

This package contains a section of the

CE SERVICE HANDBOOK FOR HP 1/4-INCH TAPE DRIVES

and consists of the following document:



HP 35401A TAPE DRIVE Part no. 35401-90905

Insert this section into a handbook binder P/N 9282-0683.

NOTE

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

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

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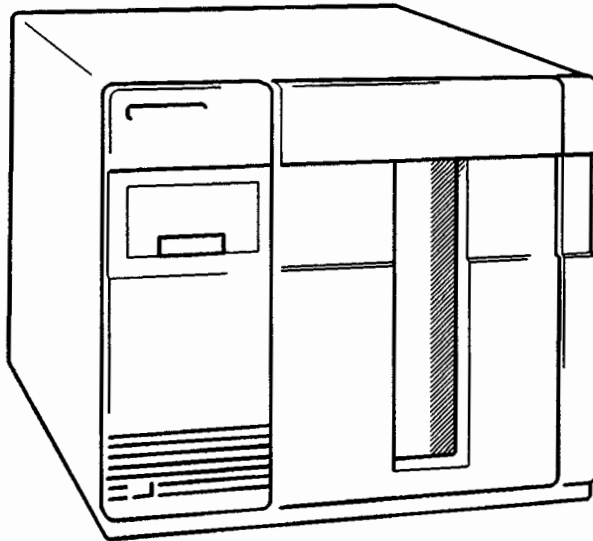
For research and education purposes only.

MAINTENANCE PRECAUTIONS

When working on Printed Circuit Assemblies in this product a "Static Discharge Work-station" should be used. Further to this it should be noted that the tape drive's front door cannot be operated manually, power must be applied to the unit and the eject button pressed before the door opens automatically. Any attempt to force the front door open will result in permanent mechanical damage to the tape drive mechanism.

RELATED MANUALS

<u>Part No.</u>	<u>Title</u>
5955-3442	<i>CS/80 Instruction Set Programming Manual</i>
5955-3462	<i>CS/80 External Exerciser Reference Manual</i>
35401-90902	<i>HP 35401A User's Manual</i>
35401-90904	<i>HP 35401A Hardware Support Manual</i>



The HP 35401A Tape Drive

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SAFETY CONSIDERATIONS

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

made inoperative and be secured against any unintended operation.

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

If this product is to be operated with an autotransformer make sure that the common terminal is connected to the earth terminal of the main power source.

SERVICING

WARNING

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

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

Capacitors inside this product may still be charged after the product has been disconnected from the main power source.

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

To install or remove a fuse, first disconnect the power cord from the device. Then, using a small flat-bladed screw driver, turn the fuseholder cap counterclockwise until the cap releases. Install either end of a properly rated fuse into the cap. Next, insert the fuse and fuseholder cap into the fuseholder by pressing the cap inward and then turning it clockwise until it locks in place.

SAFETY SYMBOLS

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



Indicates hazardous voltages.



Indicates earth (ground) terminal.



WARNING

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

CAUTION

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

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

1-1. PRODUCT DESCRIPTION

The HP 35401A is a high-capacity 1/4-inch cartridge tape drive. Its characteristics are given below:

1-2. FEATURES

- 536.8 Mbytes capacity (maximum)
- Up to 8 cartridges per magazine
- Standard 1/4-inch cartridge tapes
- HP 9144/791X (Linus) compatible
- Rugged reliable autochanger mechanism
- Built-in diagnostic capability

1-3. PHYSICAL SPECIFICATION

Net weight: 22.5 kg (50.5 lb)
Height: 260 mm (10.5 inches)
Depth: 575 mm (22.8 inches)
Width: 325 mm (12.8 inches)

1-4. ELECTRICAL SPECIFICATION

Line Voltage: 90-125 volts or 180-250 Volts (switch selectable)
Line Frequency: 48-66 Hz
Power Consumption: 125 Watts RMS

1-5. ENVIRONMENTAL SPECIFICATION

The HP 35401A Tape Drive is designed to meet the class B requirements of the HP Corporate Environmental Specification. However, the conditions under which the Tape drive will operate are limited to those allowed for the media.

Temperature:
Operating: +5°C to +40°C
Non-operating: -40°C to +45°C

Humidity: 20% to 80% with maximum wet bulb temperature (non-condensing) not to exceed 26°C

1-6. PERFORMANCE SPECIFICATION

DATA CAPACITY (FORMATTED)

67.1 Mbytes per "L" cartridge (600ft)
16.7 Mbytes per "S" cartridge (150ft)
16 tracks per cartridge
4096 user blocks/track (600ft cartridge)
1024 user blocks/track (150ft cartridge)
6 frames/block (4 for data, 2 for error correction)
256 bytes/frame
8 cartridges maximum per magazine
536.8 Mbytes total maximum per magazine.

DATA TRANSFER RATE

Maximum sustained: 2 Mbytes/min (SYSTEM DEPENDENT)

Maximum sustained transfer rate does not necessarily reflect system throughput which varies depending upon application, file structure and host tape driver specification.

Tape read/write speed: 60 inches per second

Tape search/rewind speed: 90 inches per second

ACCESS TIME

Cartridge select time: 10 seconds (min), 30 seconds (max) (transit time from magazine to drive)

Cartridge load/unload times in drive:

Load: 2 minutes 15 seconds (600ft)
1 minute 15 seconds (150ft)

Unload: 1 minute 30 seconds (600ft)
35 seconds (150 ft)

The Total Access Time is the sum of the cartridge select time and the cartridge load/unload time.

ENCODING TECHNIQUE:

MFM, Bit Density = 10,000 Bits/inch (bpi)

HARD ERROR RATE:

1 in 10^{11} transferred

1-7. OPTIONS AND ACCESSORIES

There are no options available with the HP 35401A Tape Drive.

The following items are included with the standard drive:

- 35401-90902 HP 35401A User's Manual
- 35401-90903 HP 35401A Quick Reference Guide
- 35402A Cartridge Magazine
- HP 88140LC Tape Cartridge (600 foot, 67 Mbyte)
- HP 92193E Cleaning Cartridge Kit

- 8500-1251 Tape Head Cleaning Solution
- HP 10833A 1.0 meter HP-IB Cable
- Power Cord, suitable for country of destination

The following accessories are available:

- 35401-90904 HP 35401A Hardware Support Manual
- 35401-90905 HP 35401A Customer Engineer Handbook
- HP-IB Cables:
 - 0.5 meter: HP 10833D
 - 1.0 meter: HP 10833A
 - 2.0 meter: HP 10833B
 - 4.0 meter: not recommended
- HP 88140SC Package of five 16.7 Mbyte, 150 foot tape cartridges
- HP 88140LC Package of five 67.0 Mbyte, 600 foot tape cartridges
- HP 92192C Cartridge Magazine
- HP 92193E Tape Cleaning Kit
- HP 92193P Replenishment Kit for above
- HP 92211R Design Plus mobile mini-rack system cabinet
- HP 92211S Rail kit for 92211R. Contains 4 sets of rails and module locks.
- HP 92211T Filler Panel Kit for HP 92211R. Contains 20X26mm high snap-in panels to fill the space not occupied by equipment.

The following items are needed to repackage the drive for shipment:

35401-80044	.....	Door Lock Clip (2 off)
35401-80058	.....	Spring Clip (Tray Holder)
35401-80095	.....	Foam Packaging (End Pieces)

1-8. SAFETY

- CSA Certified to CSA 22.2 No. 154
- Meets all applicable safety standards of IEC 380 and IEC 435
- UL listed to UL 114 and UL 478

Units shipped will meet the requirements of the country of destination.

1-9. SERVICE KITS

Listed below are the service kits available for the 35401A. Please note that these kits should be ordered from CPB (Div C600);

35401-67100	.....	Expensed Tool Package
35401-69197	.....	Inventory Parts Package

1-10. CONSUMABLES

- HP 88140SC Package of five 16.7 Mbyte, 150 foot tape cartridges
- HP 88140LC Package of five 67.0 Mbyte, 600 foot tape cartridges
- HP 92193E Tape Cleaning Kit
- HP 92193P Replenishment Kit for above

2-1. ENVIRONMENTAL REQUIREMENTS

Refer to section 1-5 (page 1-1) for the HP 35401A environmental specification. For more detailed environmental requirements data, refer to the Site Environmental Requirements Manual, part no. 5955-3456.

2-2. INSTALLATION

The following manuals are required to install the HP 35401A:

- Site Environmental Requirements for Disc/Tape drives, part number 5955-3456.
- HP 35401A User's Manual part number 35401-90902

2-3. CONTROLS AND INDICATORS

Figures 2-1 and 2-2 show the location of the tape drive controls and indicators.

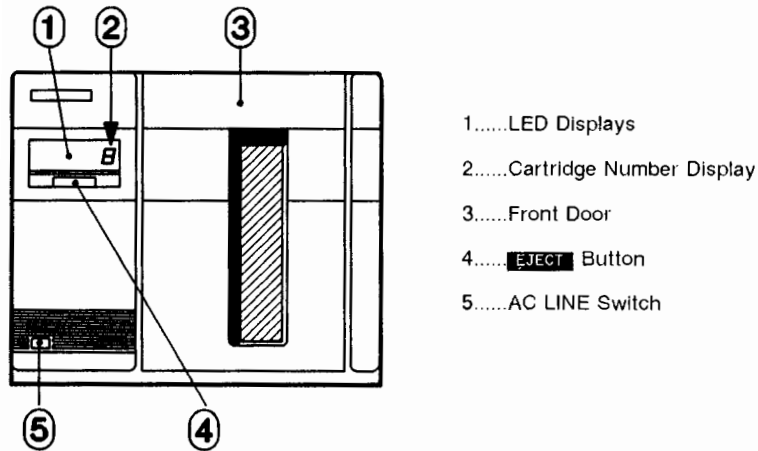


Figure 2-1. The Front Panel

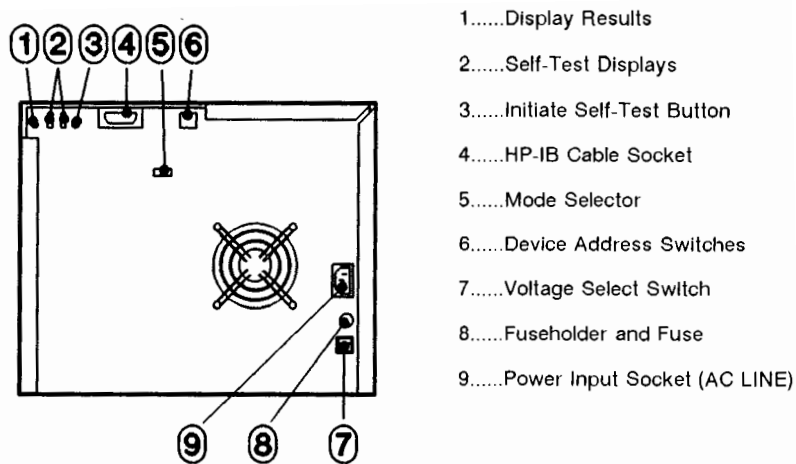


Figure 2-2. The Rear Panel

2-4. INSTALLATION CHECKLIST

- 1) Verify Input AC voltage, fuse rating and selector switch settings
- 2) Connect HP-IB cable and set address select switch
- 3) Power up and perform self test (refer to section 5)

2-5. AC POWER: VOLTAGE SELECTION/FUSES/CORDS

Voltage Selection:

CAUTION

Disconnect the power cord from the tape drive AC LINE connector before changing the VOLTAGE SELECTOR switch.

Slide the VOLTAGE SELECTOR switch to the proper position (115v or 230v) for the supply available.

Fuse:

WARNING

Remove the power cord from the tape drive before removing or replacing the fuse.

Replace the fuse with one of the same type and rating.

The same fuse is used for 115V and 230V operation:
 HP part number 2110-0003, 3.0A, 250V AC, Normal Blow.

Power cords:

See Figure 2-3. for the range of available power cords.

