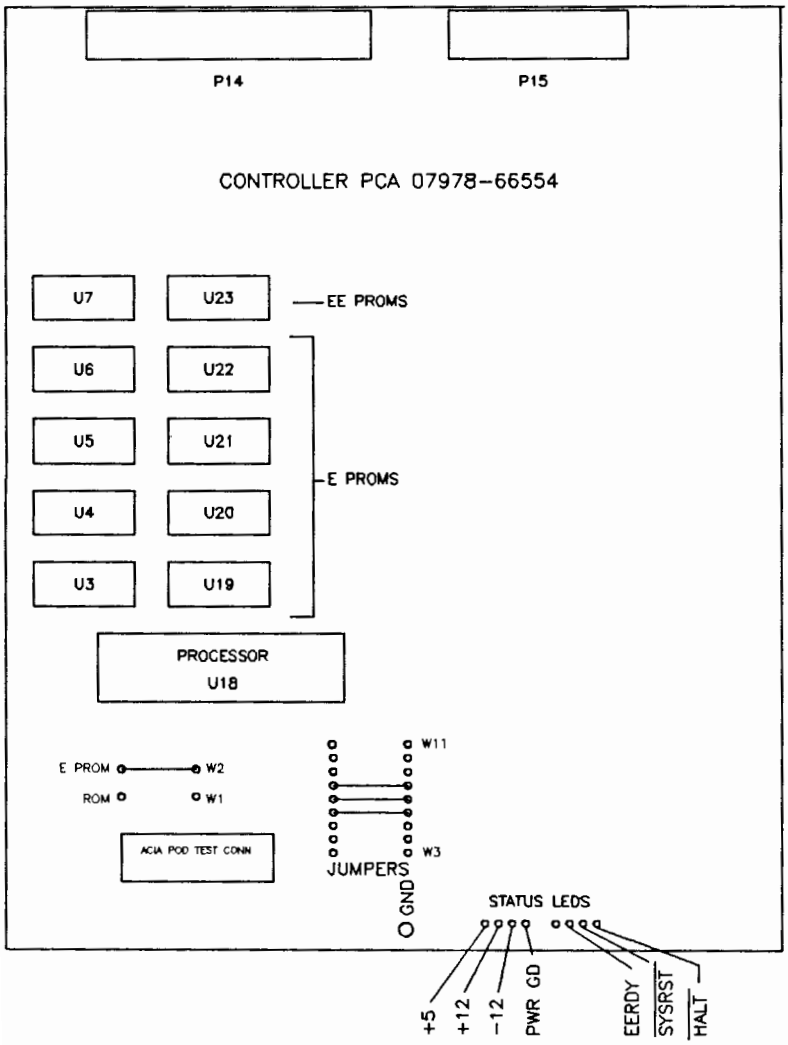
CONTROLLER PCA 07978-66504 OR 07978-66514

