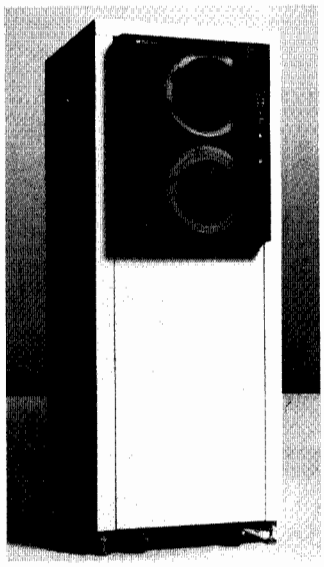
HP 7974A



Part No. 07974-90039
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 HP7974A is a 1/2-inch, HP-IB, read-after-write digital magnetic tape drive which operates at 50 IPS in the start/stop mode and 100 IPS in the streaming mode. It also uses "Immediate Response" to improve the overall transfer rate. The standard tape drive is a 1600 CPI unit mounted in a 19 inch (19X56) EIA cabinet.

A dual density (800/1600 CPI) option is available at the time of purchase, or it can be installed in the field as an upgrade. When the dual density feature is installed, the density is selected via the driver. In the 800 CPI (NRZI) mode, the maximum transfer rate is 40 kilobytes at 50 IPS & 80 kilobytes at 100 IPS. For 1600 CPI (PE) mode the transfer rate is 80 and 160 kilobytes.

In the write mode, the tape drive stores the data to be written in an internal buffer and provides an "Immediate Response" back to the host system. The host system can then send additional data to the drive. Internally, the drive uses command queuing to keep the the unit in streaming mode. In the event that the host system does not supply data at a sufficient rate to keep the unit in the streaming mode, the tape drive will revert to the start/stop mode.

In the read mode, tape access time is decreased by the "read ahead" feature. When the host system sends a read command to the tape unit, the drive fills it's buffer in anticipation of another read command. Therefore, instead moving of the tape during every read operation, data is transferred from the buffer. During lengthy read operations, the buffer is filled as needed.

Finally, the unit contains extensive internal selftest diagnostics which provide valuable troubleshooting data and information on the performance of the unit.

[2] OPTIONS

The available options are:

800	Adds 800 CPI NRZI

[3] TECHNICAL SPECIFICATIONS

ELECTRICAL SPECIFICATIONS:

A. Frequency Requirements
The tape unit is designed to operate with either 50 or 60 Hz single phase A.C. mains input. Maximum line frequency variation is 48 Hz to 62 Hz.

B. Line Voltage
The unit can be operated on the following line voltages; 100,120,220,and 240 VAC. Maximum allowable line voltage variation is +/- 10%.

NOTE: Input voltage can be selected in the field via a voltage selector plug. The unit will be shipped with a plug for either 115VAC or 230VAC.

C. Current Requirements

Power On Surge

COLD
38 Amps @ 120 VAC for one-half cycle max.
22 Amps @ 220 VAC for one-half cycle max.
HOT
50 Amps @ 120 VAC for one-half cycle max.
40 Amps @ 220 VAC for one-half cycle max.

Operating

120 VAC	4.50 Amps	Tolerated line dropout
220 VAC	2.45 Amps	1 cycle in 10 cycles.

D. Power Consumption
2050 BTU (600 Watts)

MECHANICAL SPECIFICATIONS:

Cabinet
The 7974A is vertically racked in a 56-inch EIA cabinet. The The unit is considered a stand-alone device and has its own unique HPIB address.

Vibration
Operating - 0.1g (3-15 Hz); 0.5g (15-300 Hz)

Shock
Operating - 3g 1/2 sine pulse, 10 ms duration
Packaged - 15g, 20 ms duration

[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

[5] SERVICE KIT

The following lists the minimum recommended parts for a service kit.

New P/N	Exchange P/N	Description
07974-66501		PCA, Interconnect
07978-66514	07978-69514	PCA, Master Controller
07978-66506		PCA, HP-IB
105678-TED		PCA, Power Supply
108702-TED	07974-69120	PCA, Read Logic
108705-TED		PCA, 5 Volt Regulator
108709-TED	07974-69221	PCA, Control/Motherboard
108710-TED	07974-69122	PCA, Data Formatter
108716-TED	07974-69123	PCA, NRZI
108707-TED		Strobe Light Assy
108714-TED		PCA, Switch Facia (panel)
108533-TED		BOT and EOT Sensor Assy
03575-TED		Tape Cleaner
78636-TED		Write Enable Assy
76332-TED		Door Switch Assy
78763-TED		Bridge Roller Assy
78764-TED		Roller Guide Assy
2110-0003		Fuse, 3A
2110-0051		Fuse, 10A
2110-0030		Fuse, 5A Slo-Blo
2110-0303		Fuse, 2A Slo-Blo
1826-0147		Regulator MC7812
1826-0221		Regulator MC7912
1826-0445		Regulator MC7905

SECTION 2
ENVIRONMENTAL/INSTALLATION/PM

[1] ENVIRONMENTAL CONSIDERATIONS

ENVIRONMENTAL SPECIFICATIONS:

Temperature

Hardware
 Operating - +10 to +40 degrees C
 Non-operating - -40 to +70 degrees C

Media
 Operating - +16 to +32 degrees C
 Non-operating - + 5 to +32 degrees C (recorded)
 + 5 to +48 degrees C (unrecorded)

Humidity

Hardware
 Operating - 20% to 80% (non-condensing)
 Non-operating - 10% to 95% (non-condensing)

Media
 Operating - 20% to 80% (non-condensing)
 Non-opertaing - 20% to 80% (non-condensing)

Altitude
 Operating - 0 to 10000 ft (3000m)
 Non-operating - 0 to 50000 ft (15000m)

[2] INSTALLATION PROCEDURES (Power)

POWER STRAPPING, SWITCH POSITION, AND INPUT FUSE RATING

POWER STRAPPING

The 7974A is shipped in three different power configurations; 120, 220,& 240 VAC. The tolerance for the line voltage is +/-10%. Check the supply input tolerance by measuring the voltage at the anode of D1 and D2 on the Thorn fused power distribution PCA (105678-TED). Use chassis ground as the ground reference.

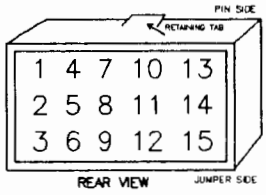
The minimum voltage is 15.6 volts. The nominal voltage is 18.5 volts. The maximum voltage is 20.6 volts.

If this tolerance is insufficient, the voltage selector may be changed to to one of the following:

Part Number	Voltage Range
78535-TED	100VAC +/-10%
78528-TED	110VAC +/-10%
78529-TED	115VAC +/-10%
78530-TED	120VAC +/-10%
78531-TED	220VAC +/-10%
78532-TED	230VAC +/-10%
78533-TED	240VAC +/-10%

In the event that the proper voltage selector is not available, the power can be changed by moving the wire jumpers on the selector per the following chart (figure on next page). Mark the selector plug with the appropriate voltage to reflect the altered plug.

Voltage	Wire Jumpers			
100	1 to 3	2 to 13	5 to 15	12 to 14
110	1 to 4	2 to 10	5 to 15	12 to 14
115	1 to 7	2 to 11	5 to 15	12 to 14
120	1 to 8	2 to 9	5 to 15	12 to 14
200	1 to 3	5 to 13		12 to 14
220	1 to 4	5 to 10		12 to 14
230	1 to 7	5 to 11		12 to 14
240	1 to 8	5 to 9		12 to 14



Input Voltage Selector

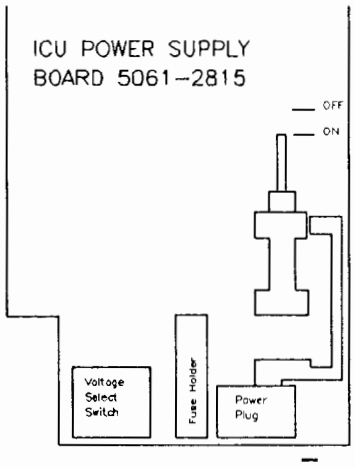
INPUT FUSE RATING

Transport Power Supply
110/115/120 VAC, FS1 5 A Slo-Blo
220/230/240 VAC, FS1 2 A Slo-Blo

ICU Power Supply
115/230 VAC, F1 3 Amp. (P/N 2110-0003)

HP CONTROLLER POWER SUPPLY

The HP controller power supply contains a switch to select either 115 or 230 VAC. Before applying power to the unit, be sure that the slide switch is in the proper position.



ICU Power Supply Fuse and Switch Location

[3] CONTROL/MOTHERBOARD CONFIGURATION

Check the configuration of the Control/Motherboard wire links and dip switch per Section 3-2.

[4] INSTALLATION PROCEDURES (Mechanical and Electrical)

Perform the following procedure IN THE ORDER LISTED:

1. "Tape Tension and Tension Balance" p. 6-3
2. "Write Enable Ring Sensor Check and Adjustment" p. 6-7
3. "Hub Height" p. 6-8
4. "Capstan Tracking" p. 6-9
5. "Power Supply" p. 6-10
6. "Capstan Offset" p. 6-10
7. "Speed" p. 6-10
8. "EOT/BOT Sensor" p. 6-11
9. "Read Threshold" p. 6-12

[5] NRZI INSTALLATION PROCEDURES (Option 800 or Accessory No. 88700A)

INSTALLATION AND CHECKOUT INSTRUCTIONS

INSTALLATION

A. Remove head deskew from from carrier plate on the rear of the head plate and insert in socket in position IC 92 on NRZI PCA. For 88700A, install the head assembly.

B. Place switch SW1 in the "0" position. Place switch SW2 in the "0" (external parity) position.

C. Insert NRZI PCA in outside slot of card cage with the Data Formatter in adjacent slot.

D. Fit head cable adaptors (P/N 109541-TED & 109542-TED) between NRZI and Data Formatter PCAs with head leads connected to the center connector.

CHECKOUT

Perform PE and NRZI electrical adjustments per Section 6; BOT/EOT Sensor, Read Threshold, and Read Skew Check.

[6] PREVENTIVE MAINTENANCE PROCEDURES

There is no regular P.M. for the Customer Engineer. Customer responsibilities are as follows:

This maintenance must be performed once per each 8 hour shift.

Material Required:

A. Lint-free cloth
B. Foam Swabs
C. Cleaning Fluid such as Freon TF (TM) or HP head cleaner.

Procedure

A. Run some tape and visually check for tape scraping on the guide flanges or uneven travel on the capstan pulley. If tape reel flanges scraping is observed, verify that the reel is properly seated on the hub.
B. Rewind and remove tape.
C. Lift up the flux shield and hold it to clean the read/write and erase head.
D. Clean read/write and erase heads and visually examine for scratches or burrs.
E. Use a lint-free cloth dampened with HP head cleaner or freon. Clean the capstan pulley. Ensure that no lint remains.
F. Use a foam swab dampened in HP head cleaner or freon. Clean the tape cleaner and the fixed guides.

WARNING

The tape cleaner has two sharp blades and should be cleaned with extreme care.

G. Use a foam swab dampened in HP head cleaner or freon. Clean the tape roller guides.

CAUTION

Roller guides are pre-greased. Cleaning fluid should be used sparingly. At no time should spray cleaner be used on the roller guides.

SECTION 3

CONFIGURATION

[1] EXTERNAL CONFIGURATION

The 7974A is supported on HP3000 series computers 37, 39, 40, 42, 42XP, 44, 48, 58, 64, & 68; HP1000 series computers A/L; & HP9000.

HP3000 Series 37,39,40,42,42XP,44,48,58,64,& 68.
= Type 24, Subtype 3, Unit 0, Driver HIOTAPE2 (Manual Reply)
= Type 24, Subtype 11, Unit 0, Driver HIOTAPE2 (Auto Reply)

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

HP9000; Unix 5.05.

HP-IB loading may be altered on the HP-IB Interface PCA by placing the appropriate load DIP in the socket provided. No load DIP will result in an HP-IB loading of ONE. Up to 6 additional loads can be installed.

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 ONL light should go out.

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

Select address-
Press the UNITS Button to select the appropriate HP-IB address.

Enter address into drive-
Press ENTER Button to enter the new address. Press ADDRESS to exit the addressing mode.

[2] INTERNAL SWITCHES, JUMPERS AND TERMINAL CONNECTIONS

CONTROL/MOTHERBOARD CONFIGURATIONS

The Control/Motherboard PCA contains wires, jumpers and a single dip switch (or 3 dip switches depending on the version of the PCA) to properly configure it.

The original version of the Control/Motherboard has 4 PROMS and 1 dip switch. The updated version of the PCA has 3 PROMS and 3 dip switches.

Before replacing the PCA insure the configuration is as follows:

OLD CONTROL/MOTHERBOARD (4-PROM VERSION)

Link No.	Position	Description
0	IN	Transport Select
1	Out	"
2	Out	"
3	Out	"
4	Out	"
5	Out	"
6	Out	"
7	Out	"
8	Not Used	
9	Not Used	
10	Not Used	
11	In	Electrocraft Capstan motor used
	Out	Torque System Capstan motor used
12	In	Torque System Capstan motor used
	Out	Electrocraft Capstan motor used
13	In	Electrocraft Capstan motor used
	Out	Torque System Capstan motor used
14	Not Used	
15	Not Used	
16	In	FBY true on leading edge of GO
17	Out	
18	In	
19	Out	

Switch SW1

Number	Position	Result
1	Off	EOT latched upon detection
2	Off	Off-line command does not initiate a "Rewind"
3	On	Invalid command sets hard error
4	On	Over temp sets hard error
5	On	Selects PL1 pin 36=HISPD PL2 pin 50=HIDEN
6	Off	Density select only via driver
7	On	Power up default to 800 BPI
8	Off	Not used by HP

NEW CONTROL/MOTHERBOARD (3-PROM VERSION)

Link No.	Position	Description
8	Not Used	
9	Not Used	
10	Not Used	
11	In	Electrocraft Capstan motor used
	Out	Torque System Capstan motor used
12	In	Torque System Capstan motor used
	Out	Electrocraft Capstan motor used
13	In	Electrocraft Capstan motor used
	Out	Torque System Capstan motor used
14	Not Used	
15	Not Used	
18	In	
19	Out	

Switch SW1

Number	Position	Result
1	Off	EOT latched upon detection
2	Off	Off-line command does not Initiate a "Rewind"
3	On	Invalid command sets hard error
4	On	Overtemp sets hard error
5	On	Selects PL1 pin 36=HISPD PL2 pin 50=HIDEN
6	Off	Density select only via driver
7	On	Power-up default to 800 BPI
8	Off	Not used by HP

Switch SW2

Unit select switch--Place in "0" position.

Switch SW3

This switch controls the timing of the formatter and replaces links 16 and 17. Place switch in following positions:

Switch position	8	6	4	2	
		**		**	** Indicate
Switch number	4	3	2	1	position of
	**		**		the switch
Switch position	7	5	3	1	

DATA FORMATTER OR NRZI PCA

The Data Formatter PCA and the NRZI PCA contain provisions for external or internal parity generation. HP uses the external parity generation. Before installing a replacement PCA insure that the configuration is as follows:

Data Formatter	Wire links in position "1" and "3"
NRZI	Switch SW1 in "0" position
	Switch SW2 in "0" (external parity) position.

POWER SUPPLY PCA

The power supply PCA terminal connections are:

Terminal No.	Wire
1	43 (yellow/orange)
2	42 (yellow/red)
3	2 (red)
4	7 (violet)
5	8 (grey)
6	3 (orange)
16	9 (white)
0V	0 (blacks)

[3] FIRMWARE UPDATE PROCEDURE

A. Mount the firmware update tape.
B. Select the diagnostic mode.
C. Select diagnostic program 30 and press ENTER Button. The front panel LEDs will display **V00**. This indicates that the version number of the update should be entered.
D. Input the version number using the TENS and UNITS Buttons on the front panel and press the ENTER Button.
E. When the ENTER Button is pushed the tape unit will read the update tape. The process takes approximately 10 sec. During the update, the display will count from 8 to 0.
F. When the countdown reaches 0 the tape unit will go into poweron selftest. The firmware update tape can be removed.

NOTE

If the RESET Button is pressed during the update sequence at the end of the countdown sequence from 8 to 0, a "D4" will be displayed. This is a code that indicates that the power should be cycled and ROMs changed. This is a special feature which allows the EEPROM update locations to be to be cleared prior to a ROM change.

If the RESET Button is pressed when the update version ID is requested, the update will be terminated.

ERROR CONDITIONS DURING LOCAL UPDATE

The following are a list of errors which can occur after a update tape is mounted. Refer to Section 4 for additional hardware errors.

D201 Timeout waiting

D202 > than 7 retries in reading a record

D203 Soft error in record just read.

D204 Tape runaway while searching for an update record.

D205 Tape position lost when trying to read update record.

D206 Controller error when trying to read update record.

D207 Servo error when trying to read update record.

D208 Door opened during an update read.

D209 Timing error during update read.

D20A Formatter error during update read.

D20B Transaction ID mismatch.

D20C Command reject.

D345 EEPROM failure detected during a firmware update. Check out EEPROM circuits with associated tests.

D365 Data buffer parity error occurred during the update. Check out data buffer circuits on Master Control.

D368 Firmware update is too big. Verify update tape is correct.

D369 Invalid ID for firmware update. Re-enter version number or get correct tape.

D36A Invalid version ID. Re-enter version number or get correct tape.

D36B Bad firmware update checksum. Retry tape or replace.

D36C Less than the minimum four bytes of data were contained in the update data record. Retry tape or replace.

D36D An odd number of bytes was in the firmware update record. Retry tape or replace.

D36E Wrong update for current ROM revision. Replace update tape with correct version.

D36F Operator pressed the RESET Button instead of entering a version number on the front panel.

D4 Firmware update successful.

[4] ROM CHANGE PROCEDURE AND INITIALIZING UPDATE AREA

When ROMs are changed the previous update information must be cleared to allow the new code to function properly. The following procedure clears the update locations in EEPROM.

NOTE

This procedure can also be used to bring the EEPROMS back to an initial state for troubleshooting. HOWEVER, an update tape or program must be available to update the firmware if the EEPROMS have an update patch installed. Diagnostic Test 27 will display "80" as the second set of displayed digits.

To clear the EEPROMS hold down the LOAD,ON-LINE, and the REWIND Buttons for one second after the power is cycled.

NOTE

The display will briefly show BUSY. The tape drive will then perform a selftest.

[5] SYSTEM HARDWARE CONFIGURATION

SYSTEM NUMBER	MAX. NO. DRIVES	INTERFACE NUMBER	NOTES
3000 37	2	PIC 30459A	No slaves offered Shipped w/1 HP-IB load Var. from 1-6 loads 1 m internal cable
3000 39/40 42/42XP	4	GIC 30079A	No slaves offered Shipped w/1 HP-IB load Var. from 1-6 loads 1 m internal cable
3000 44/48 58	4	GIC 30079A	No slaves offered Shipped w/1 HP-IB load Var. from 1-6 loads 1 m internal cable
3000 64/68 70	4	GIC 30079A	No slaves offered Shipped w/1 HP-IB load Var. from 1-6 loads 1 m internal cable

SECTION 4

TROUBLESHOOTING

[1] CHECKOUT PROCEDURES

DIAGNOSTIC CHECKS (checks to the 75% level)

A. Select and run diagnostic 200.
   When diagnostic 200 is executed (instead of 101), each test number is displayed as it is executed. A failed test is readily apparent.
B. Select and run diagnostic 01.

NOTE

1. To interpret selftest errors, see Section 5.
2. If adjustments are necessary, refer to Section 6.

POWER ON AND ZERO CAPSTAN OFFSET

A. Switch unit on and observe that the power up diagnostics have successfully completed. Front panel indicates OK.
B. Check TP5 on the control PCA for 0V +/-50mV.

DC POWER SUPPLIES (TRANSPORT)

A. Open casting and locate the fuses on the Power Supply PCA.
B. Measure the voltages on the top of the fuses. The voltages and tolerances are: (See Section 9 for fuse location.)

Fuse	DC Supply	Voltage
FS2	+24V pk	+24V pk +/-10% FWR
FS3	+24V pk	+20.1V min.
	unregulated	+25.4V max.
FS4	-24V pk	-20.1V min.
	unregulated	+25.4V max.
FS5	-14V pk	-12 V min.
	unregulated	-15 V max.

FS6	+14V pk unregulated	+12 V min. +15 V max.

C. With a digital voltmeter, check the voltage across C97 on the Data Formatter PCA for 5V +/-0.2 volts.

ARM POSITION SENSOR

A. Open casting and locate test points 9 and 10 on the Control/Motherboard.
B. Place a piece of paper between the BOT/EOT sensor and reflector and turn POWER switch on. This will place the tension arms in the relaxed position.
C. Using a voltmeter monitor test point 10 on the Control/ Motherboard. This is the supply reel arm position sensor feedback test point.
D. With the arms in the relaxed position the test point should read between +4.5 and +8.0 volts.
E. Move the arm up to the load position while monitoring the test point. With the arm at the center scribe on the cast- ing the test point should read approximately 0 V. At the load position the reading should be between -5 and -8 volts.
F. Repeat the above steps using test point 9 and moving the takeup reel tension arm. The readings should be the same.

TENSION ARM LIMIT FLAGS

A. Open casting and gain visual access to the LEDs on the Control/Motherboard.
B. Place a piece of paper between the BOT/EOT sensor and reflector and turn the POWER switch ON. This will place the tension arm in the relaxed position. DO NOT TURN POWER OFF!
C. Use a write enable ring to hold one of the arms in the operating position.
D. Move the other arm off the resting pad approximately 3/16 inch. The ARM POSITION light on the Control/Mother board should go out.
E. Continue to move the arm until the tension arm roller is approximately parallel to the fixed roller and the bridge roller. The ARM POSITION light should come back on.
F. Repeat steps D and E for the other tension arm.