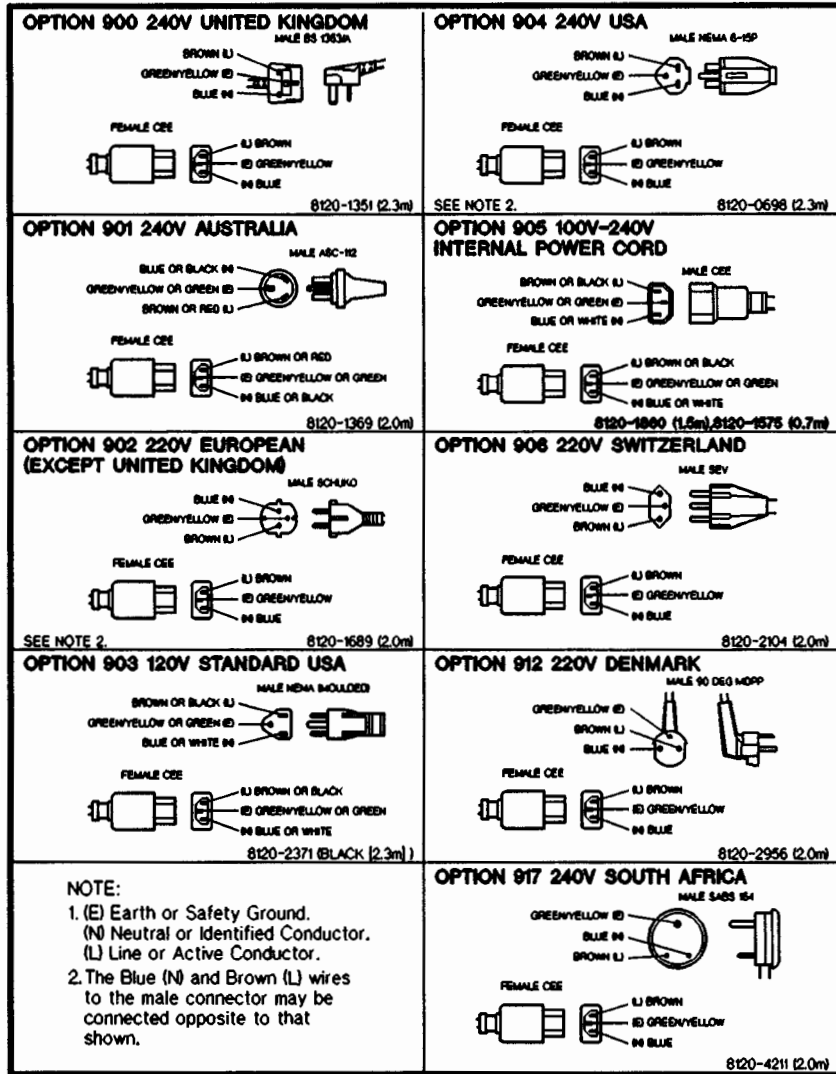


Figure 2-3. Available Power Cords

2-6. HP-IB INTERCONNECTION

WARNING

Do not connect or disconnect the HP-IB cable to the tape drive if the host system bus is active.

Do not power the tape drive up or down while still connected to the host if the host bus is active.

A 1-meter HP-IB cable is supplied with the HP 35401A. Other cables are available from CPC (PCE). See page 1-3.

2-7. HP-IB DEVICE ADDRESS

Set the HP-IB address according to Figure 2-4 and Table 2-1.

NOTE

When setting the HP-IB address switches, disregard any marking on the switch body. Set the switches according to the markings on the rear panel.

To register the new address, you must either power-cycle the drive or initiate a self-test by pressing the self-test pushbutton.

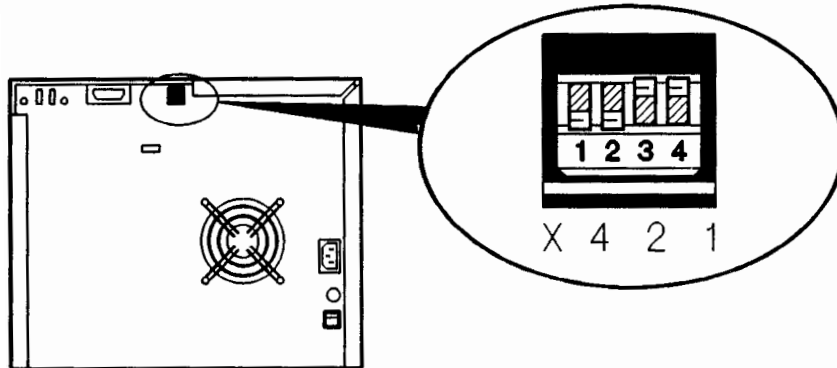


Figure 2-4. HP-IB Address Setting

Table 2-1. HP-IB Addresses

Switch	Settings	HP-IB Address
X	4 2 1	
	0 0 0	0
	0 0 1	1
	0 1 0	2
	0 1 1	3
	1 0 0	4
	1 0 1	5
	1 1 0	6
	1 1 1	7

2-8. PREVENTIVE MAINTENANCE

There is no scheduled PM on the HP 35401A.

Head cleaning should be carried out at least once a week and after using 8 new cartridges for the first time. The head should be cleaned if data errors are being experienced.

Head cleaning has been simplified by the introduction of the HP 92193E cleaning cartridge. Full instructions for use will be found with the cleaning cartridge kit.

3-1. CONFIGURATION

The Tape Drive has the capability of operating in two modes. These are the Sequential mode and the Selective mode. Each may be configured by setting the mode select switch on the rear panel (see Figure 3-1.).

SEQUENTIAL MODE

The Sequential mode is the simpler of the two, where the cartridges are accessed in order from the bottom to the top of the magazine. The cartridges may vary in capacity from one to another (16.7 or 67 Mbyte). The Tape Drive loads the cartridges in that order unless the operation is aborted by the host or the operator.

During Sequential operation the host computer has knowledge only of the cartridge which is currently loaded in the drive. Because of this, the cartridges must be put into the magazine in the order in which they are to be accessed.

SELECTIVE MODE

For this mode the host is aware of up to 8 cartridges; any one of which may be loaded and on-line at a time. The cartridges may vary in capacity from one another, and the order of access of the cartridges depends entirely upon the host computer program.

Random access may be made to any of the cartridges in the magazine using the Load command.

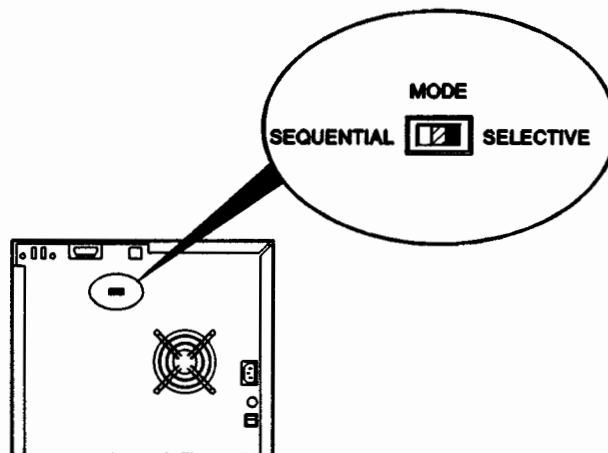


Figure 3-1. The Mode Select Switch

4-1. SELF TEST

Refer to Section 5 for self-test and diagnostic information.

4-2. FRA LOCATION AND LAYOUT

See Figures 8-1 to 8-3 for FRA locations and cabling layout.

4-3. TEST ERROR CODES

Table 4-1. Test Error Codes. For full details see Table 5-2.

FAULT CODE	FIELD REPLACEABLE ASSEMBLY	PART No.	EXCHANGE ASSEMBLY
U0, A0	NOT DISCERNABLE		
U0, A1	DRIVE MECHANISM	09144-67501	09144-69501
U0, A2	DDC PCA	09144-66512	09144-69522
U0, A3	RWS PCA	09144-66518	09144-69518
U0, A5	HDC PCA	07940-60195	07940-69195
U0, A7	RWS PCA	09144-66518	09144-69518
U0, A8	HEAD STEPPER MOTOR		CHANGE MECHANISM
U0, A9	CAPSTAN MOTOR	09144-65209	
U1, A1	MDC PCA	35401-60091	
U1, A2	VERTICAL MOTOR	35401-61000	
U1, A3	HORIZONTAL MOTOR	35401-61000	
U1, A4	MICROSWITCH PCA	35401-60094	
U1, A5	FLEXIBLE PCA		CHANGE AUTO MECHANISM
U1, A6	MECHANISM	35401-60000	35401-69000
U1, A7	HORIZONTAL CARRIAGE ASSEMBLY	35401-60011	
U1, A8	CABLING (HDC/MDC/DDC DC-1B)	35401-61601	
U2, A5	HDC PCA	07940-60195	07940-69195

This section provides service information to help you to mend a faulty Tape Drive. Fault-finding is quickly achieved by using the comprehensive self-test and diagnostic facilities built into the unit.

5-1. SAFETY CONSIDERATIONS

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

SAFETY SYMBOLS



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



Indicates hazardous voltages.



Indicates earth (ground) terminal.

WARNING

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

CAUTION

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

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

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

If this product is to be operated with an autotransformer make sure that the common terminal is connected to the earth terminal of the main power source.

WARNING

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

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

Capacitors inside this product may still be charged after the product has been disconnected from the main power source.

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

To install or remove a fuse, first disconnect the power cord from the device. Then, using a small flat-bladed screw driver, turn the fuseholder cap counterclockwise until the cap releases. Install either end of a properly rated fuse into the cap. Next, insert the fuse and fuseholder cap into the fuseholder by pressing the cap inward and then turning it clockwise until it locks in place.

5-2. TROUBLESHOOTING STRATEGY

The HP 35401A is repaired to the Field Replaceable Assembly (FRA) level. A combination of exchange and non-exchange parts from the CSD exchange program are used to achieve this.

To aid troubleshooting, the Tape Drive has self-test capabilities and diagnostic routines which may be initiated at power-on, by the operator or through the host. The results of these self-tests are listed in section 3-5. They provide an indication of the failed FRA(s), which can then be removed and replaced.

5-3. MINIMUM CONFIGURATION

The minimum configuration for host-initiated diagnostics comprises the Tape Drive linked to its HP 3000 or HP 9000 host for online or offline diagnostics. Alternatively, the existing host may be replaced by an HP 85 and diagnostics be performed using the CS/80 External Exerciser tape. If neither of these hosts are available for performing diagnostics then the Tape Drive's own internal diagnostics may be used.

5-4. TROUBLESHOOTING PROCEDURES

When troubleshooting the Tape Drive, the first thing to consider is whether the fault is repeatable or intermittent. This can be determined to some extent by repeating the self-test procedures several times. A repeatable fault usually causes the same self-test result to be presented each time the self-test is performed. By contrast, an intermittent fault occurring at random intervals may not always cause a self-test failure.

In the case of a repeatable fault, the self-test will identify the the failing FRA with a 95% certainty. In the event that more than one FRA is listed as the possible cause of the failure, replace the FRAs, one at a time, in the order given in the self-test display.

NOTE

Cable faults (such as an open-circuit conductor or a loose connector) may present a multiple FRA failure message. The FRAs listed will be the FRAs at either end of the defective cable.

All cabling should therefore be checked before replacing any FRAs.

Testing circuitry with a meter or oscilloscope should be restricted to checking the operation of the power supply. All other circuits are adequately tested by the system diagnostics and self-tests.

Test points are available on the PSU PCA next to the output connector J2. (see Figure 9-1, sheet 1). These should be checked with a digital voltmeter to confirm the correct voltages compared with Table 5-1. They should then be checked with an oscilloscope to determine the peak-to-peak ripple voltage.