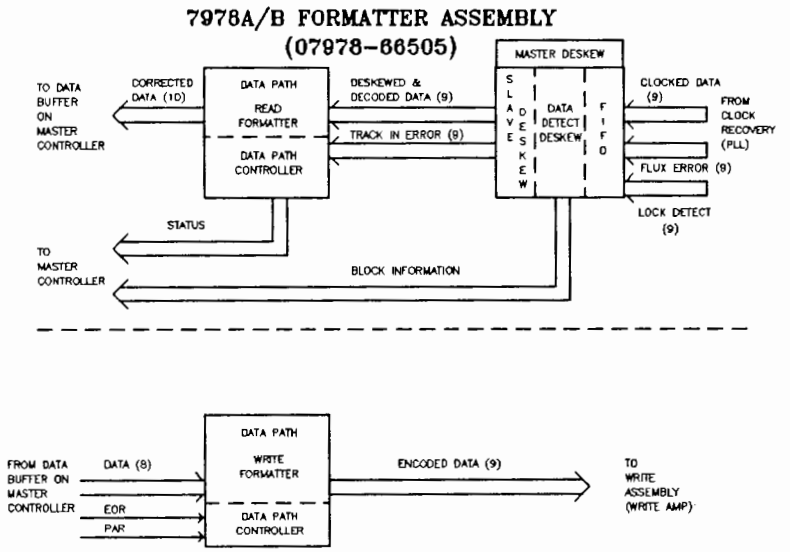
7978A/B MASTER CONTROLLER ASSEMBLY
PLUS FIRMWARE
MASTER CONTROLLER SECTION

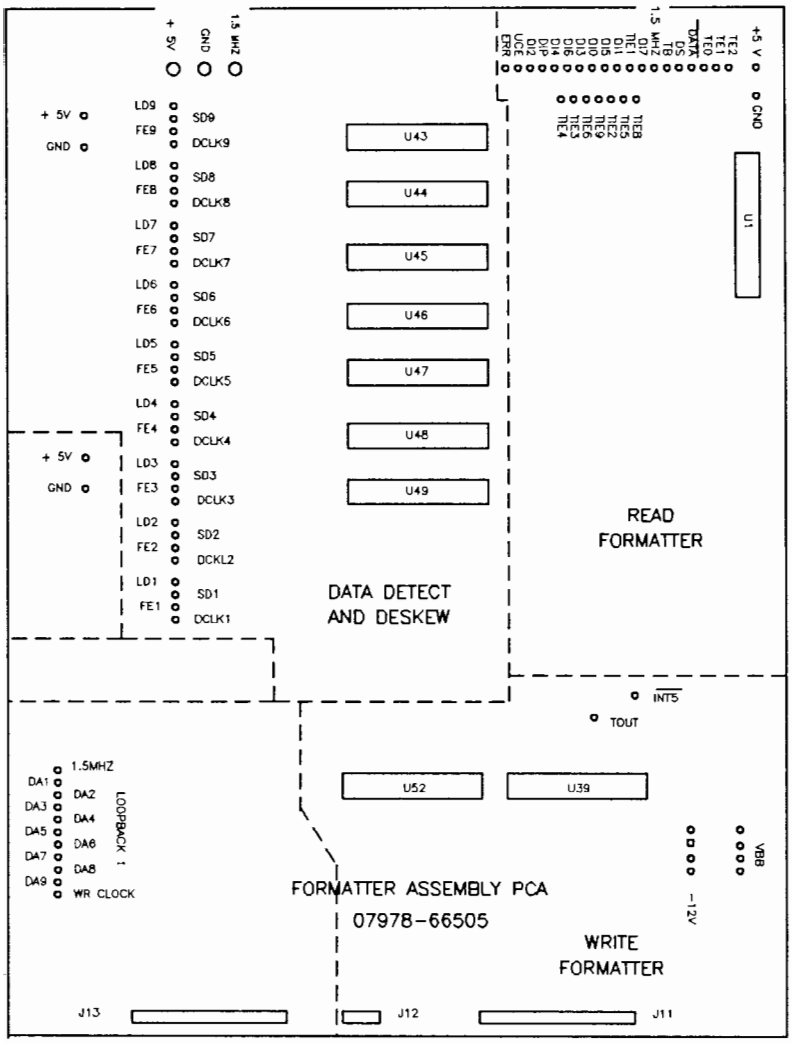


7978B MASTER CONTROLLER ASSEMBLY
(07978-66554 PLUS FIRMWARE)
DATA BUFFER SECTION



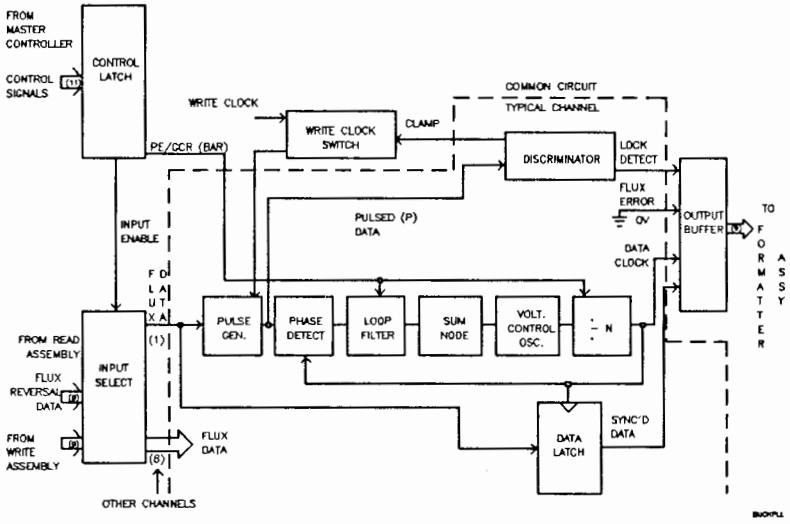

P14
P15
CONTROLLER PCA 07978-66554
U7
U23
EE PROMS
U6
U22
U5
U21
E PROMS
U4
U20
U3
U19
PROCESSOR
U18
E PROM
W2
ROM
W1
ACIA POD TEST CONN
W11
W3
JUMPERS
GND
STATUS LEDS
+5
+12
-12
PWR GD
EERDY
SYSRST
HALT