TAPE PATH AND CAPSTAN TRACKING

A. Select and run diagnostic program 200.

B. Select and run diagnostic program 52.
C. Observe the tape motion on the guides and capstan pulley. Tape should not be moving laterally across the capstan pulley or move sufficiently on the guides to distort the edges of the tape.

***** Mechanical and electrical adjustments are in Section 6. *****

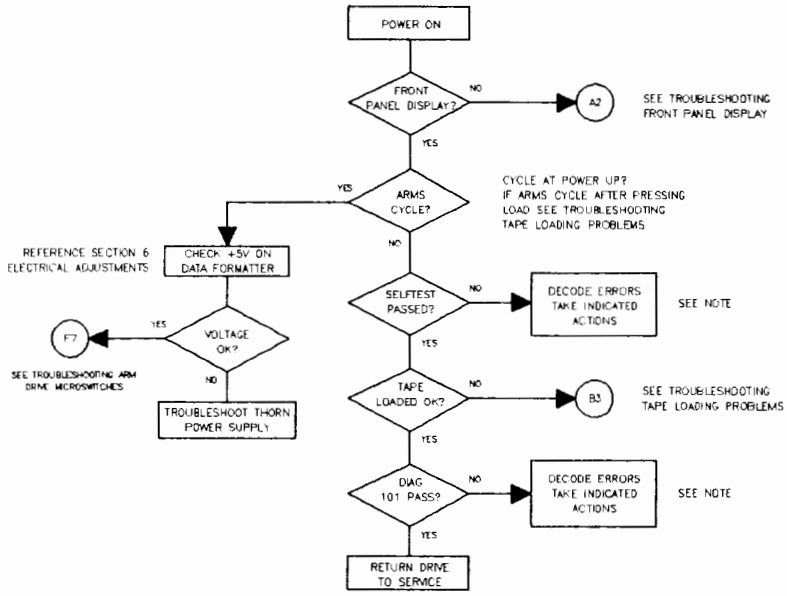
[2] OPERATING STATUS MESSAGES

MESSAGE	CAUSE	COMMENTS/ CORRECTIVE ACTION
BLNK	Blank tape; no data on first 9.1 m	1. New tape 2. If tape not new, reload.
BOT	Beginning-of-Tape marker found	Occurs after LOAD/REWIND
BOT?	1. No BOT marker found 2. No marker on tape	1. Reload tape 2. Add/replace BOT marker 3. Check excess leader
BUSY	Executing commands	OFFLINE RESET stops unit
DOOR	Door open	Close door
>ERR	Soft error rate too high 1. Dirty tape path 2. Worn/dirty tape	1. Clean tape path 2. Backup and discard worn tape
Fxxx	Diag. test xxx failed	See Section [5]
*F3	Unknown hardware failure	See Section [5]

MESSAGE	CAUSE	COMMENTS/ CORRECTIVE ACTION
*F4	Unknown hardware failure	See Section [5]
*F5	Unable to communicate with host system	Reset drive. If problem persists, see "Program descriptions" in Section 5.
HOT!	Overheating motors 1. Room temp. too high 2. Door vents blocked	NOTE: Tape motion ceases until drive is cool 1. Lower room temperature 2. Check rear vents
ID?	Tape density unknown: Not PE (1600bpi) or NRZI (800 bpi)	1. Unformatted/new tape 2. GCR format (6250 bpi)
LOAD	Load Sequence operating	Press RESET to abort
NONE	Non-existent diagnostic	See Section 5,"Prog. Desc."
OK	Operation complete	
Pxxx	Diag. Test xxx passed	
RSET	RESET pressed or Host initiated a reset	
REWD	Drive rewinding	
TAPE	No tape loaded; tape tension incorrect	1. Load tape 2. Check threading

MESSAGE	CAUSE	COMMENTS/ CORRECTIVE ACTION
Rxxx	Diag. Test xxx running	
UNLD	Drive unloading	
800 or 1600	Tape density 800 bpi Tape density 1600 bpi	Message appears after LOAD
*PWR	DC Power Line failure	Transport Power Supply
*RAM	Proc. RAM failure	Control/Motherboard failure
*CON	Trans. Connector loose	Check Transport Connectors
*BRD	Data Board missing	Re-install Data Board
*PR1	Trans. Control PROMS bad	Replace Control/Motherboard
*PR2	Trans. Diag. PROMS bad	Replace Control/Motherboard
*PR3	Diag. & Cont. PROMS bad	Replace Control/Motherboard
*DT7	Error Det. Circuit bad	Replace Data Electronics
*DT8	Data failure	Replace Read Logic PCA

[3] TROUBLESHOOTING FLOW CHARTS



NOTE

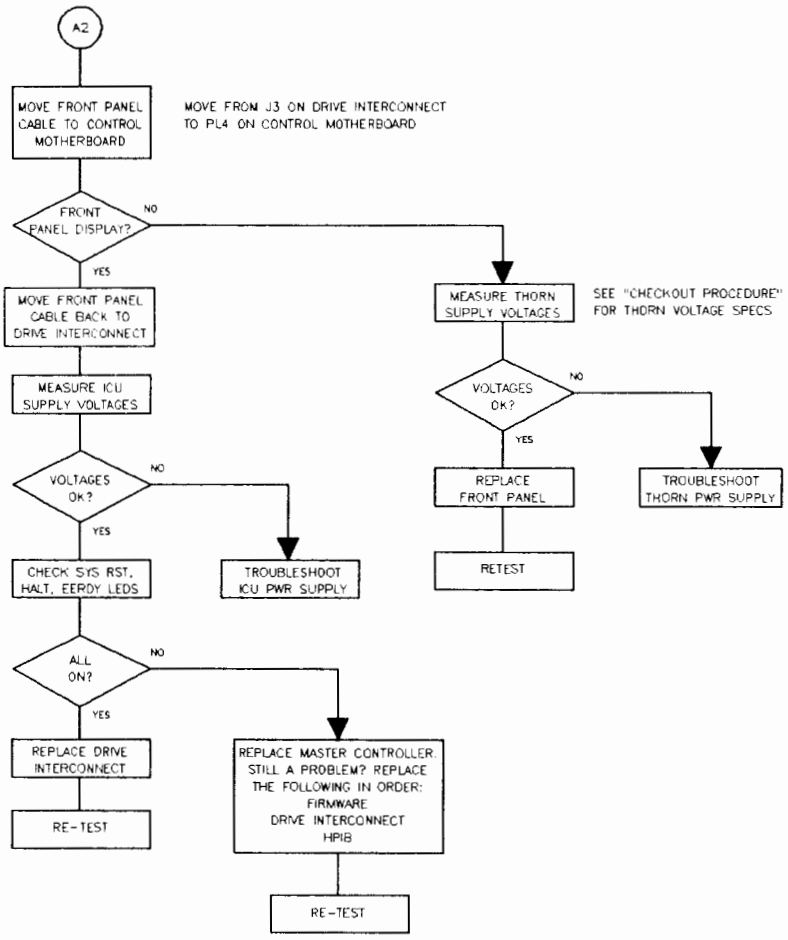
TO ISOLATE THE FAILURE BETWEEN THE THORN PORTION AND HP PORTION IT MAY BE HELPFUL TO MOVE THE FRONT PANEL CABLE FROM THE DRIVE INTERCONNECT J3 TO THE CONTROL MOTHERBOARD PL4

CAUTION

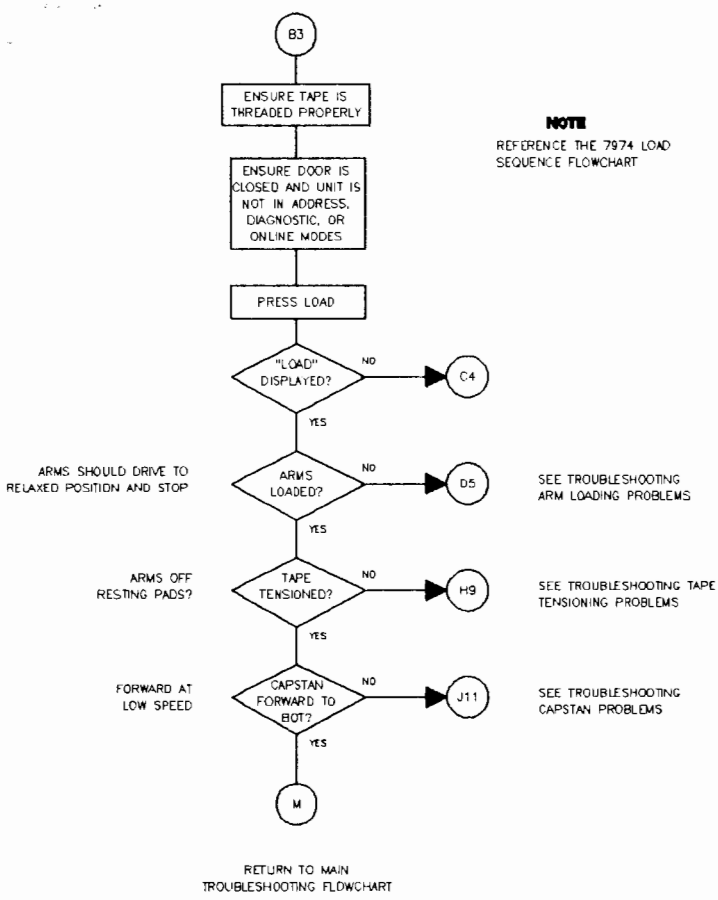
TURN POWER OFF BEFORE REMOVING OR INSTALLING ANY CABLE OR PCA

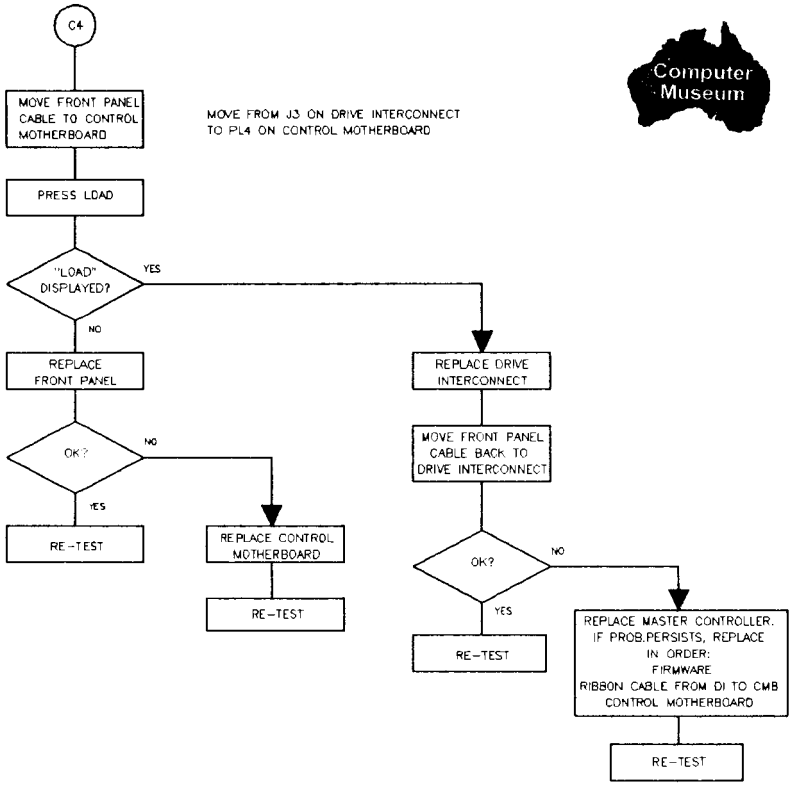
FLOW74U

TROUBLESHOOTING THE FRONT PANEL DISPLAY

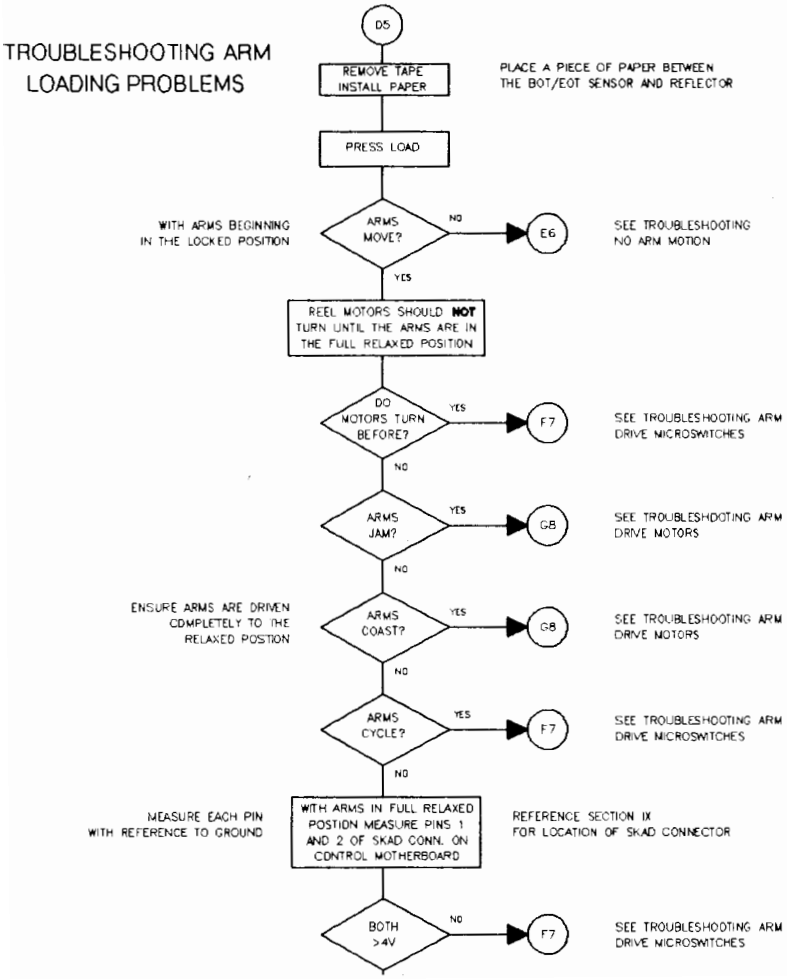


TROUBLESHOOTING TAPE LOADING PROBLEMS

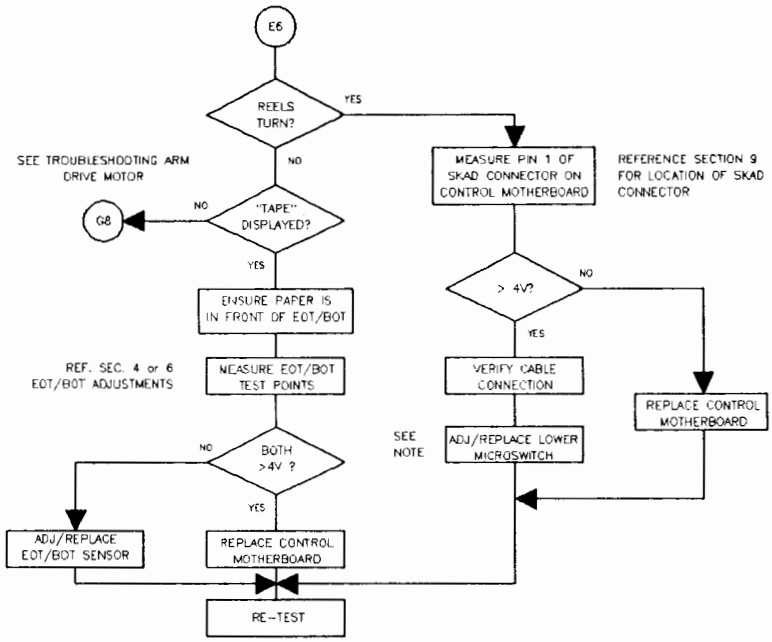




TROUBLESHOOTING ARM LOADING PROBLEMS



TROUBLESHOOTING NO ARM MOTION

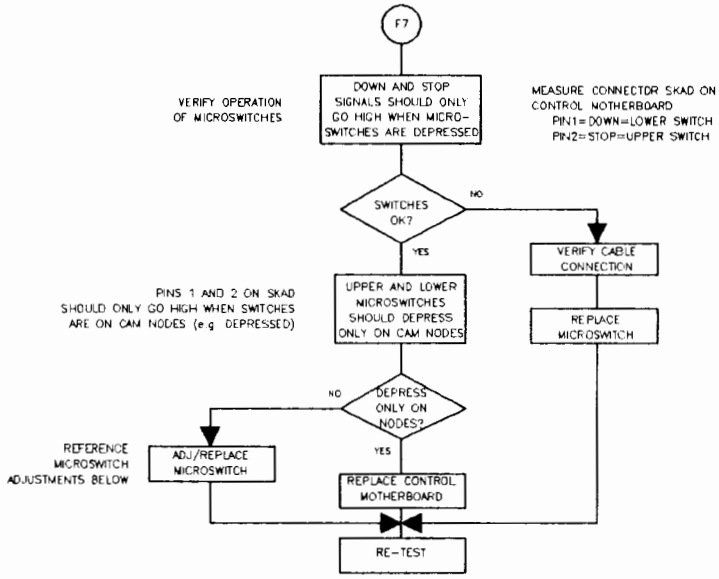


NOTE

IT MAY BE HELPFUL TO REFERENCE THE ARM DRIVE MICROSWITCH FLOWCHART F7

FLOW74EU

TROUBLESHOOTING ARM DRIVE MICROSWITCHES



ADJUSTING ARM DRIVE MICROSWITCHES

STOP SWITCH (UPPER)

WHEN THE UPPER ARM IS DRIVEN UP, IT SHOULD STOP WITHIN 1mm OF THE TOP DEAD CENTER POSITION OF THE ARM PATH. IF THE ARM DROPS SLOWLY IMMEDIATELY AFTER IT HAS STOPPED, THEN THE MICROSWITCH WAS DEPRESSED TOO LATE ON THE CAM. IF, ON RESTART, THE ARM RISES MORE THAN 1mm BEFORE FALLING, THEN THE MICROSWITCH WAS DEPRESSED TOO EARLY ON THE CAM. ADJUST THE MICROSWITCH OPERATING POINT BY MOVING THE SWITCH MOUNTING PLATE.

UP/DOWN SWITCH (LOWER)

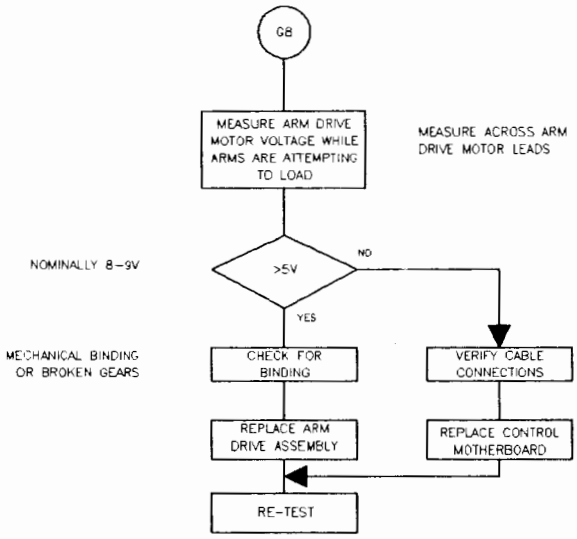
THIS SWITCH ADJUSTMENT IS NOT CRITICAL, AS LONG AS IT DEPRESSES ON THE CAM NODE. THERE SHOULD BE NO PROBLEM. IT IS ALSO ADJUSTABLE VIA THE MICROSWITCH MOUNTING PLATE.