Table 5-1. Power Supply Voltages

Test Point	Specification	Ripple (P-P)
+5V	+5 ± 150mV	50mV
+12V	+12 ± 360mV	100mV
-12V	+12 ± 60mV	100mV
+12VP	+12 ± 1V	10mV
PVAL	3.5V min	-

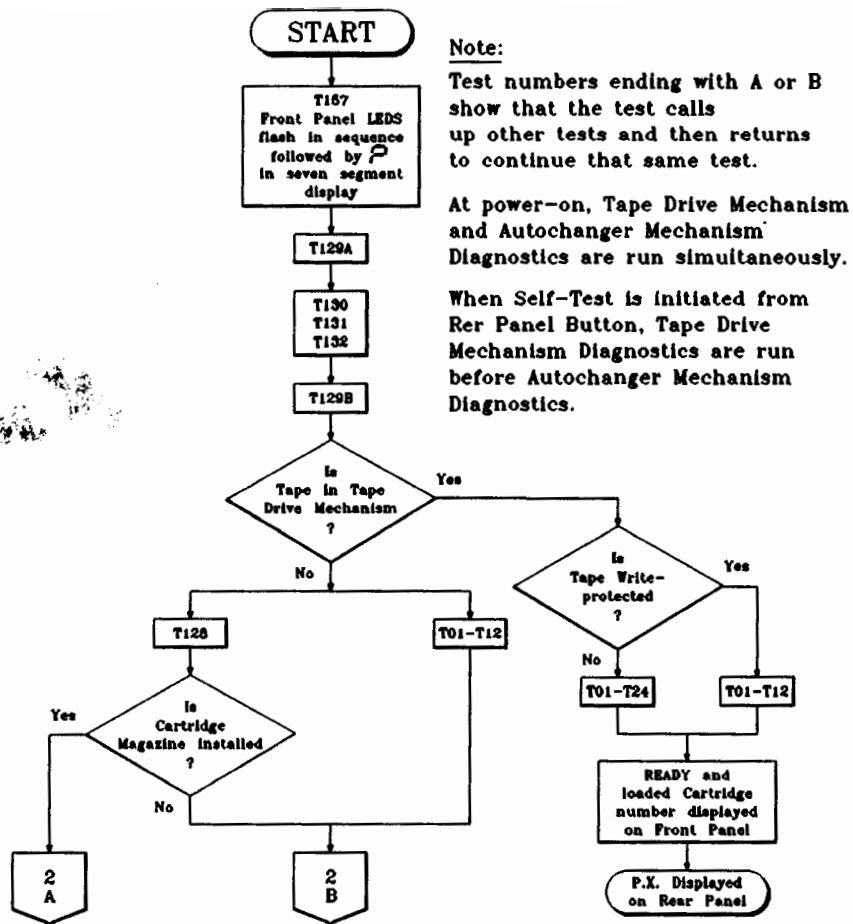


Figure 5-1. Self-Test Sequence Flowchart (sheet 1 of 3)
See Table 5-2. for a description of individual tests.

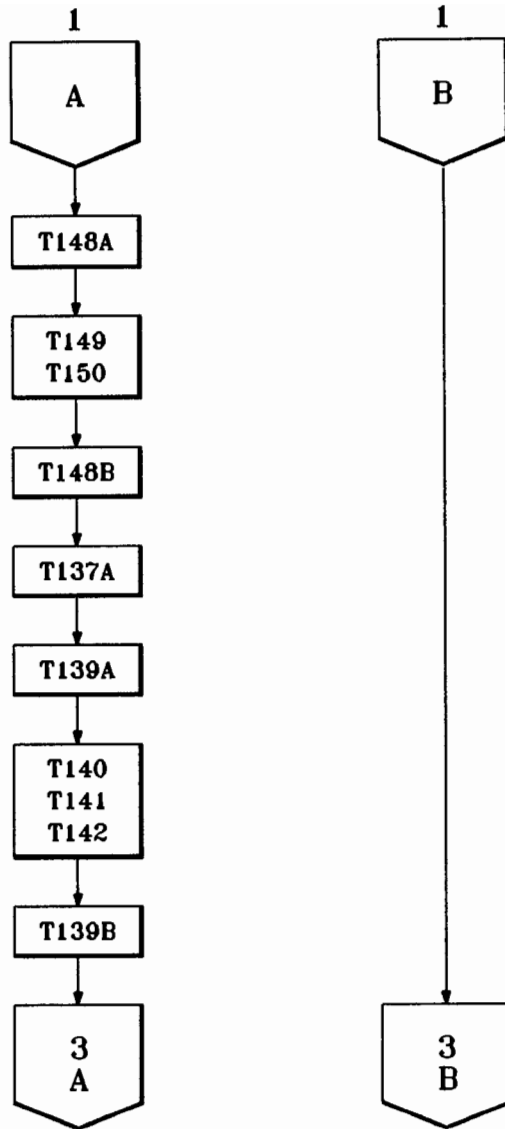


Figure 5-1. Self-Test Sequence Flowchart (sheet 2 of 3)
See Table 5-2. for a description of individual tests.

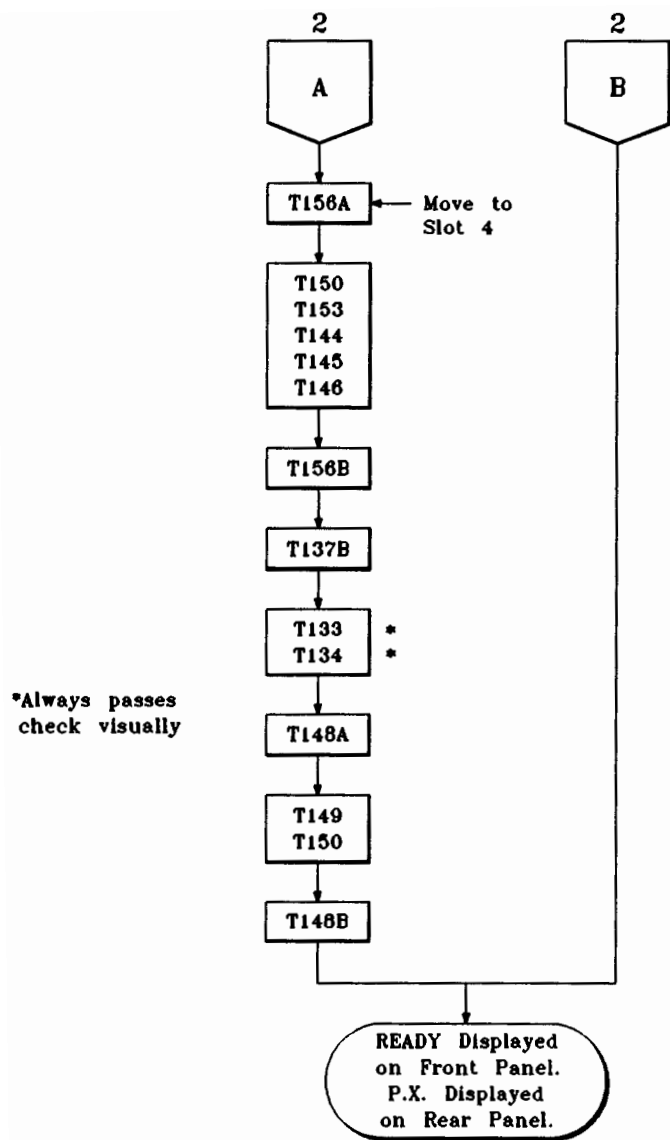


Figure 5-1. Self-Test Sequence Flowchart (sheet 3 of 3)
See Table 5-2. for a description of individual tests.

5-5. ERROR CODES

As a result of self-tests the following codes may be displayed by the self-test displays on the rear panel.

The Units which may be faulty are given by the following displays:

- U. 0.** Unit 0, the Drive Mechanism
- U. 1.** Unit 1, the Autochanger Mechanism
- U. 2.** Unit 2, the Internal Controller

For Unit 0, the Drive Mechanism, the Field Replaceable Assemblies that may be shown as faulty are:

- A. 0.** Not Discernible - an assembly failed and the test showed that it was good
- A. 1.** Drive Mechanism (including Capstan Motor and Head Stepper Motor)
- A. 2.** Device Dependent Controller (DDC)
- A. 3.** Read/Write/Servo Assembly (RWS)
- A. 4.** Probably a dirty tape head
- A. 5.** Host Dependent Controller (HDC)
- A. 7.** Read/Write/Servo Assembly (RWS)
- A. 8.** Head Stepper Motor (Not Replaceable)
- A. 9.** Capstan Motor and Optical Sensor

NOTE

There is no error code **A. 6.**

The Power Supply is faulty if either of the full stops (i.e., **■** **■**) are not illuminated.

For Unit 1, the Autochanger Mechanism, the FRAs that may be shown as faulty are:

- A. 1.** MDC PCA
- A. 2.** Vertical Motor
- A. 3.** Horizontal Motor
- A. 4.** Micro-switch PCA
- A. 5.** Flexible PCA
- A. 6.** Mechanism
- A. 7.** Horizontal Carriage Assembly

A. B. Cabling (HDC/MDC/DDC DC-IB)

If any of these faults are displayed on the self-test displays confirmation may be obtained by connecting an exchange autochanger mechanism in place of the original. (See section 5-7).

If there is a Unit 2 failure, in the Internal Controller (on the HDC), the error code sequence shown on the rear panel differs from Unit 0 or Unit 1 failure sequences (see section 5-5). The sequence is:

F. X. Fail with address "X"

U. 2. Unit 2 fails. The display does not cycle through Units 0 and 1 because the self-test routine checks the controller first. Having found a fault there, it then stops.

A. 5. Host Dependent Controller. This is the only FRA than can fail when there is only a Unit 2 failure.

If the front panel **FAULT** display is illuminated, but the test results give a Pass Condition, it is most probable that the tape cartridge is faulty. If this has occurred then the cartridge will automatically have been unloaded and the **READY** display will be lit. Loading another cartridge and repeating the test would help to establish whether it was a faulty cartridge.

Next in the self-test sequence the individual failing tests may be indicated. The following tables give the test numbers with a brief description of each test and the MSFRAs.

Table 5-2 shows the test errors which may be displayed as a result of initiating a self-test. Table 5-3 shows the errors which may be displayed at any time while the Tape Drive is in use, as the result of a fault.

5-6. INITIATING DIAGNOSTICS FROM A HOST COMPUTER

TEST PHILOSOPHY (complete self-test 00)

The test philosophy is that the Host executes a Transparent Loopback test (Read and Write) to verify functionality of the HP-IB interface and a large portion of the HDC board. If this test is unsuccessful, the host computer knows that the MSFRA (Most Suspected Field Replaceable Assembly) is the HDC assembly.

Having completed the Loopback test, the host computer instructs the HDC to Initiate Diagnostics. The parameters passed with the command tells the HDC whether to start the diagnostic at the top of the hierarchical chart, or at some lower level, and the number of times to repeat the test.

The HDC controls all levels of Diagnostic Testing. This means that the diagnostic code residing on the HDC is sent memos to execute diagnostic commands. The diagnostic code then instructs the DDC to execute its diagnostics. The diagnostic code then instructs the Servo circuitry to execute its diagnostics. Then, by using both the DDC and the Servo, the diagnostic code executes a test of the Read/Write circuitry. This must be done since there is no self-test hardware on the R/W circuitry.

If the command is to test from the beginning, the diagnostic code issues commands in a sequential order until either the test is completed or a failure is discovered. The

diagnostic code then terminates the testing and updates the MSFRA and the failing test number which are located in the Request Status summary and the back panel displays.

If the command is to execute a specific test, the diagnostic code sends the appropriate processor (e.g., DDC or RWS assembly) the command to execute the specific test. The HDC does not fail to send the message because it thinks that there is a failure higher up than the unit to be tested. For example, the diagnostic code sends a command to the DDC which tests the Read/Write circuitry even if the DDC appears to be bad.

TEST DESCRIPTIONS

HDC/DDC INTERFACE

The HDC/DDC Interface test consists of a loopback test. The diagnostic code sends the DDC a Loopback Command with an accompanying nibble (4 bits). The DDC reads this nibble, inverts it (ones complement), duplicates it into an upper nibble, and sends it back to the diagnostic code. This is done for 8 bytes. The diagnostic code decides if the correct data (the entire byte) is received and if not, declares that the DDC is faulty, with the HDC as the alternative MSFRA.

DEVICE-DEPENDENT CONTROLLER

The testing for the DDC is the self-test that is executed after every power-on. This tests >95% of the circuitry on the DDC and the results are completely independent from other circuitry, with the exception of the HDC and power supply.

This test includes testing out the microcomputer and the write and read circuitry, via internal loopback. The test stops short of sending signals to or receiving signals from the Read/Write circuitry. If the self-test fails, the DDC sends a Failing Response to the diagnostic code which causes the MSFRA to be the DDC.

If the DDC passes the self-test, it sends a Passing Response to the diagnostic code.

HDC/DDC/SERVO INTERFACE

The HDC/DDC/Servo Interface test consists of a loopback test. The diagnostic code sends the Servo a Loopback Command with an accompanying byte. The Servo reads this byte, inverts it (ones complement), and sends it back to the diagnostic code. This is done for 14 bytes. The diagnostic code decides if the correct data is received and if not, declares that the Servo is faulty, with the DDC and HDC as the alternative MSFRAs.

SERVO CIRCUITRY

The testing of the Servo circuitry tests >95% of the circuitry. The microcomputer and associated digital circuitry is tested.

The capstan motor electronics and optical sensor electronics are tested for functionality. The motor and optical sensor are then tested for functionality.

The testing for the head stepper is to determine if voltage is being sent to the motor. If there is voltage, the Servo assumes the motor works.

NOTE

Other testing (i.e., determining if a signal from the head disappears when the gap moves off the tape) is needed to verify that the head does indeed move because the head is run open loop.