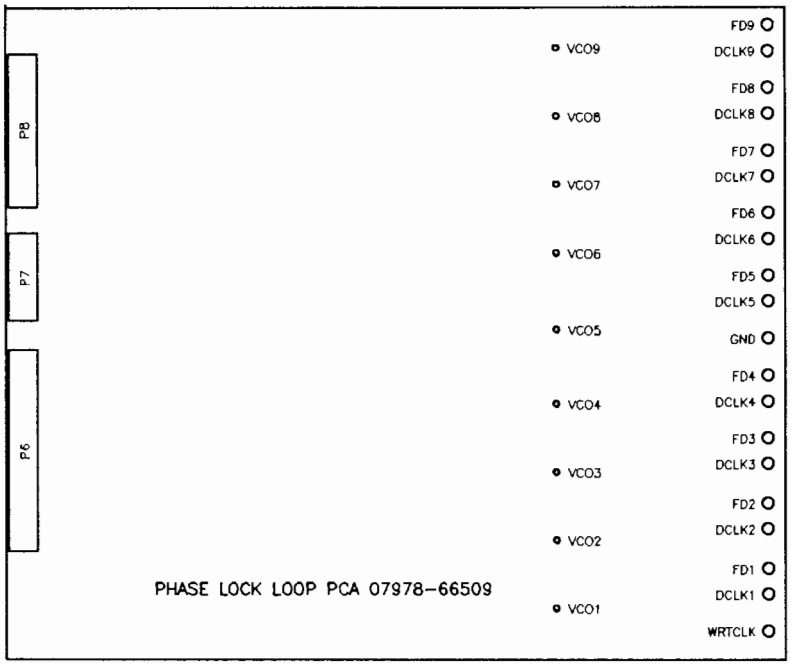

7978A/B FORMATTER ASSEMBLY
(07978-66505)
MASTER DESKEW
TO DATA BUFFER ON MASTER CONTROLLER
CORRECTED DATA (10)
DATA PATH
READ FORMATTER
DATA PATH CONTROLLER
DESKEWED & DECODED DATA (9)
TRACK IN ERROR (9)
SLAVE DESKEW
DATA DETECT DESKEW
FIFO
CLOCKED DATA (9)
FROM CLOCK RECOVERY (PLL)
FLUX ERROR (9)
LOCK DETECT (9)
STATUS
TO MASTER CONTROLLER
BLOCK INFORMATION
FROM DATA BUFFER ON MASTER CONTROLLER
DATA (8)
EOR
PAR
DATA PATH
WRITE FORMATTER
DATA PATH CONTROLLER
ENCODED DATA (9)
TO WRITE ASSEMBLY (WRITE AMP)

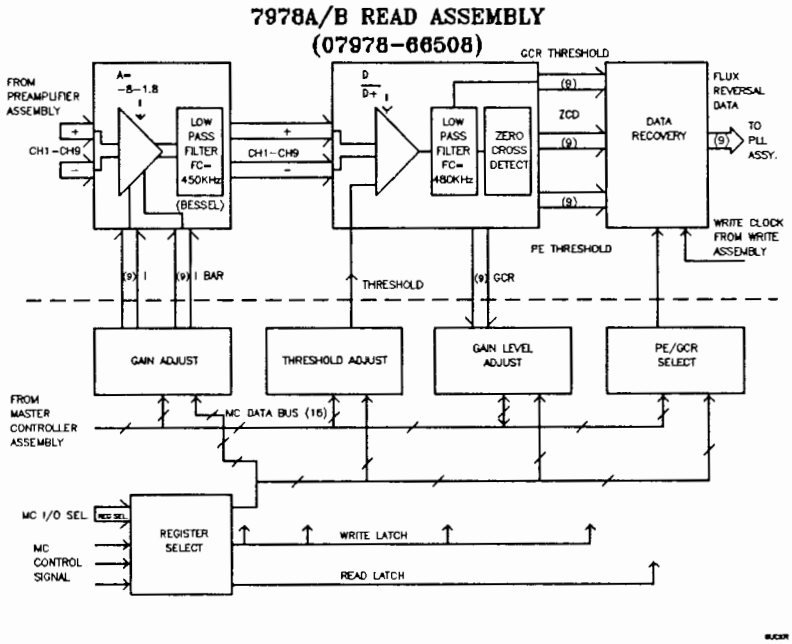

+ 5V
GND
1.5 MHZ
LD9
FE9
SD9
DCLK9
LD8
FE8
SD8
DCLK8
LD7
FE7
SD7
DCLK7
LD6
FE6
SD6
DCLK6
LD5
FE5
SD5
DCLK5
LD4
FE4
SD4
DCLK4
LD3
FE3
SD3
DCLK3
LD2
FE2
SD2
DCKL2
LD1
FE1
SD1
DCLK1
U43
U44
U45
U46
U47
U48
U49
DATA DETECT
AND DESKEW
READ
FORMATTER
+5 V
GND
U1
INT5
TOUT
1.5MHZ
DA1
DA2
DA3
DA4
DA5
DA6
DA7
DA8
DA9
WR CLOCK
LOOPBACK 1
U52
U39
VBB
-12V
FORMATTER ASSEMBLY PCA
07978-66505
WRITE
FORMATTER
J13
J12
J11