COMMON PROBLEMS

ARMS CYCLE AT POWER UP	STOP SIGNAL PERMANENTLY LOW OR DOWN SIGNAL PERMANENTLY HIGH
ARMS CYCLE AFTER LOAD IS PRESSED	DOWN SIGNAL PERMANENTLY LOW OR STOP SIGNAL PERMANENTLY LOW
ARMS DRIVE 66% DOWN THEN REEL MOTORS TURN, AFTER LOAD IS PRESSED	STOP SIGNAL PERMANENTLY HIGH
ARMS "NOD" CONTINUOUSLY 33% UP IN SLOTS AFTER UNLOAD OR POWER UP WITH ARMS IN DOWN POSITION	STOP SIGNAL PERMANENTLY HIGH

FLOW74FU

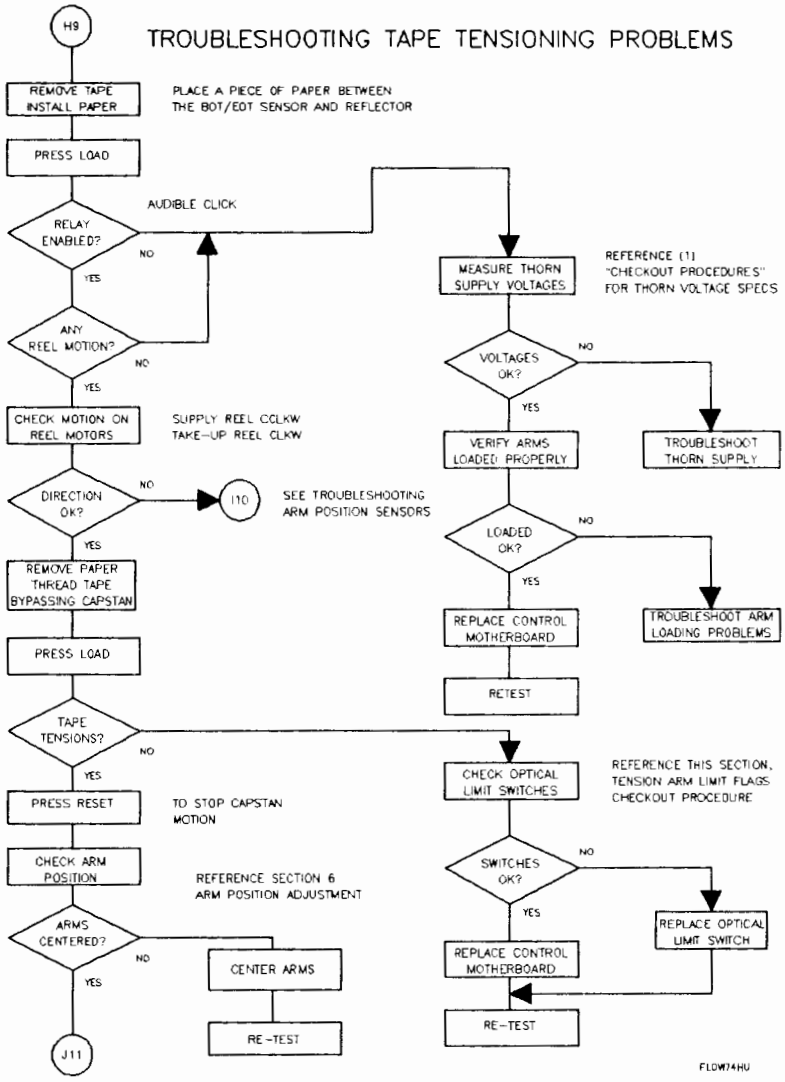
TROUBLESHOOTING ARM DRIVE MOTOR



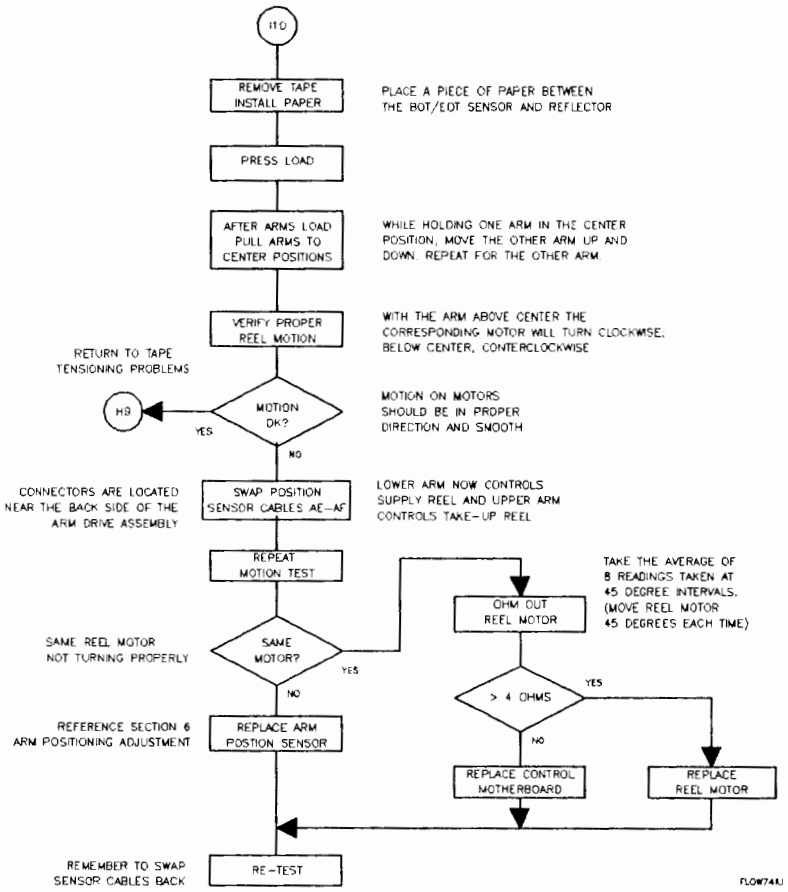
NOTE

IF THE ARM DRIVE ELECTRONICS REMAIN "IN DRIVE" WITH THE ARM MOTOR JAMMED, THE DRIVE REGULATOR OVERHEATS AND SHUTS DOWN TEMPORARILY UNTIL COOLED. THIS TEMPERATURE CYCLE CONTINUES UNTIL NORMAL LOAD CONDITIONS ARE RESTORED. ALLOW FOR THIS WHILE MEASURING ARM DRIVE MOTOR VOLTAGE.

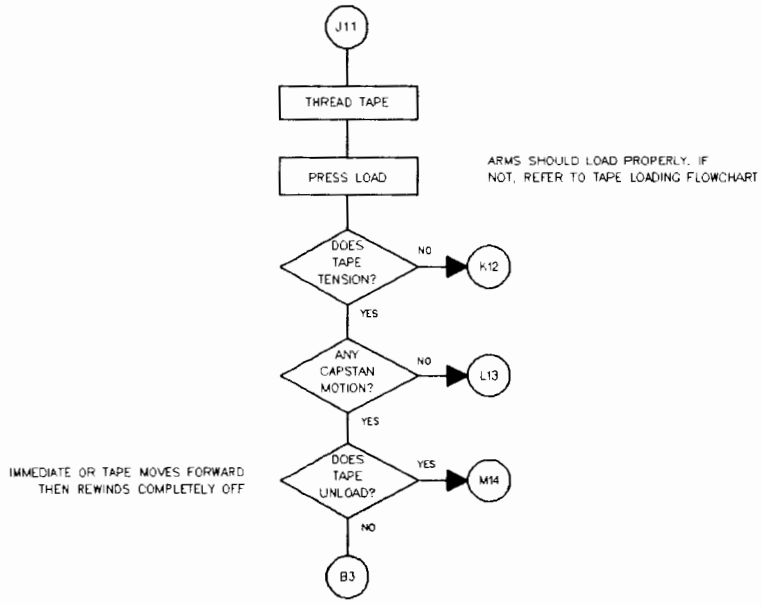
FLOW74GU


H9
TROUBLESHOOTING TAPE TENSIONING PROBLEMS
REMOVE TAPE INSTALL PAPER
PLACE A PIECE OF PAPER BETWEEN THE BOT/EOT SENSOR AND REFLECTOR
PRESS LOAD
AUDIBLE CLICK
RELAY ENABLED?
NO
YES
ANY REEL MOTION?
NO
YES
CHECK MOTION ON REEL MOTORS
SUPPLY REEL CCLKW TAKE-UP REEL CLKW
DIRECTION OK?
NO
J10
SEE TROUBLESHOOTING ARM POSITION SENSORS
YES
REMOVE PAPER THREAD TAPE BYPASSING CAPSTAN
PRESS LOAD
TAPE TENSIONS?
NO
YES
PRESS RESET
TO STOP CAPSTAN MOTION
CHECK ARM POSITION
REFERENCE SECTION 6 ARM POSITION ADJUSTMENT
ARMS CENTERED?
NO
YES
CENTER ARMS
RE-TEST
J11
MEASURE THORN SUPPLY VOLTAGES
REFERENCE (1) "CHECKOUT PROCEDURES" FOR THORN VOLTAGE SPECS
VOLTAGES OK?
NO
YES
TROUBLESHOOT THORN SUPPLY
VERIFY ARMS LOADED PROPERLY
LOADED OK?
NO
YES
TROUBLESHOOT ARM LOADING PROBLEMS
REPLACE CONTROL MOTHERBOARD
RETEST
CHECK OPTICAL LIMIT SWITCHES
REFERENCE THIS SECTION, TENSION ARM LIMIT FLAGS CHECKOUT PROCEDURE
SWITCHES OK?
NO
YES
REPLACE OPTICAL LIMIT SWITCH
REPLACE CONTROL MOTHERBOARD
RE-TEST
FLOW74HU

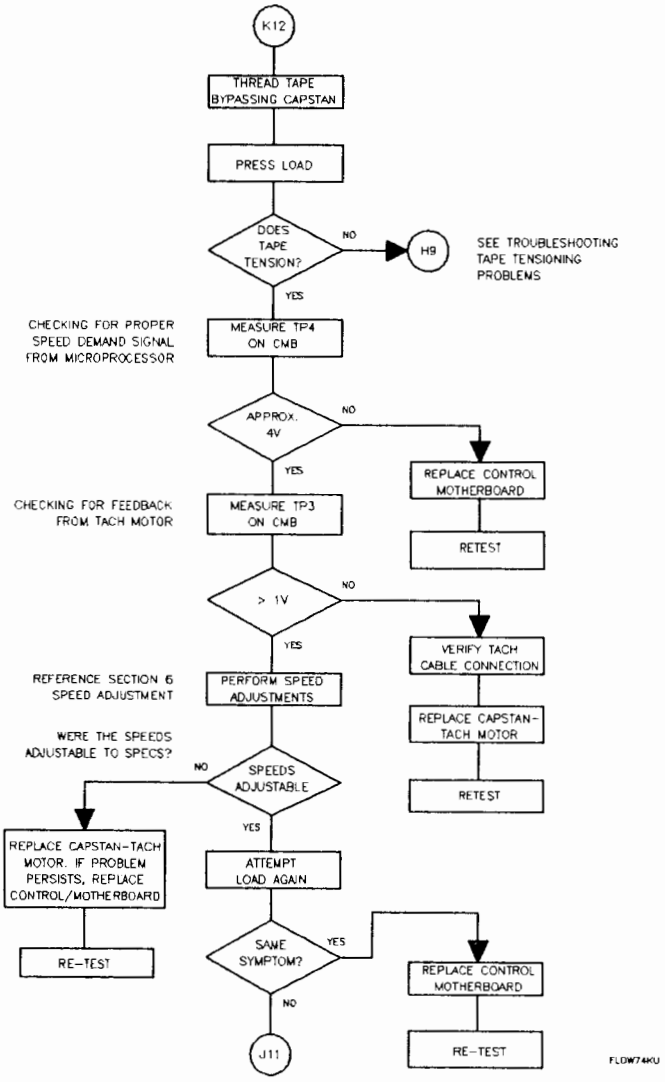
TROUBLESHOOTING ARM POSITION SENSORS

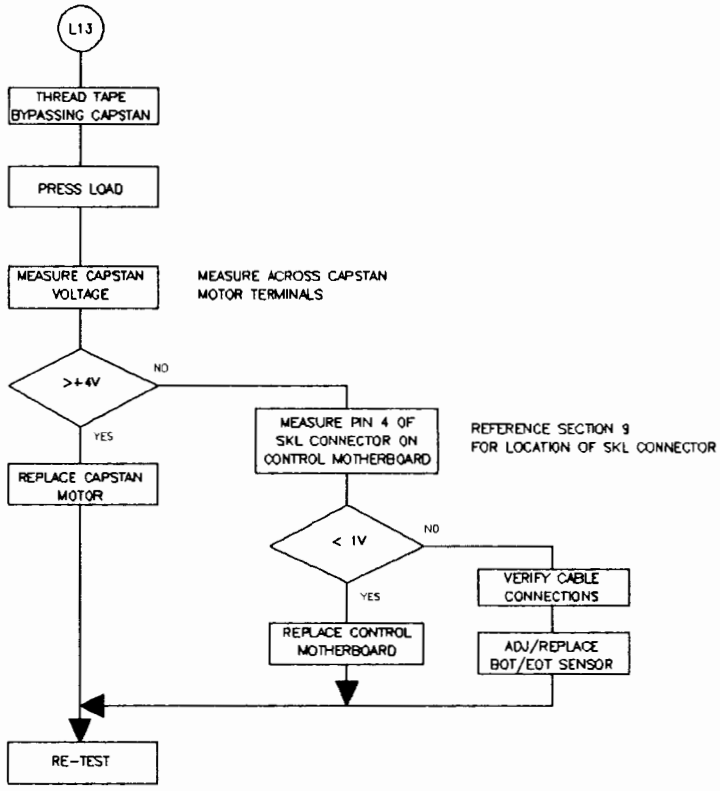


TROUBLESHOOTING CAPSTAN PROBLEMS

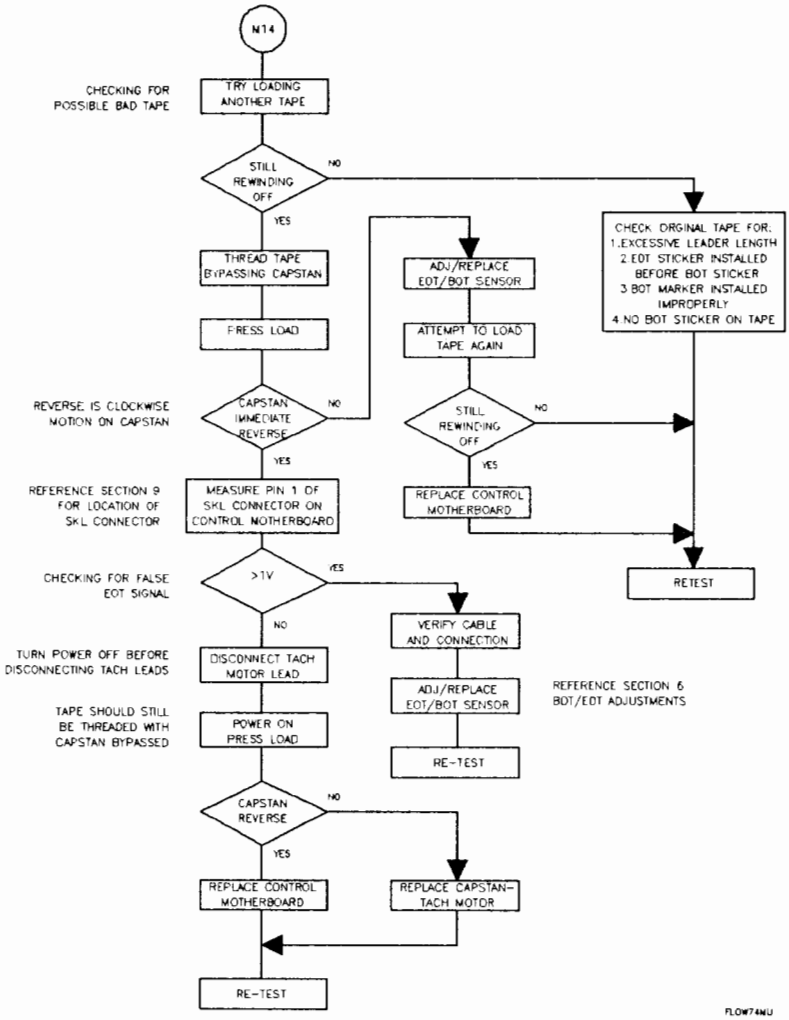


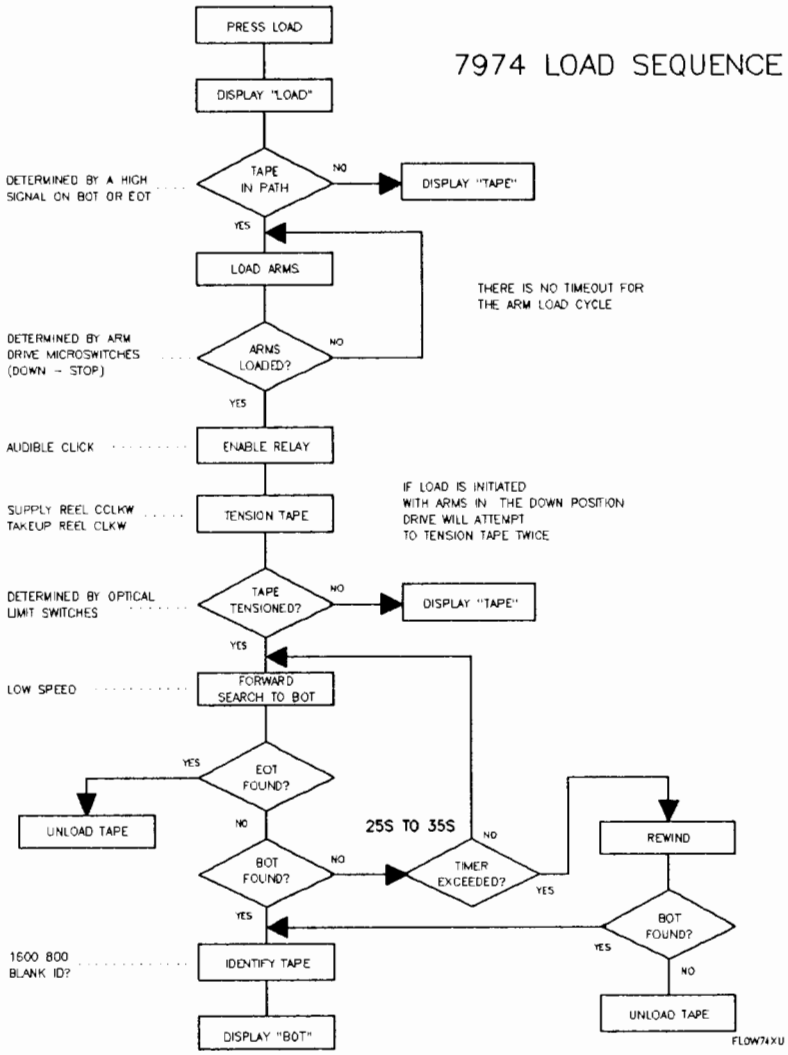
FLOW74JU


K12
THREAD TAPE BYPASSING CAPSTAN
PRESS LOAD
DOES TAPE TENSION?
NO
H9
SEE TROUBLESHOOTING TAPE TENSIONING PROBLEMS
YES
CHECKING FOR PROPER SPEED DEMAND SIGNAL FROM MICROPROCESSOR
MEASURE TP4 ON CMB
APPROX. 4V
NO
REPLACE CONTROL MOTHERBOARD
RETEST
YES
CHECKING FOR FEEDBACK FROM TACH MOTOR
MEASURE TP3 ON CMB
> 1V
NO
VERIFY TACH CABLE CONNECTION
REPLACE CAPSTAN-TACH MOTOR
RETEST
YES
REFERENCE SECTION 6 SPEED ADJUSTMENT
PERFORM SPEED ADJUSTMENTS
WERE THE SPEEDS ADJUSTABLE TO SPECS?
SPEEDS ADJUSTABLE
NO
REPLACE CAPSTAN-TACH MOTOR. IF PROBLEM PERSISTS, REPLACE CONTROL/MOTHERBOARD
RE-TEST
YES
ATTEMPT LOAD AGAIN
SAME SYMPTOM?
YES
REPLACE CONTROL MOTHERBOARD
RE-TEST
NO
J11
FLOW74KU


L13
THREAD TAPE BYPASSING CAPSTAN
PRESS LOAD
MEASURE CAPSTAN VOLTAGE
MEASURE ACROSS CAPSTAN MOTOR TERMINALS
>+4V
NO
YES
REPLACE CAPSTAN MOTOR
MEASURE PIN 4 OF SKL CONNECTOR ON CONTROL MOTHERBOARD
REFERENCE SECTION 9 FOR LOCATION OF SKL CONNECTOR
< 1V
NO
YES
VERIFY CABLE CONNECTIONS
REPLACE CONTROL MOTHERBOARD
ADJ/REPLACE BOT/EOT SENSOR
RE-TEST

FLOW74LU


N14
CHECKING FOR POSSIBLE BAD TAPE
TRY LOADING ANOTHER TAPE
STILL REWINDING OFF
NO
YES
CHECK ORGINAL TAPE FOR: 1.EXCESSIVE LEADER LENGTH 2.EOT STICKER INSTALLED BEFORE BOT STICKER 3.BOT MARKER INSTALLED IMPROPERLY 4.NO BOT STICKER ON TAPE
THREAD TAPE BYPASSING CAPSTAN
ADJ/REPLACE EOT/BOT SENSOR
PRESS LOAD
ATTEMPT TO LOAD TAPE AGAIN
REVERSE IS CLOCKWISE MOTION ON CAPSTAN
CAPSTAN IMMEDIATE REVERSE
NO
STILL REWINDING OFF
NO
YES
REFERENCE SECTION 9 FOR LOCATION OF SKL CONNECTOR
MEASURE PIN 1 OF SKL CONNECTOR ON CONTROL MOTHERBOARD
REPLACE CONTROL MOTHERBOARD
RETEST
CHECKING FOR FALSE EOT SIGNAL
>1V
YES
NO
VERIFY CABLE AND CONNECTION
TURN POWER OFF BEFORE DISCONNECTING TACH LEADS
DISCONNECT TACH MOTOR LEAD
ADJ/REPLACE EOT/BOT SENSOR
REFERENCE SECTION 6 BOT/EOT ADJUSTMENTS
TAPE SHOULD STILL BE THREADED WITH CAPSTAN BYPASSED
POWER ON PRESS LOAD
RE-TEST
CAPSTAN REVERSE
NO
YES
REPLACE CONTROL MOTHERBOARD
REPLACE CAPSTAN-TACH MOTOR
RE-TEST
FLOW74NU


7974 LOAD SEQUENCE
PRESS LOAD
DISPLAY "LOAD"
TAPE IN PATH
NO
DISPLAY "TAPE"
YES
DETERMINED BY A HIGH SIGNAL ON BOT OR EOT
LOAD ARMS
THERE IS NO TIMEOUT FOR THE ARM LOAD CYCLE
ARMS LOADED?
NO
YES
DETERMINED BY ARM DRIVE MICROSWITCHES (DOWN = STOP)
AUDIBLE CLICK
ENABLE RELAY
IF LOAD IS INITIATED WITH ARMS IN THE DOWN POSITION DRIVE WILL ATTEMPT TO TENSION TAPE TWICE
SUPPLY REEL CCLKW
TAKEUP REEL CLKW
TENSION TAPE
TAPE TENSIONED?
NO
DISPLAY "TAPE"
YES
DETERMINED BY OPTICAL LIMIT SWITCHES
LOW SPEED
FORWARD SEARCH TO BOT
EOT FOUND?
YES
UNLOAD TAPE
NO
25S TO 35S
NO
REWIND
BOT FOUND?
NO
TIMER EXCEEDED?
YES
YES
BOT FOUND?
YES
NO
1600 800 BLANK ID?
IDENTIFY TAPE
UNLOAD TAPE
DISPLAY "BOT"
FLOW74XU

SECTION 5

DIAGNOSTICS

[1] SELFTESTS

POWER-ON SELFTEST

The power-on selftest, diagnostic Test 5, is designed to check out as much of the HP7974 drive as possible without using a work tape. About 75% of the drive is tested; including the Master Controller PCA, the HP-IB PCA, and the digital data path. Test 5 accomplishes its tasks by streaming 9 diagnostic tests together as follows:

6, 2, 7, 10, 11, 13, 14, 50 and 100 (shown in order).

