This package contains a section of the

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

and consists of the following document:

HP 9144A
TAPE DRIVE
Part no. 09144-90039

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).

PRINTING HISTORY

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

NOTICE

The information contained in this document is subject to change without notice.

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MAINTENANCE PRECAUTIONS

When working on Printed Circuit Assemblies in this product a "Static Discharge Work-station" should be used.

RELATED MANUALS

Part No.	Title
5955-3442	CS/80 Instruction Set Programming Manual
5955-3462	CS/80 External Exerciser Reference Manual
09144-90000	HP 9144A User's Manual
09144-90030	HP 9144A Hardware Support Manual

ABOUT THIS MANUAL

The HP 9144A Tape Drive has undergone a series of refinements since its introduction in 1984. The electronic circuitry has been condensed from 5 PCAs to 1 PCA. The main part of this manual relates to the latest version of the HP 9144A, which for production reasons has reverted to the 2 PCA design. Information about previous versions is given in Section 10.

The HP 9144A Tape Drive

CONTENTS

CONTENTS (CONTD)

Section 6
ADJUSTMENTS
Page

There are no adjustable parts in the HP 9144A Tape Drive.

Section 7
PERIPHERALS
Page

This section is not applicable for this product.

Section 8
REPLACEABLE PARTS
Page

Section 9
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TABLES

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 is released. 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.

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PRODUCT INFORMATION SECTION 1

1-1. PRODUCT DESCRIPTION

The HP 9144A is a compact, low cost 1/4-inch cartridge tape drive. Its characteristics are given below.

1-2. FEATURES

- 16/67 Mbytes capacity (depending on tape length)
- Standard 1/4-inch cartridge tapes
- HP 791X (Linus) compatible
- Built-in diagnostic capability

1-3. PHYSICAL SPECIFICATION

Net weight: 7.6 kg (16.8 lb)
Height: 132 mm (5.2 inches)
Depth: 290 mm (11.4 inches)
Width: 325 mm (12.8 inches)

1-4. ELECTRICAL SPECIFICATION

Line Voltage: 90-132 volts or 198-264 Volts (switch selectable)
Line Frequency: 47-63 Hz
Power Consumption: 25 Watts RMS (typical)

1-5. ENVIRONMENTAL SPECIFICATION

The HP 9144A Tape Drive is designed to meet the class B2 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
    Mechanism - Non-operating: -40°C to +70°C
    Tape - 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

DATA TRANSFER RATE
Maximum sustained: 2 Mbytes/min (SYSTEM DEPENDENT)

The 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 load/unload times in drive:
Load: 2 minutes 25 seconds (600ft)
       1 minute 15 seconds (150ft)

Unload: 1 minute 35 seconds (600ft) } depending on position of
         25 seconds(150 ft)   } tape at start of unload

ENCODING TECHNIQUE:
Modified Frequency Modulation (MFM),
Bit Density = 10,000 Bits/inch (bpi)

HARD ERROR RATE:

1 in 10^{11} bits transferred

1-7. OPTIONS AND ACCESSORIES

There is an option 150, which includes a tape backup utility with the standard tape drive. This allows it to back up the HP 150 Touchscreen and HP 150 Touchscreen II.

The following items are included with the standard drive:

- 09144-90000 HP 9144A User's Manual
- 5957-6473 Material Safety Data Sheet
- 2110-0003 2 Spare Fuses
- 9300-0767 Cleaning Swabs
- 8500-1251 Tape Head Cleaning Fluid
- Power Cord, suitable for country of destination

In addition, for the option 150:

- 09144-90014 "Read This First" sheet
- 09142-87910 (5957-8750) Tape Backup Utility

Note that the 67 Mbyte cartridge has been deleted from the accessories supplied with the HP 9144A.

The following accessories are available:

- 09144-90030 HP 9144A Hardware Support Manual
- 09144-90039 HP 9144A 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 67.1 Mbyte, 600 foot tape cartridges
- 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.
- HP 19500B 19-inch Rack Mount Kit

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

- 9211-4903 . . . . Packing Box
- 09144-84403 . . . . 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

There are no service kits produced for the HP 9144A tape drive.

1-10. CONSUMABLES

- HP 88140SC Package of five 16.7 Mbyte, 150 foot tape cartridges
- HP 88140LC Package of five 67.1 Mbyte, 600 foot tape cartridges
- HP 92193E Tape Cleaning Kit
- HP 92193P Replenishment Kit for above

Table 1-1. Host Support

Host	Support	Operating System	Comments
HP 1000			
Series A	Yes	RTE-A 4.1	
Series M/E/F	Yes	RTE-6/VM	
HP9000			
Series 200	Yes	Basic 2.0	
Series 300	Yes	Basic 4.0	
		Pascal 3.1	
		HP-UX 5.0	
Series 500	Yes	Basic 2.0	
		HP-UX 4.0	
Series 800	Yes		
HP 4000	Yes	HP-UX	Q1 FY 89
HP 250/260	Yes	B07.00	
HP3000			
Series 37/39	Yes	MPE-V/E T-MIT	
Series 4X/5X/6X/70	Yes	MPE-V/E T-MIT	
MICRO 3000	Yes	MPE-V/E UB Delta 1 & T-MIT	
MICRO3000 XE	Yes	MPE-V/E T-MIT	
MICRO 3000 LX/GX	Yes		Built-in
Series 900 (MPE-XL)	No		
HP Touchscreen II	Yes		Option 150
HP Vectra	Yes	MS-DOS 3.X	HP 88500A*
IBM PC/XT/AT	Yes	PC-DOS 2.0	HP 88500A

* Not supported if disk volumes > 66 MB.

2-1. ENVIRONMENTAL REQUIREMENTS

Refer to section 1-5 (page 1-1) for the HP 9144A 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 9144A:

- Site Environmental Requirements for Disc/Tape drives, part number 5955-3456.
- HP 9144A User's Manual part number 09144-90000

2-3. CONTROLS AND INDICATORS

Figures 2-1 and 2-2 show the location of the tape drive controls and indicators.
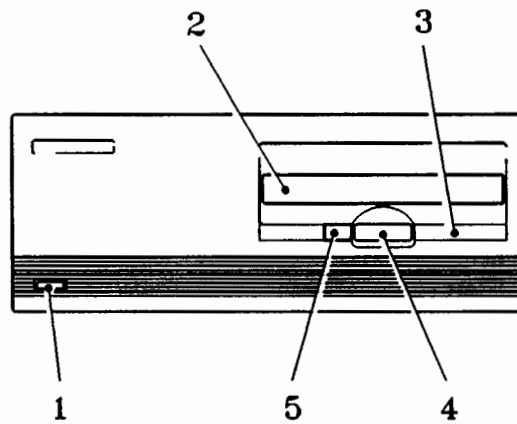
1......AC Line Switch	4...... **EJECT** Button
2......Tape Transport	5...... **Unload** Button
3......Busy Protect and Fault Lights	

Figure 2-1. The Front Panel
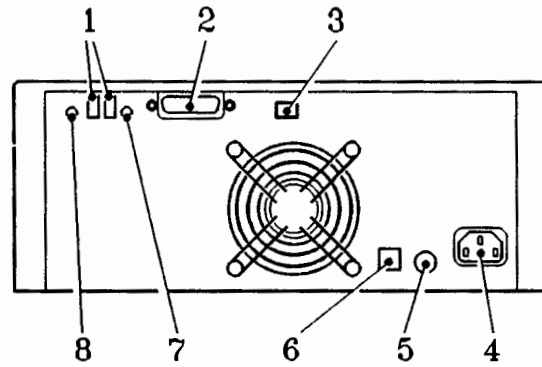
1......Self-Test LED Displays   5......Fuse
2......HP-IB Connector   6......Voltage Select Switch
3......HP-IB Address Switches   7......Initiate Self-Test Button
4......Power Cable Socket   8......Display Self-Test Results Button

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.
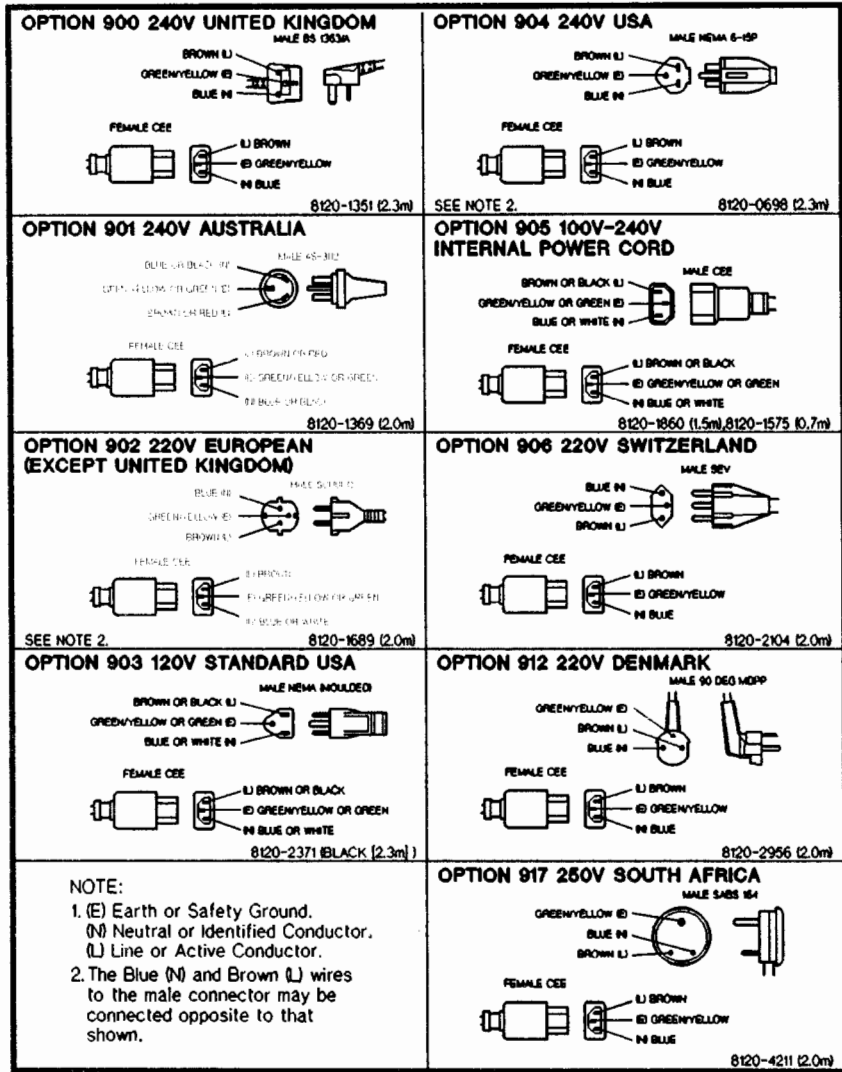
Figure 2-3. Available Power Cords

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.

No HP-IB cable is supplied with the HP 9144A. HP-IB 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.
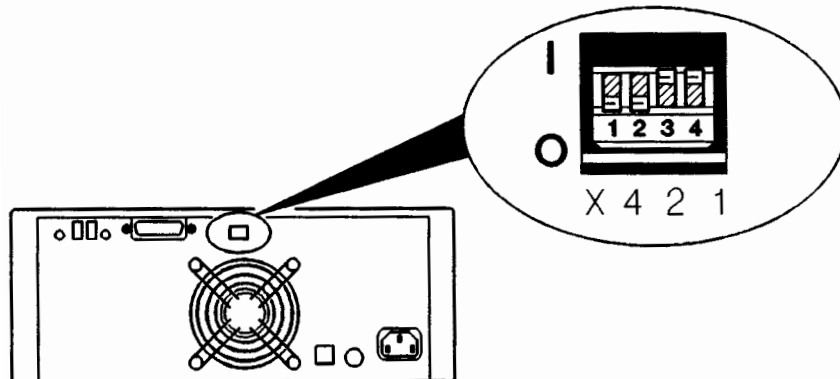
Figure 2-4. HP-IB Address Setting

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 Preventive Maintenance (PM) on the HP 9144A.

Head cleaning should be carried out at least once a week and after using each new cartridge 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. INTRODUCTION

For system configuration, please refer to system handbooks and manuals. Useful information is found in the Peripheral Configuration Guide, part number 5953-9472.

For external configuration of the Tape Drive refer to Section 2 of this manual for switch settings.

In the current version of the HP 9144A Tape Drive there are no internal configuration switches.

NOTE

In previous verions of this Tape Drive where there was a Host Dependent Controller PCA (see Section 10), there is a moveable jumper. It is found adjacent to connector J2 (see Figure 3-1) and should be in position W2.

The HDC was previously also used in other disc and disc/tape drives. Where this controller is used either in a single tape or disc drive, the jumper should be in position W2. Where a combined disc/tape drive has just one controller, the jumper should be in position W3.
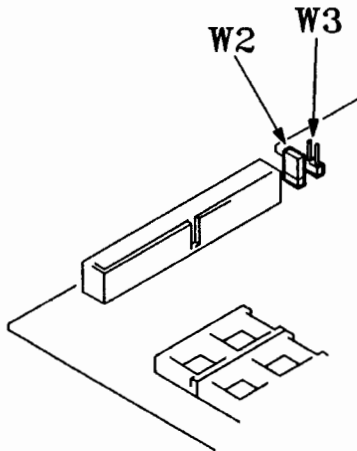
Figure 3-1. Configuring the HDC PCA

TROUBLESHOOTING   SECTION 4

4-1. SELF TEST

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

4-2. FRA LOCATION AND LAYOUT

See Figures 8-1 and 8-2 for FRA locations and cabling layout. See Section 10 for earlier versions.

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 DISCERNIBLE		
U0, A1	DRIVE MECHANISM	09144-67501	09144-69501
U0, A2	SBCONT PCA	09144-66515	09144-69515
U0, A3	RWS PCA	09144-66518	09144-69518
U0, A5	SBCONT PCA	09144-66515	09144-69515
U0, A7	RWS PCA	09144-66518	09144-69518
U0, A8	HEAD STEPPER MOTOR	CHANGE	MECHANISM
U0, A9	CAPSTAN MOTOR	CHANGE	MECHANISM
U2, A5	SBCONT PCA	09144-66515	09144-69515

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.

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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.

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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.

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 9144A 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 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 host (HP 260, 1000, 3000, 9000) 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 9-2, 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 ± 600mV	100mV
+12VP	+12 ± 1V	100mV
PVAL	3.5V min	—

```
          ┌─────────────┐
          │    START    │
          └─────────────┘
                 │
                 ▼
        ┌─────────────────┐
        │ Front Panel LEDS│
        │show BUSY, PROTECT│
        │FAULT for 1 second,│
        │ then BUSY light │
        │  flashes once.  │
        └─────────────────┘
```

Front Panel LEDS show BUSY, PROTECT FAULT for 1 second, then BUSY light flashes once.

Is Tape in Tape Drive Mechanism ? — **Yes** →

No ↓

T01–T12

Nothing displayed on Front Panel. P.?. displayed on Rear Panel.

Is Tape Write-protected ? — **Yes** →

No ↓

T01–T24

Nothing displayed on Front Panel. P.?. displayed on Rear Panel.

T01–T21 — { BUSY and PROTECT displayed during selftests

Protect displayed on Front Panel. P.?. displayed on Rear Panel.

Figure 5-1. Self-Test Sequence Flowchart
(See Table 5-2. for a description of individual tests.
T01 - T24 are tests 1 to 24 in Table 5-2, TERRORS).

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. 2. Unit 2, the Internal Controller

For Unit 0, 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 Circuitry

A. 3. Read/Write Circuitry

A. 4. Probably a dirty tape head

A. 5. Host Dependent Controller Circuitry

A. 7. Servo Circuitry

A. 8. Head Stepper Motor (Not Replaceable)

A. 9. Capstan Motor and Optical Sensor

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

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

Since the Host Dependent Controller and Device Dependent Controller are contained in the SBCONT PCA, the codes A2 and A5 indicate that the SBCONT PCA is faulty. Codes A3 and A7 indicate that the RWS PCA is faulty.

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 the Unit 0 failure sequence (see section 5-5). The sequence is:

F. ?. Fail with address "?"

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

A. 5. Host Dependent Controller Circuitry. This is the only FRA that 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 ends 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 R/W circuitry) 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 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.

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	SBCONT
02		DDC Circuitry	
03		a) Microcomputer test	SBCONT
04		b) Read/Write loopback	SBCONT
05		HDC-DDC Read/Write loopback.	SBCONT
06		HDC-DDC-Servo Interface	RWS, SBCONT
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 Read/Write circuitry. 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, SBCONT
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, SBCONT
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, SBCONT

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

NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
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, Stepper motor, SBCONT
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, SBCONT
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, SBCONT
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, SBCONT
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, SBCONT
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, SBCONT
22		Test the write portion of the Read/Write circuitry.	RWS
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, SBCONT, 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, SBCONT, Drive Mechanism

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

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
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
180	B4	DMA handshake error (one byte) Overflow or underflow has occurred between HDC and DDC. (Marginal, recoverable or unrecoverable)	SBCONT
181	B5	DMA failure (one byte) Not enough frames detected during read or read-while-write. (Marginal recoverable, or unrecoverable)	SBCONT
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)	SBCONT
186	BA	Seek error (one byte) Seek to target required retries or failed because of time-out or keys past target. (Unit fault)	SBCONT

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

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
187	BB	Seek to a jump spare (one byte) A latency was induced due to seeking to a jump spare during transaction (Latency induced)	SBCONT
190	BE	Reposition failure (one byte) Reposition of tape to next target address after tape access command required retries or failed. (Unit fault)	SBCONT
193	C1	Log overflow (two bytes) Log indicated in postbyte overflowed. (Possible loss of entries) 0 = Manufacturer's block 1 = Sparing table 2 = Error rate test log 3 = Runtime error log 4 = Use log (Maintenance track overflow)	Tape Drive Subsystem: SBCONT, RWS Drive Mechanism
194	C2	Unable to read log (two bytes) 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)	Uninitialized cartridge, Tape Drive Subsystem: SBCONT, RWS Drive Mechanism
195	C3	Unable to write log (two bytes) Log indicated in postbyte could not be written on any track in multiple retries. Postbyte log codes are defined above. (Unrecoverable data)	

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

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	**HEX**		
196	C4	Log only written on one track (two bytes)	
		Log indicated in postbyte could only be written on one track rather than the usual two. Postbyte log codes are defined above. (Unrecoverable data)	
200	C8	Servo error (two bytes)	
		Command to servo processor was not successfully executed. Postbyte contains status returned by servo processor:	
		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)	
206	CE	Load error (two bytes)	
		This cartridge failed the load sequence. Failure is recorded in postbyte:	
		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)	

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

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
207	CF	Unload error (two bytes) This cartridge did not successfully complete the normal unload sequence (logs may not have been updated). Failure Is recorded In postbyte: 1 = Diagnostic result Indicated a hardware failure so normal unload was not attempted. 2 = Seek to EOT failed (Unit fault)	
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)	

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

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
223	DF	No buffers in system (one byte) No buffers are available to complete transaction. (Controller fault)	.