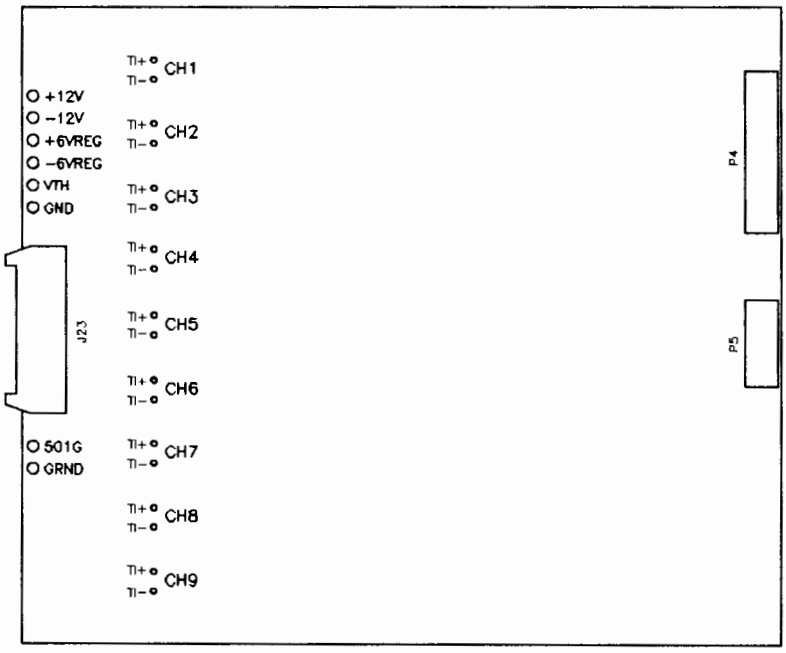
7978A/B PHASE LOCKED LOOP (CLOCK RECOVERY) ASSEMBLY

TYPICAL CHANNEL WITH COMMON CONTROL CIRCUITS



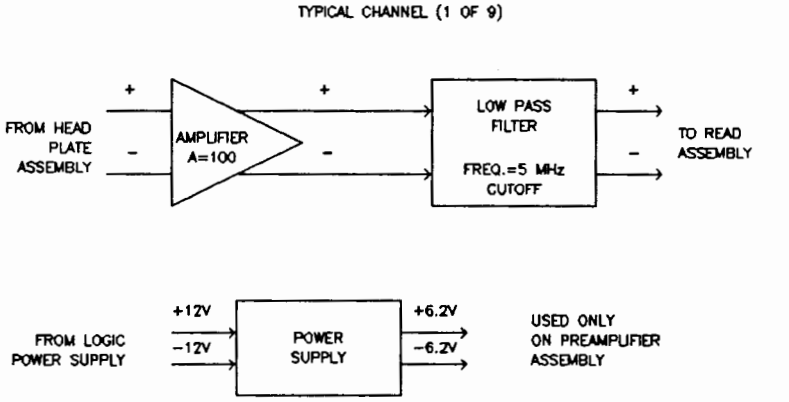

P8
P7
P6
VCO9
VCO8
VCO7
VCO6
VCO5
VCO4
VCO3
VCO2
VCO1
FD9
DCLK9
FD8
DCLK8
FD7
DCLK7
FD6
DCLK6
FD5
DCLK5
GND
FD4
DCLK4
FD3
DCLK3
FD2
DCLK2
FD1
DCLK1
WRTCLK
PHASE LOCK LOOP PCA 07978-66509

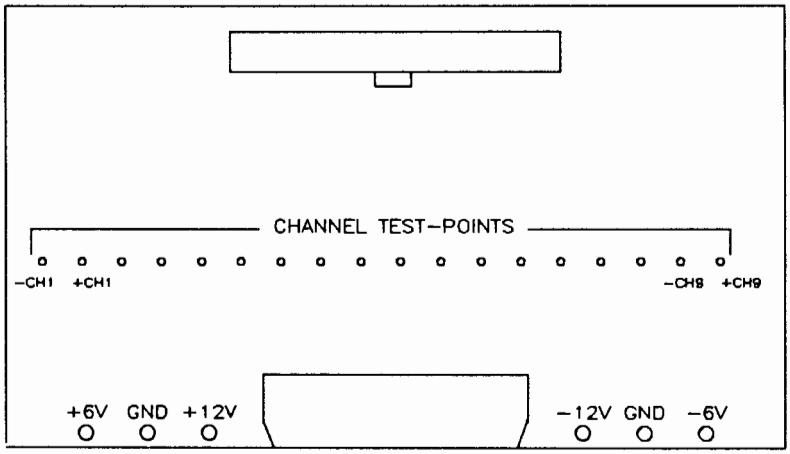

7978A/B READ ASSEMBLY
(07978-66508)
FROM PREAMPLIFIER ASSEMBLY
CH1-CH9
A=
-B-1.8
LOW PASS FILTER FC= 450KHz
(BESSEL)
CH1-CH9
D
D+
LOW PASS FILTER FC= 480KHz
ZERO CROSS DETECT
GCR THRESHOLD
ZCD
DATA RECOVERY
FLUX REVERSAL DATA
TO PLL ASSY.
WRITE CLOCK FROM WRITE ASSEMBLY
PE THRESHOLD
(9) I
(9) I BAR
THRESHOLD
(9) GCR
GAIN ADJUST
THRESHOLD ADJUST
GAIN LEVEL ADJUST
PE/GCR SELECT
FROM MASTER CONTROLLER ASSEMBLY
MC DATA BUS (16)
MC I/O SEL
MC CONTROL SIGNAL
REGISTER SELECT
WRITE LATCH
READ LATCH