When the power-on selftest executes, the following messages appear one at a time in the display:

CODE:	MEANING:
SELF TEST	- Selftest about to start
R 06	- Running Test 6
R 02	" " 2
R 07	" " 7
0000	- Test 7 scrolls the display characters
1111	The indicators light
****	after the * appears
R 10	- Running Test 10
R 11	" " 11
R 13	" " 13
R 14	" " 14
R 50	" " 50
R 100	" " 100
OK	- Test 5 passed

The testing process takes a about 30 seconds to complete. After successful completion of the power-on tests, the display message is OK or DOOR if the door is open. Diagnostics mode is then exited at the end of the test and the unit is now ready for use.

[2] 0 AND 100 LEVEL: HOST-AVAILABLE

OPERATING SEQUENCE

A. Make sure the drive is offline by pressing OFFLINE/RESET. Indicator is lit.

B. Refer to "Program Descriptions", next Subsection, and find the test needed. If a tape must be mounted, do so.

C. Press the DIAGNOSTICS Button. The diagnostics mode indicator should light. If not, repeat step A.

D. Press the UNITS Button and hold it down until the desired units digit (0-9) appears in the display.

E. Press the TENS Button and hold it down until the correct TENS/hundreds digit appears (00-10-20-... 200-210).

NOTE

The TENS and UNITS Buttons are designed to continuously cycle at a rate of two digits per second. To speed up the display, hold the FAST Button simultaneously when pressing either the TENS or UNITS Buttons.

F. Press the ENTER Button to execute the test.

A test may be repeated after either a pass or failure by pressing the ENTER Button again.

A diagnostic test may be terminated by pressing the ENTER Button. When pressed, the diagnostic currently running terminates and the display shows only the selected test number. The diagnostics mode is still active and the test may be redone or another test may be selected. If the DIAGNOSTICS Button is pressed while in the diagnostics mode, the diagnostics mode is exited.

LIST OF 0- & 100-LEVEL DIAGNOSTIC PROGRAMS

0 Error Message	103 Data Chan. Verification
1 Error Log	104 Servo Elec. & Mech.
2 Clear Error Log	105 Capstan Test
3 not used	106 FWD/REV Speed Ratio
4 not used	107 Read Error Detection
5 Power-on Selftest	108 Write/Read Test
6 Master Cntlr PCA	109 Select High-speed Mode
7 Alphanumeric Display	110 Select Low-speed Mode
8 Master Cntlr RAM	111-112 not used
9 Master Cntlr Timer	113 Worst Case Data Pattern
10 Master Cntlr EEPROM	114 Normal Data Pattern
11 Data Buffer	115-116 not used
12 Not Used	117 Write/BKspace/Read Check
13 HP-IB Internal Loop	118 Write Short Records S/S
14 HP-IB External Loop	119 Write Long Records S/S
15-18 Not Used	120 not used
19 EEPROM Cell	121 Write Long Records Strm.
20 Front Panel Buttons	122 not used
21-24 not used	123 Repositioning Ramps Test
25 Single Execution	124 Test Error Detection
26 Infinite Execution	125 not used
27 Firmware Rev. Code	126 Clear Sense Byte Register
28 Tape Usage Odometer	127 NRZI Select
29 Tape Format	128 PE Select
30 Firmware Update	129 not used
31-49 not used	130 Rewind Tape
50 Drive Report	131-171 not used
51-99 not used	172 Write/Check File Mark**
100 Drive Interconnect	173-197 not used
101 Diagnostic Workout	198 Clear Program Stack**
102 not used	200 Isolate Transport

**Not available from the front panel

PROGRAM DESCRIPTIONS (LEVELS 0 & 100)

NOTE

Letter(s) in parentheses indicate access;
L = Local Access, R = Remote Access.

Test 0 -- Error Message (L, R)

Displays the most recent diagnostic error message.

Test 1 -- Error Log (L, R)

This displays the diagnostic error log. The error log contains the last 10 error messages. The most recent 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. The error log clears when the power is turned off.

Test 2 -- Clear Error Log (L, R)

Clears the diagnostic error log.

Test 5 -- Power-On Selftest (L, R)

The following tests are called in sequence:

6, 2, 7, 10, 11, 13, 14, 50, and 100.

NOTE

If door is opened while test is running, the diagnostic will hang. Close door to resume diagnostic.

Test 6 -- Master Controller Board Test (L, R)

Checks the ROM and all registers on the board. After completing those tasks, it calls Tests 8 and 9 to finish testing the Master Controller PCA.

Test 7 -- Alphanumeric Display Test (L, R)

The digits are cycled through 0000...9999 and ****. The indicators are also lit one at a time.

Test 8 -- Master Controller RAM Test (L, R)

A series of data bytes are written to RAM and verified.

Test 9 -- Master Controller Timer Test (L, R)

The counters and timers on the Master Controller Board are checked.

Test 10 -- Master Controller EEPROM Test (L, R)

The EEPROMs are verified to be correct by reading predefined addresses containing constant values, and performing a checksum.

Test 11 -- Data Buffer Test (L, R)

Checks the data buffer's functionality by writing a set of data bytes to each buffer address and then verifying them.

Test 13 -- HP-IB Internal Loop Test (L, R)

Checks the HP-IB board functions.

Test 14 -- HP-IB External Loop Test (L, R)

This test verifies the HP-IB/Master Controller and the HP-IB/Data Buffer interfaces.

Test 19 -- EEPROM Cell Test (L) (DO NOT LOOP THIS TEST)

A test word is written into the EEPROMs to determine if a cell is worn out, not working, or if +12 volts are not available to the EEPROM chips. The test may be called a maximum of 20,000 times before cell wearout will occurs. Therefore, this test cannot be used in the infinite execution mode.

Test 20 -- Front Panel Button Test (L)

Use this test when you suspect a Button is not functioning correctly. Pressing any button will display the name of the button name as an indicator that the button is working. When the door is opened an "DOOR" will be displayed. Press the REWIND and ADDRESS Buttons simultaneously to exit this program.

Test 25 -- Single Execution Mode (L)

This utility sets the local looping environment to single- test execution. Use it after executing Test 26.

Test 26 -- Infinite Execution Mode (L)

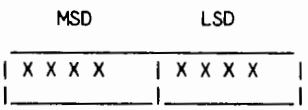
Use this utility to set the local looping environment to infinite execution. After entering Test 26, select the test you wish to execute repeatedly. The test will repeat until the RESET Button is held down. Another test may be selected at this time. If an executing test fails, an FRU code sequence is displayed until the test is terminated by pressing ENTER. To re-enter single execution mode, execute Test 25. system returns to default the next time the diagnostics mode is entered.

Test 27 -- Firmware Revision Code (L)

This utility displays the current Master Controller firmware revision number. It will remain on the display until ENTER is pressed or five seconds have elapsed.

Test 28 -- Tape Usage Odometer (L, R)

Displays the current odometer value in hexadecimal format. The odometer increments by one after 20,000 feet of tape passes the read/write head. The information is presented in the form of two hex digits. The first digit is the most significant digit (MSD) and the second is the least significant digit (LSD).



To get the footage in feet, convert the hex to decimal and multiply by 20,000.

Test 29 -- Tape Format (L)

This test displays the messages 1600 and 800 if the drive has the ability to support that tape format. The display cycles through the message(s) until ENTER is pressed.

Test 30 Firmware Update (L)

Firmware Update Utility----See Section 3, subsection [3], "Configuration."

Test 50 -- Drive Report (L, R)

This tests verifies that the drive electronics are functional.

Test 100 -- Drive Interface Test (L, R)

It is used to verify that the drive interface is able to communicate with the Drive Controller Board.

Test 101 -- Diagnostic Workout Program (L, R)

A scratch tape must be mounted. The diagnostic calls the following tests to exercise most of the functions of the tape drive (shown in order):

103,104,106,110,107,108,124,117,109,107,108,124,117,172,130,198.

However, only the message **1R101** is displayed during execution. This program should be run if the drive is suspected to be defective or for periodic performance checks.

Test 103 -- Data Channel Verification Test (L, R)

This diagnostic verifies that both the Data Formatter and Read Logic PCAs are present.

Test 104 -- Servo Electronics and Mechanics Test (L, R)

A scratch tape must be mounted. The servo motors and their mechanical parts are tested by moving the tape backwards and forwards with a decreasing period.

Test 105 -- Capstan Test (L, R)

A scratch tape must be mounted. This diagnostic is incorporated as part of the selftest to discover if there is any tape slippage on the capstan or if the servo speeds are incorrect. A tape must be mounted before executing the diagnostic.

Test 106 --Forward and Reverse Speed Ratio (L, R)

A scratch tape must be mounted. This diagnostic checks that the tape lengths of the forward streaming speed and the reverse, non-streaming speed are in the correct ratio by running through the following sequence: a) the drive rewinds a work tape to BOT, b) runs it forward for 25.4 meters and stops, c) runs it in reverse for 25.15 meters, and d) searches for BOT. If BOT is found in the next 51 cm of tape, the test passes, otherwise the test fails.

Test 107 -- Read Error Detection Test (L, R)

A scratch tape must be mounted. The write channels are multiplexed to the read channels without moving tape. A variety of "random" error conditions are written and then read back. If errors are recognized, the test passes.

Test 108 -- Write/Read Test (L, R)

A scratch tape must be mounted. The write channels are multiplexed to the read channels without moving tape. "Good" data is written and read back. If the transfer is correct, the test passes.

Test 109 -- Select High-speed Mode (L, R)

Enables the operator or host computer to set the drive to the high-speed mode prior to starting other programs.

Test 110 -- Select Low-speed Mode (L, R)

Enables the operator or host computer to set the drive to the low-speed mode prior to starting other programs.

Test 113 -- Worst Case Data Pattern (L, R)

The data pattern below is used to test the error detection circuitry at power up. Select this pattern before starting programs 118 to 121.

Data	0	1	1	0	0	1	1	1	0

Test 114 -- Normal Data Pattern (L, R)

A repetitive sequence of 16 bytes, representing "random" data is used to test the error detection circuitry at power up. Select this pattern before starting programs 118 to 121.

Test 117 -- Write/Backspace/Read Data Check (L, R)

A scratch tape must be mounted during for this test. Writes 256 records of the worst-case data, backs up to the beginning of the data, and reads the records. Status errors are interrogated when writing; status and data are checked when reading.

Test 118 -- Write Short Records (L, R)

A scratch tape must be mounted. The test is performed in the start/stop mode. Writes 256 long records of formatted data. The data pattern is selected by either program 113 or 114. Test 109 and Test 110 determine whether the records are written high speed or low speed.

Test 119 -- Write Long Records (Start/Stop) (L, R)

A scratch tape must be mounted. The test is performed in the start/stop mode. Writes 256 long records of formatted data. The data pattern is selected by either program 113 or 114. Test 109

and Test 110 determine whether the records are written high speed or low speed.

Test 121 -- Write Long Records (Streaming Mode)(L, R)

A scratch tape must be mounted. The test is performed in the streaming mode. It writes 256 long records of formatted data and the data pattern is established by either program 113 or 114. Test 109 and Test 110 determine whether the records are written high speed or low speed.

Test 123 -- Repositioning Ramps Test (L, R)

A scratch tape must be mounted. The drive rewinds the tape, then runs it forward and erases any data. A short record is written, the tape rewound, and then run forward and read at high speed. When the trailing edge of the record is detected, the tape is ramped to a halt. The tape is then run in reverse at low speed and the time taken to detect the trailing edge of the record is measured.

Test 124 -- Test Error Detection Circuitry (L, R)

A tape motion version of Test 107.

Test 126 -- Clear Sense Byte Registers (L, R)

The sense byte registers are used by the host to monitor errors during normal operation. There is usually no need to clear these registers.

Test 127 -- Select NRZI Density (L, R)

Test 128 -- Select PE Density (L, R)

Test 130 -- Rewind Tape (L, R)

Rewinds a tape to BOT. This program may be used for positioning the tape while in the diagnostics mode.

NOTE

Tests 172, and 198 are available only as part of the diagnostic number 101. They are not accessible from the front panel.

Test 172 -- Write/Check File Mark

Mount a scratch tape. A File Mark is written to tape and the write is verified using status lines.

Test 198 -- Clear Program Stack

Clears the current program stack.

INTERPRETING RESULTS

On completion of a test, either a pass designation, **Pxxx** (xxx: Test number that passed), or a five-part failure code sequence will appear and cycle continuously until the ENTER Button is pressed. Here is an example:

```
DISPLAY:          MEANING:

  F00         - Failed Test 00

  FRU         - Field Replaceable Unit code is next
  087         - 8: FRU which failed
                - 7: Subassembly in FRU which failed

 CODE         - Cause of failure next
  002         - 0: Action which caused failure
                - 2: Other subassemblies that should
                     be tested
```

The error codes are made up of the 4 digits in the FRU and CODE sequence. Therefore, to determine the meaning of the code in the above example, you would look up 8702 and find the interpretation.

FRU in error.	Subassembly within FRU in error.	The action which caused the failure.	The Multi-test code.

Graphical Breakout of the Diagnostic Error Messages

ERROR MESSAGES (0- AND 100-LEVEL)

1____ Servo and Tape Motion Assembly

11__x Capstan motor and tachometer subassembly

111x The low-speed ramps were too long.
112x The low-speed ramps were too short.
113x The high-speed ramps were too long.
114x The high-speed ramps were too short.

12_x Tape motion mechanical assembly

121x Low-speed servo failure.
122x High-speed servo failure.

x: **multi-test codes**

0 Does not apply
1 Speed adjustment, capstan assembly, power supply overload, mechanical guides and rollers.
2 Mechanical rollers/guides/arms, capstan assembly, Control Board, power supply overload, speed adjustments.

2--- NRZI Board

21yx NRZI parity circuitry failed
22yx NRZI LRC circuitry failed
23yx NRZI CRC circuitry failed
24yx Not Used
25yx No head current detected
26yx Identify status circuitry failed
27yx EOF detection circuitry failed
28yx Block valid signal timed out in test
29yx Block valid signal too long
2Ayx Failure during selftest

y: **Actions that detected the failure.**

0 Does not apply
1 Fixed data pattern
2 Random data pattern
3 Occurred during a write test only.
4 Occurred during a read test only.
5 No board installed or connector disconnected.

x: **multi-test codes**

0 Does not apply
1 NRZI board
2 NRZI board, head connectors, head
3 NRZI board, tape, head

4 Connector missing, board missing, power failure

4___0 Master Controller Assembly

41__0 CPU error on Master Controller assembly.

4110 CPU data register malfunction. The data value written was not the value read while verifying.
4120 CPU address register malfunction. Written data not data read back during verify.
4130 CPU condition code malfunction.
4140 A CPU register had its data fade after a 2-second wait.
4160 CPU addressing malfunction.

42__0 Master Controller RAM failure.

4210 Ram failure during march test.
4220 RAM failure during selective "1" walking bit test.
4230 RAM failure during selective "0" walking bit test.

43__0 Master Controller Data Buffer subassembly failure.

4300 Data buffer subassembly is unresponsive.
4310 Data Buffer RAM failure in marching RAM test.
4320 Data Buffer register failure in walking '1' bit test.
4330 Data Buffer register failure in walking '0' bit test.
4340 Data Buffer length counter/USM function failure.
4350 Data Buffer usage counter/USM function failure.
4360 Data Buffer parity/USM function failure.
4370 Data transferred not the data received.
4380 Transferred data missing EOR.
4390 Data Buffer has incorrect pre-fetch data.

44__0 Master Controller timer chip subassembly failure.

4410 Timer interrupt status error.
4420 Timer interrupt status could not be cleared.
4430 Timer 1 did not count down to zero.
4440 Timer 1 or 2 is faster than other timer.
4450 Timer 1 or 2 is slower than other timer.
4460 Timer 1 or 3 is faster than other timer.
4470 Timer 1 or 3 is slower than other timer.

45__0 Master Controller EEPROM chip subassembly failure.

4510 The read/write ready status was not present.
4520 Computed EEPROM check sum not equal to stored value.

4530 An EEPROM read value was incorrectly read.
4540 Write value into the EEPROM did not verify after write.
4550 Computed EEPROM check sum did not verify after write.
4560 EEPROM is write enabled and should not be.
4570 EEPROM is not write enabled and should be.

4600 Rom Checksum error

5___ Data Formatter board

51yx Preamble circuit failure.
52yx Postamble circuit failure.
53yx MTE circuit failure.
54yx Skew circuit failure.
55yx Vertical parity error circuit failure.
56yx Corrected error circuit failure.
57yx Data error.
5802 No head current detected.
5803 No block signal detected.
5Axx Error encountered during selftest.
5Fyx No data formatter board detected.

y: Actions that detected the failure.

0 Does not apply
1 Fixed data pattern.
2 Random data pattern.
3 Occurred during a write test only.
4 Occurred during a read test only.

5 No board installed or connector disconnected test.

x: multi-test codes

0 Does not apply
1 Data Formatter board, Read Logic board.
2 Data Formatter board, heads.
3 Read Logic, Data Formatter, tape, head.
4 Connectors loose, boards missing, power supply problems.

6__0 HP-IB Assembly

61_0 HP-IB failure.

6100 The HP-IB is unresponsive.
6110 Inbound FIFO was not empty after a clear.
6120 The internal HP-IB loopback has failed.

6130 The "end" bit in the interface is not functional.

62_0 HP-IB/Master Controller interface failure.

6210 The data transferred was not received.
6220 The data transferred was missing an EOI.

7____ Drive Interface Board

710x Data transfer module assembly.
711x Error found in testing Interface reset circuit.
712x Error detected in write interface initialization.
713x Error detected in read interface initialization.
714x Error detected in sense byte interface initialization.
715x Door opened during test.
716x Sense byte transfer test failed.
717x Sense byte value not returned correctly.
720x Front panel module assembly.
721x Virtual display test failed.
722x Virtual Button test failed.
730x Command status module assembly.
731x Error in sending diagnostic command to transport.
732x Sense byte handshake test failure.

x: multi-test codes

1 Cables, Drive Interconnect, Control/Motherboard
2 Cables, Drive Interconnect
3 Cable, Drive Interconnect, Control/Motherboard
4 not used
5 Cables, Drive Interconnect, Data Formatter, Control/Motherboard.

6 Drive Interconnect or Control/Motherboard

8____ Read Logic Board

81yx Corrected error circuit failure.
82yx False postamble detection circuit failure.
83yx Multiple track error circuit failure.
84yx Vertical parity error circuit failure.
86yx No ID status during an identify.
87yx No TM status detected when trying to write a tape mark.
88yx Block valid signal timed out during test.
89yx Block valid signal lasted longer than expected.
8A00 Error encountered during selftest.
8Byx No ID mark detected in write from BOT.

8Cyx Gap found in ID.
8F00 The hardware is not present or is unresponsive.

y: Actions that detected the failure.

0 Does not apply
1 Fixed data pattern.
2 Random data pattern.
3 Occurred during a write test only.
4 Occurred during a read test only.
5 No board installed or connector disconnected.

x: multi-test codes

0 Does not apply

1 Read Logic board, Data Formatter board, tape, head.
2 Read Logic board, Data Formatter board, heads, tape.

9____ Head/Tape Interface Assembly

91yx False preamble detected.
92yx False postamble detectd.
93yx Multiple tracks in error were detected.
94yx Skew error was detected.
95yx Vertical parity error was detected.
96yx Corrected error was detected (STE).
97yx Data error detected in read test.

y: Actions that detected the failure.

0 Does not apply
1 Fixed data pattern.
2 Random data pattern.
3 Occurred during a write test only.
4 Occurred during a read test only.
5 No board installed or connector disconnected.

x. multi-test codes

0 Multi-test code does not apply.
1 Tape, heads, Read Logic board, Data Formatter board.

A____ Drive Control/Motherboard

A10x Forward speed slow or reverse speed fast.
A11x Forward speed fast or reverse speed slow.

A12x High-speed ramp too short or low-speed ramp too long.
A13x High-speed ramp too long or low-speed ramp too short.
A14x Repositions close to limit. Check speed adjustment.
A15x Repositions beyond limit. Check speed adjustment.
A20x The RAM circuits failed RAM tests.
A30x The molex connectors are loose.
A40x The power supply (not 5V) is failing test.
A50x The ROMS are failing checksum test.
A60x Data Formatter,NRZI,or Read Logic Board not present.
A71x Drive failed to enter NRZI density.
A72x Drive failed to enter PE density.

x: multi-test codes

0 Does not apply
1 Speed adjustment, Control/Motherboard, capstan assembly, power supply overload, tension arms and guides.

B____ Unexpected Exceptions

The Master Controller CPU is capable of responding to a number of unexpected conditions. If one of these errors is detected by the CPU, a hardware or firmware error is indicated. The drive will respond by shutting down and displaying the error code.