There are no adjustable parts in the HP 9144A Tape Drive.

This section is not applicable for this product.

REPLACEABLE PARTS   SECTION 8

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 figures 8-1 and 8-2. 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 9-3 in the Hardware Support Manual (09144-90030) 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 9-1 in the Hardware Support Manual (09144-90030) 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.

8-2. ILLUSTRATED PARTS BREAKDOWN

See Figures 8-1 and 8-2 for an exploded view of the HP 9144A Tape Drive.

8-3. EXCHANGE ASSEMBLIES

The following assemblies are included in the current exchange program:

    09144-69501 DRIVE MECHANISM
    09144-69515 SBCONT PCA
    09144-69518 READ/WRITE SERVO PCA

8-4. REPLACEABLE PARTS LIST

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

8-5. SERVICE KITS

There are no service kits produced for the HP 9144A Tape Drive.
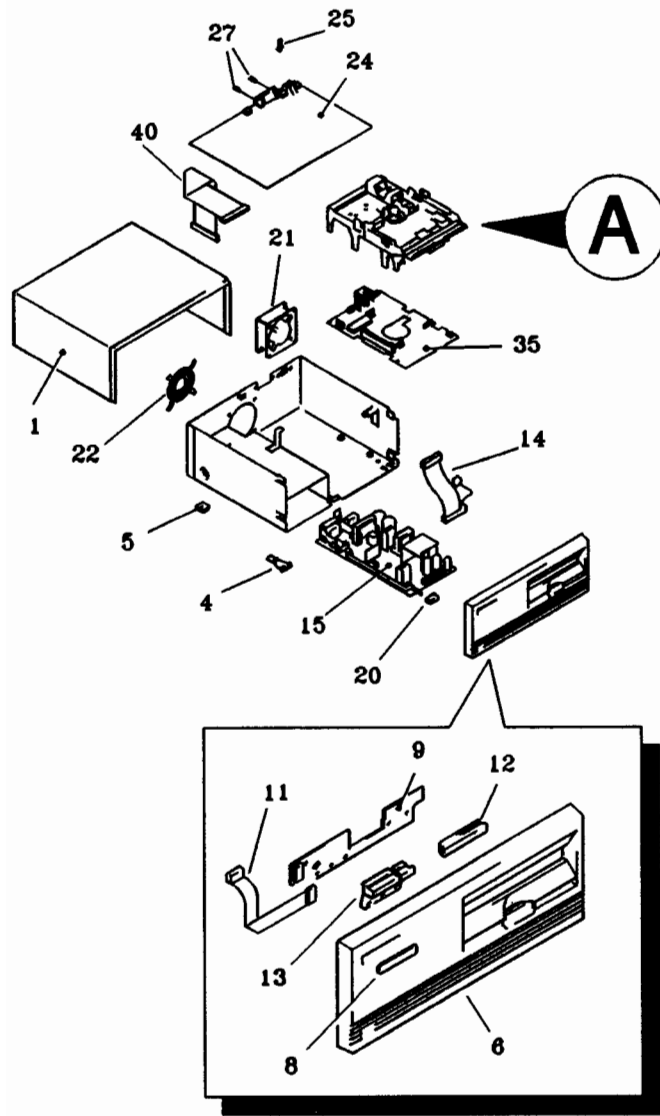
Figure 8-1. HP 9144A Exploded View (sheet 1 of 2)
(A detailed view of A is shown in Figure 8-2)

A

J8

J7
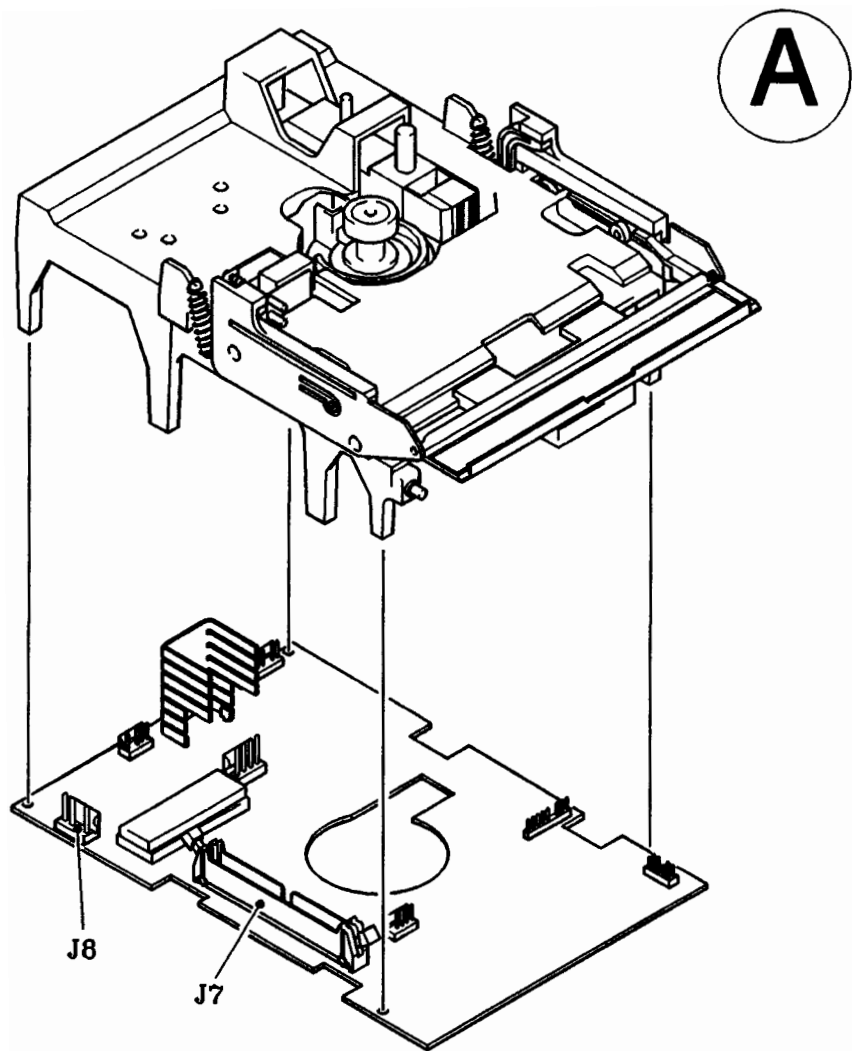
Figure 8-2. HP 9144A Exploded View (sheet 2 of 2)

Table 8-1. Replaceable Parts

FIG.& INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	UNITS PER ASSY.
REF	9144A	1/4-inch CARTRIDGE TAPE DRIVE	28480	9144A	REF
1	09144-88865	*TOP SHROUD ASSEMBLY	28480	09144-88865	1
		(Attaching Parts)			
2	0515-1079	*SCREW, machine, pnh, pozi, M3.0 by 0.5, 8mm long w/star washer.	00000	OBD	3
3	3050-0891	*Plain Washer	00000	OBD	2
		- - - X - - -			
4	09121-48303	**FRONT FOOT	28480	09121-48303	2
5	0403-0427	**BUMPER FOOT	28480	0403-0427	2
6	09144-66506	*FRONT PANEL ASSEMBLY	28480	09144-66506	1
		(Attaching Parts)			
7	0515-1079	*SCREW, machine, pnh, pozi, M3.0 by 0.5, 8mm long w/star washer	00000	OBD	5
		- - - X - - -			
8	09144-84305	**FRONT PANEL LABEL	28480	09144-84305	1
9	09144-66506	**FRONT PANEL PCA	28480	09144-66506	1
		(Attaching Parts)			
10	0524-0314	*SCREW, tapping, pnh, pozi, 4-20	00000	OBD	6
		- - - X - - -			
11	09144-61612	**FRONT PANEL CABLE	28480	09144-61612	1
12	09144-48101	**LED WINDOW	28480	09144-48101	1
13	09144-47404	**UNLOAD BUTTON	28480	09144-47404	1
14	09144-61610	*POWER CABLE	28480	09144-61610	1
15	09133-67120	*POWER SUPPLY UNIT A10	28480	09133-67120	1
		(Attaching Parts)			
16	0515-0780	*SCREW (side), machine, pnh, pozi, M4.0 by 0.7, 10mm long w/star washer	00000	OBD	1
17	0515-0105	*SCREW (front), machine, pnh, pozi, M3.0 by 15mm long	00000	OBD	1
18	0380-1724	*SPACER (front) round, .281" long	28480	0380-1724	1
19	0515-0780	*SCREW (back), machine, pnh, pozi, M4.0 by 0.7, 10mm long w/star washer	00000	OBD	1
		- - - X - - -			
20	5041-1203	**KEY CAP, WHITE (for AC line switch)	28480	5041-1203	1
21	09144-68502	*FAN ASSEMBLY	28480	09144-68502	1
22	07941-00026	**FAN GRILLE	28480	07941-00026	1
		(Attaching Parts)			
23	0624-0525	*SCREW tapping, pnh, pozi, 10-14, 16mm long	00000	OBD	4
		- - - X - - -			
24	09144-66515	*SBCONT PCA	28480	09144-66515	1
		(Attaching Parts)			
25	0380-1656	*STAND OFF SPACER (Plastic)	28480	0380-1656	1
26	0515-1079	*SCREW, machine, pnh, pozi, M3.0 by 0.5, 8mm long w/star washer.	00000	OBD	1
27	0380-0643	*STAND-OFF, HEX, 6-32, 0.255in long.	00000	OBD	2
28	2190-0017	*WASHER, split lock	00000	OBD	2
		- - - X - - -			
29	07940-890X0	*EXEC EPROM U142	28480	07940-890X0	1
30	09144-89XXX	*UNIT CODE EPROMs U133 and U150	28480	09144-89XXX	2
31	09144-8981X	*DDC PROCESSOR/ROM U13	28480	09144-8981X	1
32	09144-8911X	*SERVO PROCESSOR/ROM U18	28480	09144-8911X	1

Table 8-1. Replaceable Parts (continued)

FIG.& INDEX NO.	HP PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NO.	UNITS PER ASSY.
		- - - X - - -			
33	09144-69502	*DRIVE MECHANISM	28480	09144-69502	1
		(Attaching Parts)			
34	0515-1079	*SCREW, machine, pnh, pozi, M3.0 by 0.5, 8mm long w/star washer.	00000	OBD	4
		- - - X - - -			
35	09144-66518	*READ/WRITE SERVO PCA	28480	09144-66518	1
		(Attaching Parts)			
36	0515-1079	**SCREW, machine, pnh, pozi, M3.0 by 0.5 8mm long w/star washer		OBD	4
		- - - X - - -			
37	09144-47402	**EJECT KEY CAP	28480	09144-47402	1
38	09144-61607	**MICROSWITCHES AND CABLE	28480	09144-61607	1
38a	09144-61619	**PLUNGER MICROSWITCHES AND CABLE (See service note 9144-25)	28480	09144-61619	1
		(Attaching Parts)			
39	0515-0334	**SCREW, machine, pnh, pozi, M2.0 by 0.4, 18mm long.	00000	OBD	2
		- - - X - - -			
40	09144-61614	*CABLE, 50-WAY RIBBON, SBCONT - RWS PCA	28480	09144-61614	1

8-6

9-1. INTRODUCTION

This section contains diagrams of major electronic assemblies, cable layouts, and order of disassembly.
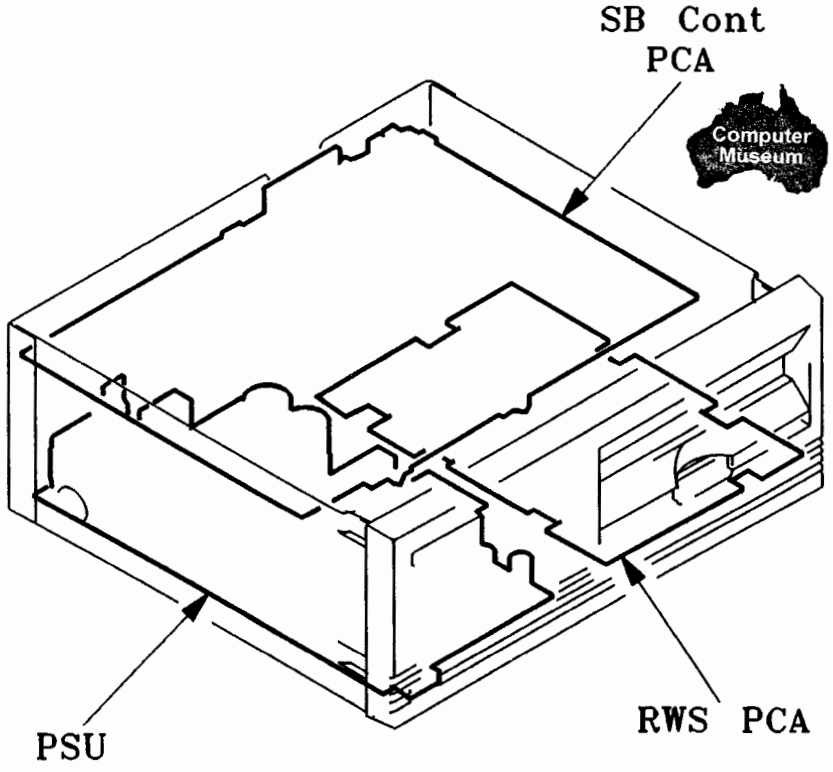
Figure 9-1. Location of Major Electronic Assemblies

Fan

PSU

SB Cont

PCA

R/W/S

	J2	
+12VP	−01	
GND	−02	
+12VP	−03	
GND	−04	
+5V	−05	
GND	−06	
+5V	−07	
GND	−08	
+5V	−09	
GND	−10	
KEY	−11	
PVAL	−12	
+12V	−13	
GND	−14	
−12V	−15	

J4	
01−	GND
02−	+5V
03−	GND
04−	+5V
05−	GND
06−	KEY
07−	PVAL
08−	+12V
09−	GND
10−	−12V

J3	
01−	GND
02−	KEY
03−	NC
04−	+12V

09144−61610

Figure 9-2. Cabling Diagram (sheet 1 of 3)

Read Write Servo

Stepper Motor

BOTTOM READ COIL

J2
01—
02—
03— GND
04—
05— KEY
06— NC
07— GND
08—
09—
10—

SHIELD

SHIELD

TOP READ COIL

J1
—01   BL1
—02   WH1
KEY —03
—04   BL2
—05   WH2
—06   YL1
—07   YL2
—08   RD2
—09   RD1

J3
01—
02—
03—
04— GND
05— GND
06— KEY
07—
08—
09—

BOTTOM WRITE COIL

SHIELD

SHIELD

TOP WRITE COIL

J4
—01   —
—02   +
GND —03   CASE
KEY —04

Capstan Motor

J6
01— GND
02—
03— GND
04—
05— KEY

WRITE PROTECT SWITCH   N.O.

CARTRIDGE IN POSITION SWITCH   N.O.

J5
—01
GND —02
—03
KEY —04
—05

Optical Sensor

Figure 9-2. Cabling Diagram (sheet 2 of 3)

SB Cont PCA   R/W/S

J1   J7

SERVO DATA0	−01	01−	DB0
DGND	−02	02−	GND (D)
SERVO DATA1	−03	03−	DB1
+5V	−04	04−	+5V
SERVO DATA2	−05	05−	DB2
DGND	−06	06−	GND (D)
SERVO DATA3	−07	07−	DB3
+5V	−08	08−	+5V
SERVO DATA4	−09	09−	DB4
DGND	−10	10−	GND (D)
SERVO DATA5	−11	11−	DB5
+5V	−12	12−	+5V
SERVO DATA6	−13	13−	DB6
DGND	−14	14−	GND (D)
SERVO DATA7	−15	15−	DB7
+5V	−16	16−	+5V
4MHZ	−17	17−	4MHZ
DGND	−18	18−	GND (D)
RESETL	−19	19−	RST
+5V	−20	20−	+5V
WENL	−21	21−	WENL
GABLE	−22	22−	GABLE
PVAL	−23	23−	PVAL
DGND	−24	24−	GND (D)
KEYFND	−25	25−	KEYFND
CGND	−26	26−	GND (D)
CHS	−27	27−	CHS
CGND	−28	28−	GND (D)
RHWL	−29	29−	RHWL
CGND	−30	30−	GND (C)
BOT	−31	31−	BOT
CGND	−32	32−	GND (C)
EOT	−33	33−	EOT
−12V	−34	34−	−12V
OVRTH	−35	35−	OVRTHH
−12V	−36	36−	−12V
NCART	−37	37−	NCART
+12V	−38	38−	+12V
WRTPT	−39	39−	WRPT
+12V	−40	40−	+12V
ZDATA	−41	41−	ZDATA
DGND	−42	42−	GND (D)
SVWL	−43	43−	SVW
DGNL	−44	44−	GND (D)
SVRL	−45	45−	SVR
DGND	−46	46−	GND (D)
GNSL	−47	47−	GNSL
DGND	−48	48−	DGND
WZDATA	−49	49−	WZDATA
CGND	−50	50−	GND (D)

09144−61614

Front Panel
PCA

J1   J2

−01	01−	WPROT−L34
−02	02−	WPROT−L2
−03	03−	ONLN−L2
−04	04−	ONLN−L34
−05	05−	NC
−06	06−	BUSY L34
−07	07−	BUSY L2
−08	08−	NC
−09	09−	ULRQL
−10	10−	NC
−11	11−	+5V
−12	12−	NC
−13	13−	GND
−14	14−	NC

09144−61612

Figure 9-2. Cabling Diagram (sheet 3 of 3)

Figure 9-3. Order of Disassembly

10-1. INTRODUCTION

Please refer to the related manuals listed on page iii of the front matter for more information on the HP 9144A.

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

10-2. PRODUCT HISTORY

This section describes the differences between earlier models of the HP 9144A and the latest version documented in the main body of this manual.