READ AMP & DECODER 07978-66508

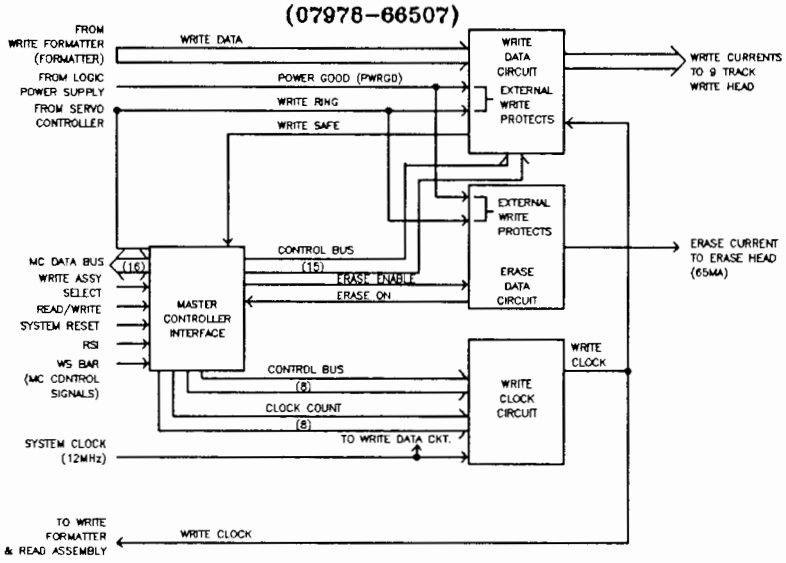
7978A/B PREAMPLIFIER ASSEMBLY (07978-66512)