B100 Address error.
B200 Illegal instruction.
B300 Divide by zero.
B400 Register bounds violation.
B500 Overflow.
B600 Privilege violation.
B700 Trace exception.
B800 Emulation of future instruction.
B900 Spurious interrupt.
BA00 Unimplemented interrupt.
BB00 Unassigned vector.

D____ Runtime-Detected errors

Run-time errors prevent the execution or completion of a diagnostic program. Errors D310, D330, D370, and D380 can be corrected by the operator and are the most commonly displayed sequences. All runtime errors are placed in the Error Log. If a fatal error occurs, Test 1 (Error log) and Test 5 (Power-on Selftest) should be run for more detail.

Code	Description	Possible Causes
D0xx	Operating System detected failure.	Master Cntlr HP-IB
D1xx	Channel Program detected failure.	Master Cntlr HP-IB
D179	Transaction ID mismatch.	Master Cntlr Drive Intercon't
D17A	Missing PND command.	Master Cntlr Drive Intercon't
D17B	Report Queue error.	Master Cntlr Drive Intercon't
D17C	Report Queue full.	Master Cntlr Drive Intercon't
D17D	Unknown command to device program.	Master Cntlr Drive Intercon't HP-IB GIC Software (Host)
D17E	Full command Queue.	Drive Intercon't Master Cntlr
D183	Data buffer byte count mismatch.	Master Cntlr Drive Intercon't HP-IB GIC Software (Host)
D184	Bad message type.	Master Cntlr HP-IB Drive Inteconnect
D185	Processor handshake abort.	Master Cntlr HP-IB GIC Software (Host)
D186	Interface exception.	Master Cntlr Drive Intercon't GIC

D187	Outbound data freeze.	HP-IB Drive Intercon't GIC Software (Host)
D188	Inbound FIFO error.	Master Cntlr HP-IB Drive Intercon't
D189	EEPROM update failure.	Master Cntlr EEPROMS
D18A	Device firmware error.	Master Cntlr EPROMS EEPROMS Drive Intercon't
D18B	Hardware utility firmware error.	Master Cntlr EPROMS EEPROMS Drive Intercon't
D18C	Channel case error.	Master Cntlr EPROMS EEPROMS Drive Intercon't
D2xx	Device Program detected failure.	
D201	No DATA BUSY detected when expected in CMD handshake.	Drive Intercon't Read Logic NRZI (Option) Master Cntlr
D202	DATA BUSY remained asserted. It should have de-asserted.	Drive Intercon't Read Logic NRZI (Option) Master Cntlr
D203	A polling loop terminated early.	Drive Intercon't Cont./Motherb'rd
D204	Unexpected status returned from the transport.	Drive Intercon't Read Logic Data Formatter NRZI (Option)

D205	Device write protected or failed to go on-line.	No Write Ring Cont./Motherb'rd
D206	Formatter busy did not assert upon receipt of a command.	Drive Intercon't Read Logic Data Formatter Cont./Motherb'rd NRZI (Option)
D207	The HP interface board did not initialize correctly.	Drive Intercon't HP-IB Master Cntlr GIC Software (Host)
D208	The rewind command handshake failed.	Drive Intercon't Master Cntlr Cont./Motherb'rd Front Panel
D209	Read record command returned an unidentifiable tape.	BOT/EOT Adj. Drive Intercon't Blank tape Unknown density
D20A	Transport failed to be put in the intended density.	Cont./Motherb'rd SW1 set wrong. CPU sent a CMD as unit attempted to ID.
D20B	Formatter BUSY remained asserted when it should have de-asserted.	Read Logic Data Formatter NRZI (Option)
D20C	Transport encountered an unrecognized command.	Drive Intercon't Master Cntlr
D20D	A reposition took longer than expected.	Speed Adjustment Cont./Motherb'rd +5 Volt Regulator
D20E	Erase current not detected in head.	Data Formatter Cont./Motherb'rd NRZI (Option)

D20F	A command was rejected by the transport.	Drive Intercon't Master Cntlr Cont./Motherb'rd
D210	Sense bytes were lost when a sense byte read was attempted.	Drive Intercon't Master Cntlr Cont./Motherb'rd
D211	Power was partially or totally lost during the last operation.	
D212	The door was open during a CMD.	Bad Door Switch
D213	The transport failed to complete a command. (Time out)	Cont./Motherb'rd Read Logic Data Formatter NRZI (Option)
D214	Formatter BUSY was asserted too long during a Sense Byte Read.	Cont./Motherb'rd Read Logic Data Formatter NRZI (Option)
D215	Position was lost during retries.	Speed Adjustment +5 Volt Adj. Tension Adj. Dirty tape path
D216	Online failure.	Drive Intercon't Cont./Motherb'rd
D22D	Multiple track error.	Data Formatter Read Logic Tape Head
D22F	Gap in ID.	Data Formatter Drive Intercon't Cont./Motherb'rd
D231	ID found in read.	Data Formatter Drive Intercon't Cont./Motherb'rd
D233	Gap in block found.	Data Formatter Read Logic Cont./Motherb'rd

D237	Door open error.	Bad Door Switch
D239	Skew error.	Read Logic Head
D23A	False preamble/postamble.	Read Logic Data Formatter Cont./Motherb'rd Drive Intercon't
D23B	Corrected write error.	Single Trk Error Dirty tape path Tape
D253	Servo shutdown error.	Door opened while in "Unload" mode.
D25A	No BOT Marker.	Tape BOT/EOT Sensor Cont./Motherb'rd
D25E	Tape Position Failure.	Speed Adjustment +5 Volt Adj. Tension Adj. Dirty tape path
D268	Erase failure.	Read Logic NRZI (Option) Cont./Motherb'rd Head
D269	No read-after-write detected.	Data Formatter NRZI (Option) Drive Intercon't Cont./Motherb'rd
D26B	Hardware failure.	Data Formatter Drive Intercon't Cont./Motherb'rd
D26C	Timeout error. No DATA BUSY.	Read Logic Drive Intercon't
D277	Transaction ID mismatch.	Master Cntlr Drive Intercon't
D27A	Missing PND command.	Master Cntlr Drive Intercon't

D27B	Report Queue error.	Master Cntlr Drive Intercon't
D27C	Report Queue full.	Master Cntlr Drive Intercon't
D27D	Unknown command to device program.	Master Cntlr Drive Intercon't HP-IB GIC Software (Host)
D27E	Full command Queue.	Master Cntlr Drive Intercon't
D280	Missing EOR in data buffer.	Master Cntlr Drive Intercon't Read Logic NRZI (Option)
D283	False EOR in data buffer.	Master Cntlr Drive Intercon't Read Logic NRZI (Option)
D284	Bad message type.	Reserved
D285	Processor handshake abort.	Master Cntlr HP-IB GIC Software (Host)
D286	HP-IB Interface exception.	Master Cntlr Drive Intercon't GIC
D287	Outbound data freeze.	Drive Intercon't HP-IB GIC Software (Host)
D288	Inbound FIFO error.	Master Cntlr HP-IB Drive Intercon't
D289	EEPROM update failure.	Master Cntlr EEPROMS

D28A	Device firmware error.	Master Cntlr EPROMS EEPROMS Drive Intercon't
D28B	Hardware utility firmware error.	Master Cntlr EPROMS EEPROMS Drive Intercon't
D28C	Channel Program error.	Master Cntlr EPROMS EEPROMS Drive Intercon't
D3xx	Diagnostic Program detected failure.	
D310	No tape was loaded when a read or write diagnostic test was selected.	
D320	Wrong density.	
D330	No write ring was installed when a write test was selected.	No Write Ring Write Enable Bad
D340	A tape-related error has occurred during a local firmware update.	Unrecovered error on update tape. No 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.	Master Cntlr EEPROMS
D370	Door opened while running test.	Door open Magnet fell off
D380	BOT/EOT was detected abnormally during a diagnostic operation.	BOT/EOT Adj.
D3F0	An unknown failure code was received from the transport.	Failure to clear firmware upgrade area in EEPROMS.
D3F1	The user pressed the ENTER Button during the test.	Redo the test.

D3FF The selftest was terminated early. RESET pushed

Host Protocol Errors

E0A1 Command Queue not empty.

E0A2 Request DSJ expected.

E0A3 Request status expected

E0A7 Data byte expected.

E0A8 Missing EOI on data byte.

E0AA Write Command phase protocol error.

E0AC Read protocol error.

E0AD Report phase protocol error.

E0AE Cold load protocol error.

E0B0 End complete expected.

E0B2 End data expected.

E0B4 Improper secondary.

E0B5 Misplaced data byte.

E0B8 Interface loopback protocol error.

E0B9 Selftest protocol error.

E0BC Command parity error.

E0BD Reset by operator.

E0BE Device clear (reset by Host).

Diagnostic Procedure Errors

FCFC Only local access to the diagnostic allowed.

FDFD Incorrect Online/Offline mode for diagnostic.

FEFE not used

FFFF Diagnostic passed.

Bus Error Exceptions

A Bus Error will occur whenever the Master Controller accesses subsystems which do not respond within an allowable amount of time. Since the error can occur during a CPU instruction, the unit is shut down immediately to prevent the Master Controller from executing unpredictably. These Bus error codes usually indicate a failure of the HP-IB, Master Controller, or Drive Interconnect.

4300 The Master Controller Data Buffer is unresponsive.

6100 The HP-IB is unresponsive.

DTAK Microprocessor did not receive a DTAK.

[3] 200 LEVEL: INTERNAL AND TRANSPORT

The transport diagnostics provide a method of bypassing the HP portion of the tape drive. These diagnostics can only be run via the front panel.

The transport diagnostics are accessed as follows:

A. Take the unit offline.
B. Press the DIAGNOSTIC Button.
C. Select program 200 and press ENTER.
D. Indicator should display "00".

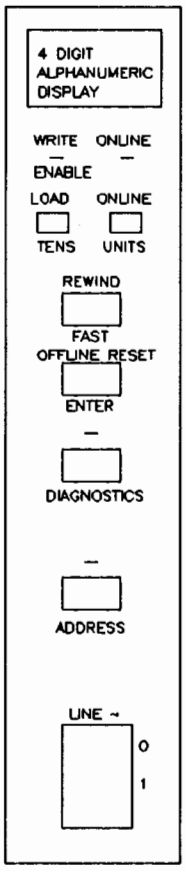
NOTE

In the transport diagnostic mode, the description and function of the front panel buttons have been redefined as follows:

HP/std	Transport diagnostic
Rewind-Fast Inc	Rewind-Enter
Reset-Enter	Reset-Run/Stop
Diagnostic	Diagnostic
Address	Density

NOTE

Prior to running a data test, select and run diagnostic program 26 (Clear the Sense Byte Registers). If this is not run, the Sense Byte Registers will contain inaccurate information.



Operator Panel

LIST OF 200-LEVEL DIAGNOSTIC PROGRAMS

0 Program Enter Point
1 Auto Program Sequencer
2 not used
3 PE Data Channel Present
4 Servo Test
5 Capstan Test
6 FWD/REV Speed Comparison
7 Test Error Circuit (non cor)
8 Write/Read Test (non cor)
9 Select High Speed
10 Select Low speed
11 Set "n"
12 Power-on Selftest (Thorn)
13 Select Fixed Data (default)
14 Select Random Data
15 Fail Skip
16 not used
17 Write/BackSpace/Read Check
18 Write "n" Short Records S/S
19 Write "n" Long Records S/S
20 Write "n" Short Records STR
21 Write "n" Long Records STR
22 not used
23 Repositioning Test
24 Test Error Detection
25 not used
26 Clear Sense Bytes
27 Select NRZI
28 Select PE
29 not used
30 Rewind
31-35 not used
36 Sensors Test
37 File Protect Test
38-39 not used
40 Display Firmware Rev. No.
41 Display Sense Byte A
42 Display Sense Byte B
43 Display Sense Byte C
44 Display Sense Byte D
45 Display Sense Byte E
46 Display Sense Byte F
47 Display Sense Byte G
48 Display Sense Byte H
49 not used
50 Step FWD (low speed)
51 Step REV (low speed)
52 Alternate (low speed)
53 Step FWD (high speed)
54-59 not used
60 Erase to EOT
61 Write Alternate 1&0s to EOT
62 Write All 1s to EOT
63 Read FWD to EOT (low speed)
64 Rd FWD (Hi-Speed Strobe on)
65 Rd REV (Low Speed Strobe on)
66-67 not used
68 Write/Check ID
69 not used
70 Space FWD "n" Rec. (Lo-Speed)
71 Space REV "n" Rec. (Lo-Speed)
72 Write/Check EOF
73 Read FWD "n" Records
74 Read REV "n" Rec. (Lo-Speed)
75-81 not used
82 NRZI Read Skew Test
83 NRZI Write Skew Test
84-96 not used
97 Modify Operator's Stack
98 Clear Operator's Stack
99 Run Operator's Stack

DESCRIPTION OF TESTS AND ERROR MESSAGES

Test No.	Description	Errors
0	Stack Entry	None
1	Auto Program Sequencer Program clears stack and runs Test 3,4,6,10,7,8,24,17,9,7, 8,24,17,72,10,30,& 98.	Refer to individual programs
3	PE Data Channel Present Checks the presence of PE Data Formatter or Read Logic PC assemblies.	1 No Data Formatter PCA 2 No Read Logic PCA
4	Servo Test Tape is run FWD/REV with gradually increasing duration	1 Failure at low speed 2 Failure at high speed 91 BOT/EOT unexpectedly found
5	Capstan Test Checks the total distance of the start/stop ramps	1 Low speed ramps to long 2 Low speed ramps to short 3 High speed ramps to long 4 High speed ramps to short 89 No write ring 90 No head current 91 BOT/EOT detected 93 Timeout waiting on block. 94 Timeout wait on block end 96 No ID on write from BOT. 97 Premature end of ID.
6	FWD/REV Speed Comparison Checks that the FWD high speed and the REV low speed are the correct ratio	1 Forward high speed is low, reverse low speed is high 2 Forward high speed is high, reverse low speed is low 91 Not moved off BOT
7	Error Detection Test LWR is performed with various data patterns	PE 1 Failure of corrected error circuitry 2 Failure to detect false postamble. 3 Failure of MTE circuitry 4 Failure of VPE circuitry NRZI 1 Failure of VPE circuitry

		2 Failure of CRC circuitry 3 Failure of LRC circuitry PE/NRZI 93 Timeout waiting on block. 94 Timeout wait on block end
8	Write/Read Test LWR is performed with fixed and random data patterns Pattern 1 =Fixed Data Pattern 2 =Random Data	PE 1 False preamble---pattern 1 2 False postamble--pattern 1 3 MTE-------------pattern 1 4 VPE-------------pattern 1 5 Corrected error--pattern 1 11 False preamble---pattern 2 12 False postamble--pattern 2 13 MTE-------------pattern 2 14 VPE-------------pattern 2 15 Corrected error--pattern 2 NRZI 1 VPE-------------pattern 1 2 CRC-------------pattern 1 3 LRC-------------pattern 1 11 VPE-------------pattern 2 12 CRC-------------pattern 2 13 LRC-------------pattern 2 PE/NRZI 17 Data error (Read) 93 Timeout waiting on block 94 Timeout wait on block end
9	Select High Speed	None
10	Select Low Speed	None
11	Set "n" range from 1-FF hex. Default value is FF	None
12	Power-on Selftest	*PWR - DC Power Line failure *RAM - Proc. Ram Failure *CON - Connector Loose *BRD - Data Board Missing *PR1 - Control PROMs incompatible with each other *PR2 - Diagnostic PROMs incompatible with each other *PR3 - Control PROMs incompatible with

		Diagnostic PROMs *DT3 - 2 NRZI PCAs installed *DT7 - E-E Error Detection Circuitry Failure. *DT8 - E-E Data Failure.
13	Select Data Pattern 1 Sets data pattern to 09E hex	None
14	Select Data Pattern 2 Sets data pattern to 16-bit random pattern	None
15	Failure Skip Causes the failing test in a sequence of tests to be aborted if an error occurs	None
17	Write/Backspace/Read Test Writes "n" records of a fixed data pattern (see Test 13)	PE 1 False preamble (Write) 2 False postamble (Write) 3 MTE (Write) 4 Skew Error (Write) 5 VPE (Write) 6 Corrected error (Write) 96 No ID status (Write) 97 Premature end to ID (Write) 11 False preamble (Read) 12 False postamble (Read) 13 MTE (Read) 14 Skew Error (Read) 15 VPE (Read) 16 Corrected error (Read) 97 Unexpected ID status (Read) NRZI 1 VPE (Write) 2 CRC (Write) 3 LRC (Write) 11 VPE (Read) 12 CRC (Read) 13 LRC (Read) PE/NRZI 17 Data Error (Read) 87 Reposition close to limit 88 Reposition outside limit 89 No write ring 90 No head current 91 BOT/EOT detected

		93 Timeout waiting on block 94 Timeout wait on block end
18	Write "n" Short Records Writes short records of fixed data pattern start/stop	PE 1 False preamble 2 False postamble 3 MTE 4 Skew error 5 VPE 6 Corrected error 96 No ID status 97 Premature end to ID. NRZI 1 VPE 2 CRC error 3 LRC error PE/NRZI 87 Reposition close to limit 88 Reposition outside limit 89 No write ring 90 No head current 91 BOT/EOT detected 93 Timeout waiting on block 94 Timeout wait on block end
19	Write "n" Long Records Writes long records of fixed data pattern start/stop	See program 18
20	Write "n" Short Records Writes short records of fixed data pattern streaming	See program 18
21	Write "n" Long Records Writes long records of fixed data pattern streaming	See program 18
23	Repositioning Test Checks accuracy of tape speed adjustment	1 High-speed ramp too short, or low-speed ramp to long 2 High-speed ramp too long, or low-spd ramp too short 89 No write ring 90 No head current 91 BOT/EOT detected 93 Timeout waiting on block 94 Timeout wait on block end 96 No ID status 97 Premature end to ID.

24	Error Detection Test Writes random data to tape and checks error detection	PE 1 Corrected error inoperative 2 False postamble detection circuitry inoperative 3 MTE detection inoperative 4 VPE detection inoperative 96 No ID status 97 Premature end of ID, NRZI 1 Failure of VPE circuitry 2 Failure of CRC circuitry 3 Failure of LRC circuitry PE/NRZI 87 Repostion close to limit 88 Reposition beyond limit 89 No write ring 90 No head current 93 Timeout waiting on block 94 Timeout wait on block end
26	Clear Sense Byte Registers	None
27	Select NRZI	92 No NRZI
28	Select PE	None
30	Rewind Tape	None
36	Sensors Test Checks the BOT/EOT No Tape, 2 "*"s are displayed	None
37	File Protect Test Operator intervention required	1 Ring circuit active, with no write ring 2 Ring circuit non-active, with write ring
40	Display CMB PROM Rev. No. Hidden test. When run the display shows "NONE", if at this time the REWIND Button is pressed, the current PROM revision number is displayed.	None
41	Display Sense Byte A Contains a log of hard errors The no. of errors is displayed	None

	on the front panel in hex (see Sense Byte Register Table)	
42	Display Sense Byte B Contains a log of hard read errors. Front panel displays no. of errors in hex (see Sense Byte Register Table)	None
43	Display Sense Byte C Contains the test number of the interface diagnostic (see Sense Byte Register Table)	None
44	Display Sense Byte D Contains the error code on interface diagnostics and the error count in fail skip mode (see Sense Byte Register Table)	None
45	Display Sense Byte E Track in Error Log (see Sense Byte Register Table)	None
46	Display Sense Byte F Contains additional status (see Sense Byte Register Table)	None
47	Display Sense Byte G Contains additional status (see Sense Byte Register Table)	None
48	Display Sense Byte H Contains additional status (see Sense Byte Register Table)	None
50	Step FWD - low-speed tape is stepped FWD at low speed to EOT. The size of the steps can be altered by the LOAD/ON-LINE Button	None
51	Step REV - low-speed tape is stepped REV at low speed to BOT. LOAD/ON-LINE Button controls size of step	None

52	Alternate - low-Speed tape run FWD/REV. Size of step controlled by LOAD/ON-LINE	None
53	Step FWD - high-speed tape is stepped FWD at high speed to EOT. LOAD/ON-LINE Button controls size of step	None
60	Erase to EOT and Rewind Tape is erased to EOT	89 No write ring 90 No head current
61	Write Alternate 1's and 0's Alternate 1's & 0's are written to EOT & rewind is initiated.	See program 60
62	Write All 1's All 1's are written to EOT and rewind is initiated	See program 60
63	Move FWD to EOT (low speed)	None
64	Move FWD to EOT (high speed) Capstan strobe is enabled to adjust speed	None
65	Move REV to BOT (Low speed) Capstan strobe is enabled to adjust speed	None
68	Write Ident Test (PE) (Writes until EOT or RESET is pressed	89 No write ring 90 No write current 90 No write current
70	Space FWD "n" Records Space FWD over "n" records	87 Reposition close to limit 88 Reposition beyond limit 90 EOT detected 93 Timeout waiting on block 94 Timeout wait on block end
71	Space REV "n" Records Spaces REV at low speed over "n" records Fails if started ??BOT	87 Reposition close to limit 88 Reposition beyond limit 91 EOT detected 93 Timeout waiting on block. 94 Timeout wait on block end