READ/WRITE CIRCUITRY

The testing of the Read/Write circuitry depends on the Servo circuitry being functional. The test first tests out the read channel. It accomplishes this using the adjustable gain of the read amplifier and the Overthreshold circuitry. This checks out the functionality of the heads, pre-amps, multiplexer, and part of the secondary amplifier. A failure on one of these, but not all, is probably indicative of a damaged or dirty Head. Otherwise the failure is on the Read/Write circuitry.

If the read channel is operational, the write channel is checked. This is done by creating one block of random data, writing the data to a scratch block of the tape, reading it back, and verifying that the read data was identical to the written data. In the event of a failure this is done repetitively on different tracks to ensure that the tape is not at fault. This is done using both head channels.

AVAILABLE TESTS

The discrete unit tests are accessible to the Host via CS/80 Commands. These tests are defined as shown in Table 5-2.

5-7. USING THE SERVICE CABLE ASSEMBLY

The service cable assembly (35401-61602) can be used to verify an autochanger mechanism fault, without having to remove the suspect unit:

- 1 Remove the top shroud.
- 2 Place a new mechanism next to the Tape Drive.
- 3 Remove the cable from connector J4 on the MDC PCA and plug in the service cable.
- 4 Connect the 20-way socket to the flexible PCA on the new mechanism.
- 5 Connect the 14-way connector to the microswitch PCA and the 10-way connector to the vertical motor PCA.
- 6 Power-up the unit and see if the fault has now gone.

Table 5-2. Diagnostic/Self-Test Errors (TERRORS)

NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
00		Complete test of Tape Drive	
01		HDC-DDC interface. Read Servo Status	DDC, HDC
02		DDC Board	
03		a) Microcomputer test	DDC
04		b) Read/Write loopback	DDC
05		HDC-DDC Read/Write loopback.	DDC, HDC
06		HDC-DDC-Servo Interface	Servo, DDC, HDC
07		Servo Circuitry	
08		a) Microcomputer	Servo
09		b) Capstan Motor Drive Circuit	Servo, Capstan Motor
10		c) Tachometer	Servo, Capstan Motor
11		d) Capstan Motor	Capstan Motor, Servo
12		e) Head Stepper Circuit	Servo and Head Stepper
13		Test the read portion of the RWS PCA Start by executing a Put Gaps on Tape command. This will assume unit works and a Key Found signal can be generated. A failure of this command will cause the test to continue through the read tests, trying to diagnose what caused the failure. If the read tests all pass, the testing will halt and this test number will be the failing test.	RWS PCA, DDC

Table 5-2. Diagnostic/Self-Test Errors (TERRORS) continued

NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
14		With Read Gain set to minimum and Channel 0 positioned on the tape, enable Read with Read Head 0 and check for Overthreshold not being set.	RWS, DDC, HDC
15		With Read Gain set to minimum and Channel 0 positioned on the tape, enable Read with Write Head 0 and check for Overthreshold not being set.	RWS, DDC, HDC
16		With Read Gain set to a maximum and Channel 0 positioned on the tape, enable Read with Read Head 0 and check for Overthreshold being set.	RWS, DDC
17		With Read Gain set to maximum and Channel 0 positioned on the tape, enable Read with Write Head 0 and check for Overthreshold being set.	RWS, DDC, HDC
18		With Read Gain set to a minimum and Channel 1 positioned on the tape, enable Read with Read Head 1 and check for Overthreshold not being set.	RWS, DDC, HDC
19		With Read Gain set to a minimum and Channel 1 positioned on the tape, enable Read with Write Head 1 and check for Overthreshold not being set.	RWS, DDC, HDC
20		With Read Gain set to a maximum and Channel 1 positioned on the tape, enable Read with Read Head 1 and check for Overthreshold being set.	RWS, DDC
21		With Read Gain set to maximum and Channel 1 positioned on the tape, enable Read with Write Head 1 and check for Overthreshold being set.	RWS, DDC
22		Test the Write portion of the RWS PCA.	RWS

Table 5-2. Diagnostic/Self-Test Errors (TERRORS) continued

NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
23		After the edge of tape has been found and the tape wound to BOT, execute a Locate and Write to track 0, Key 4 with Channel 0. Read back the written data and verify it is the same data that was written. If not, return an error.	RWS, DDC, Drive Mechanism
24		Execute a Locate and Write to track 7, Key 5 with Channel 1. Read back the written data and verify it is the same data that was written. If not, return an error.	RWS, DDC, Drive Mechanism
128	80	Test entire autochanger mechanism subsystem. There is an initial check of the MDC. If it passes, some sensors are checked to see if a mechanism diagnostic is allowed. It is run if the Vertical Home sensor is active; the cartridge-under-arm (CUA) and Write-Protect sensors show no cartridge (cleaning or normal) is under the arm; and the Magazine sensor is active (there is a magazine present). If these conditions are all true then the mechanism diagnostic (No. 137) is executed. If no magazine is loaded then no mechanism diagnostics are executed.	N/A
129	81	MDC PCA Test all but motor drivers and controllers. No mechanism movement. DC-IB, NOVRAM and one channel of the 8253 timer IC are tested. This test calls test Nos 157, 130, 131, 132, exiting at the first failure.	MDC
130	82	Data/Control Interface Bus (DC-IB) A loopback register is provided in the MDC, so that the last value written to the MDC can be read back. This register is exercised with a series of data patterns. The test passes if no integrity errors are encountered.	MDC, HDC, DC-IB Cable

Table 5-2. Diagnostic/Self-Test Errors (TERRORS) continued

NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
131	83	NOVRAM Power interruption during this test will leave the NOVRAM corrupted for the next power-on. If a magazine is loaded then no test is performed, and the test always passes. If the sensor detects no magazine present, then a superficial non-volatility test is performed. The mechanism logs are not tested, but can be by using the Clear Logs Utility (see section 10 of HSM).	MDC, DC-IB Cable
132	84	8253 Timer IC Functional check of third channel of timer. Also measures period of count provided by on-board oscillator by comparison with HDC clock. It calibrates the counter from this clock to allow for component tolerances.	N/A
133	85	Eject Solenoid Visual check: solenoid activated and deactivated after half a second.	N/A
134	86	Arm Solenoid Visual check: solenoid activated and deactivated after half a second.	N/A
137	89	Mechanism Starts with vertical axis check (No. 139). If this passes, it moves horizontal carriage assembly to a height suitable for horizontal axis check (No. 143). If this also passes, then the eject solenoid (No. 133) and arm solenoid (No. 134) checks are performed. Finally, the mechanism is moved to the "home" position. Testing is aborted when the first failure is detected. WARNING: Ensure the mechanism path is clear before running this diagnostic.	N/A

Table 5-2. Diagnostic/Self-Test Errors (TERRORS) continued

NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
138	8A	<p>Half Mechanism Test</p> <p>This test performs as complete a check of the mechanism as is possible allowing for the door being open (and a magazine loaded). It is called during a complete self-test when the magazine is absent. Vertically it performs the same functions as Test No. 137, but horizontally the test is abbreviated. WARNING: Ensure the mechanism path is clear before running this diagnostic.</p>	N/A
139	8B	<p>Vertical Axis Movement</p> <p>This test executes the vertical motor (No. 140), vertical sensors (No. 141) and vertical travel (No. 142) tests to check all FRAs associated with vertical movement. WARNING: Ensure the mechanism path is clear before running this diagnostic.</p>	N/A
140	8C	<p>Vertical Motor</p> <p>Vertical motor is powered-up. Vertical counter channel and vertical slot and home sensors are examined for evidence of vertical movement. If no evidence is found, then the horizontal axis is tested in the same way to see if the fault is unique to either motor/encoder or the MDC or cable connecting them.</p>	Vertical Motor, MDC
141	8D	<p>Vertical Sensors</p> <p>By moving the vertical motor, the test checks that the vertical home and vertical slot sensors change state as the vertical movement is attempted. It checks that the vertical slot sensor becomes active at the correct heights above the vertical home sensor. WARNING: Ensure the mechanism path is clear before running this diagnostic.</p>	Autochanger Mechanism, Vertical Motor, Microswitch PCA

Table 5-2. Diagnostic/Self-Test Errors (TERRORS) continued

NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
142	8E	<p>Vertical Travel</p> <p>Platform moved from top to bottom of vertical axis to check that it is the correct length. It checks that the mechanism path is unobstructed and that there is little or no backlash in the vertical gearbox. WARNING: Ensure the mechanism path is clear before running this diagnostic.</p>	Autochanger Mechanism, Vertical Motor
143	8F	<p>Horizontal Axis Movement</p> <p>This test executes the horizontal motor (No. 144), horizontal sensor (No. 145) and horizontal travel (No. 146) tests, to check all FRAs associated with horizontal movement. Testing is aborted when the first failure is detected. WARNING: Ensure the mechanism path is clear before running this diagnostic.</p>	N/A
144	90	<p>Horizontal Motor</p> <p>Horizontal motor is powered-up. Counter channel and horizontal B and C sensors are examined for evidence of horizontal movement. If no evidence is found, then the vertical axis is similarly tested to see if the fault is unique to either motor/encoder or is caused by the MDC or connecting cable.</p>	Horizontal Motor, MDC
145	91	<p>Horizontal Sensors</p> <p>By moving the horizontal motor, the test checks that the horizontal B or C sensors change state as axis movement is performed. It then checks that the correct sequence of sensor states occurs as the arm moves along the horizontal axis. WARNING: Ensure the mechanism path is clear before running this diagnostic.</p>	Horizontal Carriage

Table 5-2. Diagnostic/Self-Test Errors (TERRORS) continued


NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
146	92	<p>Horizontal Travel</p> <p>Check length of horizontal travel. Checks that travel is unobstructed and there is little or no backlash in the horizontal gearbox. WARNING: Ensure the mechanism path is clear before running this diagnostic.</p>	<p>Autochanger Mechanism, Horizontal Motor</p> 
148	94	<p>Find Home</p> <p>At power-on this test is used to move the mechanism to the horizontal home position. It calls the horizontal home test (No. 149), followed by the vertical home test (No. 150).</p>	N/A
149	95	<p>Find Horizontal Home</p> <p>The mechanism is moved to home to prepare for a mechanism diagnostic (half or full).</p>	Autochanger Mechanism, Horizontal Motor
150	96	<p>Find Vertical Home</p> <p>The mechanism is moved to vertical home position to prepare for a mechanism diagnostic (half or full).</p>	Autochanger Mechanism, Microswitch PCA
157	9D	<p>Front Panel Display</p> <p>Activate each LED segment on front panel for visual check. Starts with all LEDs illuminated then all LEDs off. Then LEDs activated in sequence: READY, UNLOAD, FAULT, PROTECT, LOAD and BUSY. Then the segments of the seven-segment display are illuminated in sequence.</p>	Front Panel PCA

Table 5-3. Run-Time Drive Errors (DERRORS)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
16	10	Success	None
17	11	Vertical motor jammed or counter stopped	Vertical motor, cables
18	12	Horizontal motor jammed or counter stopped	Horizontal motor, cables
19	13	Vertical motor did not stop at the end of its travel	Belt tension, motor
20	14	Horizontal motor did not stop at the end of its travel	Belt tension, motor
21	15	Invalid sensor state - vertical, HB, HC, or CUA sensors in wrong state	Failed sensors, cables
22	16	Faulty count	Slack mechanism or gearbox
23	17	Not used	None
24	18	Not used	None
25	19	Magazine not present	No magazine, door open, sensor failed
26	1A	Load timed-out. Tape Drive mechanism took too long to load cartridge.	Cabling, MDC
27	1B	Not used	None
28	1C	Not used	None
29	1D	Clear received from host	None
30	1E	Cartridge not loaded in drive mechanism, when attempt is made to activate "cartridge present" sensor	CUA sensors, cartridge removed illegally
31	1F	Unload failed	MDC

Table 5-3. Run-Time Drive Errors (DERRORS) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
32	20	Cleaning cartridge found during preload	None
33	21	Invalid parameter specified in load or unload	None
34	22	Vertical slot not reached	Jammed mechanism, failed sensor, blocked slot, cable, MDC
35	23	Vertical slot passed	Slack mechanism or gearbox, failed sensor, blocked slot, cable, MDC
36	24	Faulty vertical count	Slack mechanism or gearbox
37	25	Faulty horizontal count	Slack mechanism or gearbox
38	26	Unable to load. Tape mechanism diagnostics have failed.	
39	27	Cleaning cycle time-out. Cleaning cycle did not complete.	
40	28	Not used	None
↓	↓		
48	30	Not used	None
49	31	HB sensor invalid	Sensor, cable, MDC
50	32	HC sensor invalid	Sensor, cable, MDC
51	33	HB and HC sensors invalid	Sensors, cables, MDC
52	34	VH sensor invalid	Sensor, cable, MDC
53	35	VH and HB sensors invalid	Sensors, cables, MDC
54	36	VH and HC sensors invalid	Sensors, cables, MDC