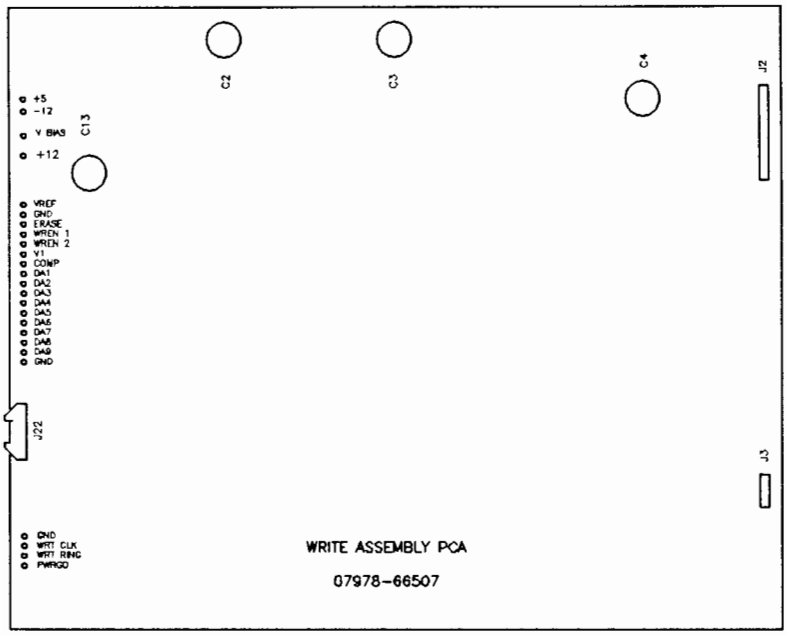




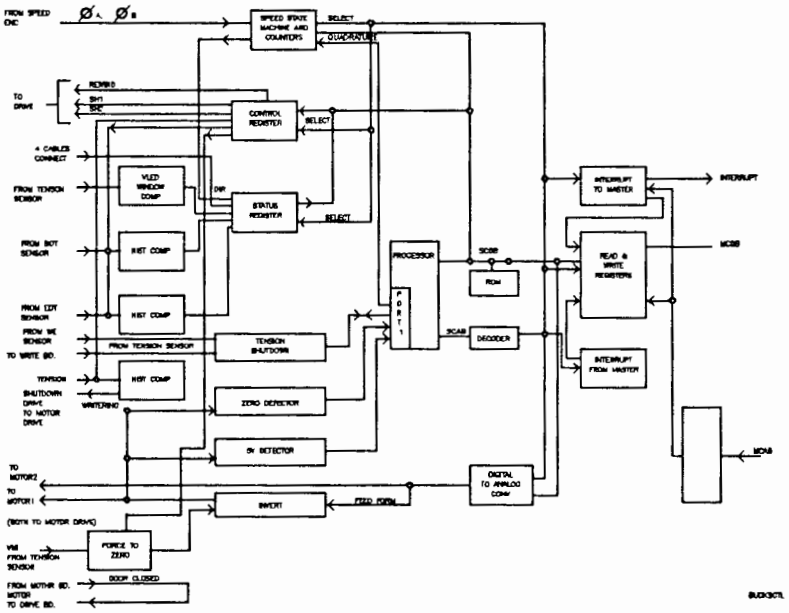
PREAMP 07978-66512

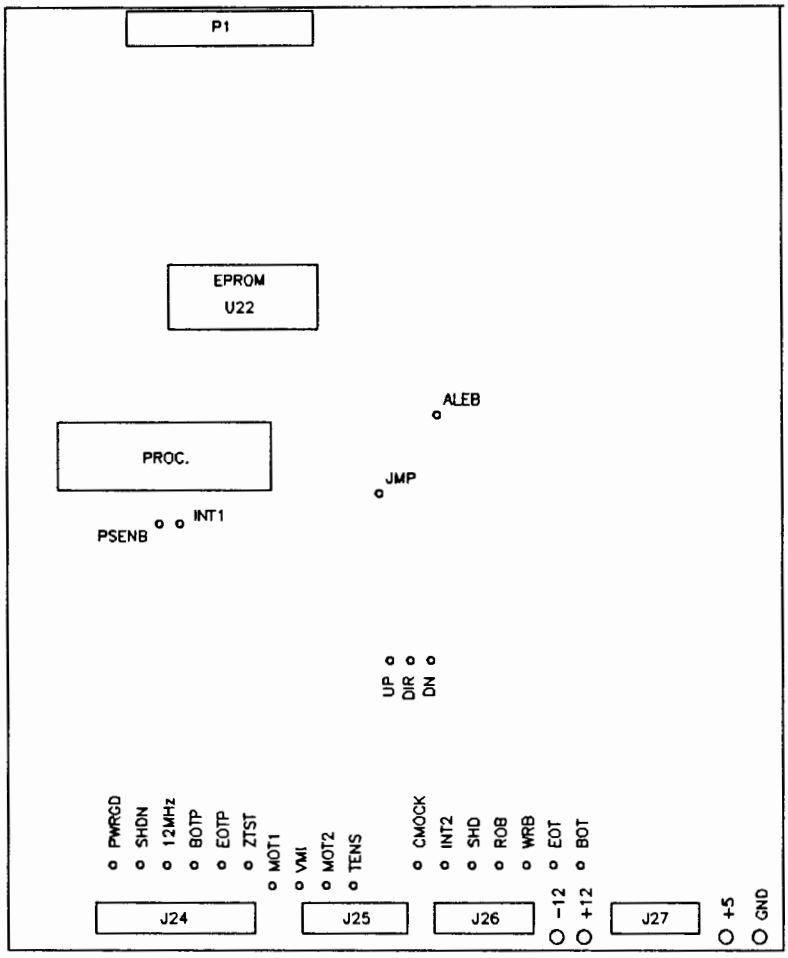
7978A/B WRITE ASSEMBLY (07978-66507)




C2
C3
C4
J2
+5
-12
Y BIAS
C13
+12
VREF
GND
ERASE
WREN 1
WREN 2
Y1
COMP
DA1
DA2
DA3
DA4
DA5
DA6
DA7
DA8
DA9
GND
J22
J3
GND
WRT CLK
WRT RING
PWRGD
WRITE ASSEMBLY PCA
07978-66507