There are five distinct earlier versions of the HP 9144A:

- 5 PCA (HDC, DDC1, DDC2, R/W, S)

- 4 PCA (HDC, DDC, R/W, S)

- 3 PCA (SBCONT, R/W, S)

- 2 PCA (SBCONT, RWS)

- 1 PCA (DE)

HDC - Host Dependent Controller
DDC - Device Dependent Controller
SBCONT - Single Board Controller
R/W - Read Write
S - Servo
RWS - Read Write Servo
DE - Drive Electronics PCA
PSU - Power Supply Unit

5 PCA VERSION

When the Tape Drive was first released (beginning with serial prefix number 2418A) it had five PCAs, as well as the power supply and front panel PCAs.

It was functionally the same as the present version but used more, simpler circuitry. Some of the Read/Write and Servo circuitry used analogue techniques, which have now been replaced by digital circuits.

The replaceable parts which differ from the present version include:

```
07940 - 60195  HDC PCA
09144 - 68702  Double DDC PCA
09144 - 66513  R/W PCA
09144 - 66517  S PCA
09144 - 60094  PSU PCA
09144 - 04401  Chassis
09144 - 61601  Cable DDC - R/W - S
09144 - 61602  Cable Power
09144 - 61605  Cable DDC - Front Panel PCA
09144 - 61606  Cable HDC - DDC
```

The layout of the major electronic assemblies is shown in figure 10-1. Figures 10-2 to 10-5 show the PCAs. Figures 10-6 to 10-8 show the interconnections between the PCAs. The connections between the two DDC PCAs are not shown, but consist of a single 100-way connector (J5).

Figure 10-9 shows the order of disassembly. When using this chart refer to section 6 for appropriate safety warnings and cautions.

Table 10-1 shows the Diagnostic/Self-Test Errors (which are displayed as a result of performing self-tests) and their interpretation. Table 10-2 shows the Run-Time Drive Errors (which may occur at any time, as the result of a fault) and their interpretation.

R/W PCA

HDC

(Upper) DDC

PSU

(Lower) DDC
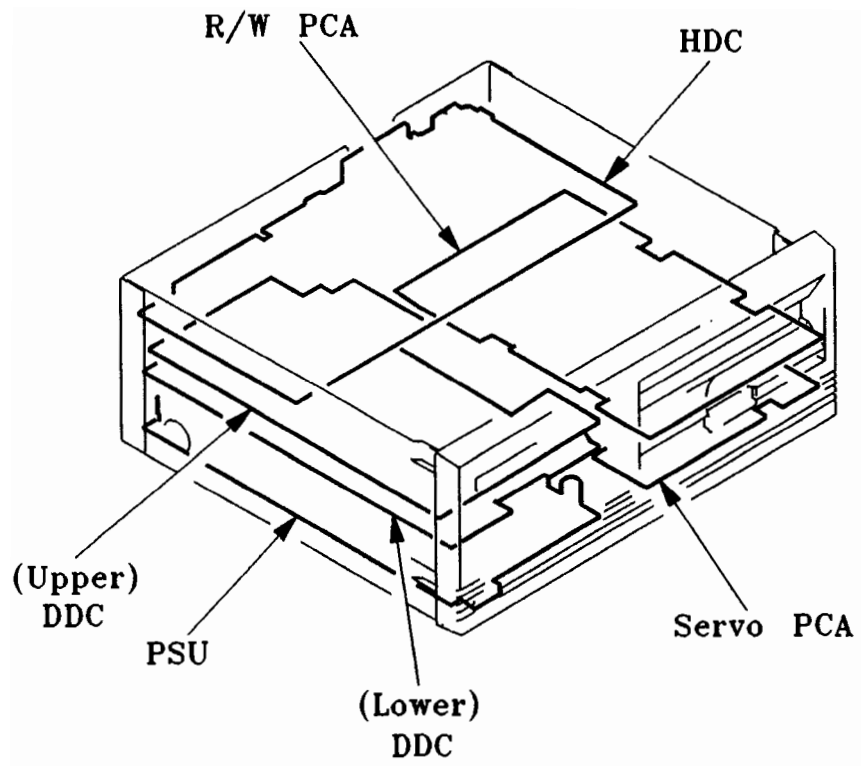
Servo PCA

Figure 10-1. Location of PCAs (5 PCA version)
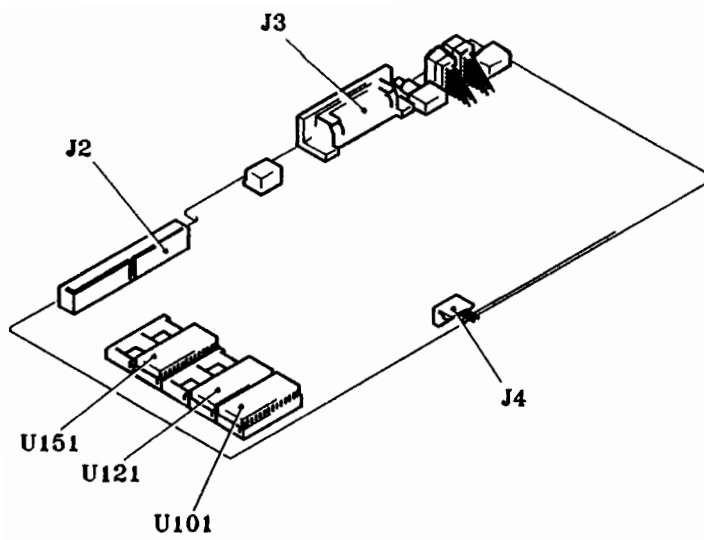
Figure 10-2. The HDC PCA (5 PCA version)
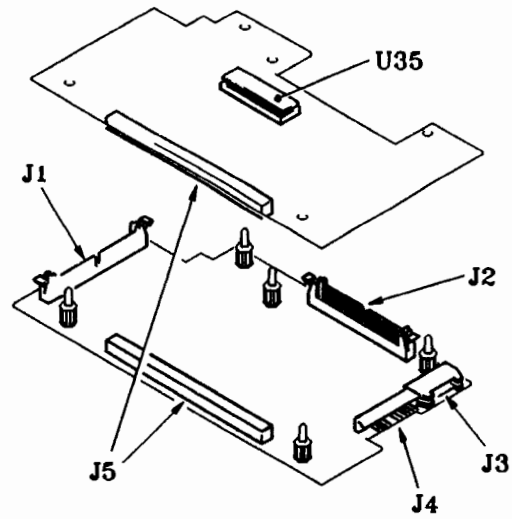
Figure 10-3. The DDC PCAs (5 PCA version)
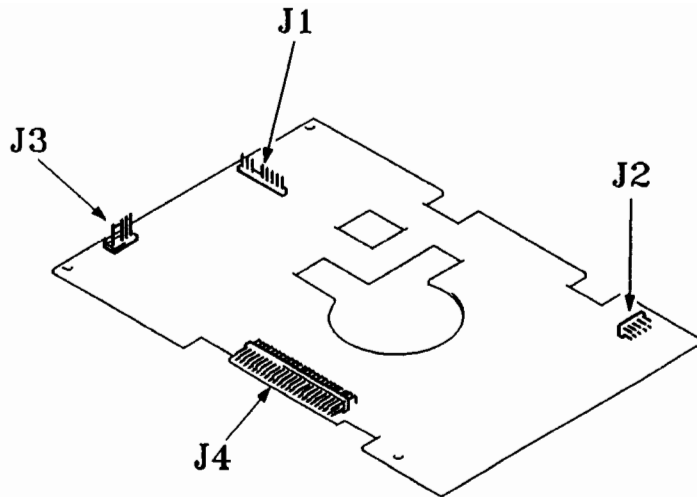
Figure 10-4. The R/W PCA (5 PCA version)
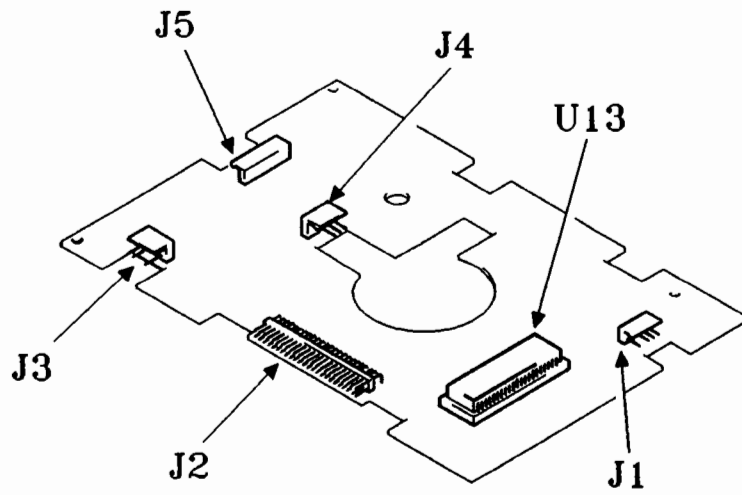
Figure 10-5. The Servo PCA (5 PCA version)

Fan

PSU

J2
+12VP	−01
GND	−02
+12VP	−03
GND	−04
+5V	−05
GND	−06
+5V	−07
GND	−08
+5V	−09
GND	−10
KEY	−11
PVAL	−12
+12V	−13
GND	−14
−12V	−15

HDC

J4
01−	NC
02−	+5V
03−	KEY

**Servo
PCA**

J3
01−	GND
02−	KEY
03−	NC
04−	+12V

DDC

J4
01−	GND
02−	+5V
03−	GND
04−	+5V
05−	GND
06−	KEY
07−	PVAL
08−	+12V
09−	GND
10−	−12V

09144−61610
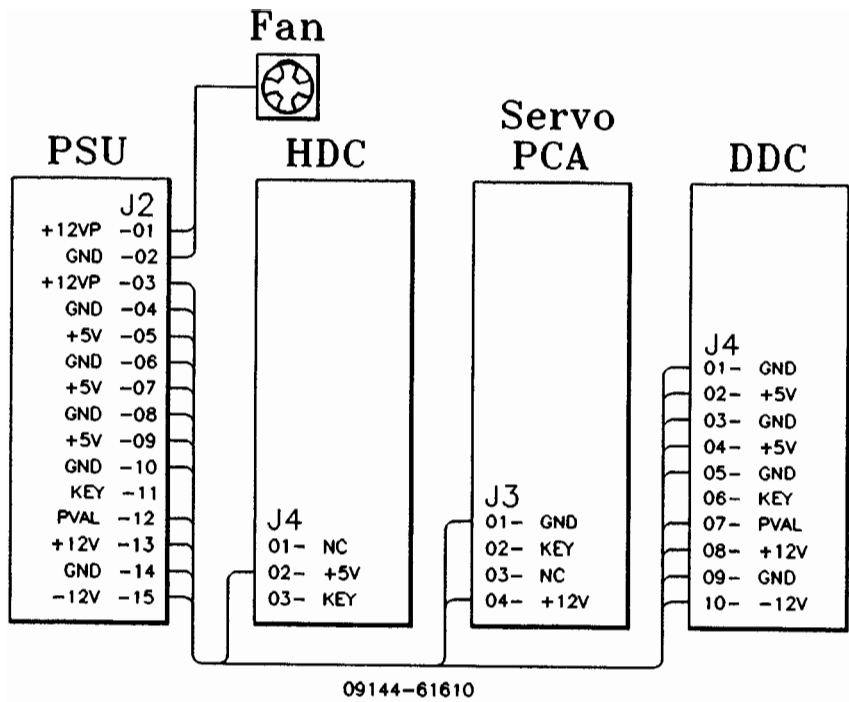
Figure 10-6. Power Cabling (5 PCA version)
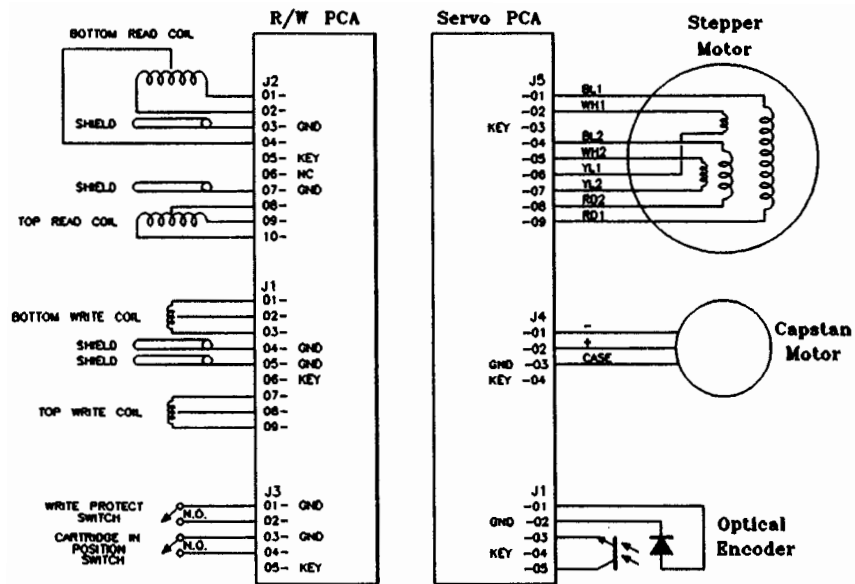
Figure 10-7. Drive Mechanism cabling (5 PCA version)
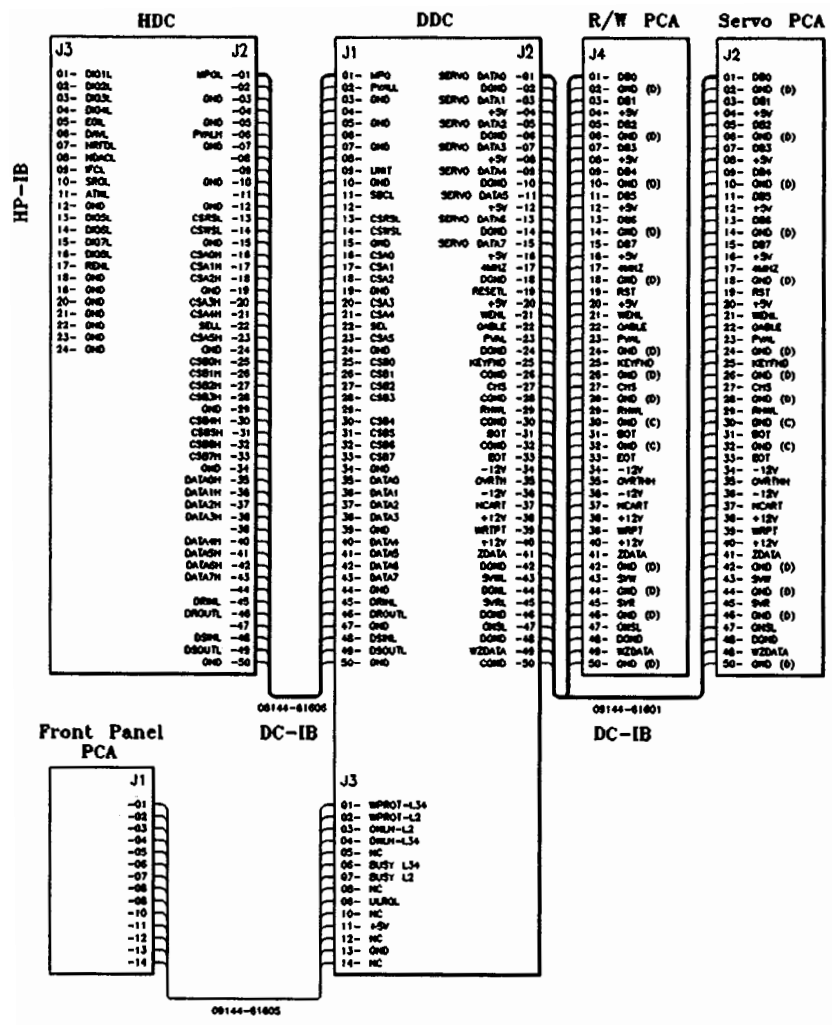
Figure 10-8. Signal Cabling (5 PCA version)

```
┌──────────────┐
│ Preparation  │
│     for      │
│   Service    │
└──────┬───────┘
       │
┌──────┴───────┐
│     Top      │
│    Shroud    │
└──────┬───────┘
       │
   ┌───┴────────────────┐
┌──┴───────────┐  ┌─────┴─────┐
│    Front     │  │    HDC    │
│ Panel Assy.  │  │   EPROMS  │
└──┬───────────┘  └───────────┘
```
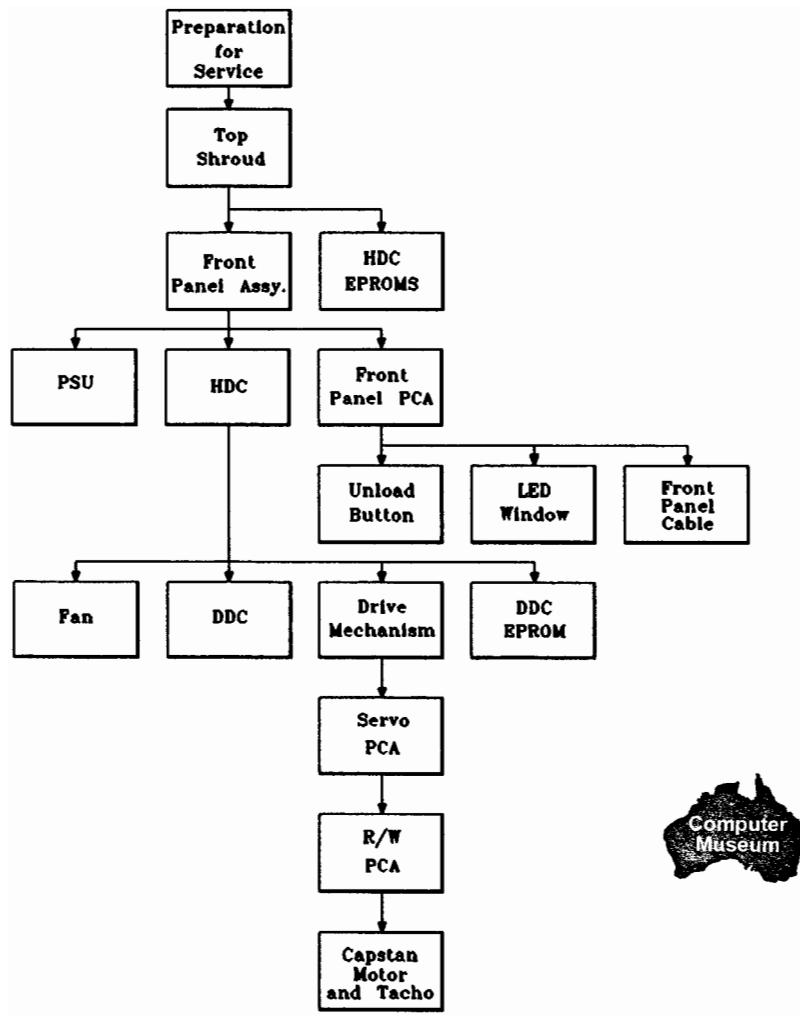
Figure 10-9. Order of Disassembly (5 PCA version)

Boxes: Preparation for Service → Top Shroud → (Front Panel Assy., HDC EPROMS)

Front Panel Assy. → (PSU, HDC, Front Panel PCA)

Front Panel PCA → (Unload Button, LED Window, Front Panel Cable)

HDC → (Fan, DDC, Drive Mechanism, DDC EPROM)

Drive Mechanism → Servo PCA → R/W PCA → Capstan Motor and Tacho

Computer Museum

Table 10-1. Diagnostic/Self-Test Errors (TERRORS) (5 PCA)

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 Circuitry	
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 Read/Write assembly. 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.	Read/Write, DDC, Servo
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.	Read/Write, 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.	Read/Write, DDC, HDC

Table 10-1. Diagnostic/Self-Test Errors (TERRORS) (5 PCA) continued

NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
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.	Read/Write, Stepper motor, 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.	Read/Write, Servo, DDC
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.	Read/Write, 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.	Read/Write, 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.	Read/Write, Servo, 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.	Read/Write, Servo, DDC
22		Test the write portion of the Read/Write assembly.	Read/Write
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.	Read/Write, 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.	Read/Write, DDC, Drive Mechanism

Table 10-2. Run-Time Drive Errors (DERRORS) (5 PCA).