Table 5-3. Run-Time Drive Errors (DERRORS) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
55	37	VH, HB and HC sensors invalld	Sensors, cables, MDC
56	38	CUA sensor invalid	Sensor, cable, MDC
57	39	CUA and HB sensors invalld	Sensors, cables, MDC
58	3A	CUA and HC sensors invalld	Sensors, cables, MDC
59	3B	CUA, HB and HC sensors Invalid	Sensors, cables, MDC
60	3C	CUA and VH sensors invalid	Sensors, cables, MDC
61	3D	CUA, VH and HB sensors invalid	Sensors, cables, MDC
62	3E	CUA, VH and HC sensors Invalid	Sensors, cables, MDC
63	3F	CUA, VH, HB and HC sensors Invalid	Sensors, cables, MDC
177	B1	Recoverable dual errors (one byte) Two frames were bad (CRC error or missing) which were recoverable through XOR circuitry. (Marginal or recoverable)	None
178	B2	Single frame error (one byte) Only one frame with bad CRC or missing. (Marginal or recoverable)	None
179	B3	Unrecoverable data (one byte) Combination of frame CRC errors or missing frames such that data could not be recovered through XOR circuitry. (Marginal, recoverable or unrecoverable)	None

Table 5-3. Run-Time Drive Errors (DERRORS) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
180	B4	DMA handshake error (one byte) Overflow or underflow has occurred between HDC and DDC. (Marginal, recoverable or unrecoverable)	HDC, DDC
181	B5	DMA failure (one byte) Not enough frames detected during read or read-while-write. (Marginal recoverable, or unrecoverable)	HDC, DDC
185	B9	Key error (one byte) One key past target, keys past target, bad key CRC, time-out of key sync, wrong key sent or verify failed. This error occurs during transfer, not seek to target or seek to perform retries. (Marginal, recoverable, unrecoverable, or latency induced)	DDC
186	BA	Seek error (one byte) Seek to target required retries or failed because of time-out or keys past target. (Unit fault)	DDC
187	BB	Seek to a jump spare (one byte) A latency was induced due to seeking to a jump spare during a transaction (Latency induced)	DDC
190	BE	Reposition failure (one byte) Reposition of tape to next target address after tape access command required retries or failed. (Unit fault)	DDC

Table 5-3. Run-Time Drive Errors (DERRORS) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
193	C1	<p>Log overflow (two bytes)</p> <p>Log indicated in postbyte overflowed. (Possible loss of entries)</p> <p>0 = Manufacturer's block 1 = Sparing table 2 = Error rate test log 3 = Runtime error log 4 = Use log (Maintenance track overflow)</p>	<p>Tape Drive Subsystem: DDC RWS Drive Mechanism</p>
194	C2	<p>Unable to read log (two bytes)</p> <p>Log indicated in postbyte could not be read in multiple retries. (For sparing table, this could mean that it was never written or errors preclude it from being written. For other logs, if log was never written this error will not occur. Log will be returned as empty.) Postbyte log codes are defined above. (Unrecoverable data, uninitialized media, unit fault)</p>	<p>Uninitialized cartridge, Tape Drive Subsystem: DDC RWS Drive Mechanism</p>
195	C3	<p>Unable to write log (two bytes)</p> <p>Log indicated in postbyte could not be written on any track in multiple retries. Postbyte log codes are defined above. (Unrecoverable data)</p>	
196	C4	<p>Log only written on one track (two bytes)</p> <p>Log indicated in postbyte could only be written on one track rather than the usual two. Postbyte log codes are defined above. (Unrecoverable data)</p>	

Table 5-3. Run-Time Drive Errors (DERRORS) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
200	C8	<p>Servo error (two bytes)</p> <p>Command to servo processor was not successfully executed. Postbyte contains status returned by servo processor:</p> <p>00H = Power on state (servo processor is reset) FFH = Busy/Active 1(T)H = Rewind/T = track 2(T)H = Forward/T = track 3(T)H = Stopped/T = track 40H = Invalid command 41H = Loss of speed control 44H = Cannot find edge of tape 48H = Pre-pos gaps, no keys 50H = Cannot calibrate speed 61H = Unspool likely, no keys found 64H = EOT active 68H = BOT active (Unit fault)</p>	
206	CE	<p>Load error (two bytes)</p> <p>This cartridge failed the load sequence. Failure is recorded in postbyte:</p> <p>1 = Load diagnostics failed 2 = Seek to EOT failed 3 = Speed calibration failed 4 = Gain set failed 5 = Seek to BOT failed 6 = Edge find failed (Unit fault)</p>	
207	CF	<p>Unload error (two bytes)</p> <p>This cartridge did not successfully complete the normal unload sequence (logs may not have been updated). Failure is recorded in postbyte:</p> <p>1 = Diagnostic result indicated a hardware failure so normal unload was not attempted. 2 = Seek to EOT failed (Unit fault)</p>	

Table 5-3. Run-Time Drive Errors (DERRORS) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
209	D1	Not certified This cartridge is not certified. (Uninitialized media)	None
210	D2	Certify command failed Attempt to certify a cartridge failed. Possible reasons are: 1 Requires >80% of the spares to be used up. 2 Can't write spares table to tape. 3 Error rate test failed due to log overflow or seek failure. 4 Transfer canceled 5 Certify specified with 0 loops. (Uninitialized media)	
216	D8	Hardware fail (one byte) Attempt to access the tape (with a non-diagnostic command) when previous diagnostic command, power-on or load diagnostics indicated a hardware failure. (Unit fault)	
217	D9	Write circuit failure (one byte) Attempt to perform a write command when write circuitry has failed power-on or load diagnostics or has failed a diagnostic command. (Unit fault)	
223	DF	No buffers in system (one byte) No buffers are available to complete a transaction. (Controller fault)	

The only adjustments to be made in the Tape Drive concern the autochanger mechanism drive belts. The horizontal belt tension is adjustable, whereas the vertical drive belts have self-adjusting tensioners.

The vertical drive belts, however, have to be checked for position. If either belt slips over the toothed pulley at the bottom of the mechanism, the result is that the platform assembly is no longer parallel with the mechanism.

6-1. SAFETY CONSIDERATIONS

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

SAFETY SYMBOLS



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



Indicates hazardous voltages.



Indicates earth (ground) terminal.

WARNING

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

CAUTION

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

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

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

If this product is to be operated with an autotransformer make sure that the common terminal is connected to the earth terminal of the main power source.

SERVICING

WARNING

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

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

Capacitors inside this product may still be charged after the product has been disconnected from the main power source.

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

To install or remove a fuse, first disconnect the power cord from the device. Then, using a small flat-bladed screw driver, turn the fuseholder cap counterclockwise until the cap releases. Install either end of a properly rated fuse into the cap. Next, insert the fuse and fuseholder cap into the fuseholder by pressing the cap inward and then turning it clockwise until it locks in place.

6-2. REQUIRED TOOLS/EQUIPMENT

In addition to the Customer Engineer toolkit and the TORX kit, a drive-belt tension-checking tool (35401-60030) is needed to make the required adjustments.

6-3. PREPARATION FOR ADJUSTMENTS

Before making any adjustments in the Tape Drive, take the following steps to prepare it for service:

- 1 Set the AC line switch to the "off" (push-button out) position. Disconnect the power cord from the AC line socket on the rear of the Tape Drive.
- 2 Disconnect the HP-IB cable assembly from the connector on the rear panel.
- 3 Place the Tape Drive on the anti-static mat and connect the wrist strap to the pad. When the top shroud is removed, ground the frame of the Tape Drive to the mat.

CAUTION

Ensure that the anti-static wrist strap is attached to your wrist before removing or replacing any components in the Tape Drive.

6-4. SETTING HORIZONTAL BELT TENSION

To check or adjust the horizontal drive belt tension you must proceed through the preparation section (6-3) and remove the top shroud.

The horizontal carriage assembly (50) should be positioned at the middle or top of its travel and at the forward limit of its travel. If it is not there, gently move it by hand to the correct position.

CAUTION

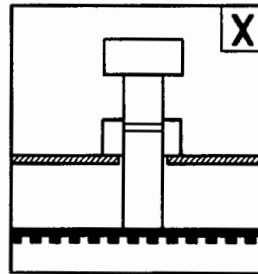
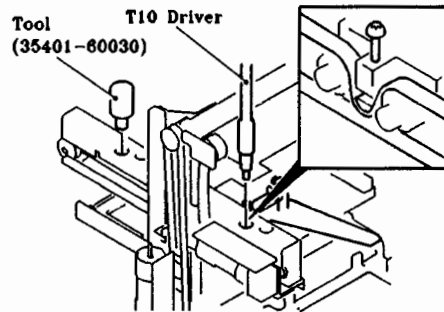
Gently apply force to the center of the platform to move it up or down. Parts of the mechanism could be permanently deformed if force is applied elsewhere.

Take care not to open the door with the horizontal carriage assembly forward and near the bottom of its travel. The door would damage the arm on the assembly.

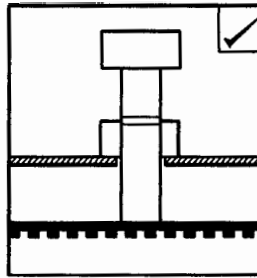
Gently move the flexible PCA away from over the holes in the horizontal sensor bar.

The belt tension may be checked by placing the tool (35401-60030) through the hole in the horizontal sensor bar, as shown in Figure 6-1. (Near the middle of the belt length). If the tension is correct, a single groove will show above the sliding collar resting on the horizontal sensor bar. If the belt is too tight, then two grooves will show above the collar. If the belt is too slack, then no grooves will show.

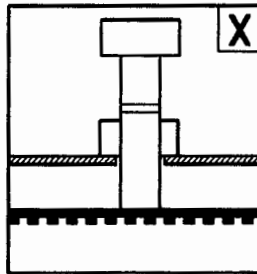
If the tension is not correct, it should be adjusted using a T10 driver, as shown in Figure 6-1. Slacken the belt first by unscrewing the T10 screw and pressing down on the belt. Then tighten the belt until the belt tension tool just shows one groove.



Belt too slack



Tension correct



Belt too tight

Figure 6-1. Belt Tension Adjustment

6-5. SETTING VERTICAL BELT POSITION

If either of the vertical drive belts loses its tension it is possible for that belt to slip over the toothed pulley. This can occur if you move the platform too fast or too hard at one side by hand. If this occurs, then the platform assembly becomes no longer parallel with the mechanism. This makes its vertical movement become noticeably stiff and can cause loading problems.

To check or set the position of the vertical drive belts proceed through the preparation section (6-3) and remove the top shroud.

The horizontal carriage assembly (50) should be at the upper limit of its travel. If it is not there, gently move it by hand to the correct position.

The belt position may now be checked by noting the gap between the vertical castings and the top cap of the mechanism (see Figure 6-2). If the position is correct then the gap should be the same on each side.

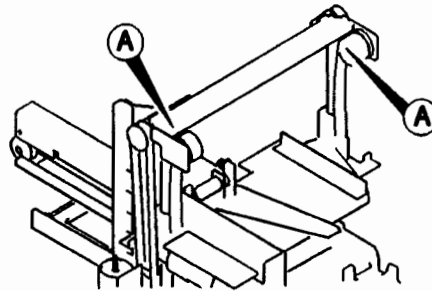
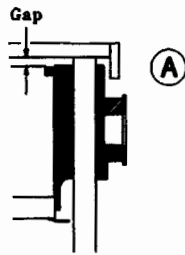


Figure 6-2. Platform Leveling

If the gaps are not equal, then the belt next to the DDC PCA should be adjusted. With a flat-bladed screwdriver, completely slacken the belt tensioner. The belt may now be slipped over the teeth on the bottom pulley to correct the position.

Re-tighten the belt adjuster and check the gaps. If they are still not equal, repeat the procedure until they are equal. Check that the carriage now moves more freely vertically.

If the gaps cannot be made to match by less than 0.5mm then the mechanism is likely to give loading problems.

Power up the drive and check that the mechanism functions correctly during self-test.

7-1. INTRODUCTION

This section is not applicable for this product.