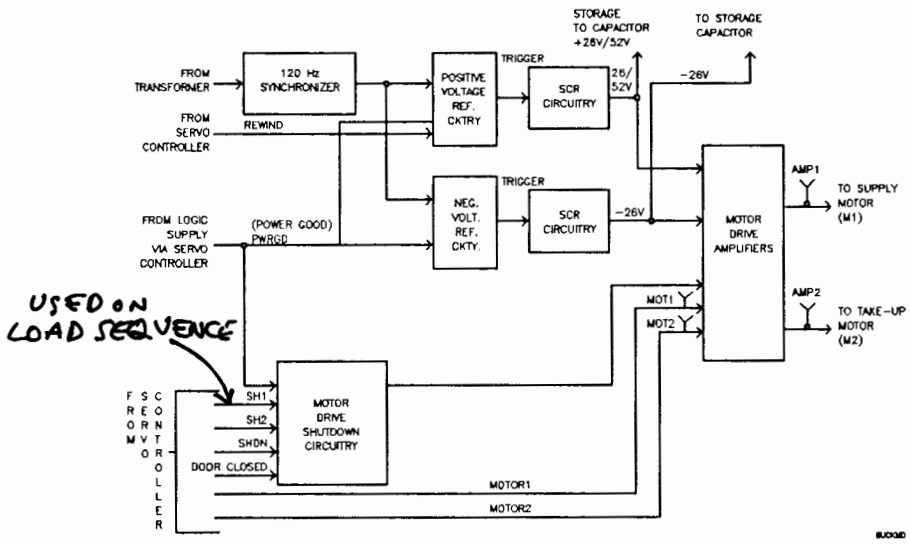
7978A/B SERVO CONTROLLER

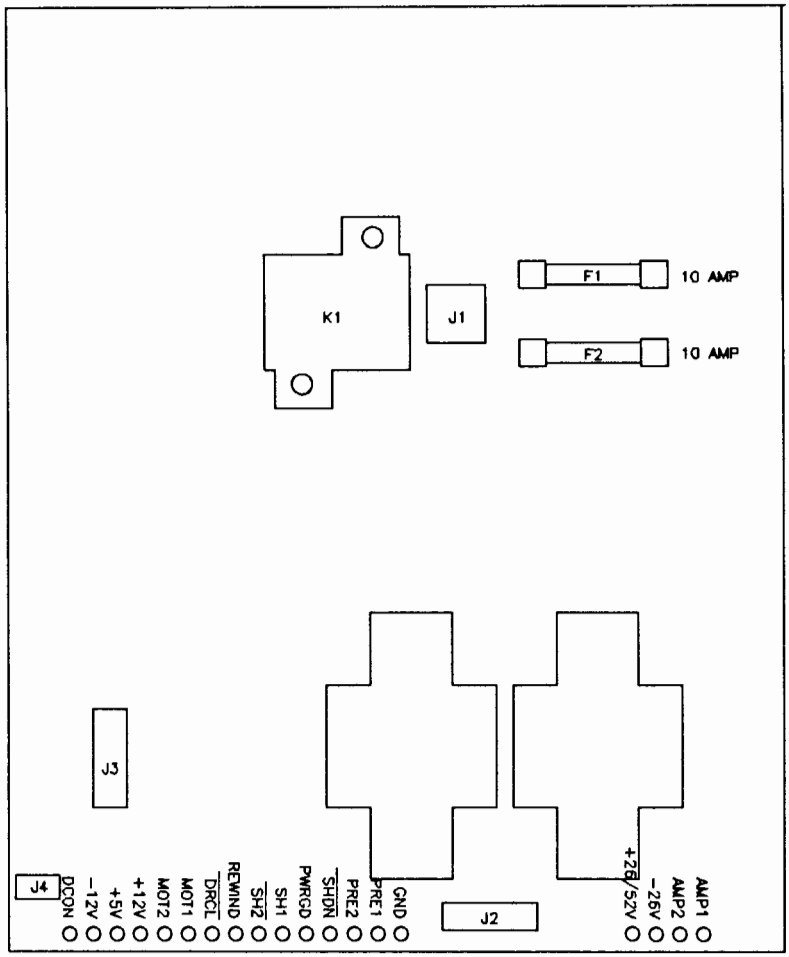




SERVO CONTROLLER 07978-66501 OR 07978-66551

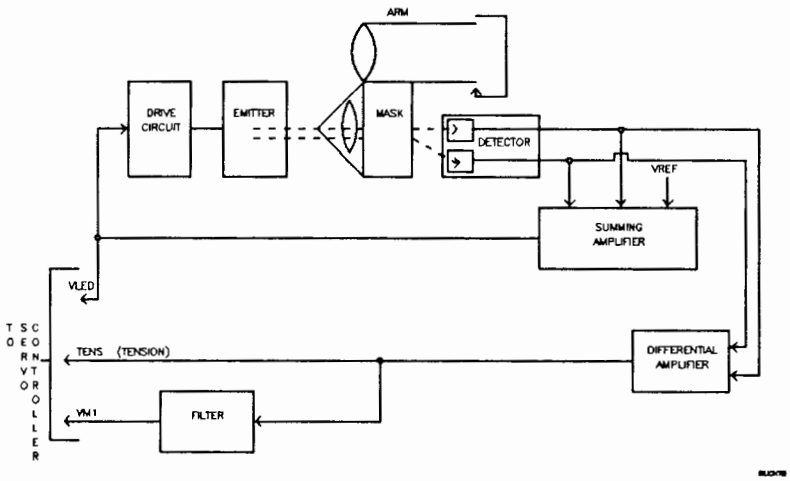
7978A/B MOTOR DRIVE ASSEMBLY



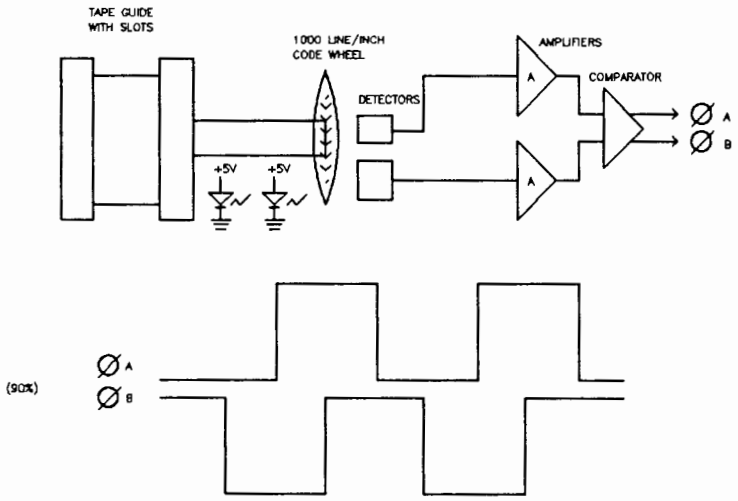


MOTOR DRIVER PCA 07978-66502 OR 07978-66522

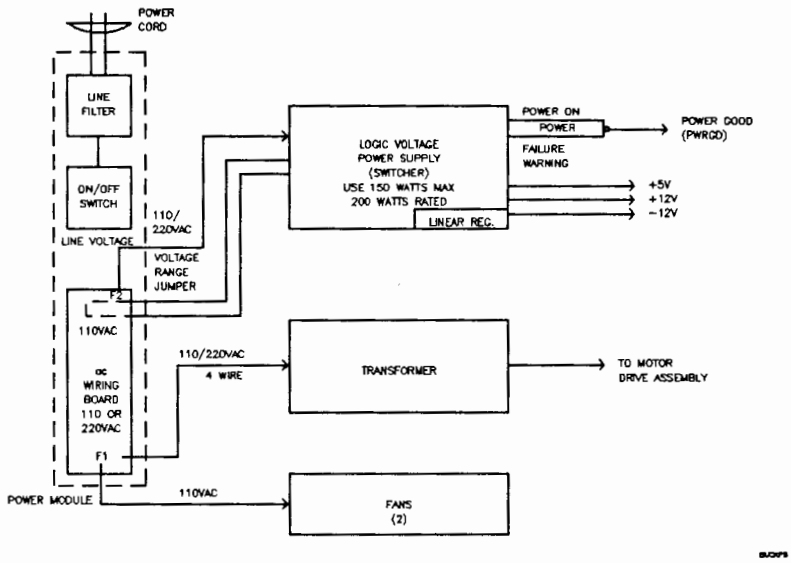
7978A/B TENSION BUFFER ARM (07978-67905)



7978A/B SPEED ENCODER (07978-67901)



7978A/B POWER SUPPLY SYSTEM



SECTION 10

REFERENCE

The HP 7978A/B Magnetic Tape Subsystem Operator's Manual	07978-90000
HP 7978A/B 1/2-inch Tape Drive Service Manual	07978-90030

SECTION 11

SERVICE NOTES/IOSMs

This section of the handbook may be used to file service notes.

Service Notes at Handbook printing date are as follows:

Seq. No.	Pub. Date	Title
7978A-1	8/84	Modification to Master Controller
7978A-1A	11/84	Modification to Master Controller
7978A-2	4/85	Static Friction (stiction) Upgrade
7978A-3	5/85	Broken Hinges
7978A-3A	8/86	Broken Hinges