72	EOF Test	1 No EOF status 87 Reposition close to limit 88 Reposition beyond limit 89 No write ring 90 No head current 91 BOT/EOT detected 93 Timeout waiting on block 94 Timeout wait on block end
73	Read FWD "n" Records "N" records of formatted data are read and status errors checked.	PE 1 False preamble 2 False postamble 3 MTE 4 Skew error 5 VPE 6 Corrected error 97 Unexpected ID status NRZI 1 VPE 2 CRC error 3 LRC error NRZI/PE 87 Reposition close to limit 88 Reposition beyond limit 91 EOT detected 93 Timeout waiting on block 94 Timeout wait on block end
74	Read REV "n" Records "N" records of formatted data are read and status errors checked.	See Program 73
82	NRZI Read Skew Test Write an all 1's tape and read it back.	1 None all 1's data detected 92 No NRZI
83	NRZI Write Skew Test Writes all 1's to check write skew	1 None all 1's data detected 89 No write ring 90 No head current 92 No NRZI 93 Timeout waiting on block
97	Modify Operator Stack Allows the modification of the program stack	None
98	Clear Operator Stack Clears operator stack	None

```
99   Run Operator Stack              See individual programs
     Runs operator stack

                -----SENSE BYTE DESCRIPTION-----

Sense Byte A
       Used to log all hard and corrected errors reported during
       write operations. Cleared by diagnostic program 26.

Sense Byte B
       Used to log all hard errors reported during read
       operations. Cleared by diagnostic program 26.

Sense Byte C
       Used to report the results of interface diagnostic to the
       host. It contains the number of the last interface-
       diagnostic test.

Sense Byte D
       This register has two uses:
       -used to report the results of an interface-diagnostics
          test to the Host.
       -used to count the number of errors occuring in "fail
          skip" mode during operator diagnostics.

Sense Byte E
       Used to report Track-In-Error information.
       Cleared to zero on power-up.

Sense Byte F
       Used in both PE and NRZI mode. Gives possible indication
       of the causes of the Hard Error.
       PE (Bit 7=0)
          MTE          Multi-track in error
          VPE          Vertical parity error
          FPRE         False preamble detected
          FPOST        False postamble detected
          SKEW         Skew buffer overflow
          CERS         Corrected error (STE)
          ID Found     ID detected while reading
       NRZI (Bit 7=1)
          VPE          Vertical parity error
          CRCE         CRC error
          LRCE         LRC error
        Cleared at power-up or at the start of next motion
        command.
```

Sense Byte G

Contains additional error information

FMLB	File mark last block
BEYOND EOT	Set when EOT passes sensor in forward Resets when EOT passes sensor in reverse
ID ERROR	ID burst not found in PE Mode
BLANK	Set if 25 ft of blank tape has been detected
WTNG	Write head current sensed
INCOMPLETE	Set if the last operation was terminated unexpectedly
REJ'T	Unable to do command (illegal command)
RFAIL	No read after write data detected

Sense Byte H

Additional status information

TEMP1	Delay activated between high-speed commands
TEMP2	Extra long delay between high-speed commands
REP ERR 1	Reposition was close to specified limits
REP ERR 2	Reposition out of limits
REP LAST BLK	Indicates last operation was preceeded by a reposition
TEMP	Indicates temperature sensor activated
TEMP LATCHED	Indicates the state of the temperature sensor at the end of previous operation
BOT TIMEOUT	Sets if tape does not move off BOT during a reposition from BOT

SENSE BYTE REGISTER TABLE

	MOST SIGN. HEX DIGIT				LEAST SIGN. HEX DIGIT				
BYTE	RD7	RD6	RD5	RD4	RD3	RD2	RD1	RD0	Data Chn'l
A	2**7	2**6	2**5	2**4	2**3	2**2	2**1	2**0	Write Error Log
B	2**7	2**6	2**5	2**4	2**3	2**2	2**1	2**0	Read Error Log
C	-	2**6	2**5	2**4	2**3	2**2	2**1	2**0	Diagnostic Test No.
D	2**7	2**6	2**5	2**4	2**3	2**2	2**1	2**0	Diagnostic Error Code
E	TRK 7	TRK 6	TRK 5	TRK 4	TRK 3	TRK 2	TRK 1	TRK 0	Dead Track
F PE	0	ID F'ND	CERS	VPE	SKEW	MTE	FPOST	FPRE	
F NRZI	1	-	-	-	-	LRCE	CRCE	VPE	EXTRA
G	RFAIL	INC'P	REJ'T	BLANK	IDENT ERROR	PAST EOT	FMLB	WTNG	
H	BOT T/OUT	TEMP LATCH	TEMP	REPOS LSTBL	REP ERR 2	REP ERR 1	TEMP2	TEMP1	

Sense bytes are not normally updated (except C and D) in diagnostic mode.

SECTION 6

ADJUSTMENTS

[1] TOOLS REQUIRED

ELECTRICAL

A. Multimeter Range 10 mV to 250 VDC; up to 240 VAC
B. Oscilloscope 50 MHZ bandwidth

TAPES

A. Master Skew Tape 9162-0027
B. Scratch Tape

MECHANICAL

A. Parallel Bar 76120-TED
B. Spring Scale 8750-0039
C. Loop of tape 20 inches long (loops at each end).

[2] ORDER OF ADJUSTMENTS

The adjustments should always be done in the order they are presented in this Section.

[3] MECHANICAL ADJUSTMENTS

MECHANICAL PRE-SETS

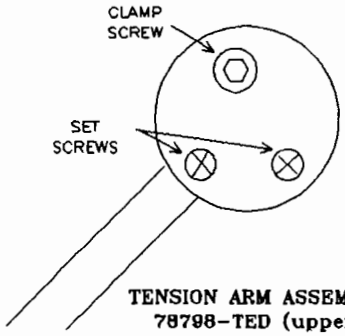
A. Tape roller heights are factory pre-set, or are accurately manufactured. There are, therefore, no height adjustments for tape rollers.
B. The capstan motor mounting surface is accurately machined with reference to the motor shaft. If the motor is mounted correctly, the capstan will be normal to the tape path. The capstan shimming procedure is described in "Tape Guide Shimming" in this Section.

ARM ROLLER ANGLE

NOTE

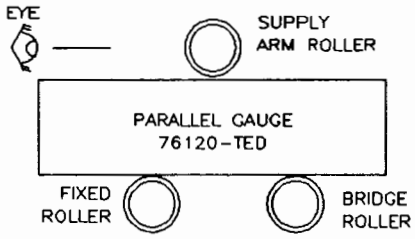
Arm roller height is pre-set and non-adjustable. Arm roller angle is fixed by a clamp and socket head screw. Adjustment is normally not necessary.

A. Remove transport cover from the front of the unit.
B. Place the tension arms in the "at rest" (down) position. This can be accomplished by inserting a piece of paper between the BOT/EOT sensor and reflector and pressing the LOAD Button on the front panel.
C. Disconnect the tension spring from the anchor clamp.
D. Move the arm so that the roller is on the "load" side of the bridge rollers.
E. Place the parallel gauge across the bridge rollers and move the arm so that the arm roller surface is against the surface of the gauge. See the figure "Arm Roller Angle Check."
F. Check that the arm roller is square to the gauge. If necessary, adjust the fit by releasing the arm clamp screw and rotate the arm. See following figure for Clamp Screw.



TENSION ARM ASSEMBLY 78798-TED (upper)

G. Tighten the arm clamp screw.
H. Repeat steps A to F for the other arm.
I. Replace the tension arm springs and tie wraps.
J. Replace the front cover.



Arm Roller Angle Check

TAPE TENSION AND TENSION BALANCE

NOTE

Tape tension resulting from the tension arm spring is balanced either side of the capstan. If one arm and spring assembly is changed, the replacement assembly can be balanced against the other arm. If both assemblies are replaced, tension must be set on the upper arm and the lower arm adjusted to the upper arm.

A. Spring tension adjustment (upper tension arm)

1. Place the tension arm to the "relaxed position". This can be accomplished by placing a piece of paper between

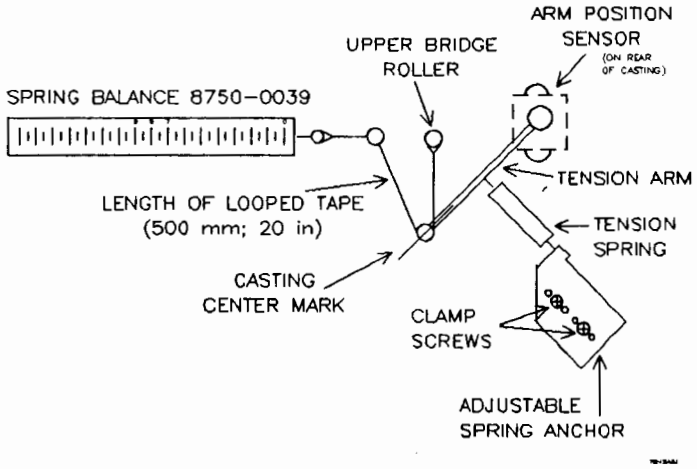
slowly means approximately 2 seconds to move the arm thru approximately 45 degrees (1/2 its total travel)

Top Arm is oil dampened

The readings obtained will be different; the second reading should be larger than the first. The readings should be between 270 and 320 grams. If they are not, readjust the spring and repeat the test to obtain the readings between these limits. Note the average value of the two readings.

B. Spring tension adjustment (lower tension arm)

1. Connect the tape test loop and spring scale to the bottom tension arm. Pull the arm down to the center
2. Pull the arm down to the casting center mark and note the reading. It should be within 10 grams of the average value obtained when measuring the upper tension arm. If it is not, adjust the lower spring tension.



Tension Arm Spring Adjustment

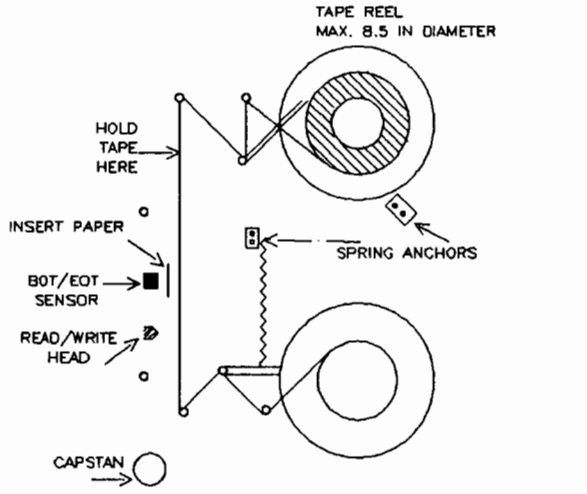
C. Tension balance check

NOTE

This method checks for balance of the supply and takeup tensions. When the tape is stationary or gently accelerating, adjustment is not required.

0. Remove Head Block assembly.

1. Mount a scratch tape (8.5 inches in diameter maximum) so that the head and capstan are by-passed. See "Tension Balance" figure. Wind the tape by hand until there are 4 to 5 turns on the takeup reel.
2. Insert a piece of paper between the BOT/EOT sensor and reflector. See figure "Tension Balance."
3. Hold the tape (as indicated in the "Tension Balance" figure) and press the LOAD Button.
4. When tape is tensioned press the RESET Button, retain the hold on the tape.
5. Momentarily release the hold on the tape and observe the resultant tape motion. Tape should remain stationary or gently move. If the tape winds to the supply reel or the takeup reel, the servo system is unbalanced and the upper and lower tension should be rechecked.



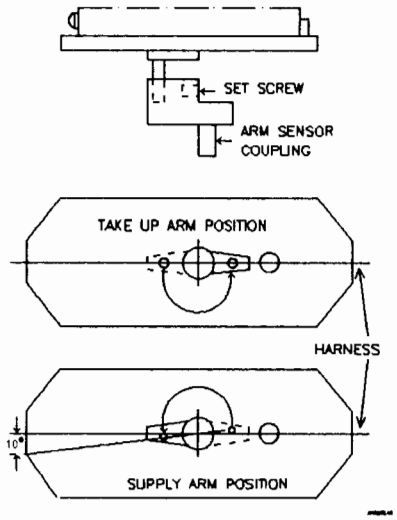
Tension Balance

D. Arm Position

1. Load a scratch tape to BOT.
2. Adjust the arm postion sensor for the individual arms until the arm corresponds to the center mark on the casting. See "Tension Arm Spring Adjustment" figure. If correct position can not be obtained or the sensor is being replaced, the arm position coupler will need to be adjusted per the following procedure.
   a) Slacken the arm coupling set screw and rotate the coupling counterclockwise on the shaft to the position indicated in the "Arm Sensor Assembly" figure.
   b) Hold the coupling and shaft against the internal stop and tighten the coupling set screw.

NOTE

The position of the coupling on the shaft is different for each arm sensor assembly.



Arm Sensor Assembly

c) Refit the arm position sensor and repeat the arm position adjustment procedure.

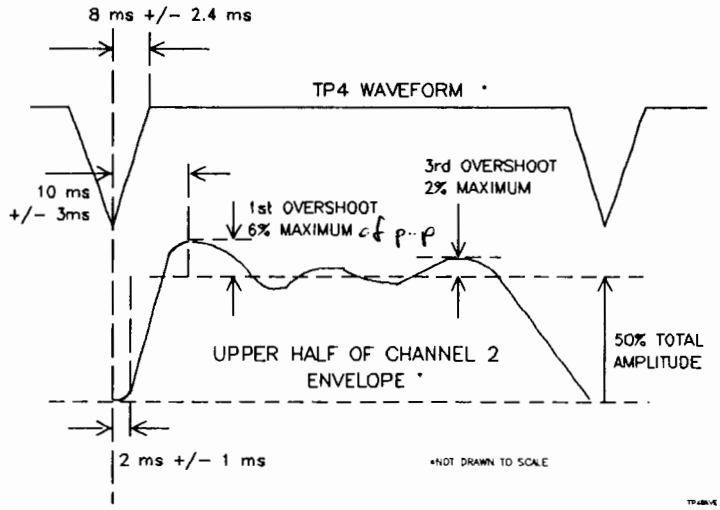
E. Write Enable Ring Sensor Check and Adjustment

1. Remove the tape from the transport.
2. Turn the Power off.
3. Connect an ohmmeter across the Write Enable Switch.
4. Using a straight edge, depress the ring sensor probe to the same height as the rear hub flange surface. At this height, the switch should be made (0 ohms).
5. If 0 ohms is not obtained, depress the probe further to determine whether the microswitch will operate.
   a) If the switch operates:
      1) Loosen the set screw holding the plastic cone to the write enable shaft.
      2) Adjust the plastic cone so that 0 ohms is obtained with the ring sensor probe at the same height as the hub flange. Tighten screw.
   b) If the switch does not operate:
      1) Loosen the screws holding the microswitch and adjust it so that the switch activates with the sensor probe at the correct height.
      2) Replace the switch.
6. Load a scratch tape and check that the WTEN indicator lights after approximately 3 seconds.

TENSION ARM DAMPING

A. Select and run diagnostic program 200.
B. Select and run diagnostic program 62-PE all 1's.
C. Rewind tape to BOT. - [illegible] 30 to RW.
D. Connect oscilloscope to channel "2" on the Data Formatter PCA and trigger from TP4 on the Control PCA.
E. Select and run diagnostic program 50.
F. Compare the waveform on the oscilloscope to the next figure, "Tension Arm Damping Waveform".
G. Select and run diagnostic program ~~63~~ 64 and position the tape to the middle of the reel.
H. Select and run diagnostic program 50. Observe the waveform.
I. Select and run diagnostic program ~~63~~ 64 and run tape to EOT.
J. Select and run diagnostic program 30 for 5 to 6 seconds. This moves the tape back from EOT.
K. Select and run diagnostic program 50. Observe the waveform.
L. The first overshoot on the waveform for all three tests should be less than 6% of the total waveform amplitude and

the third waveform should be less than 2% of the total amplitude.



TENSION ARM DAMPING WAVEFORM

HUB HEIGHT (BOTH)

A. Load a reel of tape which does not have the flanges distorted.
B. Adjust the hub heights so that the tape does not touch either flange of the reel. Lay a 1/2-inch rule across the two fixed roller guides. Extend the rule between the flanges of an empty reel and adjust the hub height so that the rule is an equal distance from the flanges on both sides of the reel. This is a trial and error procedure.

NOTE

Hub height can be approximated by measuring the distance from the casting face to the hub flange. The distance is approximately 26 mm.

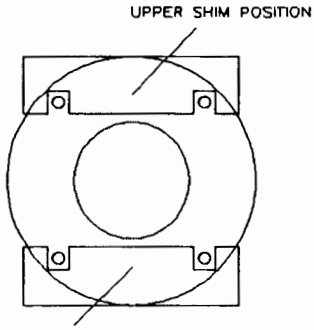
CAPSTAN TRACKING

NOTE

If a ball head hex driver is used, it is possible to loosen the mounting screws behind the capstan wheel without removing the strobe disc as explained in steps A and B. The procedure can be picked up at step C.

A. Remove the pulley and strobe disc from the motor shaft.
B. Remove the strobe disc from the pulley and replace the pulley on the capstan shaft. Clean Pulley
C. Partly loosen the four capstan mounting screws so that the motor is held against the mounting face by the pressure of the spring washers.
D. Remove the head plate assembly from the transport. Do not disconnect.
E. Place a piece of paper between the BOT/EOT sensor and reflector on the head assembly.
F. Mount a scratch tape and press LOAD and allow the tape unit to search for BOT. Press RESET Button after about 15 seconds before the unit goes into automatic rewind.
G. Enter the transport diagnostic mode by selecting and executing program 200.
H. Run diagnostic program 52. Use the ON-LINE and LOAD Buttons to adjust the forward/reverse transition time to 2-3 seconds.
I. While tape is transitioning forward and reverse, gently exert force up or down on the capstan motor (NOT THE TACH) and observe the direction the tape travels. Shim either the top or bottom of the capstan mounting surface to achieve a tape traverse distance of .005 inch or less. See the following figure, "Capstan Shimming."
J. Tighten the four capstan mounting screws and replace the head, capstan pulley and strobe disc.

Replace Capstan Pulley
every 12-18 mths



Capstan Shimming

[4] ELECTRICAL ADJUSTMENTS

POWER SUPPLY

Turn the power on and monitor the voltage across C97 on the Data Formatter PCA. Adjust R25 on the +5 Volt Regulator for 5 V +/- 0.1 Volts.

CAPSTAN OFFSET

Connect a digital voltmeter between TP5 and TP0VA on the Control/Motherboard. Adjust R72 for 0 +/-50mV.

SPEED

A. Mount a scratch tape
B. Select and run diagnostic program 200.
C. Select and run diagnostic program 64 and adjust R43 on the Control/Motherboard so that the dots on the capstan strobe disc do not drift more than 1 dot per second. See Section 9 for Control/Motherboard component location.
D. Select and run diagnostic program 65 and adjust R44 on the Control/Motherboard so that the dots on the capstan strobe disc do not drift more than 1 dot per second.
E. Close up drive and verify that the speed does not drift. If it drifts repeat steps C and D.

BOT/EOT SENSOR

ADJUSTMENT METHOD IF ONLY ONE TYPE OF TAPE IS USED

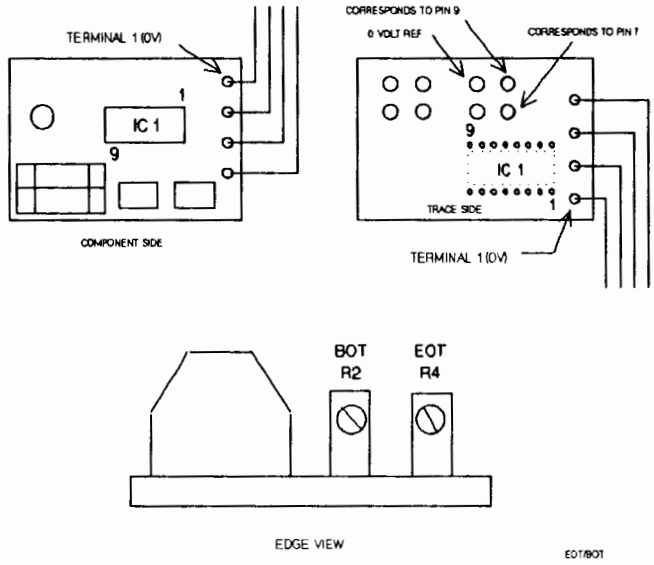
A. Remove the right and left head cover from the unit.
B. Turn power ON and insure that the tape is unloaded.
C. Connect the ground of the oscilloscope or DVM to 0V (terminal 1) or 0V test point on Data Formatter PCA.
D. At the rear of the BOT/EOT Sensor PCA, monitor the DC voltage at IC1 pin 9. Adjust R2 (BOT sensor) until it is as close to +200 mV as possible. Adjust the reflector block to achieve this value, if possible. Reject the sensor if the voltage is more than +300 mV or less than +100 mV.
E. Repeat step C for the EOT. This time monitor IC1 pin 7 and adjust R4.
F. Load a scratch tape, cancel the load point search before BOT is reached.
G. Check that more than +3.6 volts is indicated at IC1 pins 7 & 9 (max. +5 volts). This checks to insure that sensor output exceeds the threshold of IC1 with no BOT or EOT present.
H. Press the LOAD Button to continue to BOT.
I. Select and run diagnostic program 200.
J. Select and run diagnostic program 64. This runs the tape to EOT to check that the EOT marker is detected. Rewind the tape to check that BOT is detected.

ADJUSTMENT METHOD IF MULTIPLE BRANDS OF TAPE ARE USED

NOTE

When using multiple types of tapes, use a non-coated (shiny) backed tape for the adjustment rather than a tape that has a coated (matte black) back.

A. Load a tape and push RESET before the tape reaches BOT.
B. Monitor IC1 pin 9 on the BOT/EOT sensor and adjust R2 for approximately 4.2 to 5 volts.
C. Monitor IC1 pin 7 on the BOT/EOT sensor and adjust R4 for approximately 4.2 to 5 volts.
D. Run diagnostics to insure the tape unit will sense both BOT and EOT.