This section provides listings of all field-replaceable parts and an illustrated parts breakdown for the subsystem.

8-1. REPLACEABLE PARTS INFORMATION

Replaceable parts for the subsystem are listed in disassembly order in table 8-1 and illustrated in figure 8-1. In the table, attaching parts are listed immediately after the item they attach. Items in the DESCRIPTION column are indented to indicate relationship to the next higher assembly. In addition, the symbol "---X---" follows the last attaching part for that item. Indentation of the items in the tables is as follows:

Major Assembly

*Replaceable Assembly

*Attaching Parts for Replaceable Assembly

**Subassembly or Component Part

**Attaching parts for Subassembly or Component Part

The replaceable parts listings provide the following information for each part:

- FIG. & INDEX NO. The figure and index number which indicates where the replaceable part is illustrated.
- HP PART NO. The Hewlett-Packard part number for each replaceable part.
- DESCRIPTION. A description of each replaceable part. Refer to table 9-4 in the HSM (35401-90904) for an explanation of abbreviations used in the description column.
- MFR CODE. The 5-digit code that denotes a typical manufacturer of a part. Refer to table 9-5 in the HSM (35401-90904) for a list of manufacturers who correspond to the codes.
- MFR PART NO. The manufacturer's part number of each replaceable part.
- UNITS PER ASSY. The total number of each part used in the major assembly.

The MFR CODE and MFR PART NO. for common hardware items are listed as 00000 and OBD (order by description) respectively, because these items can usually be purchased locally.

In addition, the parts labelled OBD may be ordered as a kit (35401-60016), which is found in the Inventory Parts Package (35401-67197).

8-2. ILLUSTRATED PARTS BREAKDOWN

See Figures 8-1 and 8-2 for an exploded view of the HP 35401A Tape Drive.

See Figure 9-3 for details of preparing a replacement drive mechanism prior to fitting.

8-3. EXCHANGE ASSEMBLIES

The following assemblies are included in the current exchange program:

09144-69518 R/W /SERVO PCA
09144-69522 DDC PCA
07940-69195 HDC PCA
35401-69000 AUTOCHANGER MECH.

8-4. REPLACEABLE PARTS LIST

See Table 8-1 for a list of Field Replaceable Parts.

8-5. SERVICE KITS

The service kits for the HP 35401A are supplied at two levels:

IPP (Inventory Parts Package) (35401-67197) contains all the necessary parts to repair an HP 35401A Tape Drive.

ETP (Expensed Tools Package) (35401-67100) includes extra tools and equipment to aid servicing.

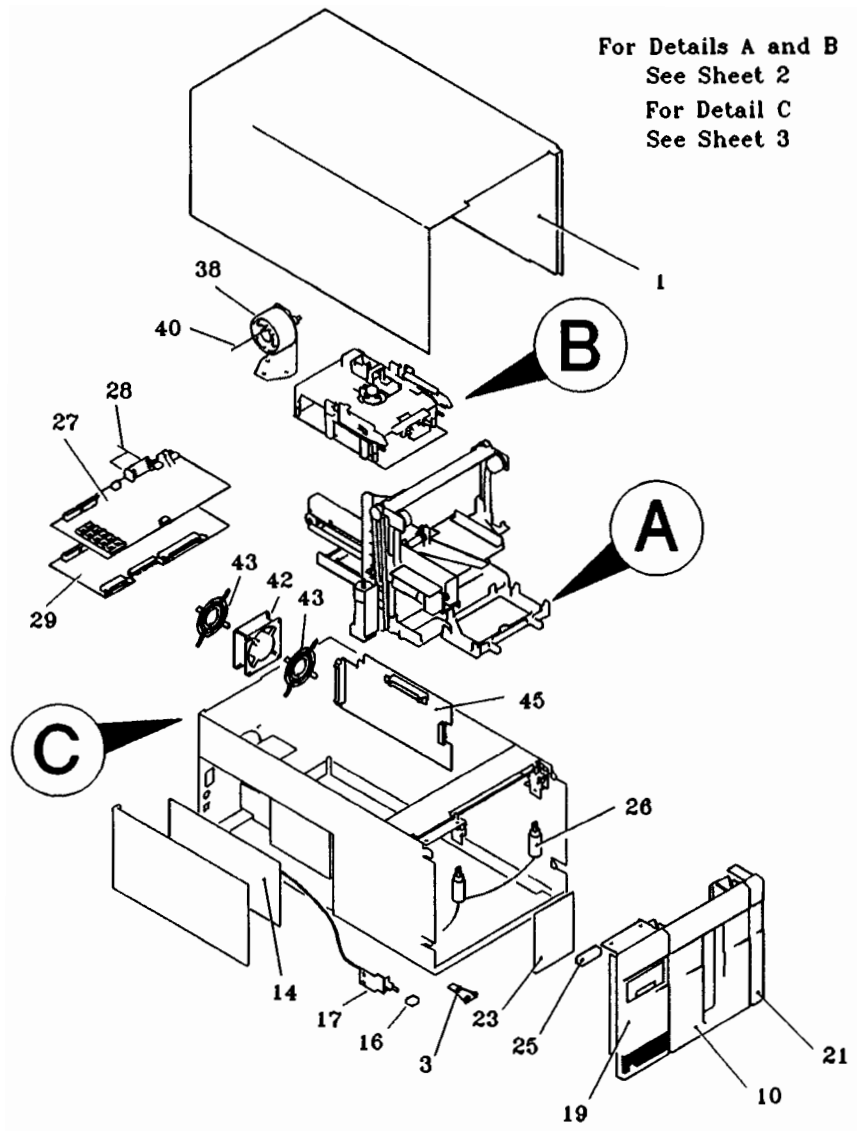


Figure 8-1. HP 35401 Exploded View (sheet 1 of 3)

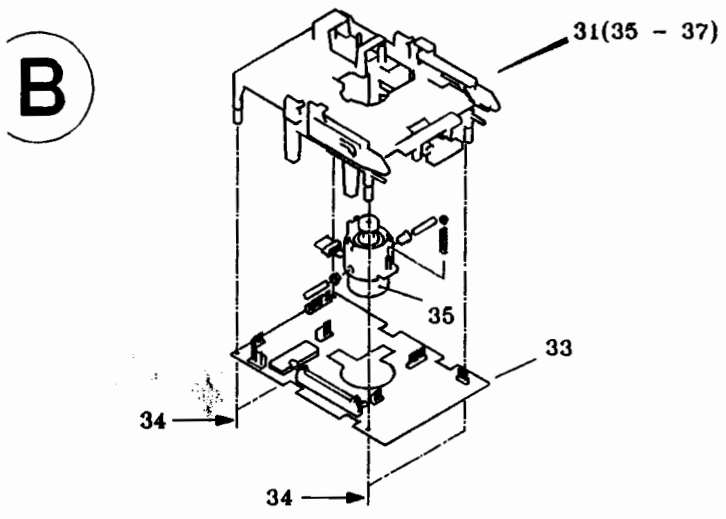
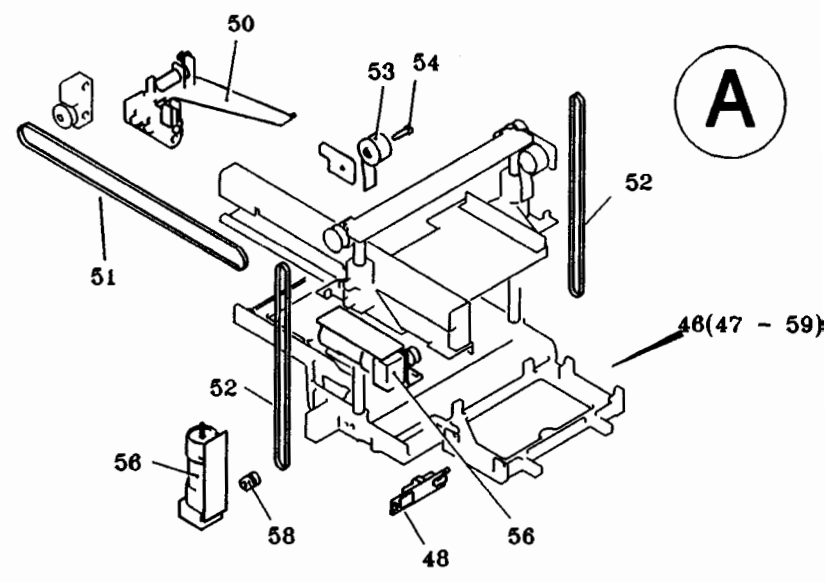


Figure 8-2. HP 35401 Exploded View (sheet 2 of 3)

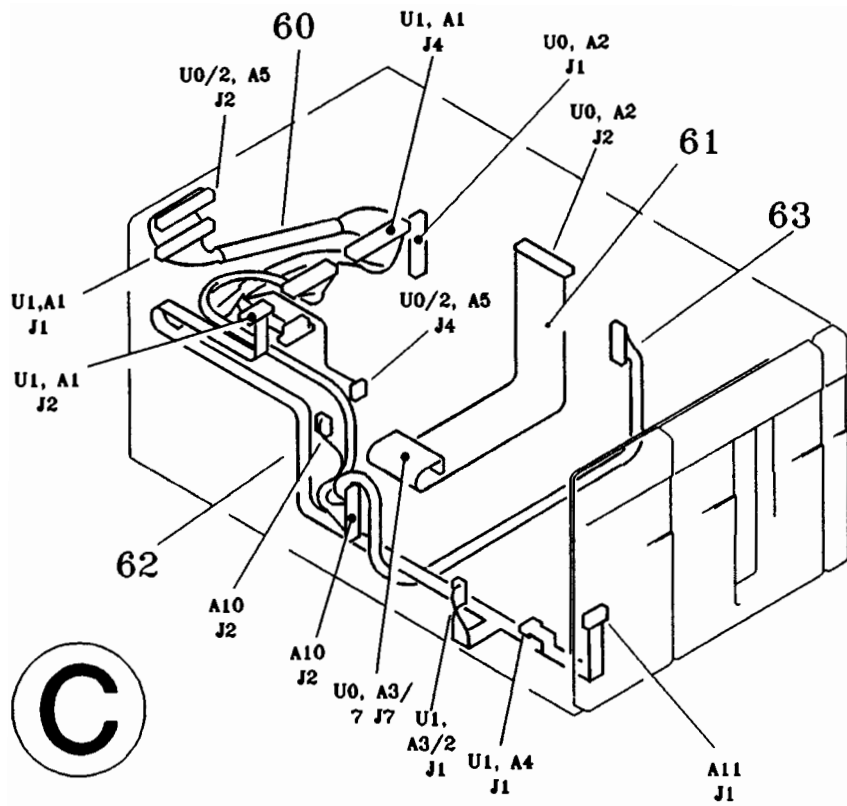


Figure 8-3. HP 35401A Cabling Layout (sheet 3 of 3)

Table 8-1. Replaceable Parts

FIG.& INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	UNITS PER ASSY.
	35401A	1/4 INCH CARTRIDGE TAPE DRIVE	28480	35401A	REF
1	35401-60020	*TOP SHROUD (Attaching Parts)	28480	35401-60020	1
2	0515-0372	*SCREW, machine, pnh, T10, M3.0 by 0.5 8mm long, w/scw - - - X - - -	28480	0515-0372	6
3	09121-48303	**FRONT FOOT	28480	09121-48303	2
4	09144-898XX	*EPROM, DDC (U35)	28480	09144-898XX	1
5	09144-892XX	*EPROM, HDC (U151)	28480	09144-892XX	1
6	09144-895XX	*EPROM, HDC (U121)	28480	09144-895XX	1
7	35401-895XX	*EPROM, MDC (U161)	28480	35401-895XX	1
8	35401-896XX	*EPROM, MDC (U131)	28480	35401-896XX	1
9	35401-897XX	*EPROM, EXEC (U101)	28480	35401-897XX	1
10	35401-60004	*DOOR ASSEMBLY (Attaching Parts)	28480	35401-60004	1
11	0515-0430	*SCREW, machine, pnh, T10, M3.0 by 0.5 8mm long, w/scw	00000	OBD	2
12	0515-0372	*SCREW, machine, pnh, T10, M3.0 by 0.5 8mm long, w/scw	00000	OBD	2
13	35401-40000	*CARTRIDGE MAGAZINE	28480	35401-40000	1
14	09133-67120	*POWER SUPPLY UNIT A10 (Attaching Parts)	28480	09133-67120	1
15	0515-0430	*SCREW, machine, pnh, T10, M3.0 by 0.5 8mm long, w/scw - - - X - - -	00000	OBD	5
16	5014-1203	**KEY CAP, WHITE (for AC line switch)	28480	5014-1203	1
17	35401-80038	*BOWDEN CABLE ASSEMBLY (Attaching Parts)	28480	35401-80038	1
18	0515-0430	*SCREW, machine, pnh, T10, M3.0 by 0.5 8mm long, w/scw - - - X - - -	00000	OBD	2
19	35401-60012	*FRONT PANEL ASSEMBLY (no metalwork) A11 (Attaching Parts)	28480	35401-60012	1
20	0515-0430	*SCREW, machine, pnh, T10, M3.0 by 0.5 8mm long, w/scw - - - X - - -	00000	OBD	6
21	35401-40003	*END PANEL (Attaching Parts)	28480	35401-40003	1
22	0515-0430	*SCREW, machine, pnh, T10, M3.0 by 0.5 8mm long, w/scw	00000	OBD	5
23	35401-60093	*FRONT PANEL PCA (Attaching Parts)	28480	35401-60093	1
24	0624-0512	*SCREW, tapping, pnh, T9, 4-20, 0.375in - - - X - - -	00000	OBD	3
25	35401-40004	*EJECT PUSH-BUTTON	28480	35401-40004	1
26	35401-80024	*SOLENOID, DOOR LATCH (pair with cable)	28480	35401-80024	1
27	07940-60195	*HOST DEPENDENT CONTROLLER PCA U0 U2 A5 (Attaching Parts)	28480	07940-60195	1
28	0380-0643	*STAND-OFF, HEX, 6-32, 0.255in long - - - X - - -	00000	OBD	2