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
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
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

Table 10-2. Run-Time Drive Errors (DERRORS) (5 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
187	BB	Seek to a jump spare (one byte) A latency was induced due to seeking to a jump spare during 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
193	C1	Log overflow (two bytes) Log indicated in postbyte overflowed. (Possible loss of entries) 0 = Manufacturer's block 1 = Sparing table 2 = Error rate test log 3 = Runtime error log 4 = Use log (Maintenance track overflow)	Tape Drive Subsystem: DDC, R/W Drive Mechanism
194	C2	Unable to read log (two bytes) 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)	Uninitialized cartridge, Tape Drive Subsystem: DDC, R/W Drive Mechanism
195	C3	Unable to write log (two bytes) Log indicated in postbyte could not be written on any track in multiple retries. Postbyte log codes are defined above. (Unrecoverable data)	

Table 10-2. Run-Time Drive Errors (DERRORS) (5 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
196	C4	Log only written on one track (two bytes) Log indicated in postbyte could only be written on one track rather than the usual two. Postbyte log codes are defined above. (Unrecoverable data)	
200	C8	Servo error (two bytes) Command to servo processor was not successfully executed. Postbyte contains status returned by servo processor: 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)	
206	CE	Load error (two bytes) This cartridge failed the load sequence. Failure is recorded in postbyte: 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)	

Table 10-2. Run-Time Drive Errors (DERRORS) (5 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	**HEX**		
207	CF	Unload error (two bytes) This cartridge did not successfully complete the normal unload sequence (logs may not have been updated). Failure is recorded in postbyte: 1 = Diagnostic result indicated a hardware failure so normal unload was not attempted. 2 = Seek to EOT failed (Unit fault)	
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)	

10-15

Table 10-2. Run-Time Drive Errors (DERRORS) (5 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
223	DF	No buffers in system (one byte)	
		No buffers are available to complete transaction. (Controller fault)	

4 PCA VERSION

The four PCA version first appeared in tape drives beginning at serial number 2440A00779 (see Service Note 9144A-1). This included a single DDC PCA which replaced the dual board DDC. By using VLSI technology the new PCA was the same size as one of th PCAs it replaced. This single board DDC obsoleted the dual board DDC. The DDC remained functionally the same.

The replaceable parts which differ from the present version include:

07940 - 60195 HDC PCA
09144 - 66512 DDC PCA
09144 - 66513 R/W PCA
09144 - 66517 S PCA
09144 - 60094 PSU PCA
09144 - 04401 Chassis
09144 - 61601 Cable DDC - R/W - S
09144 - 61602 Cable Power
09144 - 61605 Cable DDC - Front Panel PCA
09144 - 61606 Cable HDC - DDC

The layout of the major electronic assemblies is shown in figure Figures 10-11 to 10-14 show the PCAs. Figures 10-15 to 10-17 show the interconnections between the PCAs.

Figure 10-18 shows the order of disassembly. When using this cha refer to section 6 for appropriate safety warnings and cautions.

Table 10-3 shows the Diagnostic/Self-Test Errors (which are disp as a result of performing self-tests) and their interpretation. Table 10-4 shows the Run-Time Drive Errors (which may occur at a time, as the result of a fault) and their interpretation.

10-17
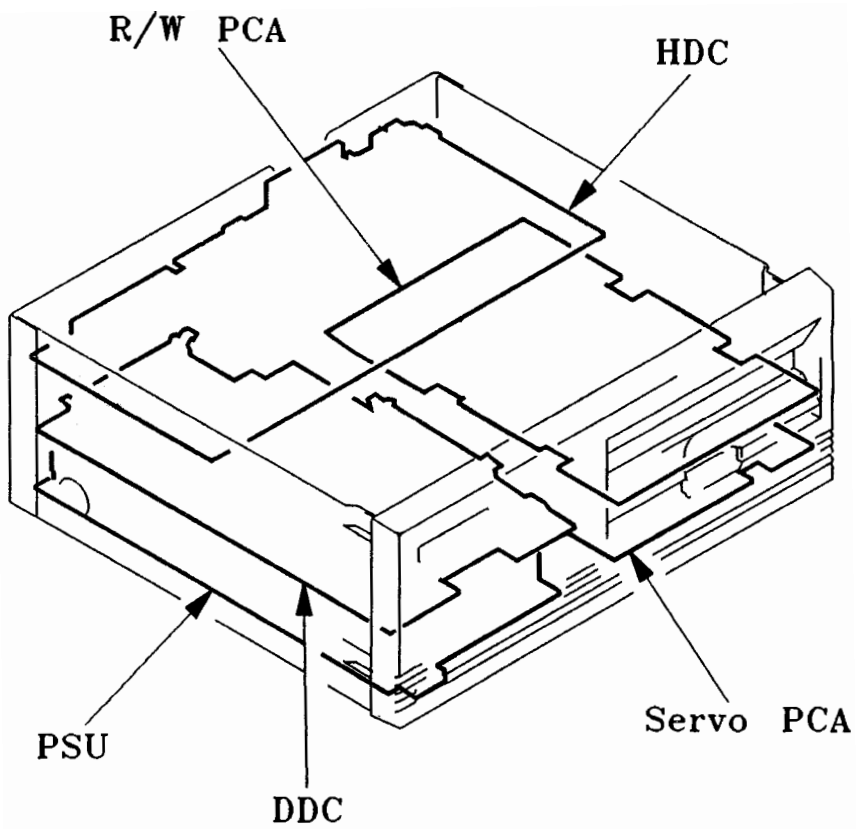
Figure 10-10. Location of PCAs (4 PCA version)
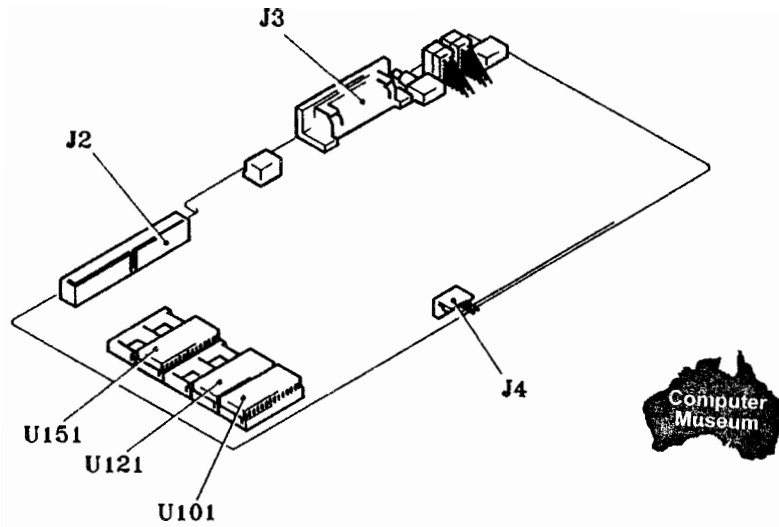
Figure 10-11. The HDC PCA (4 PCA version)
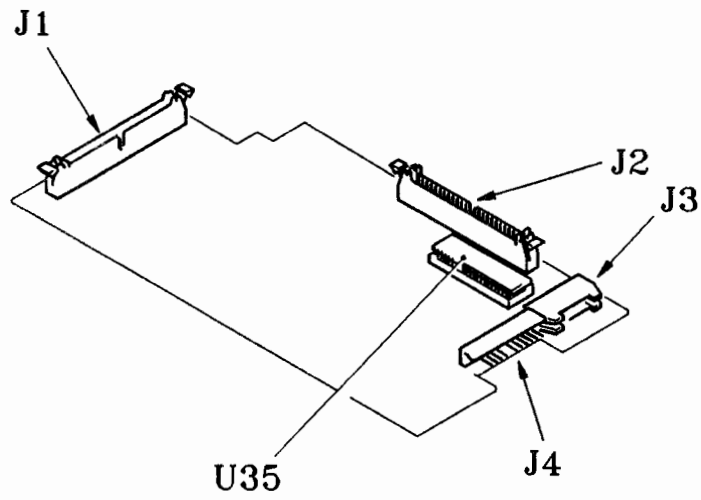
Figure 10-12. The DDC PCA (4 PCA version)
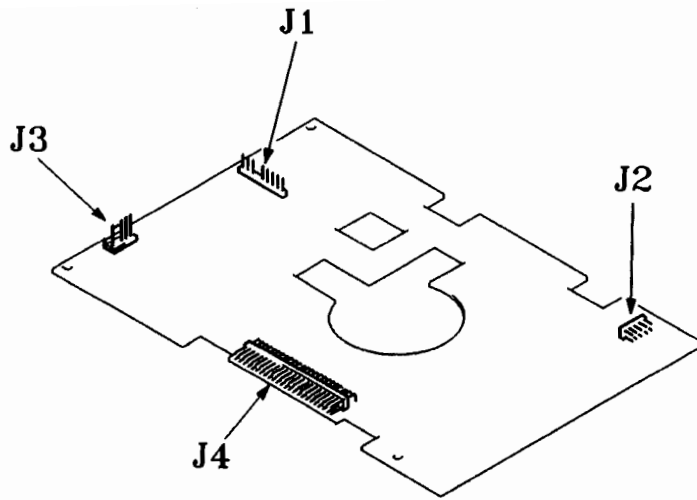
Figure 10-13. The R/W PCA (4 PCA version)
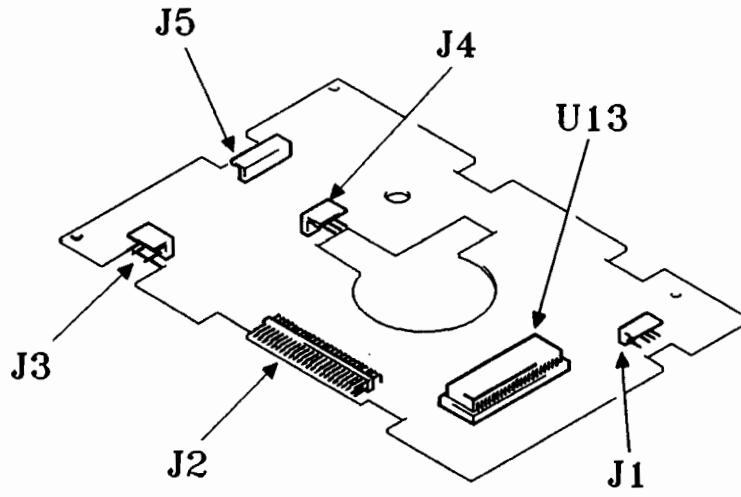
Figure 10-14. The Servo PCA (4 PCA version)

Fan

PSU   HDC   Servo PCA   DDC

J2
+12VP −01
GND −02
+12VP −03
GND −04
+5V −05
GND −06
+5V −07
GND −08
+5V −09
GND −10
KEY −11
PVAL −12
+12V −13
GND −14
−12V −15

J4
01− NC
02− +5V
03− KEY

J3
01− GND
02− KEY
03− NC
04− +12V

J4
01− GND
02− +5V
03− GND
04− +5V
05− GND
06− KEY
07− PVAL
08− +12V
09− GND
10− −12V

09144−61610
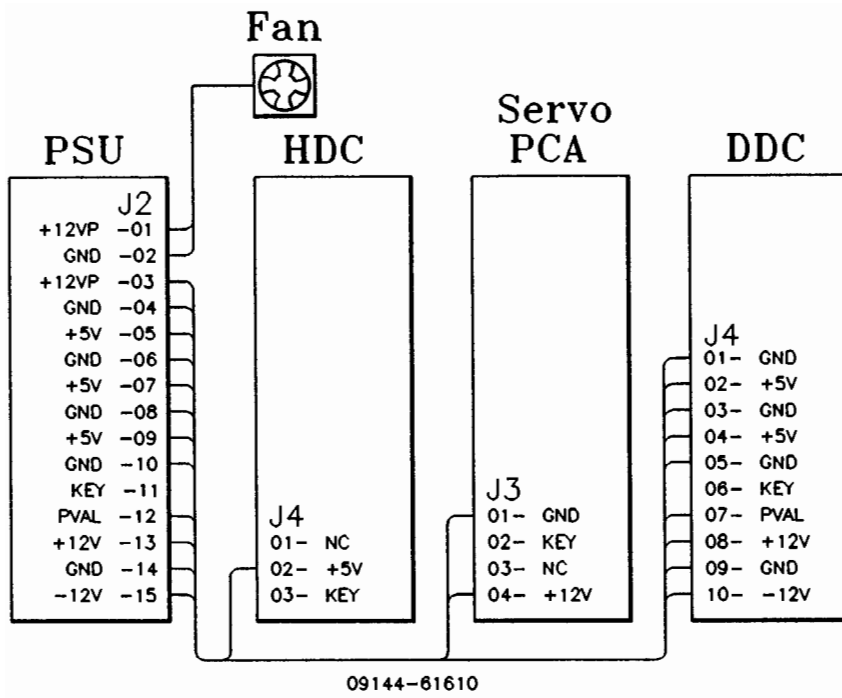
Figure 10-15. Power Cabling (4 PCA version)

10-21
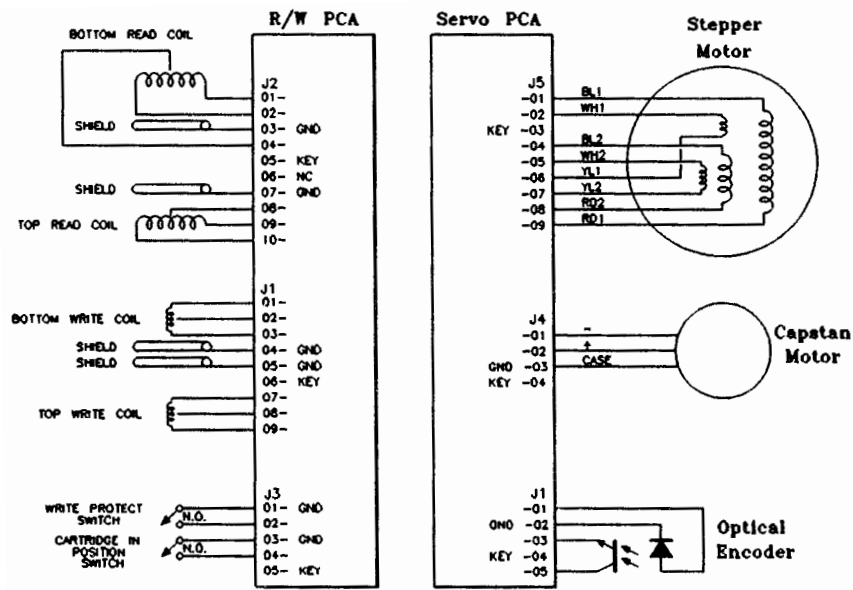
Figure 10-16. Drive Mechanism cabling (4 PCA version)

HDC DDC R/W PCA Servo PCA
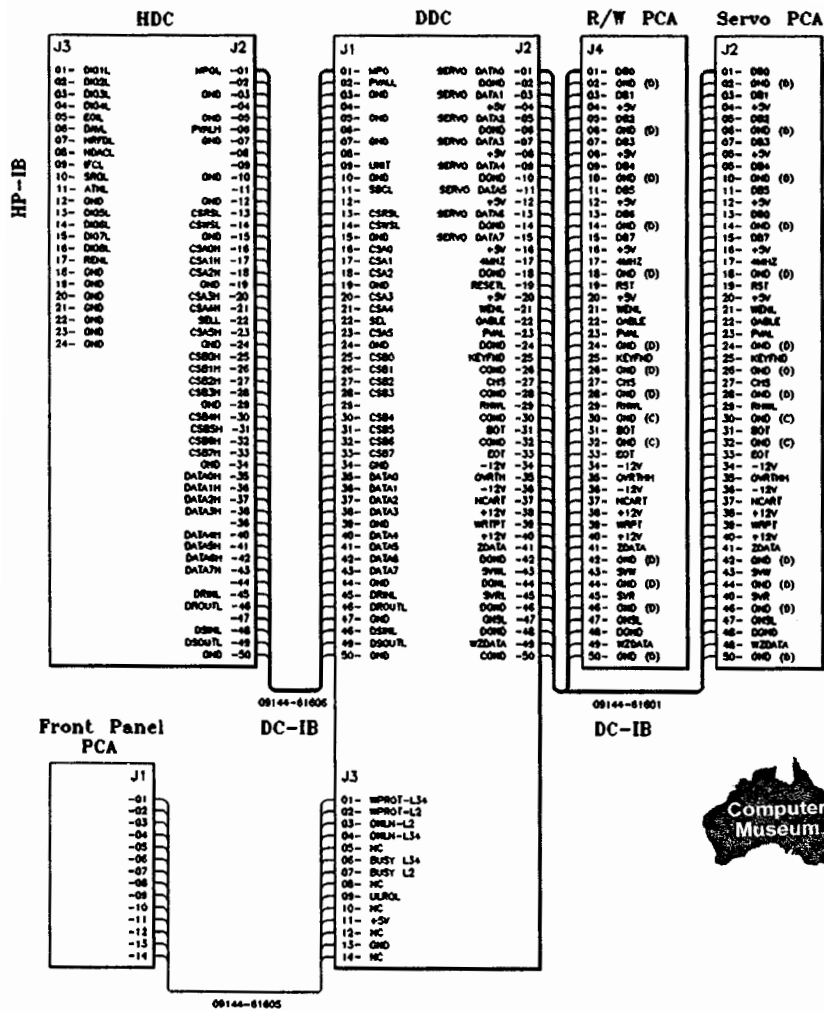
Figure 10-17. Signal Cabling (4 PCA version)