7978A-4	5/85	Tension Loss/Tape Rub
7978A-5	6/85	+26/52 Volt Power Supply
7978A-6	6/85	Random Power Cycles
7978A-7	7/85	Noisy Tape Displacement Unit
7978A-8	7/85	Problems With BOT/EOT Sensor
7978A-8A	9/85	Problems With Reflective Tape
7978A-9	9/85	EPROM P/N Change (07978-89908 to -89909)
7978A-10	10/85	Firmware Upgrade
7978A-11	7/86	Tapes threaded incorrectly
7978A-12	7/86	Door Interlock Override Tool
7978A-13A	6/86	Buffer Arm Bracket Avail. 07978-61200
7978A-14	8/86	Buffer Arm P/N Change - 07978-67935
7978A-15	8/86	Hinge Assembly P/N Change 07978-61201
7978A-16	11/86	07978-66509 PCA made surface-mount

7978B Service Notes on next page.

Seq. No.	Pub. Date	Title
7978B-1	1/86	Door Hinge P/N Change
7978B-2	7/86	Tapes threaded incorrectly
7978B-3	6/86	Buffer Arm Pad failure
7978B-3A	6/86	Buffer Arm Bracket Avail. 07978-61200
7978B-4	7/86	Door Interlock Override Tool
7978B-5	8/86	Buffer Arm P/N Change - 07978-67935
7978B-6	8/86	Hinge Assembly P/N Change 07978-61201
7978B-7	11/86	07978-66509 PCA made surface-mount