BOT/EOT TEST POINTS AND ADJUSTMENTS

READ THRESHOLD

A. Phase Encoded (PE)

1. Move the Data Formatter PCA to the left card slot.
2. Load a good scratch tape or amplitude reference tape.
3. Select and run diagnostic program 200.
4. Select and run diagnostic program 28 (PE mode).
5. Select and run diagnostic program 10.
6. Select and run diagnostic program 62.
7. Record the POSITIVE PEAK value of each of the 9 analog test points (ground the scope on 0VC TP) on the Data Formatter PCA. See Section 9 for Data Formatter component location.
8. Calculate the average value of the 9 channel amplitude measurements recorded in step 7.
9. Monitor the THS TP on the Data Formatter PCA and adjust RV4 on the PCA for 25% of the POSITIVE PEAK value. Typical values vary from 0.4 volts to 0.6 volts. The maximum channel to minimum channel ratio must not exceed 1.38.
10. Select and run diagnostic program 9.
11. Select and run diagnostic program 62.

12. Repeat step 7 and 8.
13. Monitor the THS TP on the Data Formatter and adjust RV3 for 25% of the average POSITIVE PEAK value.

NOTE

If NRZI is not installed, check head skew in the next subsection. IF NRZI is installed, proceed with step B.

B. Non-return to Zero Invert (NRZI)

1. Turn power off.
2. Move the NRZI board to the left card slot and re-cable.
3. Load a good scratch tape or amplitude reference tape.
4. Turn power on. Select and run diagnostic program 200.
5. Select and run diagnostic program 27.
6. Select and run diagnostic program 10.
7. Select and run diagnostic program 62.
8. Record the POSITIVE PEAK value of each of the 9 analog test points (ground scope on 0V TP) on the NRZI PCA. See Section 9 for NRZI component location.
9. Calculate the average value of the 9 channel amplitude measurements recorded in step 8.
10. Monitor the THS TP on the NRZI PCA and adjust R228 for 43% of the POSITIVE PEAK value calculated in step 9. The maximum channel to minimum channel ratio must not exceed 1.38.
11. Select and run diagnostic program 9.
12. Select and run diagnostic program 62.
13. Repeat step 9 and 10.
14. Monitor the THS TP on the NRZI PCA and adjust R229 on the PCA for 43% of the value calculated in step 13.

[5] HEAD SKEW

Skew on a head is a characteristic of variations of the read stack of the tape head. Skew for NRZI is much more critical than it is for PE. Therefore, if skew is within limits during a NRZI check, it is not necessary to check PE on the same unit.

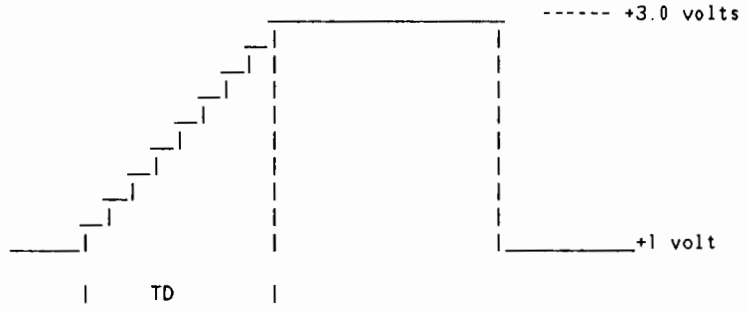
This procedure is a two-pass operation. The first pass establishes (and corrects, if necessary) the read stack skew. The second pass verifies the composite skew characteristic of the combined read and write stacks.

READ SKEW CHECK (NRZI)

A. Load a master skew tape to BOT.
B. Select and run diagnostic 27 (NRZI)
C. Select and run diagnostic programs 10 & 63 (read forward low speed).
D. Monitor TP1 (skew TP) with oscilloscope, ground the scope at -VE end of C1, and observe inverted waterfall waveform. Measure the interchannel displacement error TD, representing both static and dynamic skew. This should be within 3 micro seconds when checking or 2.0 microseconds when adjusting. If read skew requires adjusting, proceed to the next paragraph, "Read Skew Check (PE).

NOTE

Sync oscilloscope external
negative on NRZI pre-amp TP 2.

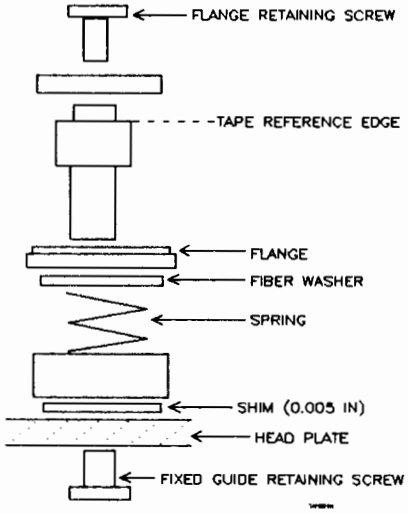


E. Run diagnostic program 82 (reduced read cat) as a confidence check.
F. Unload the master alignment tape and load a scratch tape.
G. Select diagnostic program 83 and monitor TP1 and check that the skew is within check limit in step 3.
H. Select diagnostic programs 9 & 83 as a 100 ips confidence test.

READ SKEW CHECK (PE)

A. Move the Data Formatter to the left card cage slot.
B. Remove the head covers.
C. Load a Master Skew tape.
D. Select and run diagnostic program 200.

E. Select and run diagnostic program 63.
F. Connect Chan. A of the scope to Chan. 2 TP (GND to 0V TP).
G. Adjust the scope trace so that the positive going signal crosses in the center of the screen.
H. Set the scope as follows:
   Channel A and B sensitivity to .1 V/cm
   Timebase to 1 microsecond/cm
I. Monitor and record the deviation (RHT or LFT of center) the tape channels in the following sequence, 4, 6, 0, 1, P, 3, 7, 5.
J. Add the highest value from the left and the right. The sum represents 'S'. THIS SUM EQUALS TOTAL READ HEAD SKEW.
K. If 'S' is less than 2.25 microseconds, no adjustment is necessary. Proceed to "Recheck of the Read Head Skew."
L. If 'S' is greater than 2.25 microseconds, the head must be shimmed. Run program 65 to return the tape to the load point. Head shimming is accomplished by adjusting the height of the upper (leading) guide. THE LOWER (TRAILING) GUIDE MUST NEVER BE CHANGED FROM IT'S DESIGNED SETTING.



Tape Guide Shimming

Head Shim Kit Part # 76881-TED
If really keen only!

NOTE

If tape channels 4, 6, 0, 1, generally lead (to the right of reference) and tape channels P, 3, 7, 5, generally lag (to the left of reference); *INCREASE* the leading guide shim.

If tape channels 4, 6, 0, 1, generally lag (to the left of reference) and tape channels P, 3, 7, 5, generally lead (to the right of reference), *DECREASE* the leading guide shim.

READ DESKEWING PROCEDURE (SHIMMING)

NOTE

A shim increment of 0.0005 inch corresponds to approximately 50 microinches of effective skew.

Using 'D' (in seconds) as the difference between 'S' (step I-J) and the nominal 3 microseconds compute:

10 x tape speed (ips) x D (seconds)
= shim increment in inches

NOTE

The leading guide shimming must not be adjusted by more than +/-0.0025 inch. If the shim increment required is greater than 0.0025 inch increment by 0.0025 inch. If the shim increment required is less than 0.0025 inch, increment to the nearest 0.0005 inch.

READ DESKEW EXAMPLE

Skew measurements for the nine tape channels (Chan. 2-ref.)

Channel	4	6	0	1	2	P	3	7	5
Microsec.	+2.5	+3.0	+1.0	+1.5	0	-1.0	-2.0	-3.5	-3.0

'S' = 3.0 (Chan. 6) + 3.5 (Chan. 7)
= 6.5 microseconds
For 50 ips machines; 'D' + 6.5 - 3 = 3.5 microseconds

Required shim adjustment is, therefore;

10 x 50 x 3.5/10**6
= 0.00125
= 0.0015

Since, in the example, tape channels 4, 6, 0, 1, generally lead channel 2, and tape channels P, 3, 7, 5, generally lag channel 2, the leading guide shim must be increased by 0.0015 inch to 0.0065 inch. This can be accomplished by removing the standard 0.005-inch shim and replacing it with a 0.004-inch and a 0.0025-inch shims.

RECHECK OF THE READ HEAD SKEW
(Composite Read/Write Skew Check)

A. Load a scratch tape.
B. Run diagnostic program 10 followed by program 61.
C. Recheck the channel skew spread as in step I of "Read Deskew Check." Check that the total 'S' does not exceed 6.3 microseconds.

SECTION 7

PERIPHERALS

Intentionally Blank.

SECTION 8

REPLACEABLE PARTS

[1] REPLACEABLE PARTS LIST

New P/N	Exch. P/N	Description
07914-67804		Fan Kit 7914ST Cabinet (Only)
07974-61603		ICU Power Supply Cable
07974-61606		ICU AC Power Cable
07974-66501		PCA, Interconnect
	07974-69020	Replaced by 07974-69120
	07974-69021	Replaced by 07974-69121
	07974-69022	Replaced by 07974-69122
	07974-69023	Replaced by 07974-69123
	07974-69120	Exchange Read Logic PCA
	07974-69121	Replaced by 07974-69221
	07974-69123	Exchange NRZI PCA
	07974-69221	Exchange Control/Motherboard
	07974-69122	Exchange Data Formatter PCA
07974-89702		EEPROM U7
07974-89802		EEPROM U23
07974-89507		EPROM 7.0 U21
07974-89607		EPROM 7.0 U5
07974-89107		EPROM 7.0 U19
07974-89207		EPROM 7.0 U3
07974-89307		EPROM 7.0 U20
07974-89407		EPROM 7.0 U4
07978-66504		Replaced by 07978-66514
07978-66506		PCA, HP-IB I/O
07978-66514	07978-69514	Master Control PCA (Rev2425)
07978-67910		Crenlo Cabinet
07978-69504		Replaced by 07978-69514
103575-TED		Tape Cleaner
103710-TED		Power Supply Assy
103720-TED		Card Frame
105610-TED		Hub Assembly, Take up
105665-TED		Power Cable PKL to SKB
105678-TED		PCA, Fused Distribution Supply
108494-TED		Arm Drive Assy
108533-TED		BOT and EOT Sensor Assy
108702-TED	07974-69120	Read Logic PCA (109570)

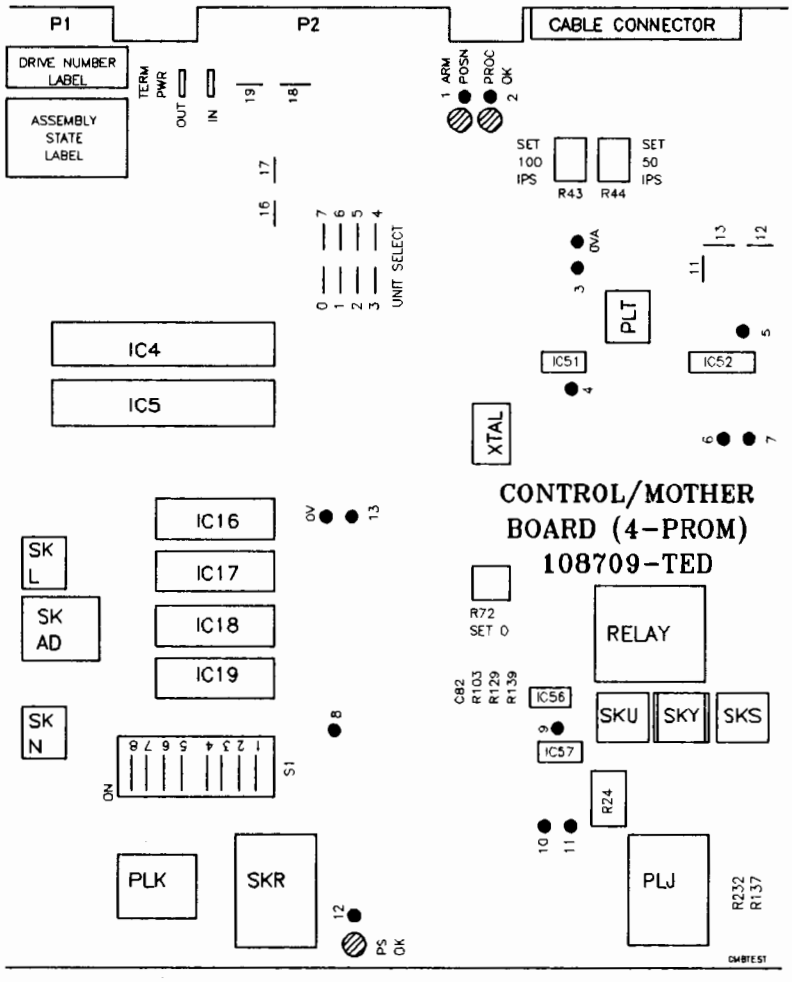
108705-TED		PCA, 5 Volt Regulator
108706-TED		Head Assy, PE/NRZI w/prom
108707-TED		Strobe Light Assy
108709-TED	07974-69221	Control/Motherboard (109590)
108710-TED	07974-69122	Data Formatter (109580)
108714-TED		Switch Facia PCA Assy
108715-TED		Motor and Cap Assy
108716-TED	07974-69123	NRZI PCA (109530)
108717-TED		Tension Arm (Upper)
108718-TED		Tension Arm (Lower)
109541-TED		NRZI Head Adaptor (Write)
109542-TED		NRZI Head Adaptor (Read)
109786-TED		Front Panel W/O Switch Facia
76332-TED		Door Switch Assy
76449-TED		Capstan Motor Shim Kit
76881-TED		Head Deskew Kit (Shims)
76952-TED		Motor Reel (upper and lower)
78528-TED		Voltage Selector 110 VAC
78529-TED		Voltage Selector 115 VAC
78530-TED		Voltage Selector 120 VAC
78531-TED		Voltage Selector 220 VAC
78532-TED		Voltage Selector 230 VAC
78533-TED		Voltage Selector 240 VAC
78535-TED		Voltage Selector 100 VAC
78636-TED		Write Enable Assy
78641-TED		Roller Cap
78758-TED		Arm Position Sensor
78762-TED		Capstan and Strobe Disk Assy
78763-TED		Bridge Roller Assy
78764-TED		Roller Guide Assy
78769-TED		Capstan Motor and Tach Assy
78798-TED		Replaced by 108717-TED
78799-TED		Replaced by 108718-TED
79140-TED		Hub Assembly, File
79169-TED		Hub Ejector Button
0515-0065		Tape Cleaner Screw (M3, 25mm)
0515-0927		Screw, Capstan Pulley (Torque Sys)
1490-0502		Reel, Take-up
1535-4875		4-Digit Alphanumeric display
1810-0408		HP-IB Load Network DIP (1 load)
1810-0409		HP-IB Load Network DIP (4 load)
1810-0410		HP-IB Load Network DIP (2 load)
1826-0147		Regulator MC7812
1826-0221		Regulator MC7912
1826-0445		Regulator MC7905
2110-0002		Fuse, 2AMP
2110-0003		Fuse, 3AMP
2110-0051		Fuse, 10AMP

2110-0030	Fuse, 5AMP Slo-Blo
2110-0303	Fuse, 2AMP Slo-Blo
2680-0099	Screw, Capstan Pulley (Elec'craft)
3030-0013	Screw, Takeup Hub 6-32x3/4
3101-2565	Microswitch, Top/Up-Down
5060-9456	HP-IB Cable, 2 Metre
5061-2815	Power Supply (HP Controller)
8120-3446	Cable, HP-IB, 2 metre
9162-0062	BOT/EOT Tabs
9164-0158	Magnetic Tape, 1 Reel
BS2972-TED	Washer, Fiber (Control/Motherboard)
103789-TED	Spring, Tension Arm

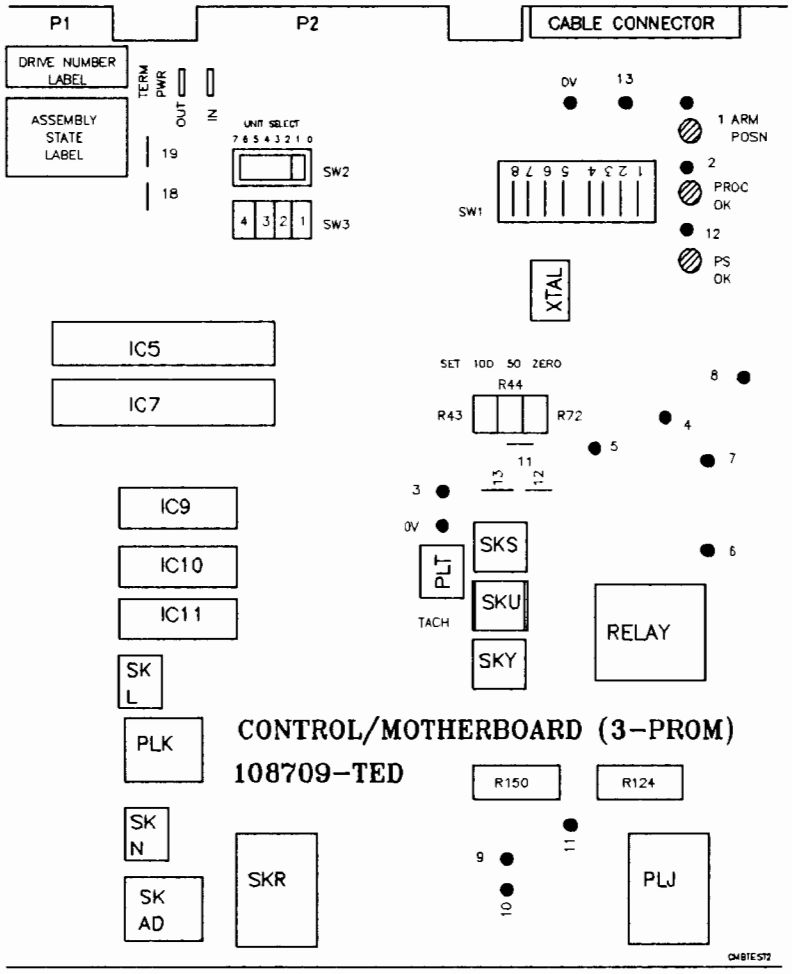
SECTION 9

DIAGRAMS

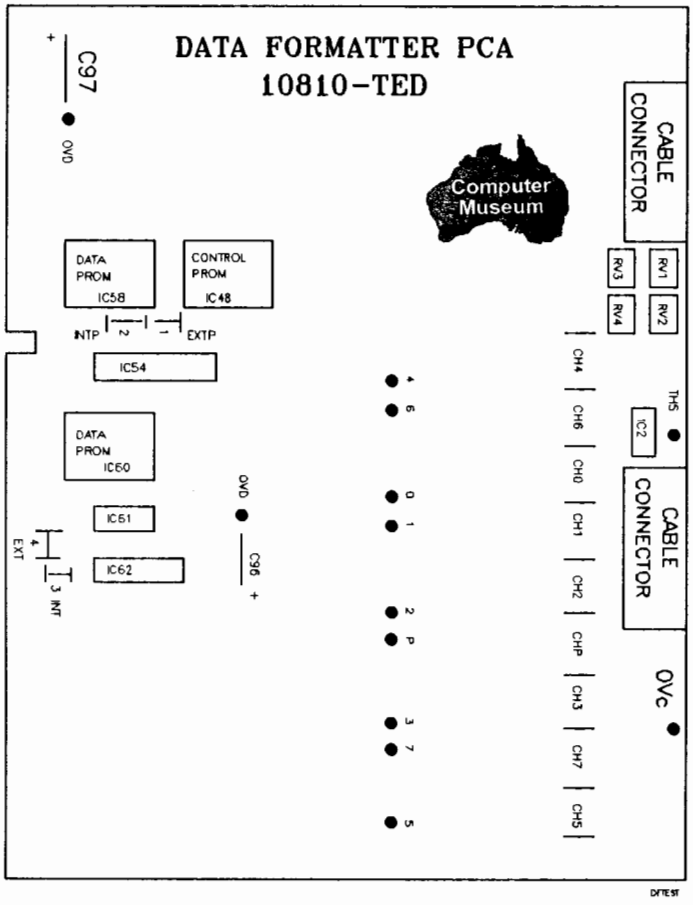
[1] TROUBLESHOOTING DIAGRAMS



Control/Mother Board
(4-PROM)
108709-TED



Control/Mother Board
(3-PROM)
108709-TED

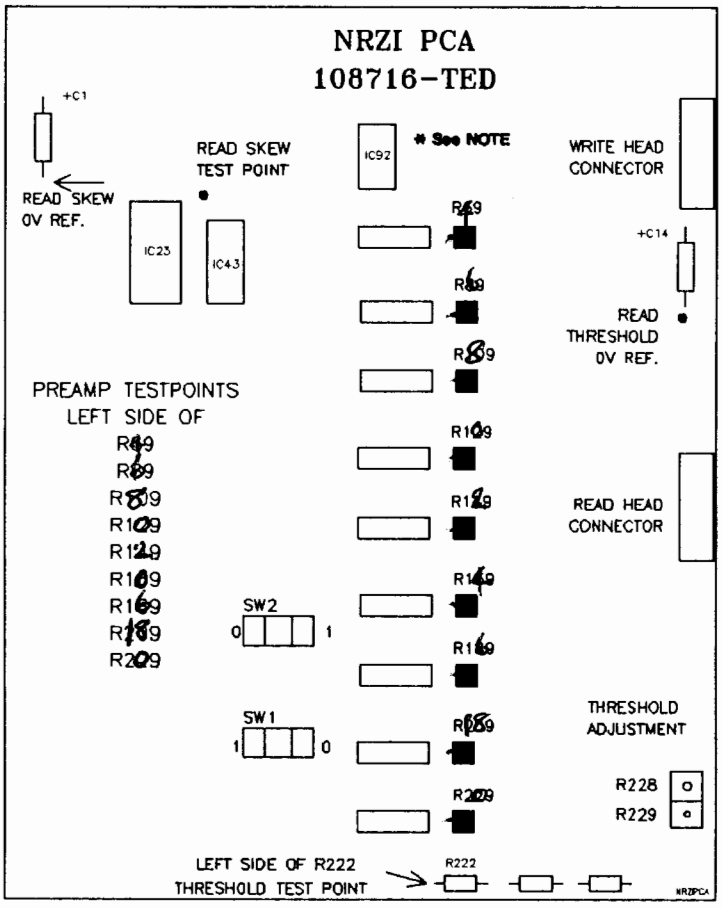


NOTE

-Use the 0Vc test point for Preamp checks and threshold adjustments.