Front Panel PCA DC-IB DC-IB

HP-IB
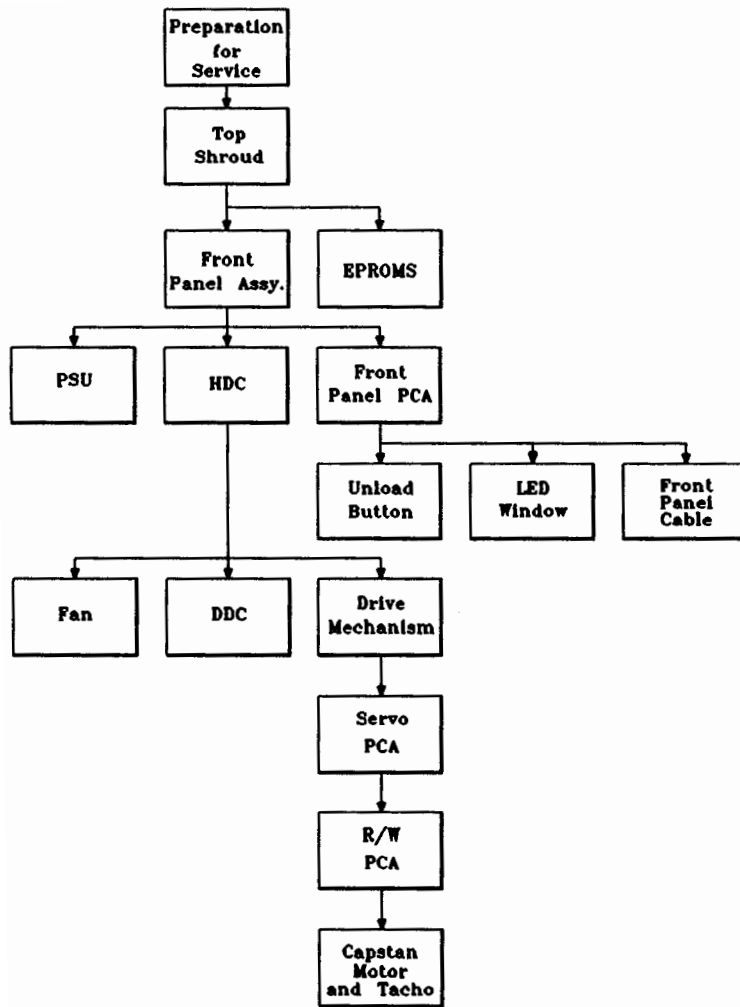
Figure 10-18. Order of Disassembly (4 PCA version)

Table 10-3. Diagnostic/Self-Test Errors (TERRORS) (4 PCA)

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 Circuitry	
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 Read/Write assembly. 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.	Read/Write, DDC, Servo
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.	Read/Write, 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.	Read/Write, DDC, HDC

Table 10-3. Diagnostic/Self-Test Errors (TERRORS) (4 PCA) continued

NUMBER		CAUSE	SUSPECT
DEC	HEX	OR TEST DESCRIPTION	HARDWARE
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.	Read/Write, Stepper motor, 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.	Read/Write, Servo, DDC
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.	Read/Write, 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.	Read/Write, 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.	Read/Write, Servo, 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.	Read/Write, Servo, DDC
22		Test the write portion of the Read/Write assembly.	Read/Write
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.	Read/Write, 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.	Read/Write, DDC, Drive Mechanism

Table 10-4. Run-Time Drive Errors (DERRORS) (4 PCA).

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	**HEX**		
177	B1	Recoverable dual errors (one byte)	None
		Two frames were bad (CRC error or missing) which were recoverable through XOR circuitry. (Marginal or recoverable)	
178	B2	Single frame error (one byte)	None
		Only one frame with bad CRC or missing. (Marginal or recoverable)	
179	B3	Unrecoverable data (one byte)	None
		Combination of frame CRC errors or missing frames such that data could not be recovered through XOR circuitry. (Marginal, recoverable or unrecoverable)	
180	B4	DMA handshake error (one byte)	HDC, DDC
		Overflow or underflow has occurred between HDC and DDC. (Marginal, recoverable or unrecoverable)	
181	B5	DMA failure (one byte)	HDC, DDC
		Not enough frames detected during read or read-while-write. (Marginal recoverable, or unrecoverable)	
185	B9	Key error (one byte)	DDC
		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)	
186	BA	Seek error (one byte)	DDC
		Seek to target required retries or failed because of time-out or keys past target. (Unit fault)	

Table 10-4. Run-Time Drive Errors (DERRORS) (4 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
187	BB	Seek to a jump spare (one byte) A latency was induced due to seeking to a jump spare during 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
193	C1	Log overflow (two bytes) Log indicated in postbyte overflowed. (Possible loss of entries) 0 = Manufacturer's block 1 = Sparing table 2 = Error rate test log 3 = Runtime error log 4 = Use log (Maintenance track overflow)	Tape Drive Subsystem: DDC, R/W Drive Mechanism
194	C2	Unable to read log (two bytes) 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)	Uninitialized cartridge, Tape Drive Subsystem: DDC, R/W Drive Mechanism
195	C3	Unable to write log (two bytes) Log indicated in postbyte could not be written on any track in multiple retries. Postbyte log codes are defined above. (Unrecoverable data)	

Table 10-4. Run-Time Drive Errors (DERRORS) (4 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
196	C4	Log only written on one track (two bytes) Log indicated in postbyte could only be written on one track rather than the usual two. Postbyte log codes are defined above. (Unrecoverable data)	
200	C8	Servo error (two bytes) Command to servo processor was not successfully executed. Postbyte contains status returned by servo processor: 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)	
206	CE	Load error (two bytes) This cartridge failed the load sequence. Failure is recorded in postbyte: 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)	

Table 10-4. Run-Time Drive Errors (DERRORS) (4 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
207	CF	Unload error (two bytes) This cartridge did not successfully complete the normal unload sequence (logs may not have been updated). Failure is recorded in postbyte: 1 = Diagnostic result indicated a hardware failure so normal unload was not attempted. 2 = Seek to EOT failed (Unit fault)	
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)	

Table 10-4. Run-Time Drive Errors (DERRORS) (4 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
223	DF	No buffers in system (one byte) No buffers are available to complete transaction. (Controller fault)	

3 PCA VERSION

In the three PCA version of the HP 9144A Tape Drive the HDC and DDC PCAs have been combined to produce a single board contro This version appeared in tape drives beginning at serial number 2444A01281 (see Service Note 9144A-4). The new PCA was functiona the same, occupied less space and was more reliable than the two PCAs it replaced. This new PCA did not render the DDC and HDC PC obsolete. These continued to be manufactured for use in other pr

This was the first type of HP 9144A to be manufactured in Bristo (UK), having been transferred from Greeley (USA).

During the production run of the three PCA version, the power supply PCA was replaced by one of improved performance and relia (see Service Note 9144A-10). The introduction began at serial nu 2519A03764.

The replaceable parts which differ from the present version include:

```
09144 - 66515  SBCONT PCA
09144 - 66513  R/W PCA
09144 - 66517  S PCA
09133 - 67120  PSU PCA (same as present version)
09144 - 04401  Chassis
09144 - 61611  Cable SBCONT - R/W - S
09144 - 61610  Cable Power
09144 - 61612  Cable SBCONT - Front Panel PCA
```

The layout of the major electronic assemblies is shown in figure Figures 10-20 to 10-22 show the PCAs. Figures 10-23 to 10-25 show the interconnections between the PCAs.

Figure 10-26 shows the order of disassembly. When using this cha refer to section 6 for appropriate safety warnings and cautions.

Table 10-5 shows the Diagnostic/Self-Test Errors (which are disp as a result of performing self-tests) and their interpretation. Table 10-6 shows the Run-Time Drive Errors (which may occur at a time, as the result of a fault) and their interpretation.

R/W PCA

SB Cont
PCA

PSU
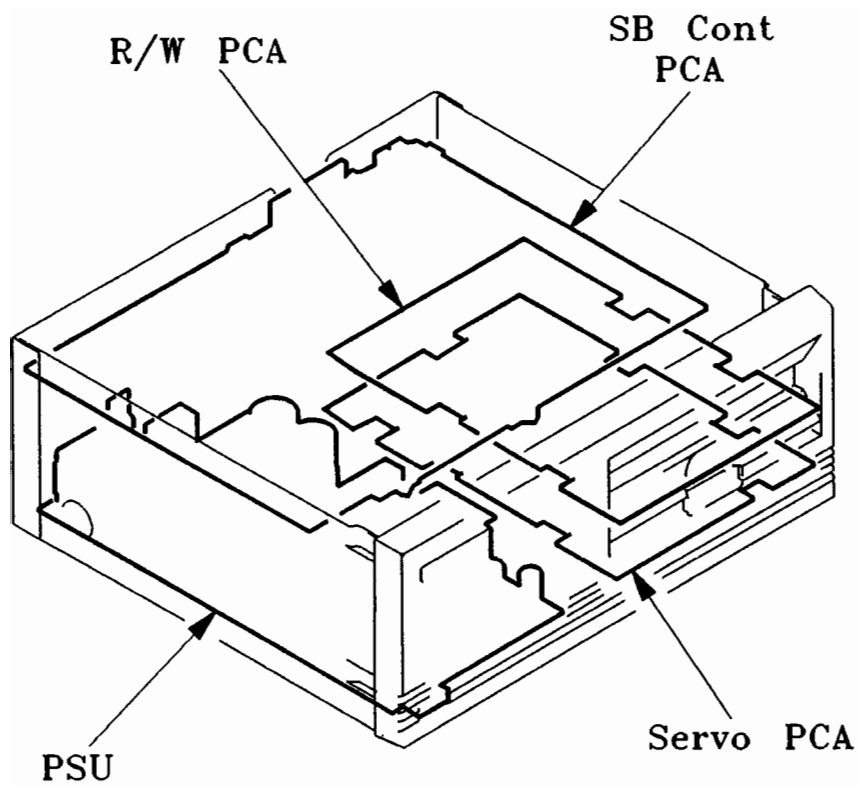
Servo PCA

Figure 10-19. Location of PCAs (3 PCA version)
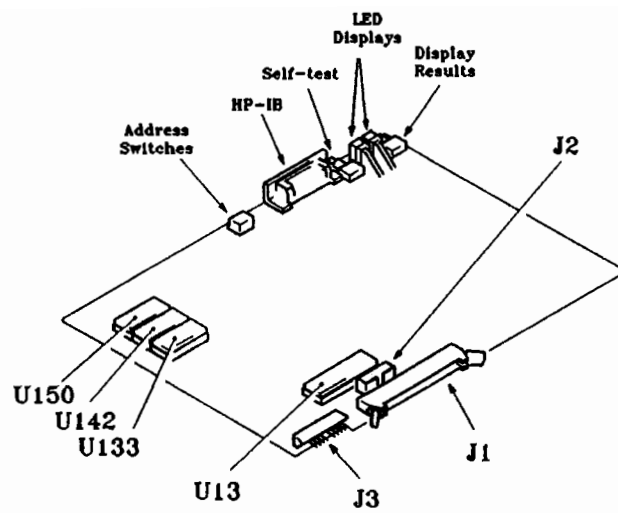
Figure 10-20. The SBCONT PCA (3 PCA version)
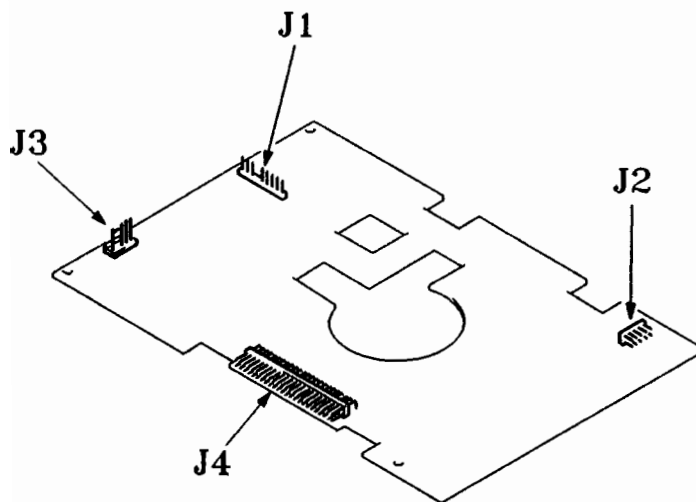
Figure 10-21. The R/W PCA (3 PCA version)
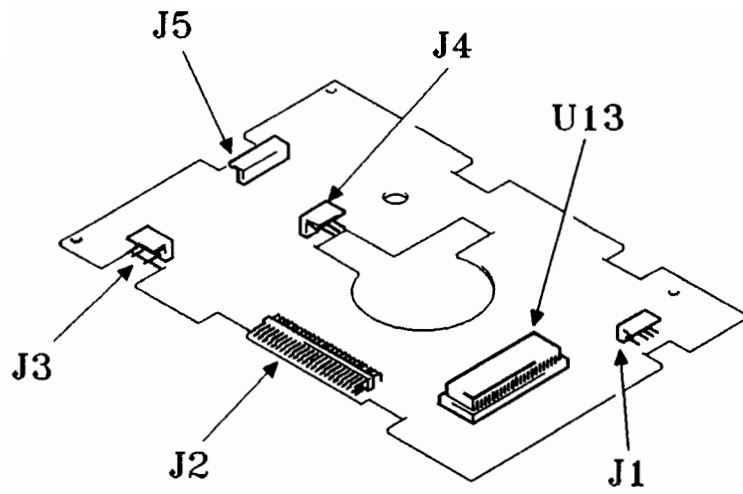
Figure 10-22. The Servo PCA (3 PCA version)
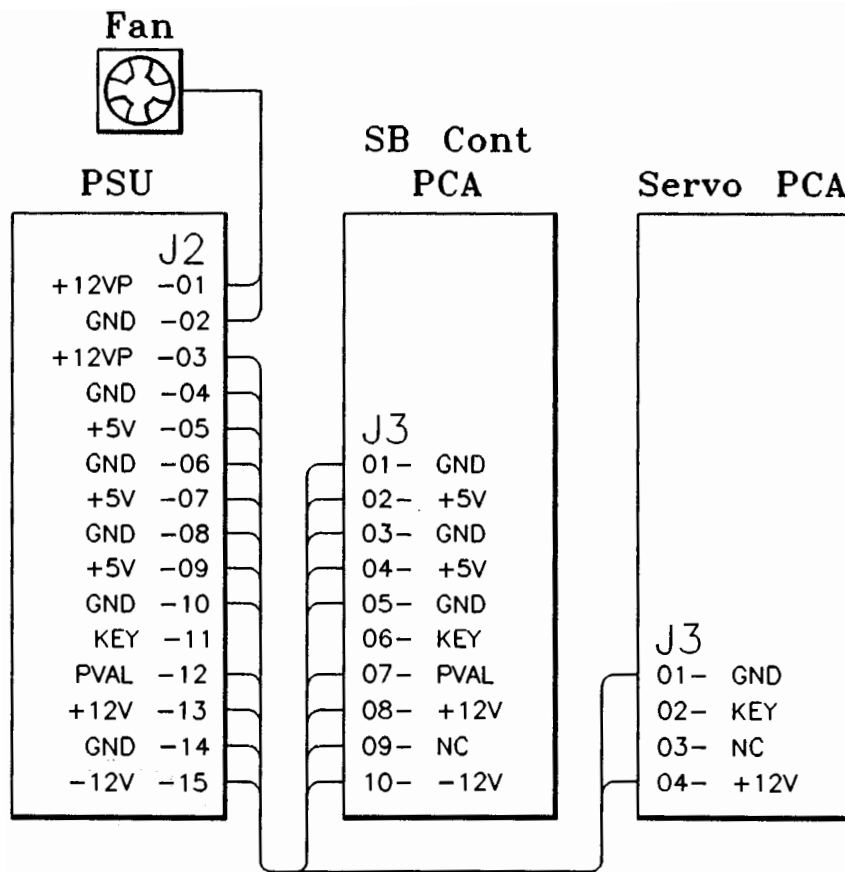
Figure 10-23. Power Cabling (3 PCA version)