Table 8-1. Replaceable Parts (continued)

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	UNITS PER ASSY.
29	35401-60091	*MDC PCA U1 A1 (Attaching Parts)	28480	35401-60091	1
30	0515-0430	**SCREW, machine, pnh, T10, M3.0 by 0.5 6mm long, w/scw - - - X - - -	00000	0BD	1
31	09144-67501	*DRIVE MECHANISM ASSEMBLY U0 A1 (Attaching Parts)	28480	09144-67501	1
32	0515-0446	**SCREW, machine, pnh, T10, M3.0 by 0.5 22mm long, w/scw - - - X - - -	00000	0BD	4
33	09144-66518	**READ/WRITE /SERVO PCA U0 A3, A7 (Attaching Parts)	28480	09144-66518	1
34	0515-0353	**SCREW, machine, pnh, poz1, M3.0 by 0.5 10mm long - - - X - - -	00000	0BD	4
35	09144-65209	**CAPSTAN MOTOR/TACHOMETER ASSEMBLY U0 A9 (Attaching Parts)	28480	09144-65209	1
36	0515-0150	**SCREW, machine, pnh, poz1, M3.0 by 0.5 6mm long	00000	0BD	2
37	0515-0154	**SCREW, set, cup point, M3.0 by 0.5 3mm long - - - X - - -	00000	0BD	2
38	35401-60010	*EJECT SOLENOID AND BRACKET (Attaching Parts)	28480	35401-60010	1
39	0515-0430	*SCREW, machine, pnh, T10, M3.0 by 0.5 6mm long w/scw - - - X - - -	00000	0BD	3
40	35401-20015	**COLLAR, EJECT SOLENOID (Attaching Parts)	00000	0BD	1
41	0515-0154	**SCREW, set, cup point, M3.0 by 0.5 3mm long - - - X - - -	00000	0BD	1
42	35401-68502	*FAN (including cable and connector)	28480	35401-68502	1
43	07940-00026	**FAN GUARD (Attaching Parts)	28480	07940-00026	2
44	0624-0661	**SCREW, tapping, pnh, T20, 10-14 0.625in long - - - X - - -	00000	0BD	8
45	09144-66512	*DDC PCA U0 A2	28480	09144-66512	1
46	35401-60000	*AUTOCHANGER ASSEMBLY (complete) U1 A6 (Attaching Parts)	28480	35401-60000	1
47	0515-0446	*SCREW, machine, pnh, T10, M3.0 by 0.5 22mm long, w/scw - - - X - - -	00000	0BD	6
48	35401-60094	**MICROSWITCH PCA U1 A4 (Attaching Parts)	28480	35401-60094	1
49	0515-0430	**SCREW, machine, pnh, T10, M3.0 by 0.5 6mm long - - - X - - -	00000	0BD	2
50	35401-60011	**HORIZONTAL CARRIAGE ASSEMBLY U1 A7 (including vertical sensor and cable)	28480	35401-60011	1

Table 8-1. Replaceable Parts (continued)

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	UNITS PER ASSY.
51	35401-80022	**HORIZONTAL DRIVE BELT	28480	35401-80022	1
52	35401-80012	**VERTICAL DRIVE BELT	28480	35401-80012	2
53	35401-80015	**VERTICAL SPRING AND DRUM ASSEMBLY (includes 2 springs and drums, LH/RH) (Attaching Parts)	28480	35401-80015	1
54	35401-80023	**SCREW, special	00000	08D	1
55	0515-0430	**SCREW, machine, pnh, T10, M3.0 by 0.5 6mm long, w/scw - - - X - - -	00000	08D	1
56	35401-61000	**MOTOR (including PCA and brkt) U1 A2, A3 (Attaching Parts)	28480	35401-61000	2
57	0515-0430	**SCREW, machine, pnh, T10, M3.0 by 0.5 6mm long, w/scw - - - X - - -	00000	08D	2
58	35401-80017	**COUPLING, HUCC (Attaching Parts)	28480	35401-80017	1
59	0515-0154	**SCREW, set, cup point, M3.0 by 0.5 3mm long, w/scw - - - X - - -	00000	08D	4
60	35401-61601	*CABLE, HDC/MDC/DDC	28480	35401-61601	1
61	35401-61607	*CABLE, DRIVE MECHANISM/DOC	28480	35401-61607	1
62	35401-61800	*CABLE, MDC/FRONT PANEL	28480	35401-61600	1
63	35401-61603	*CABLE ASSEMBLY, POWER	28480	35401-61603	1
64	35401-61602	*CABLE, SENSORS/MOTORS/MICROSWITCH	28480	35401-61602	1
65	8120-1351	*CORDSET BS1363/CEE	28480	8120-1351	1
66	8120-1369	*CORDSET ASC112/CEE	28480	8120-1369	1
67	8120-1689	*CORDSET GMBH/CEE	28480	8120-1689	1
68	8120-1378	*CABLE ASSEMBLY 18 AWG	28480	8120-1378	1
69	8120-1575	*CABLE ASSEMBLY 18 AWG	28480	8120-1575	1
70	8120-2104	*CORDSET SEV/CEE	28480	8120-2104	1
71	8120-2956	*CORDSET MDPP/CEE	28480	8120-2956	1
72	8120-4211	*CABLE ASSEMBLY	28480	8120-4211	1
73	35401-60007	*DOOR LATCH ASSEMBLY (includes 35401-80024 solenoids)	28480	35401-60007	1
74	9211-5381	*PACKING OUTER BOX	28480	9211-5381	1
75	35401-80095	*FOAM END CAP	28480	35401-80095	2
76	9211-5379	*ACCESSORY BOX	28480	9211-5379	1
77	9222-1244	*PLASTIC BAG	28480	9222-1244	1
78	35401-80043	*MAGAZINE FOAM BLOCK	28480	35401-80043	1
79	35401-80044	*DOOR LOCK CLIP (RED)	28480	35401-80044	2
80	35401-80058	*SPRING CLIP	28480	35401-80058	1

Table 8-2. Inventory Parts Package (35401-67197)

FIG.& INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	UNITS PER ASSY.
26	35401-80024	SOLENOID, DOOR LATCH (pair with cable)	28480	35401-80024	1
38	35401-60010	EJECT SOLENOID AND BRACKET	28480	35401-60010	1
17	35401-80038	BOWDEN CABLE ASSEMBLY	28480	35401-80038	1
29	35401-60091	MDC PCA	28480	35401-60091	1
23	35401-60093	FRONT PANEL PCA	28480	35401-60093	1
48	35401-60094	MICROSWITCH PCA	28480	35401-60094	1
46	35401-60000	AUTOCHANGER ASSEMBLY (complete)	28480	35401-60000	1
60	35401-61601	CABLE, HDC/MDC/DOC	28480	35401-61601	1
64	35401-61602	CABLE, SENSORS/MOTORS/MICROSWITCH	28480	35401-61602	1
63	35401-61603	CABLE ASSEMBLY, POMEY	28480	35401-61603	1
61	35401-61607	CABLE, DRIVE MECHANISM/DOC	28480	35401-61607	1
62	35401-61600	CABLE, MDC/FRONT PANEL	28480	35401-61600	1
13	35401-40000	CARTRIDGE MAGAZINE	28480	35401-40000	1
56	35401-61000	MOTOR (including PCA and bracket)	28480	35401-61000	1
7-9	35401-10301	ROM KIT (2 X MDC and 1 X EXEC ROM)	28480	35401-10301	1
51	35401-80022	HORIZONTAL BELT	28480	35401-80022	1
52	35401-80012	VERTICAL DRIVE BELT	28480	35401-80012	1
53	35401-60015	VERTICAL SPRING AND DRUM ASSEMBLY (includes 2 springs and drums, LH/RH)	28480	35401-60015	1
58	35401-80017	COUPLING, HUCO	28480	35401-80017	1
50	35401-60011	HORIZONTAL CARRIAGE ASSEMBLY (including vertical sensor and cable)	28480	35401-60011	1
	35401-60016	FASTENER KIT	28480	35401-60016	1
42	35401-68502	FAN	28480	35401-68502	1

Table 8-3. Expensed Tools Package (35401-67100)

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	UNITS PER ASSY.
64	35401-61602	CABLE, SENSORS, MOTORS, MICROSWITCH	28480	35401-61602	1
	35401-90904	HARDWARE SUPPORT MANUAL	28480	35401-90904	1
	35401-90905	CE HANDBOOK	28480	35401-90905	1
	8710-1570	HEX BALLDRIVER	28480	8710-1570	1
	8710-0805	WRENCH-RATCHET BOX	28480	8710-0805	1
	9211-3769	CARTON	28480	9211-3769	1
	9220-0007	PLASTIC BAG	28480	9220-0007	1
	35401-60030	BELT SETTING TOOL	28480	35401-60030	1

9-1. INTRODUCTION

This section contains diagrams of cable layouts, order of disassembly and steps required to prepare a replacement drive mechanism.

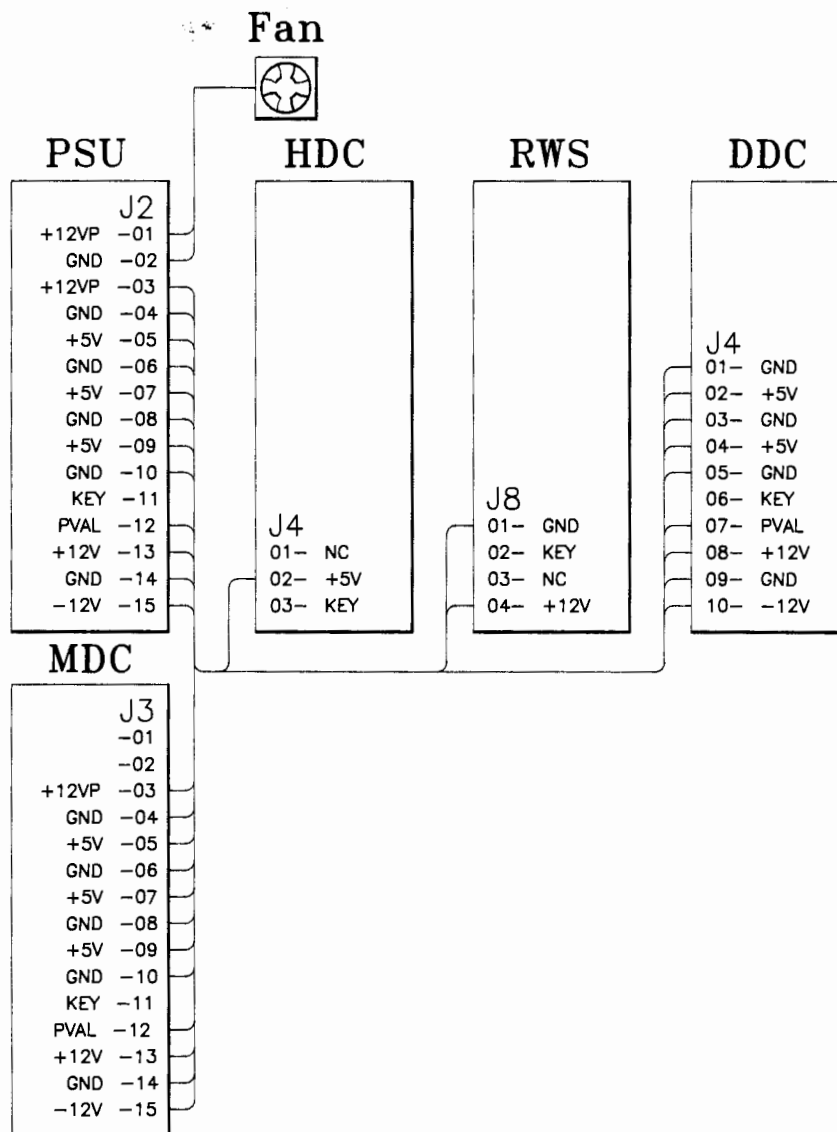


Figure 9-1. Cabling Diagram (sheet 1 of 4)