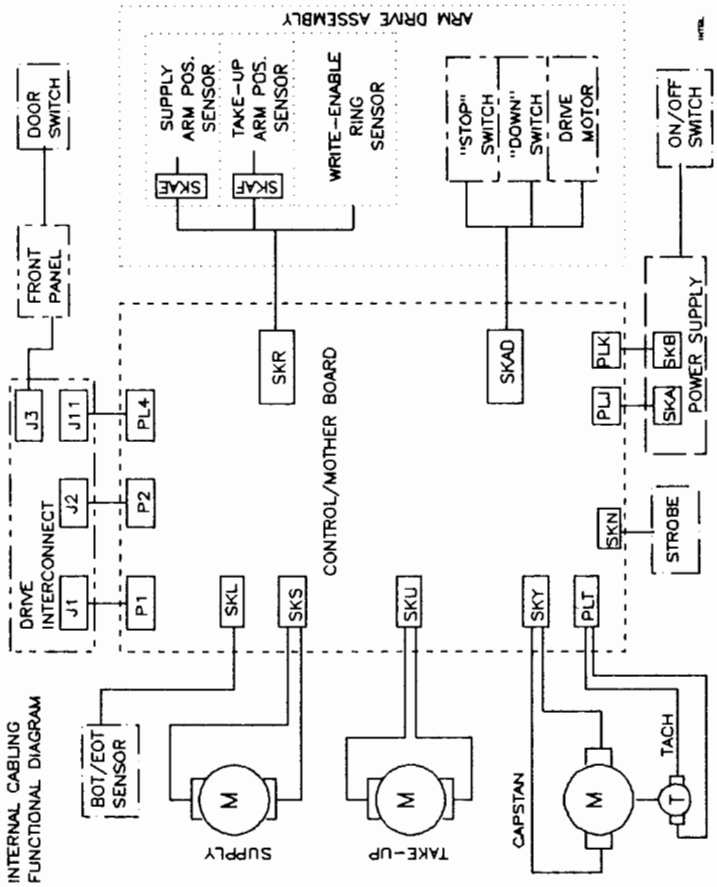
-Set Link 1 (EXTP) for external parity.

Data Formatter PCA
108710-TED

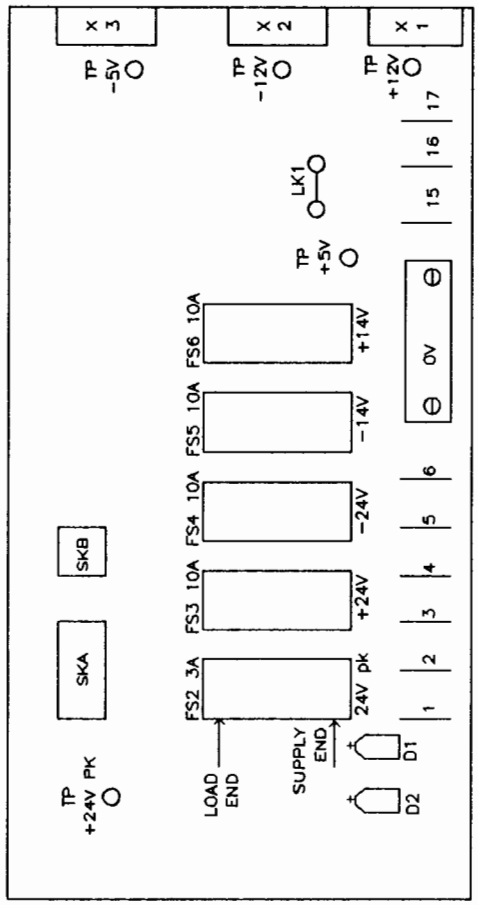


*** NOTE**

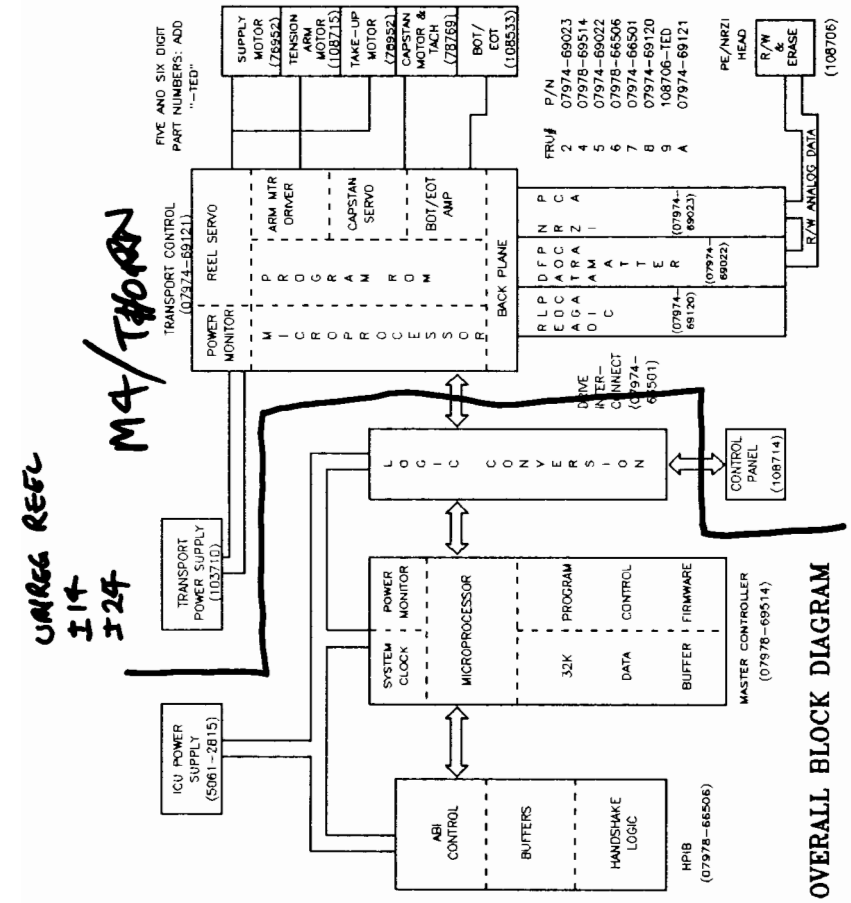
Deskew PROM (IC92) must always be matched with the head. When exchanging PCA, move PROM to the new PCA.



INTERNAL CABLING FUNCTIONAL DIAGRAM

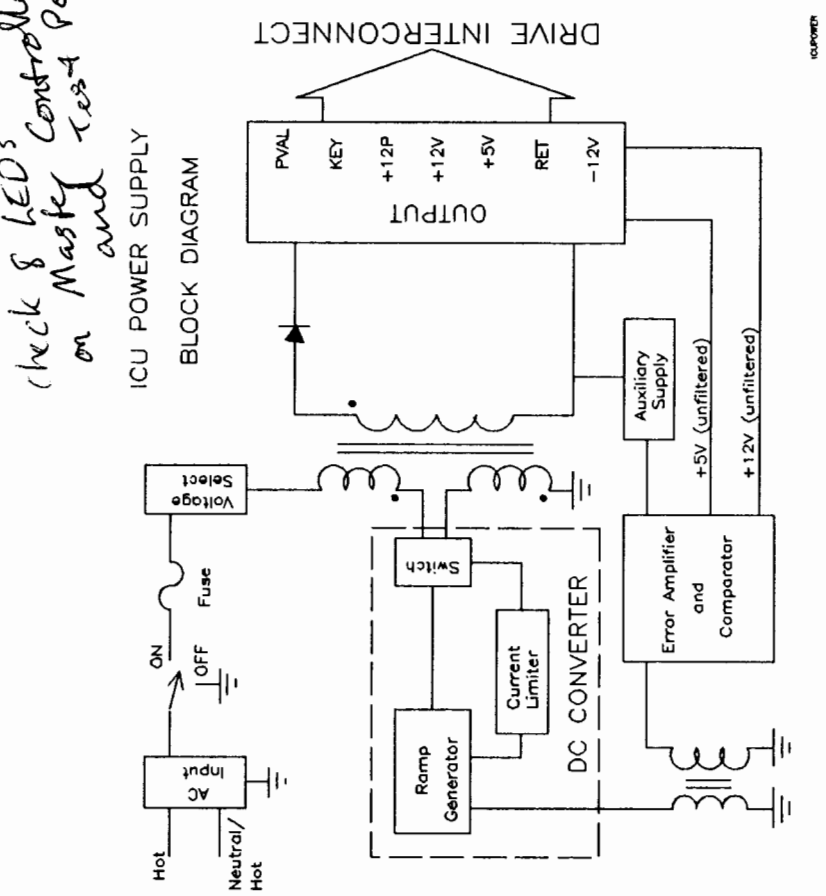


TRANSPORT POWER SUPPLY PCA
105678-TED

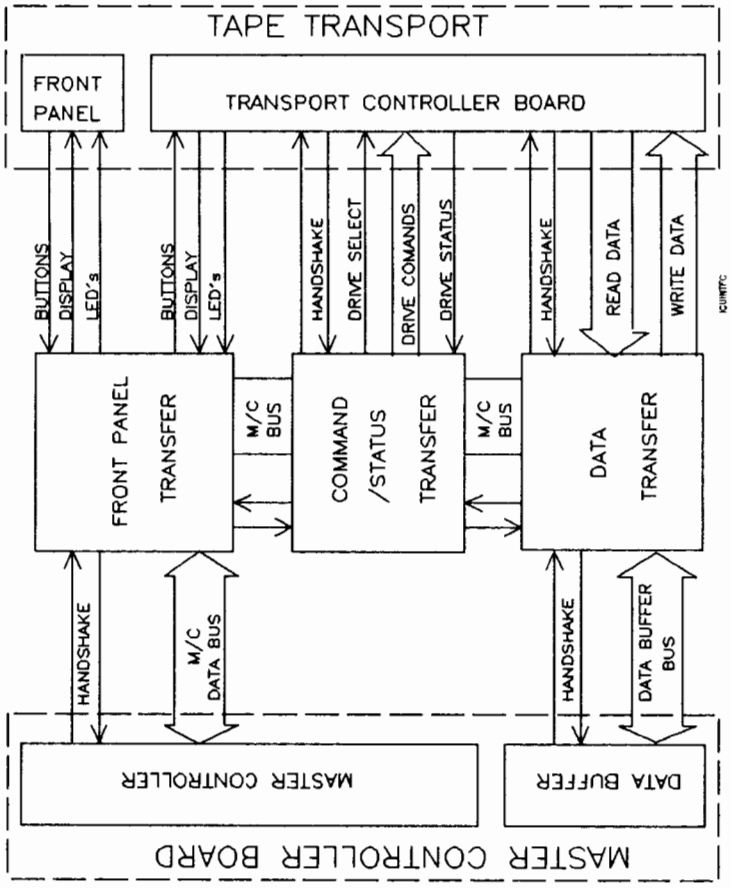


OVERALL BLOCK DIAGRAM

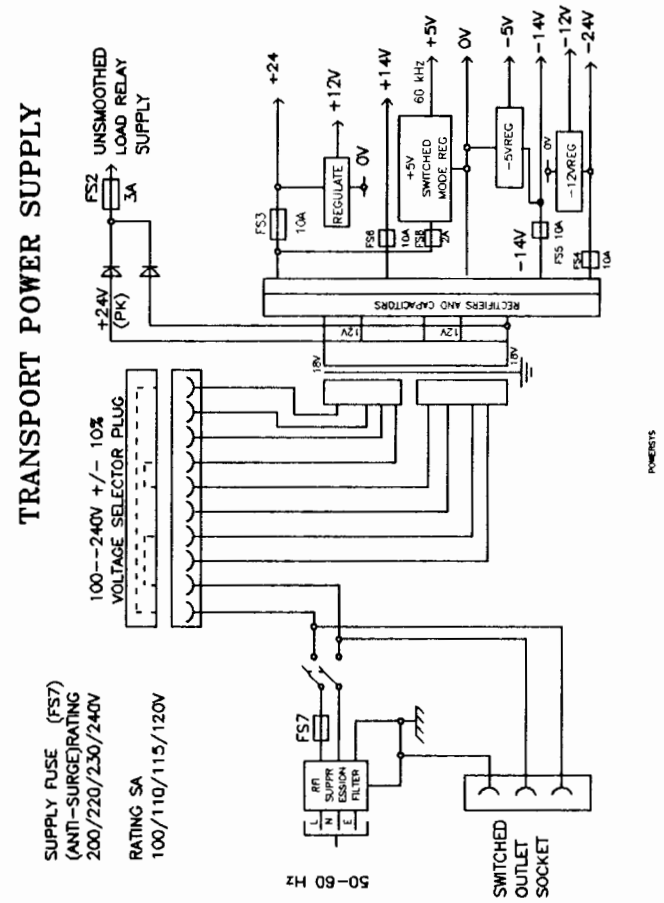
(Wick & LED's on Controller and Masky Test Points

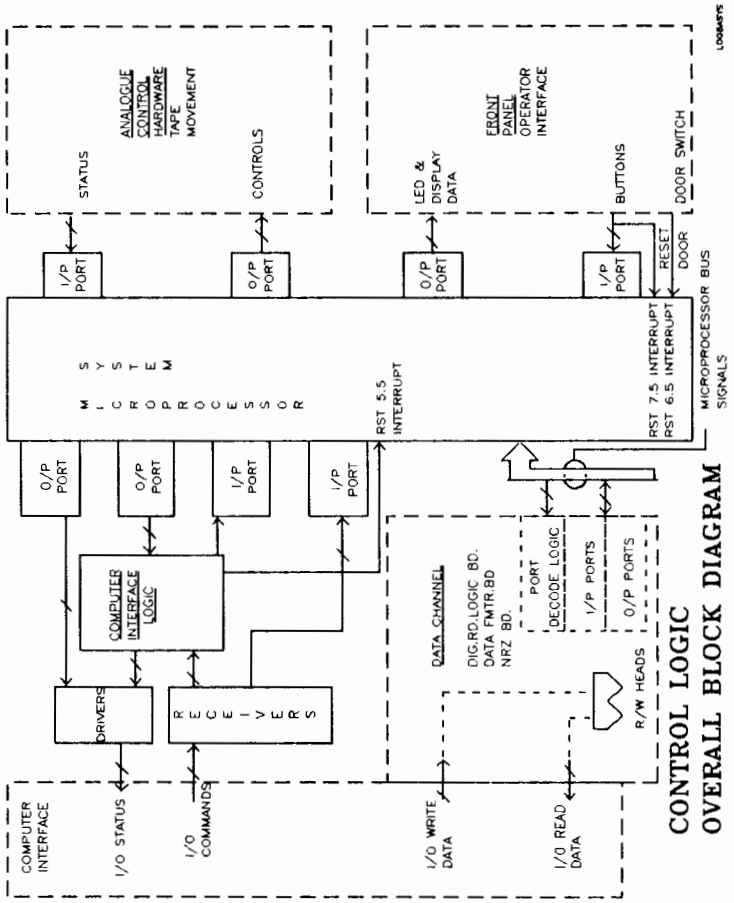


ICU POWER SUPPLY BLOCK DIAGRAM

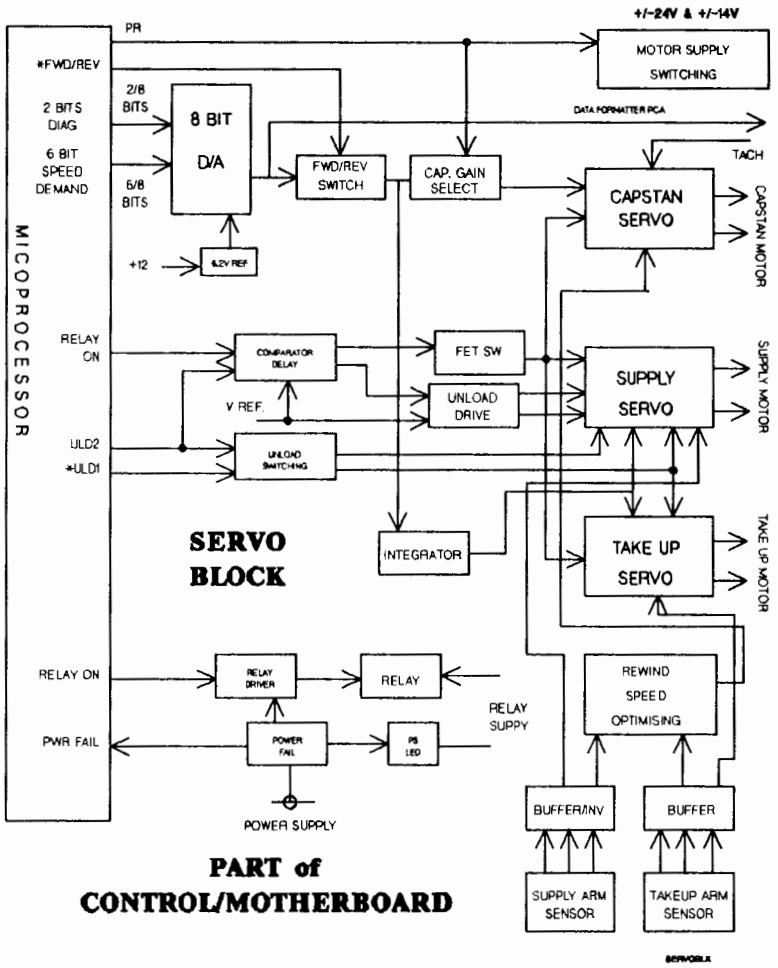


DRIVE INTERCONNECT FUNCTIONAL BLOCK DIAGRAM


TRANSPORT POWER SUPPLY
FS2
UNSMOOTHED LOAD RELAY SUPPLY
3A
+24V (PK)
FS3
10A
REGULATE
+24
+12V
0V
+14V
60 kHz
+5V SWITCHED MODE REG
+5V
0V
-5V
-5VREG
-14V
FS5 10A
-12VREG
-12V
-24V
FS4 10A
FS6 10A
2A
RECTIFIERS AND CAPACITORS
12V
12V
18V
18V
100--240V +/- 10%
VOLTAGE SELECTOR PLUG
SUPPLY FUSE (FS7)
(ANTI-SURGE)RATING
200/220/230/240V
RATING 5A
100/110/115/120V
FS7
RFI SUPPRESSION FILTER
L
N
E
50-60 Hz
SWITCHED OUTLET SOCKET
POWERSYS



CONTROL LOGIC
OVERALL BLOCK DIAGRAM


+/-24V & +/-14V
MOTOR SUPPLY SWITCHING
PR
*FWD/REV
2 BITS DIAG
6 BIT SPEED DEMAND
2/8 BITS
6/8 BITS
8 BIT D/A
DATA FORMATTER PCA
TACH
FWD/REV SWITCH
CAP. GAIN SELECT
CAPSTAN SERVO
CAPSTAN MOTOR
MICOPROCESSOR
+12
6.2V REF
RELAY ON
COMPARATOR DELAY
FET SW
V REF.
UNLOAD DRIVE
SUPPLY SERVO
SUPPLY MOTOR
ULD2
*ULD1
UNLOAD SWITCHING
SERVO BLOCK
INTEGRATOR
TAKE UP SERVO
TAKE UP MOTOR
RELAY ON
RELAY DRIVER
RELAY
REWIND SPEED OPTIMISING
RELAY SUPPY
PWR FAIL
POWER FAIL
PS LED
POWER SUPPLY
BUFFER/INV
BUFFER
SUPPLY ARM SENSOR
TAKEUP ARM SENSOR
PART of CONTROL/MOTHERBOARD

SECTION 10

REFERENCE

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

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
1	4/84	Failure to Stop Reel Motors at Unload
2	4/84	Firmware Update & Detention Modification
3	7/84	Modification to Read Logic PCA
4	8/84	Modification to Master Controller
5	10/84	Revision 5 Firmware, Master Controller
6	10/84	New Control/Motherboard
7	10/84	Drive Interconnect Modification
8	10/84	BOT/EOT Adjustment
9	11/84	New ICU Power Supply
10	7/85	Possible Shock Hazard (Europe only)
11	7/85	Cleaning Procedure
12	3/85	Adjustment Procedure (Threshold)
13	6/85	Upper Tension Arm Adjustment
14	2/86	New Data Formatter
15	8/85	Modification for External Parity
16	10/85	Modification to NRZI PCA
17	8/85	Incorrectly Wired Voltage Selector
18	2/86	Control/Motherboard Modification
19	12/85	Revision 7 Firmware
20	_____	_____
21	_____	_____
22	_____	_____
23	_____	_____
24	_____	_____
25	_____	_____
26	_____	_____
27	_____	_____
28	_____	_____
29	_____	_____