10-36
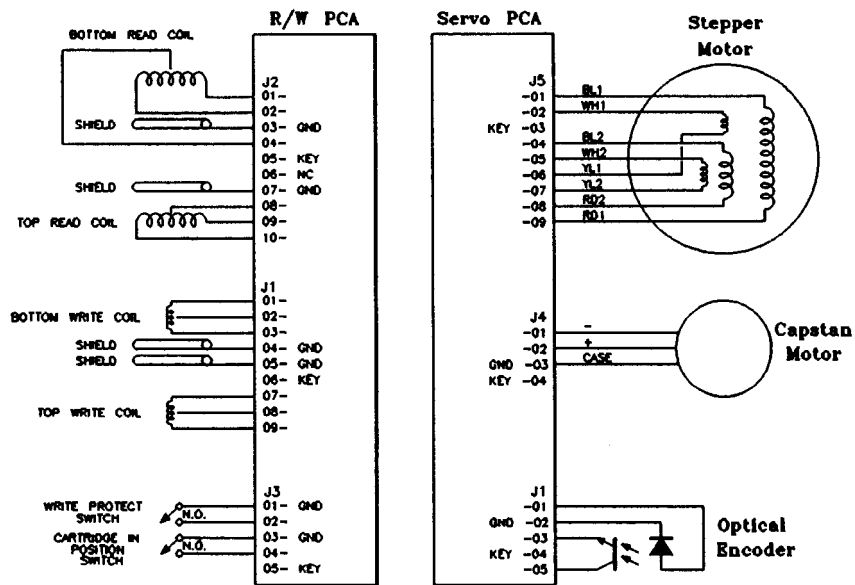
Figure 10-24. Drive Mechanism cabling (3 PCA version)
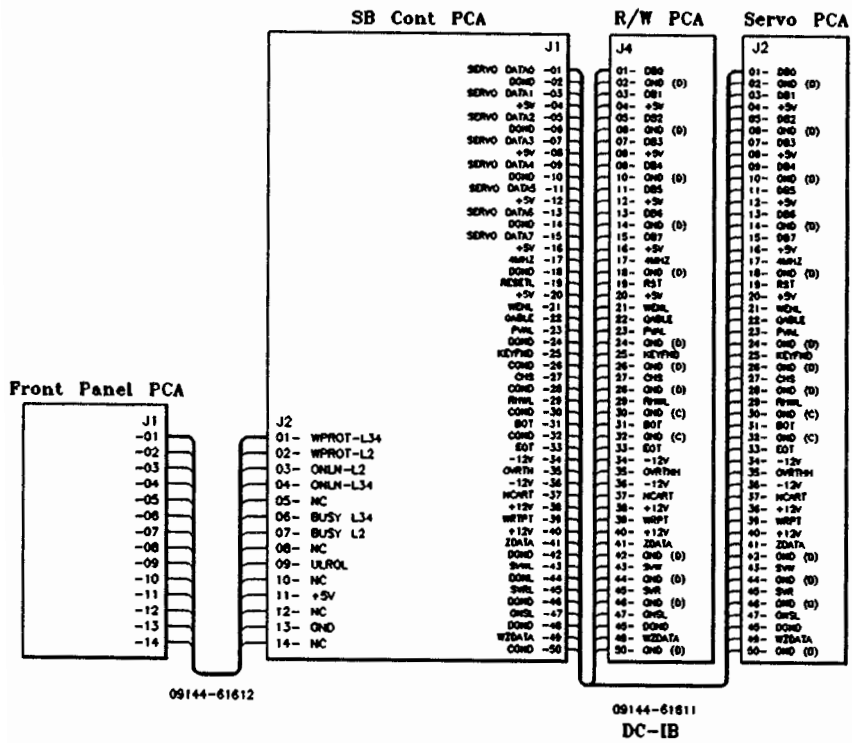
Figure 10-25. Signal Cabling (3 PCA version)

```
                    ┌──────────────┐
                    │ Preparation  │
                    │     for      │
                    │   Service    │
                    └──────┬───────┘
                           │
                    ┌──────▼───────┐
                    │     Top      │
                    │    Shroud    │
                    └──────┬───────┘
                           │
              ┌────────────┴────────────┐
       ┌──────▼───────┐          ┌──────▼───────┐
       │    Front     │          │   EPROMS     │
       │ Panel Assy.  │          │              │
       └──────┬───────┘          └──────────────┘
              │
    ┌─────────┼─────────┬─────────────┐
 ┌──▼──┐  ┌───▼───┐  ┌──▼───┐    ┌────▼────┐
 │ PSU │  │ Front │  │ SB   │    │  Drive  │
 │     │  │ Panel │  │ Cont │    │Mechanism│
 │     │  │  PCA  │  │ PCA  │    │         │
 └─────┘  └───┬───┘  └──┬───┘    └────┬────┘
             ...
```

Preparation for Service

Top Shroud

Front Panel Assy. — EPROMS

PSU — Front Panel PCA — SB Cont PCA — Drive Mechanism

LED Window — Front Panel Cable — Unload Button — Fan — Servo PCA

R/W PCA

Capstan Motor and Tacho
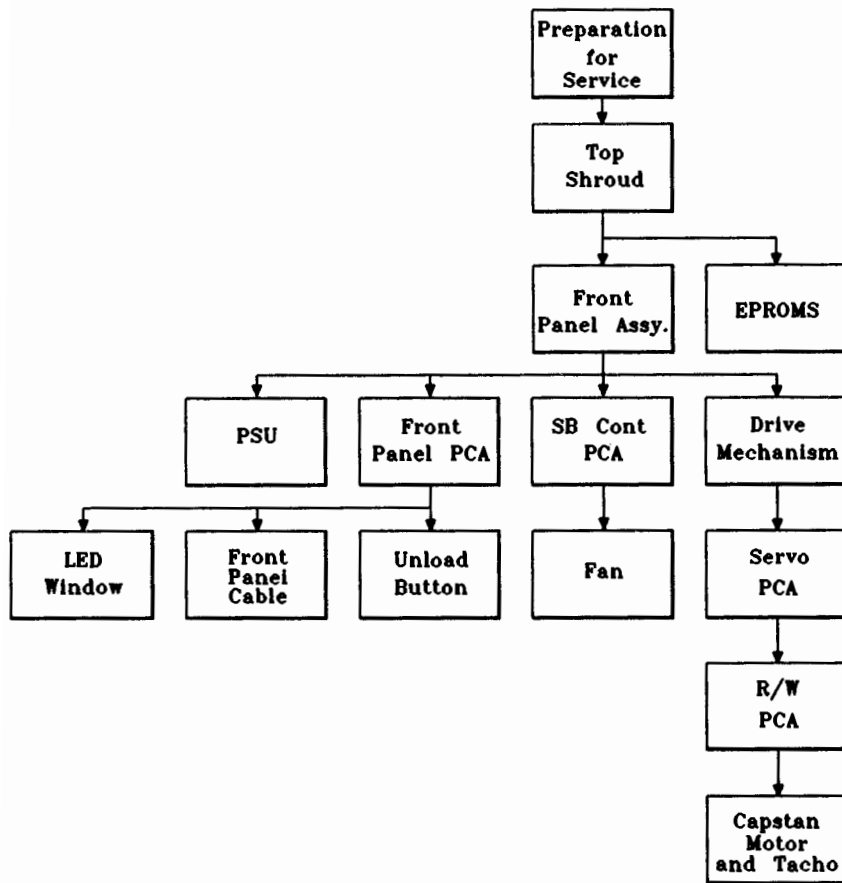
Figure 10-26. Order of Disassembly (3 PCA version)

Table 10-5. Diagnostic/Self-Test Errors (TERRORS) (3 PCA)

NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
00		Complete test of Tape Drive	
01		HDC-DDC Interface. Read Servo Status	SBCONT
02		DDC Circuitry	
03		a) Microcomputer test	SBCONT
04		b) Read/Write loopback	SBCONT
05		HDC-DDC Read/Write loopback.	SBCONT
06		HDC-DDC-Servo Interface	Servo, SBCONT
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 Read/Write assembly. 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.	Read/Write, SBCONT, Servo
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.	Read/Write, SBCONT
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.	Read/Write, SBCONT

Table 10-5. Diagnostic/Self-Test Errors (TERRORS) (3 PCA) continued

NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
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.	Read/Write, Stepper motor, SBCONT
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.	Read/Write, Servo, SBCONT
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.	Read/Write, SBCONT
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.	Read/Write, SBCONT
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.	Read/Write, Servo, SBCONT
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.	Read/Write, Servo, SBCONT
22		Test the write portion of the Read/Write assembly.	Read/Write
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.	Read/Write, SBCONT, 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.	Read/Write, SBCONT, Drive Mechanism

Table 10-6. Run-Time Drive Errors (DERRORS) (3 PCA).

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	**HEX**		
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
180	B4	DMA handshake error (one byte) Overflow or underflow has occurred between HDC and DDC. (Marginal, recoverable or unrecoverable)	SBCONT
181	B5	DMA failure (one byte) Not enough frames detected during read or read-while-write. (Marginal recoverable, or unrecoverable)	SBCONT
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)	SBCONT
186	BA	Seek error (one byte) Seek to target required retries or failed because of time-out or keys past target. (Unit fault)	SBCONT

Table 10-6. Run-Time Drive Errors (DERRORS) (3 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	**HEX**		
187	BB	Seek to a jump spare (one byte) A latency was induced due to seeking to a jump spare during transaction (Latency induced)	SBCONT
190	BE	Reposition failure (one byte) Reposition of tape to next target address after tape access command required retries or failed. (Unit fault)	SBCONT
193	C1	Log overflow (two bytes) Log indicated in postbyte overflowed. (Possible loss of entries) 0 = Manufacturer's block 1 = Sparing table 2 = Error rate test log 3 = Runtime error log 4 = Use log (Maintenance track overflow)	Tape Drive Subsystem: SBCONT, R/W Drive Mechanism
194	C2	Unable to read log (two bytes) 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)	Uninitialized cartridge, Tape Drive Subsystem: SBCONT, R/W Drive Mechanism
195	C3	Unable to write log (two bytes) Log indicated in postbyte could not be written on any track in multiple retries. Postbyte log codes are defined above. (Unrecoverable data)	

Table 10-6. Run-Time Drive Errors (DERRORS) (3 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
196	C4	Log only written on one track (two bytes) Log indicated in postbyte could only be written on one track rather than the usual two. Postbyte log codes are defined above. (Unrecoverable data)	
200	C8	Servo error (two bytes) Command to servo processor was not successfully executed. Postbyte contains status returned by servo processor: 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)	
206	CE	Load error (two bytes) This cartridge failed the load sequence. Failure is recorded in postbyte: 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)	

Table 10-6. Run-Time Drive Errors (DERRORS) (3 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
207	CF	Unload error (two bytes) This cartridge did not successfully complete the normal unload sequence (logs may not have been updated). Failure is recorded in postbyte: 1 = Diagnostic result indicated a hardware failure so normal unload was not attempted. 2 = Seek to EOT failed (Unit fault)	
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)	

Table 10-6. Run-Time Drive Errors (DERRORS) (3 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
223	DF	No buffers in system (one byte) No buffers are available to complete transaction. (Controller fault)	

2 PCA VERSION

The two PCA version first appeared in tape drives beginning at serial number prefix 2542A and 2542E (see Service Note 9144A-15). This included a single Read/Write Servo PCA which replaced the Read/Write and Servo PCAs. By using digital techniques the new PCA was the same size as one of PCAs it replaced. This RWS PCA did not obsolete the R/W and Serv PCAs. The circuitry remained functionally the same.

The replaceable parts which differ from the present version include:

09144 - 66515 SBCONT PCA
09144 - 66518 RWS PCA
09133 - 67120 PSU PCA (same as present version)
09144 - 04401 Chassis
09144 - 61614 Cable SBCONT - RWS
09144 - 61610 Cable Power
09144 - 61612 Cable SBCONT - Front Panel PCA

The layout of the major electronic assemblies is shown in figure Figures 10-28 to 10-29 show the PCAs. Figures 10-30 to 10-32 show the interconnections between the PCAs.

Figure 10-33 shows the order of disassembly. When using this cha refer to section 6 for appropriate safety warnings and cautions.

Table 10-7 shows the Diagnostic/Self-Test Errors (which are disp as a result of performing self-tests) and their interpretation. Table 10-8 shows the Run-Time Drive Errors (which may occur at a time, as the result of a fault) and their interpretation.

**SB Cont
PCA**

RWS PCA

PSU
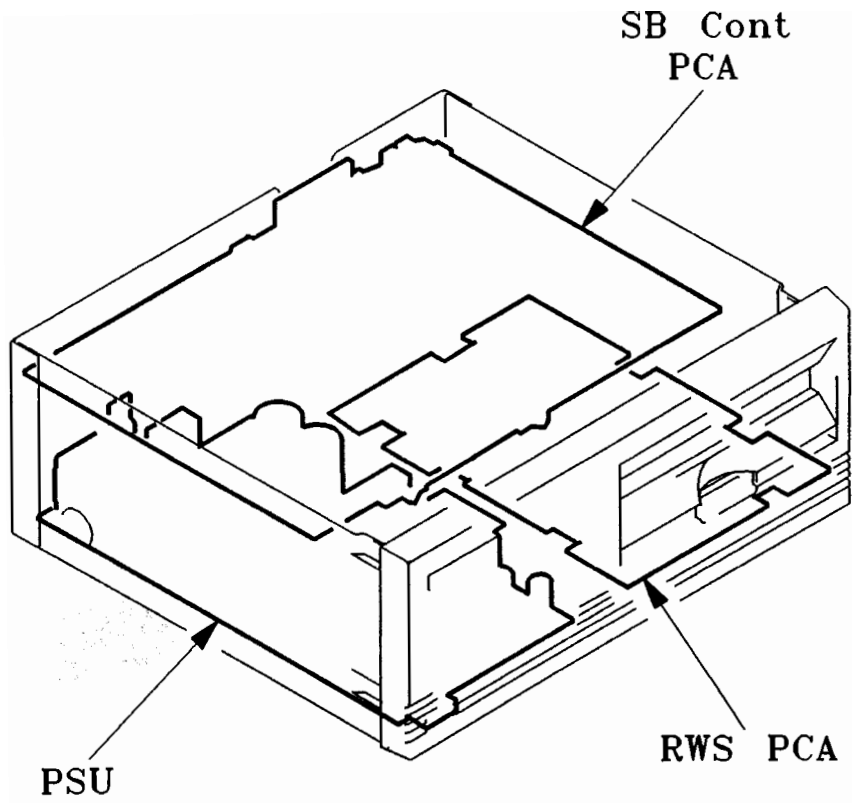
Figure 10-27. Location of PCAs (2 PCA version)
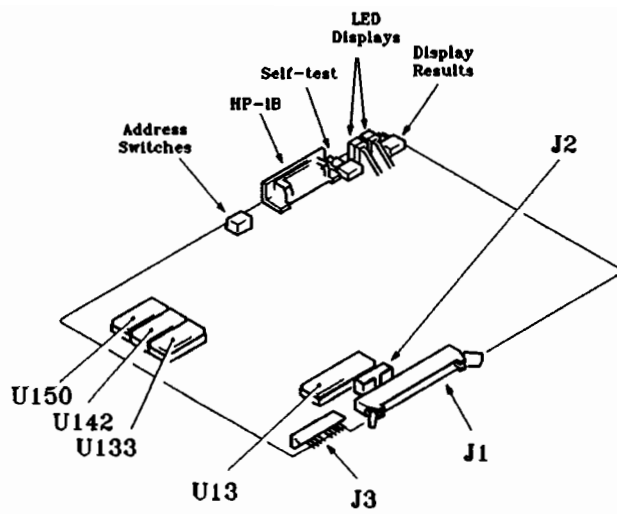
Figure 10-28. The SBCONT PCA (2 PCA version)
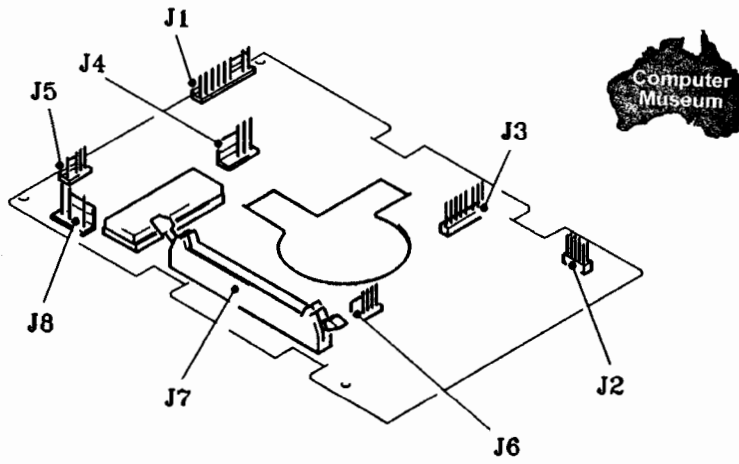
Figure 10-29. The RWS PCA (2 PCA version)

Fan

PSU

SB Cont
PCA

R/W/S

J2			J4			J3	
+12VP	-01						
GND	-02						
+12VP	-03						
GND	-04						
+5V	-05		01-	GND			
GND	-06		02-	+5V			
+5V	-07		03-	GND			
GND	-08		04-	+5V			
+5V	-09		05-	GND			
GND	-10		06-	KEY			
KEY	-11		07-	PVAL		01-	GND
PVAL	-12		08-	+12V		02-	KEY
+12V	-13		09-	GND		03-	NC
GND	-14		10-	-12V		04-	+12V
-12V	-15						

09144-61610
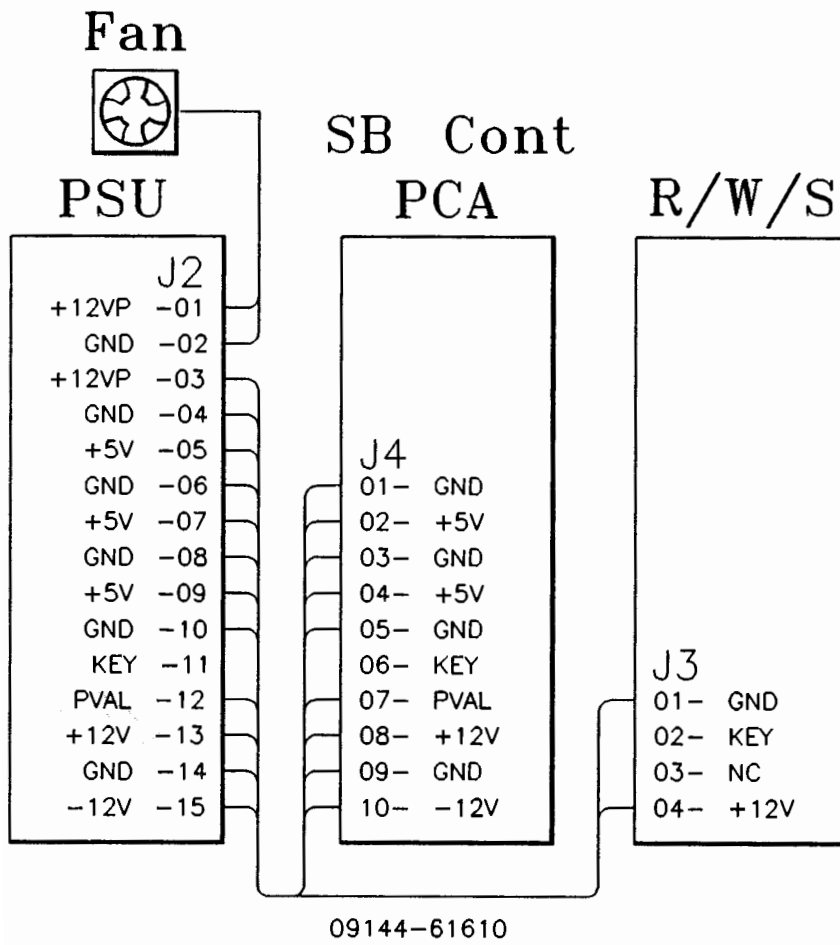
Figure 10-30. Power Cabling (2 PCA version)