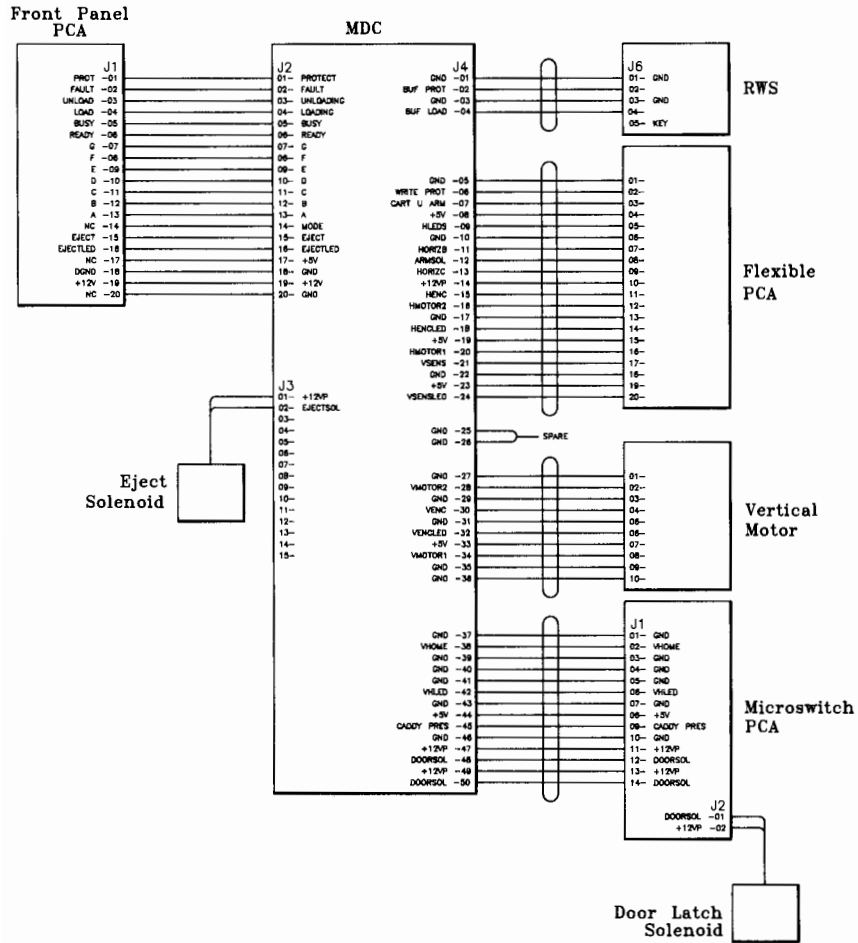


Figure 9-1. Cabling Diagram (sheet 2 of 4)

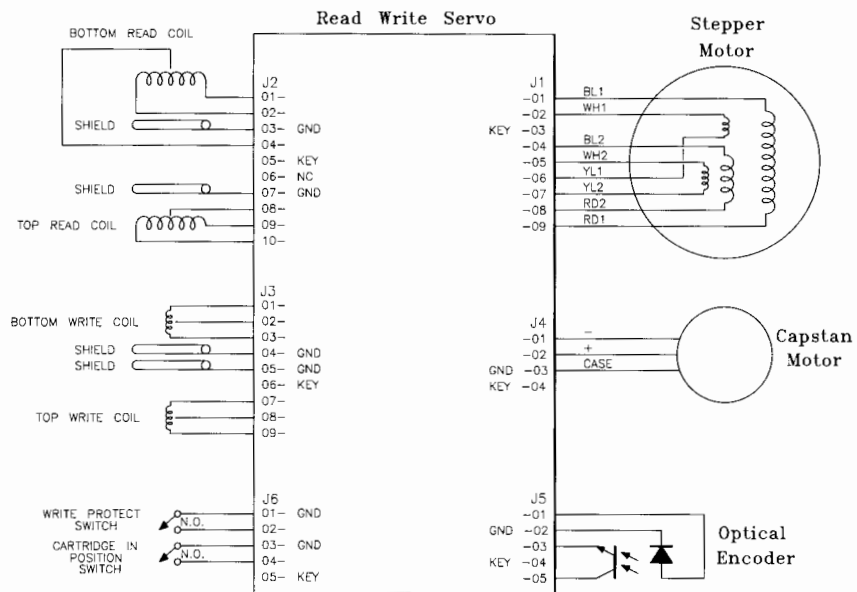


Figure 9-1. Cabling Diagram (sheet 3 of 4)

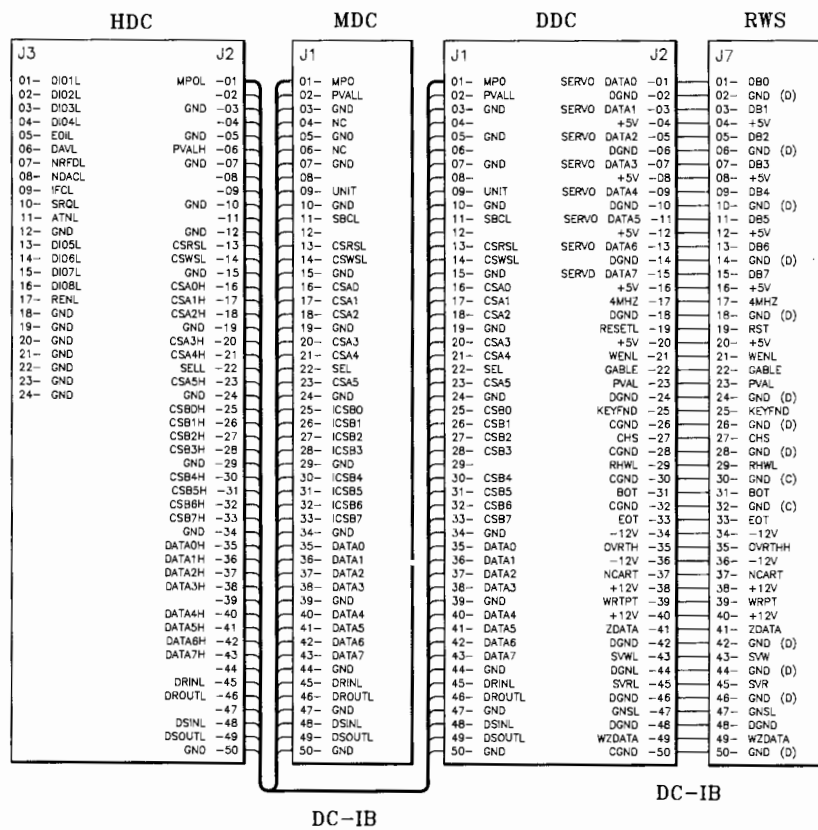


Figure 9-1. Cabling Diagram (sheet 4 of 4)

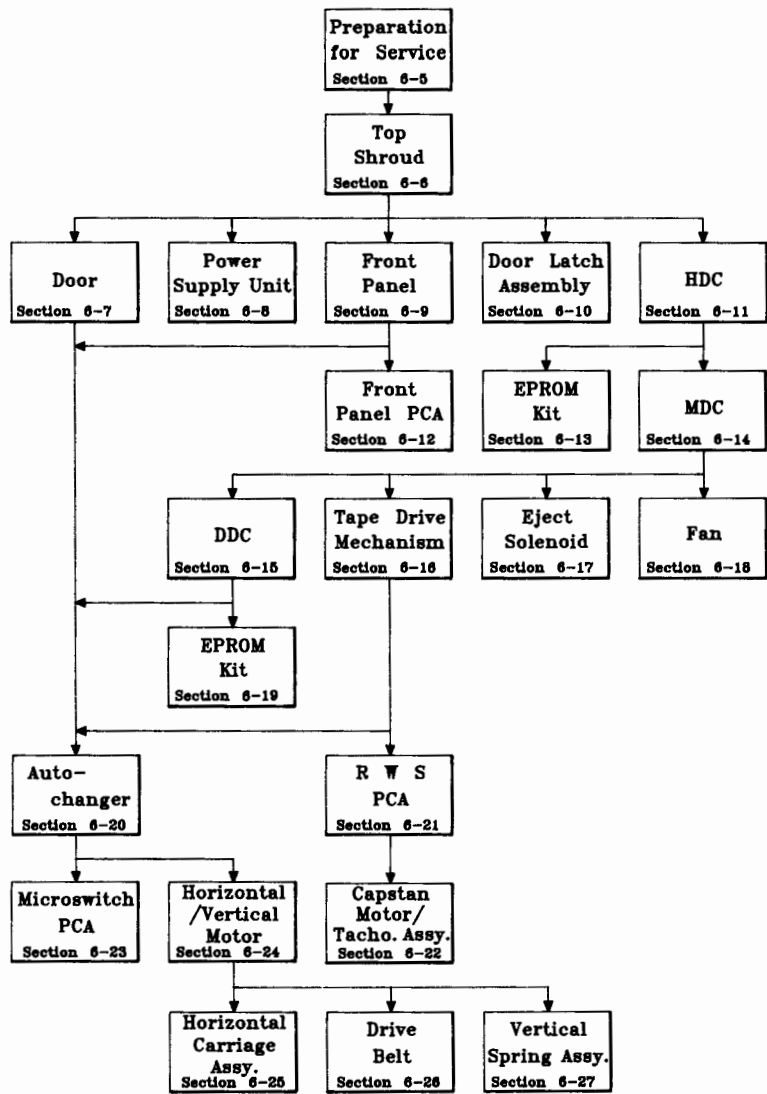


Figure 9-2. Order of Disassembly

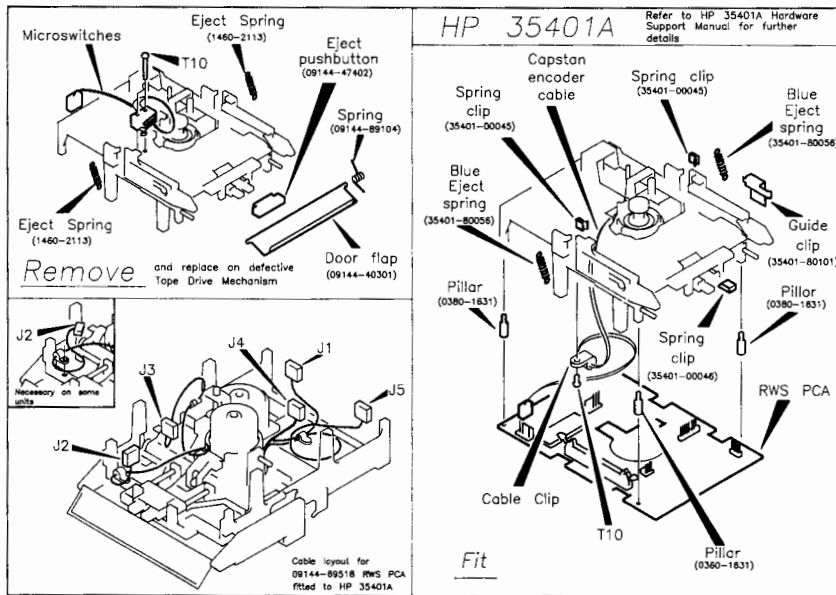


Figure 9-3. Preparing the Replacement Drive Mechanism

10-1. INTRODUCTION

Please refer to the related manuals listed on page iii of the front matter for more information on the 35401A.

For information on the host system please refer to the applicable system manuals and handbook.

11-1. INTRODUCTION

No service notes exist at the time of printing.