10-50
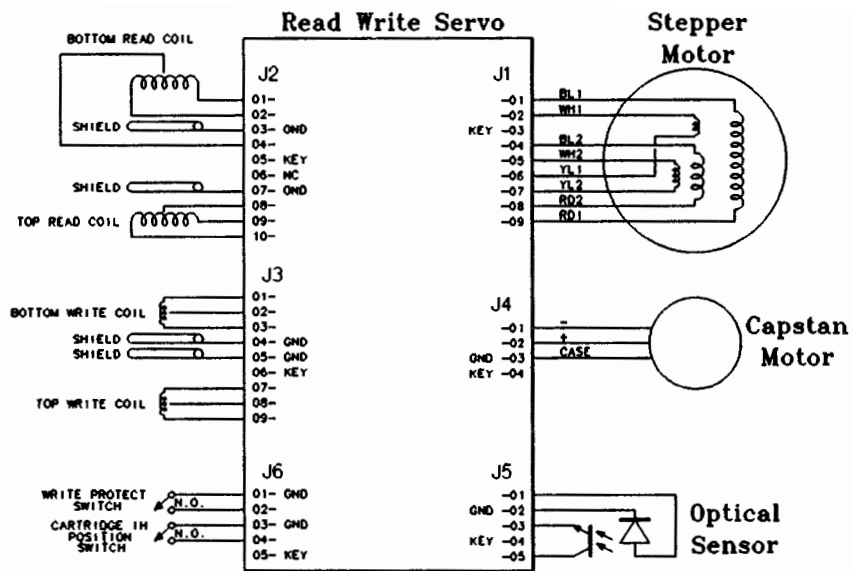
Figure 10-31. Drive Mechanism cabling (2 PCA version)

SB Cont PCA

R/W/S

J1

J7

	J1		J7	
SERVO DATA0	-01	01-	DB0	
DGND	-02	02-	GND	(D)
SERVO DATA1	-03	03-	DB1	
+5V	-04	04-	+5V	
SERVO DATA2	-05	05-	DB2	
DGND	-06	06-	GND	(D)
SERVO DATA3	-07	07-	DB3	
+5V	-08	08-	+5V	
SERVO DATA4	-09	09-	DB4	
DGND	-10	10-	GND	(D)
SERVO DATA5	-11	11-	DB5	
+5V	-12	12-	+5V	
SERVO DATA6	-13	13-	DB6	
DGND	-14	14-	GND	(D)
SERVO DATA7	-15	15-	DB7	
+5V	-16	16-	+5V	
4MHZ	-17	17-	4MHZ	
DGND	-18	18-	GND	(D)
RESETL	-19	19-	RST	
+5V	-20	20-	+5V	
WENL	-21	21-	WENL	
GABLE	-22	22-	GABLE	
PVAL	-23	23-	PVAL	
DGND	-24	24-	GND	(D)
KEYFND	-25	25-	KEYFND	
CGND	-26	26-	GND	(D)
CHS	-27	27-	CHS	
CGND	-28	28-	GND	(D)
RHWL	-29	29-	RHWL	
CGND	-30	30-	GND	(C)
BOT	-31	31-	BOT	
CGND	-32	32-	GND	(C)
EOT	-33	33-	EOT	
-12V	-34	34-	-12V	
OVRTH	-35	35-	OVRTHH	
-12V	-36	36-	-12V	
NCART	-37	37-	NCART	
+12V	-38	38-	+12V	
WRTPT	-39	39-	WRPT	
+12V	-40	40-	+12V	
ZDATA	-41	41-	ZDATA	
DGND	-42	42-	GND	(D)
SVWL	-43	43-	SVW	
DGNL	-44	44-	GND	(D)
SVRL	-45	45-	SVR	
DGND	-46	46-	GND	(D)
GNSL	-47	47-	GNSL	
DGND	-48	48-	DGND	
WZDATA	-49	49-	WZDATA	
CGND	-50	50-	GND	(D)

09144-61614

Front Panel PCA

J1

J1		J2	
-01	01-	WPROT-L34	
-02	02-	WPROT-L2	
-03	03-	ONLN-L2	
-04	04-	ONLN-L34	
-05	05-	NC	
-06	06-	BUSY L34	
-07	07-	BUSY L2	
-08	08-	NC	
-09	09-	ULRQL	
-10	10-	NC	
-11	11-	+5V	
-12	12-	NC	
-13	13-	GND	
-14	14-	NC	

09144-61612

Figure 10-32. Signal Cabling (2 PCA version)

```
                    ┌──────────────┐
                    │ Preparation  │
                    │     for      │
                    │   Service    │
                    └──────┬───────┘
                           │
                    ┌──────┴───────┐
                    │    Top       │
                    │   Shroud     │
                    └──────┬───────┘
                           │
                    ┌──────┴──────────────┐
                    │                     │
            ┌───────┴──────┐      ┌───────┴──────┐
            │   Front      │      │   EPROMS     │
            │ Panel Assy.  │      │              │
            └───────┬──────┘      └──────────────┘
                    │
     ┌──────┬───────┼───────────┬──────────────┐
     │      │       │           │              │
┌────┴──┐ ┌─┴──────┐ ┌─────────┐ ┌──────────┐
│ PSU   │ │ Front  │ │SB Cont  │ │  Drive   │
│       │ │Panel   │ │  PCA    │ │Mechanism │
│       │ │ PCA    │ │         │ │          │
└───────┘ └───┬────┘ └────┬────┘ └─────┬────┘
  │           │           │            │
┌─┴─────┐ ┌───┴───┐ ┌─────┴──┐   ┌─────┴──┐
│ LED   │ │Front  │ │Unload  │   │        │
│Window │ │Panel  │ │Button  │   │ R W S  │
│       │ │Cable  │ │        │   │  PCA   │
└───────┘ └───────┘ └────────┘   └────────┘
                     ┌────────┐        │
                     │  Fan   │   ┌────┴─────┐
                     │        │   │ Capstan  │
                     └────────┘   │  Motor   │
                                  │and Tacho │
                                  └──────────┘
```

Figure 10-33. Order of Disassembly (2 PCA version)

Table 10-7. Diagnostic/Self-Test Errors (TERRORS) (2 PCA)

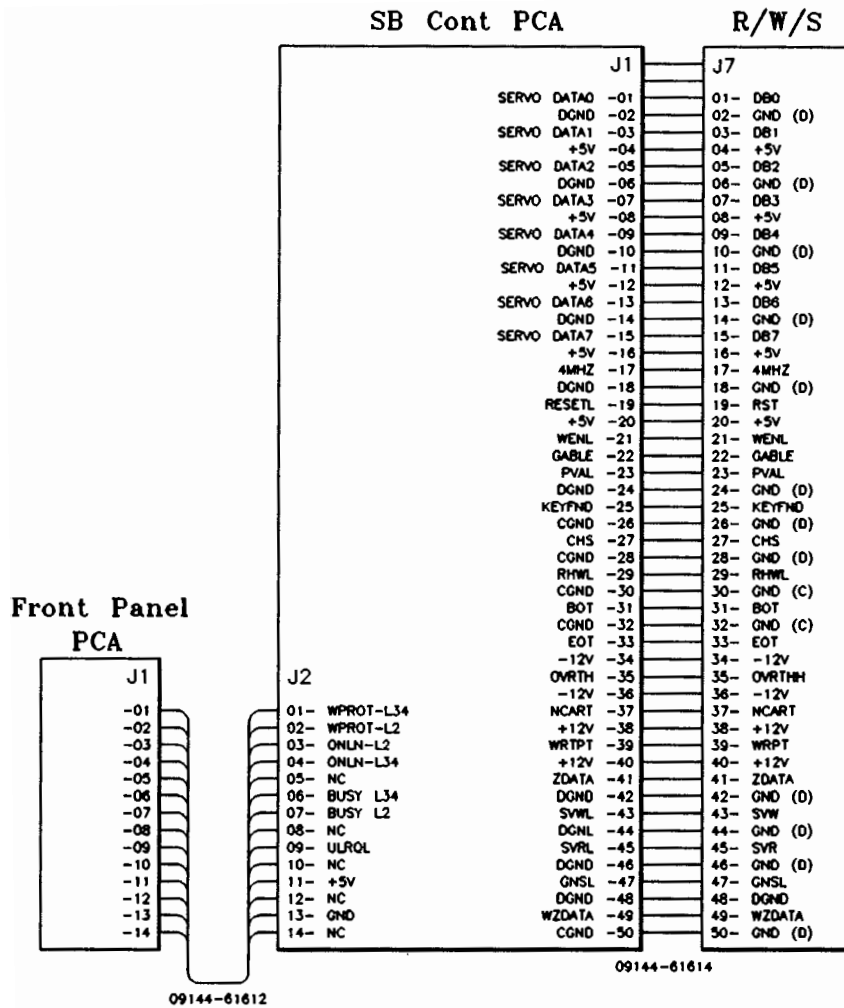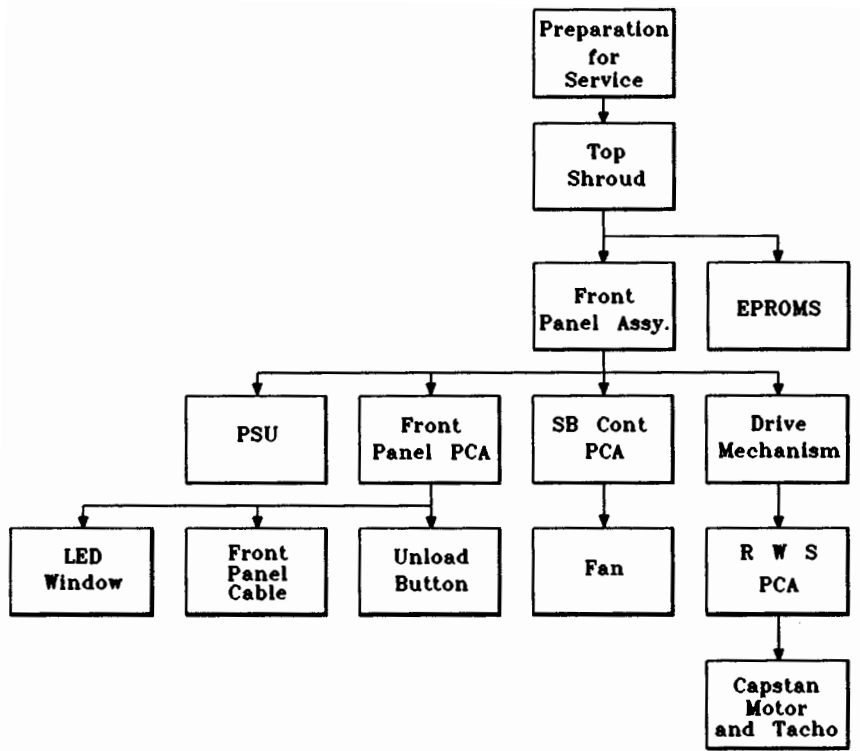| NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
00		Complete test of Tape Drive	
01		HDC-DDC Interface. Read Servo Status	SBCONT
02		DDC Circuitry	
03		a) Microcomputer test	SBCONT
04		b) Read/Write loopback	SBCONT
05		HDC-DDC Read/Write loopback.	SBCONT
06		HDC-DDC-Servo Interface	RWS, SBCONT
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 Read/Write circuitry. 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, SBCONT
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, SBCONT
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, SBCONT

Table 10-7. Diagnostic/Self-Test Errors (TERRORS) (2 PCA) continued

NUMBER		CAUSE	SUSPECT
DEC	**HEX**	**OR TEST DESCRIPTION**	**HARDWARE**
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, Stepper motor, SBCONT
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, SBCONT
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, SBCONT
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, SBCONT
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, SBCONT
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, SBCONT
22		Test the write portion of the Read/Write circuitry.	RWS
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, SBCONT, 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, SBCONT, Drive Mechanism

Table 10-8. Run-Time Drive Errors (DERRORS) (2 PCA).

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
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
180	B4	DMA handshake error (one byte) Overflow or underflow has occurred between HDC and DDC. (Marginal, recoverable or unrecoverable)	SBCONT
181	B5	DMA failure (one byte) Not enough frames detected during read or read-while-write. (Marginal recoverable, or unrecoverable)	SBCONT
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)	SBCONT
186	BA	Seek error (one byte) Seek to target required retries or failed because of time-out or keys past target. (Unit fault)	SBCONT

10-56

Table 10-8. Run-Time Drive Errors (DERRORS) (2 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
187	BB	Seek to a jump spare (one byte) A latency was induced due to seeking to a jump spare during transaction (Latency induced)	SBCONT
190	BE	Reposition failure (one byte) Reposition of tape to next target address after tape access command required retries or failed. (Unit fault)	SBCONT
193	C1	Log overflow (two bytes) Log indicated in postbyte overflowed. (Possible loss of entries) 0 = Manufacturer's block 1 = Sparing table 2 = Error rate test log 3 = Runtime error log 4 = Use log (Maintenance track overflow)	Tape Drive Subsystem: SBCONT, RWS Drive Mechanism
194	C2	Unable to read log (two bytes) 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)	Uninitialized cartridge, Tape Drive Subsystem: SBCONT, RWS Drive Mechanism
195	C3	Unable to write log (two bytes) Log indicated in postbyte could not be written on any track in multiple retries. Postbyte log codes are defined above. (Unrecoverable data)	

Table 10-8. Run-Time Drive Errors (DERRORS) (2 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
196	C4	Log only written on one track (two bytes) Log indicated in postbyte could only be written on one track rather than the usual two. Postbyte log codes are defined above. (Unrecoverable data)	
200	C8	Servo error (two bytes) Command to servo processor was not successfully executed. Postbyte contains status returned by servo processor: 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)	
206	CE	Load error (two bytes) This cartridge failed the load sequence. Failure is recorded in postbyte: 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)	

Table 10-8. Run-Time Drive Errors (DERRORS) (2 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
207	CF	Unload error (two bytes) This cartridge did not successfully complete the normal unload sequence (logs may not have been updated). Failure is recorded in postbyte: 1 = Diagnostic result indicated a hardware failure so normal unload was not attempted. 2 = Seek to EOT failed (Unit fault)	
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)	

Table 10-8. Run-Time Drive Errors (DERRORS) (2 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
223	DF	No buffers in system (one byte) No buffers are available to complete transaction. (Controller fault)	

1 PCA VERSION

The one PCA version first appeared in tape drives beginning at serial number prefix 2613. This consisted of a single Drive Electronics PCA which replaced the SBCONT and RWS PCAs. The new board was the same size as the SBCONT PCA and accommodated all the circuitry previously held on 2 PCAs. The circuitry itself remained functionally the same.

The replaceable parts which differ from the present version include:

    09144-66519 Drive Electronics PCA
    09144-61615 Drive Motor Extender Cable

The layout of the major electronic assemblies is shown in figure 10-34. Figure 10-35 shows the Drive Electronics PCA. Figures 10-36 and 10-37 show the cabling layouts.

Figure 10-38 shows the order of disassembly. When using this chart, refer to section 6 of the HP 9144A Hardware Support Manual for appropriate safety warnings and cautions.

Table 10-9 shows the Diagnostic/Self-Test Errors (which are displayed as a result of performing self-tests) and their interpretation. Table 10-10 shows the Run-Time Drive Errors (which may occur at any time, as the result of a fault) and their interpretation.

REVERSION TO 2 PCA DESIGN

In order to rationalize production of the HP 9144A and HP 9144S tape drives, it was decided that production of the HP 9144A should revert to the 2 PCA design which is detailed earlier in this section.

This reversion applies to tape drives beginning at serial number prefix 2808E. The main body of the manual has been updated to show the 2 PCA design, and the Replaceable Parts List has been amended accordingly.

Note that the Capstan Motor and Tachometer are no longer replaceable as separate items.
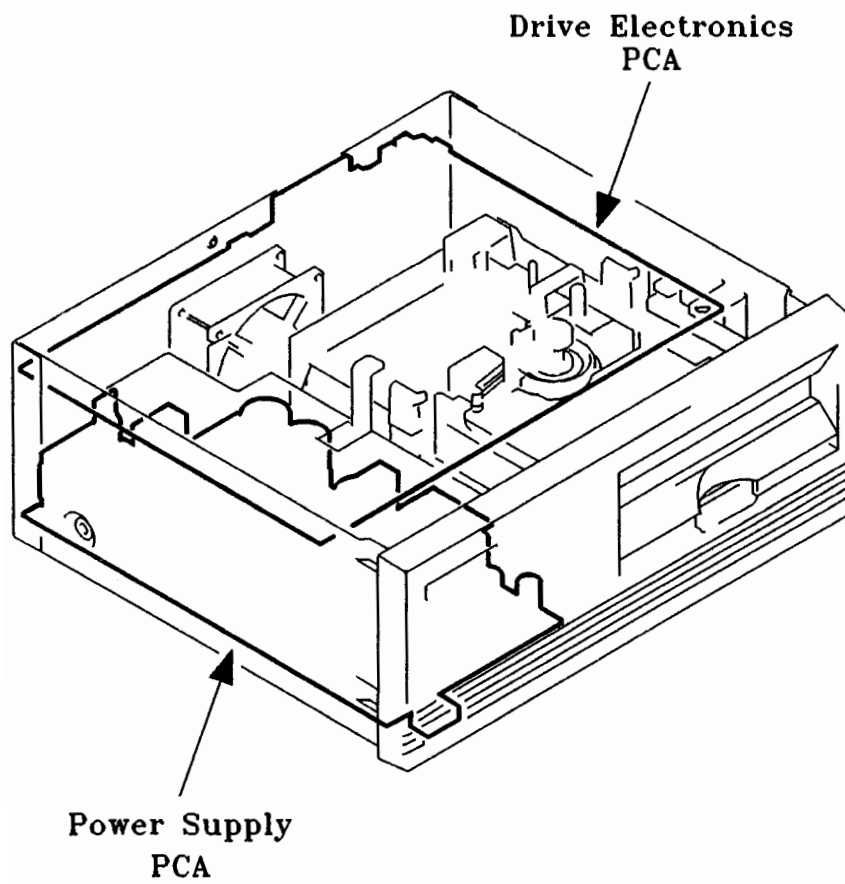
Figure 10-34. Location of Major Electronic Assemblies
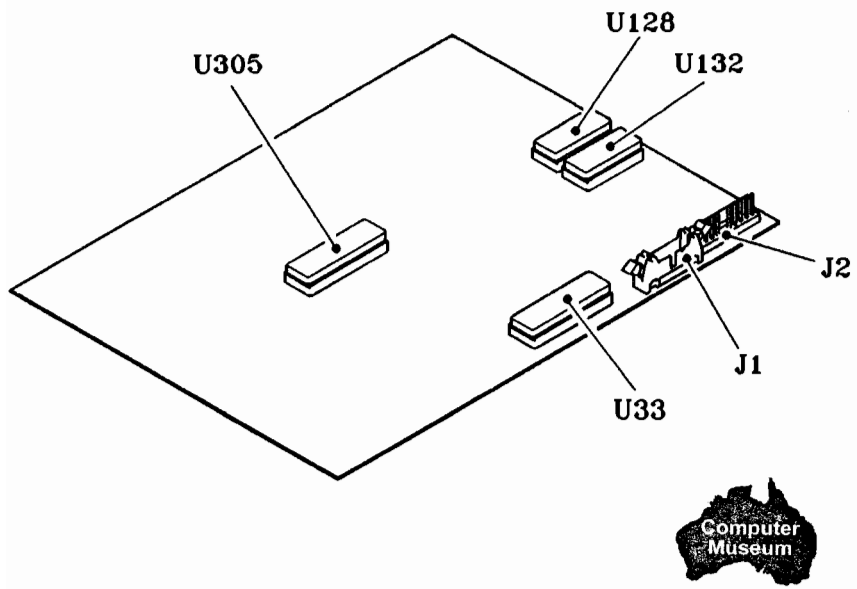
Figure 10-35. The Drive Electronics PCA (1 PCA version)

Fan

PSU

J2

+12VP	-01
GND	-02
+12VP	-03
GND	-04
+5V	-05
GND	-06
+5V	-07
GND	-08
+5V	-09
GND	-10
KEY	-11
PVAL	-12
+12V	-13
GND	-14
-12V	-15

DE PCA

J303

01-	MGND
02-	KEY
03-	NC
04-	+12VM

J2

01-	GND
02-	+5V
03-	GND
04-	+5V
05-	GND
06-	KEY
07-	PVAL
08-	+12V
09-	GND
10-	-12V
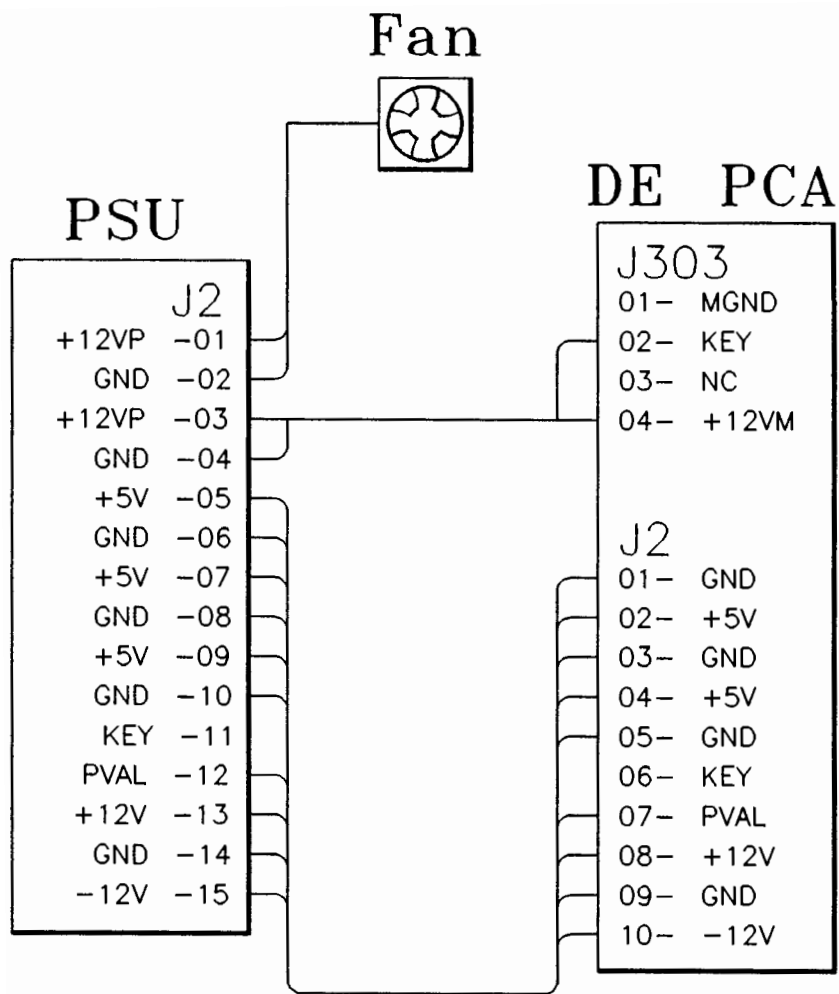
Figure 10-36. Power Cabling (1 PCA version)

10-64

Drive Electronics PCA

BOTTOM READ COIL

SHIELD

SHIELD

TOP READ COIL

J201
- 01 –
- 02 –
- 03 – GND
- 04 –
- 05 – KEY
- 06 – NC
- 07 – GND
- 08 –
- 09 –
- 10 –

BOTTOM WRITE COIL

SHIELD
SHIELD

TOP WRITE COIL

J202
- 01 –
- 02 –
- 03 –
- 04 – GND
- 05 – GND
- 06 – KEY
- 07 –
- 08 –
- 09 –

WRITE PROTECT SWITCH

CARTRIDGE IN POSITION SWITCH

J203
- 01 – GND
- 02 –
- 03 – GND
- 04 –
- 05 – KEY

Stepper Motor

J302
- 01 – BL1
- 02 – WH1
KEY – 03 –
- 04 – BL2
- 05 – WH2
- 06 – YL1
- 07 – YL2
- 08 – RD2
- 09 – RD1

Capstan Motor

J304
- 01 – –
- 02 – +
GND – 03 – CASE
KEY – 04 –

Optical Encoder

J301
- 01 –
GND – 02 –
- 03 –
KEY – 04 –
- 05 –

Front Panel PCA

J1
- 01 –
- 02 –
- 03 –
- 04 –
- 05 –
- 06 –
- 07 –
- 08 –
- 09 –
- 10 –
- 11 –
- 12 –
- 13 –
- 14 –

J1
- 01 – WPROT–L34
- 02 – WPROT–L2
- 03 – ONLN–L2
- 04 – ONLN–L34
- 05 – NC
- 06 – BUSY L34
- 07 – BUSY L2
- 08 – NC
- 09 – ULROL
- 10 – NC
- 11 – +5V
- 12 – NC
- 13 – GND
- 14 – NC

Figure 10-37. Drive Electronics Cabling (1 PCA version)

```
            ┌─────────────┐
            │ Preparation │
            │ for Service │
            │ Section 6-5 │
            └──────┬──────┘
                   │
            ┌──────┴──────┐
            │     Top     │
            │   Shroud    │
            │ Section 6-6 │
            └──────┬──────┘
          ┌────────┴────────────┐
   ┌──────┴──────┐      ┌───────┴──────┐
   │    Front    │      │    Drive     │
   │ Panel Assy. │      │ Electronics  │
   │ Section 6-7 │      │     PCA      │
   └──────┬──────┘      │ Section 6-13 │
          │             └──────┬───────┘
          │              ┌─────┴──────────┐
          │       ┌──────┴──────┐  ┌──────┴──────┐
          │       │     Fan     │  │   EPROMS    │
          │       │ Section 6-18│  │ Section 6-14│
          │       └──────┬──────┘  └──────┬──────┘
   ┌──────┴──────┐  ┌────┴────┐    ┌──────┴──────┐
   │    Front    │  │   PSU   │    │    Drive    │
   │  Panel PCA  │  │         │    │  Mechanism  │
   │ Section 6-8 │  │Section  │    │ Section 6-15│
   └──────┬──────┘  │  6-12   │    └──────┬──────┘
          │         └─────────┘    ┌──────┴──────┐
          │                        │   Capstan   │
┌─────────┼───────────┐            │    Motor    │
│         │           │            │  and Tacho  │
┌────┴───┐┌───┴────┐┌───┴────┐     │ Section 6-17│
│  LED   ││ Front  ││ Unload │     └─────────────┘
│ Window ││ Panel  ││ Button │
│Section ││ Cable  ││        │
│ 6-10   ││Section ││Section │
│        ││ 6-11   ││  6-9   │
└────────┘└────────┘└────────┘
```
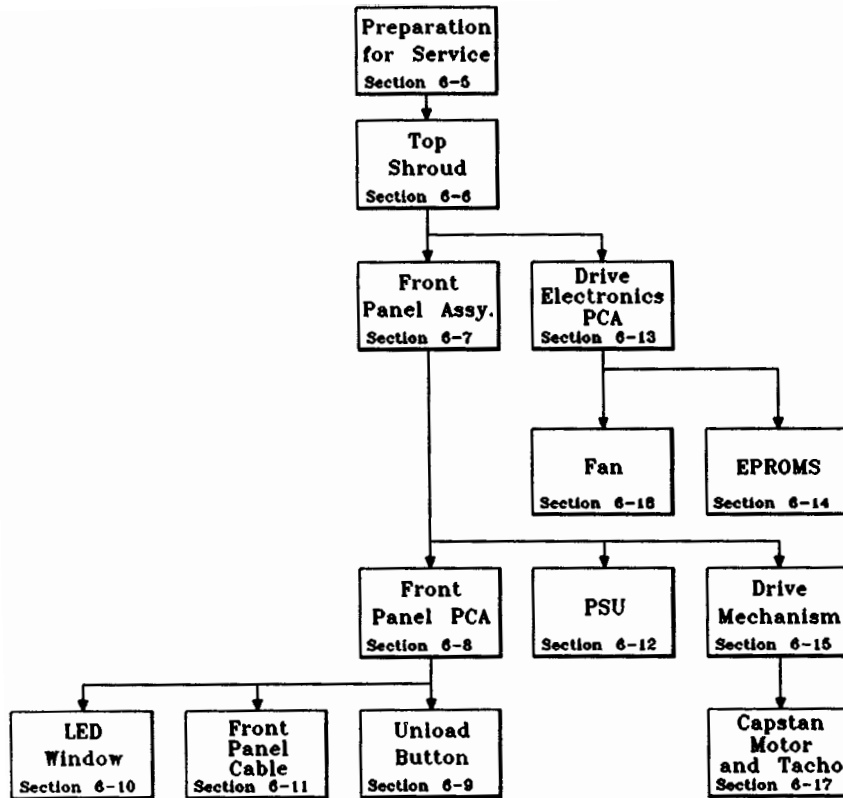
Figure 10-38. Order of Disassembly (1 PCA version)

Table 10-9. Diagnostic/Self-Test Errors (TERRORS) (1 PCA)

NUMBER		CAUSE OR TEST DESCRIPTION	SUSPECT HARDWARE
DEC	HEX		
00		Complete test of Tape Drive	
01		HDC-DDC interface. Read Servo Status	DE PCA
02		DDC Circuitry	
03		a) Microcomputer test	DE PCA
04		b) Read/Write loopback	DE PCA
05		HDC-DDC Read/Write loopback.	DE PCA
06		HDC-DDC-Servo Interface	DE PCA
07		Servo Circuitry	
08		a) Microcomputer	DE PCA
09		b) Capstan Motor Drive Circuit	DE PCA, Capstan Motor
10		c) Tachometer	DE PCA, Capstan Motor
11		d) Capstan Motor	Capstan Motor, DE PCA
12		e) Head Stepper Circuit	DE PCA and Head Stepper
13		Test the read portion of the R/W Circuitry	DE 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 the test number shown will be the failing test.	

Table 10-9. Diagnostic/Self-Test Errors (TERRORS) (I PCA) 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.	DE PCA
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.	DE PCA
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.	DE PCA
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.	DE PCA
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.	DE PCA
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.	DE PCA
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.	DE PCA
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.	DE PCA
22		Test the Write portion of the R/W Circuitry.	DE PCA

Table 10-9. Diagnostic/Self-Test Errors (TERRORS) (1 PCA) 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.	DE PCA, 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.	DE PCA, Drive Mechanism

Table 10-10. Run-Time Drive Errors (DERRORS) (1 PCA)

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
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
180	B4	DMA handshake error (one byte) Overflow or underflow has occurred between HDC and DDC. (Marginal, recoverable or unrecoverable)	DE PCA
181	B5	DMA failure (one byte) Not enough frames detected during read or read-while-write. (Marginal recoverable, or unrecoverable)	DE PCA
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)	DE PCA
186	BA	Seek error (one byte) Seek to target required retries or failed because of time-out or keys past target. (Unit fault)	DE PCA

Table 10-10. Run-Time Drive Errors (DERRORS) (1 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
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)	DE PCA
190	BE	Reposition failure (one byte) Reposition of tape to next target address after tape access command required retries or failed. (Unit fault)	DE PCA
193	C1	Log overflow (two bytes) Log indicated in postbyte overflowed. (Possible loss of entries) 0 = Manufacturer's block 1 = Sparing table 2 = Error rate test log 3 = Runtime error log 4 = Use log (Maintenance track overflow)	Tape Drive Subsystem: DE PCA Drive Mechanism
194	C2	Unable to read log (two bytes) 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)	Uninitialized cartridge, Tape Drive Subsystem: DE PCA Drive Mechanism
195	C3	Unable to write log (two bytes) Log indicated in postbyte could not be written on any track in multiple retries. Postbyte log codes are defined above. (Unrecoverable data)	

Table 10-10. Run-Time Drive Errors (DERRORS) (1 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
196	C4	Log only written on one track (two bytes) Log indicated in postbyte could only be written on one track rather than the usual two. Postbyte log codes are defined above. (Unrecoverable data)	
200	C8	Servo error (two bytes) Command to servo processor was not successfully executed. Postbyte contains status returned by servo processor: 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)	
206	CE	Load error (two bytes) This cartridge failed the load sequence. Failure is recorded in postbyte: 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)	

Table 10-10. Run-Time Drive Errors (DERRORS) (1 PCA) continued.

NUMBER		CAUSE	SUSPECT HARDWARE
DEC	HEX		
207	CF	Unload error (two bytes)	
		This cartridge did not successfully complete the normal unload sequence (logs may not have been updated). Failure is recorded in postbyte: 1 = Diagnostic result indicated a hardware failure so normal unload was not attempted. 2 = Seek to EOT failed (Unit fault)	
209	D1	Not certified	None
		This cartridge is not certified. (Uninitialized media)	
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)	

11-1. INTRODUCTION

Twenty-five service notes exist at the time of printing.

9144A-1

S E R V I C E   N O T E

Supersedes:

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

9144A
09144-69512
S/N 2440A00779

SINGLE BOARD DDC

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

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

WARRANTY EXTENDED UNTIL:

Beginning with serial number 2440A00779 9144A 1/4 inch tape drives will be
manufactured with a single board Device Dependent Controller(SBDDC) P/N
09144-69512. The single board DDC replaces the dual board DDC P/N 09144-68702
and can be built on one board the same size as one of the dual board pair
using VLSI technology.

The single and dual board DDC's are functionally identical. The single
board has been implemented on the CSR exchange program and will
obsolete the dual board which is not an exchange assembly. Current inventory
of dual board DDC's may still be used as repair parts and when the supply
has been depleted all defective DDC's may be repaired by the single board
DDC.

KR/tm   11/20/84-5800

S E R V I C E   N O T E

Supersedes:

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

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

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

WARRANTY EXTENDED UNTIL:

9144A
09144-67501
S/N 2440A01150

SEALED MOUNTING SCREWS

Problem: The screws which mount the cartridge locking mechanism to the drive
motor housing are sealed with an orange colored anti-tamp sealer
making the Drive Motor/Tach Assembly, P/N 09144-65209, difficult to
remove if a failure were to occur.

Solution: The Drive Motor/Tach Assembly, P/N 09144-65209, is a field replaceable
part that is mounted to the Drive mechanism P/N 09144-67501 and
consists of the capstan motor, capstan, encoder disc, and motor
housing. The eject button locking mechanism uses the motor housing as
a mounting location and must be removed in order to replace the Drive
Motor/Tach Assembly.

9144A tape drives built before serial number 2440A01150 and drive
mechanims with electrical date codes prior to 2440 will require that
the orange colored sealer be scraped off with an x-acto knife
before removing the mounting screws. When installing the new Drive
Motor/Tach Assembly the locking mechanism should be mounted with new
screws P/N 0510-0150 and lockwashers P/N 2190-0643. These parts
may be obtained from CPC and should be stocked as service inventory.

KR/tm   11/19/84-5800

S E R V I C E   N O T E

Supersedes:

APPLIES TO:	All Lines ☒		Only Lines on Agreement ☐
PERFORM:	Immediately ☒		At Performance Call ☐
	On Failure ☐		Information Only ☐

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

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

WARRANTY EXTENDED UNTIL:

9144A

09144-69512
OLD DATE CODE: 2412

09144-69522
NEW DATE CODE: 2445

IMPROPERLY TERMINATED Vpp PIN

PROBLEM: The DDC microcomputer may hang when the high end of its temperature
threshold rating is approached.

SOLUTION: Certain lots of the DDC microcomputer are more sensitive to
temperature variation than others. The EPROM versions of the
microcomputer on the 09144-69512 board improperly terminated
the Vpp pin causing the part to exhibit an even greater sensitivity
to temperature. The proper termination for the Vpp pin is
to tie it to Vcc, but on boards with electrical date code prior to
2412 the pin has been grounded. Single board DDCs manufactured
after electrical date code 2412 and which have the EPROM
version of the microcomputer, properly terminate the Vpp pin to
Vcc minimizing the parts susceptibility to temperature variations.

Return all service inventory of 09144-69512 Single Board DDC's
to CSR for upgrade (this will affect approximately 25 boards in
FSI). The exchange part number for the Single board DDC will be
changed to the new number, 09144-69522.

KR/tm

12/10/84-5800

S E R V I C E   N O T E

Supersedes:

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

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

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

WARRANTY EXTENDED UNTIL:

9144A
09144-69515

S/N 2444A001281

Single Board Controller

Beginning with serial number 2444A01281 9144A tape drives will be
manufactured with a Single Board Controller (SBCONT) P/N D9144-69515.
The SBCONT incorporates both the Host Dependent Controller (HDC) and Device
Dependent Controller (DDC) on one PCA lowering manufacturing cost and increas-
ing reliability. The new assembly will replace the HDC and DDC in the prod-
uction of 9144A tape drives but does not obsolete them. The HDC and DDC will
remain in production with the 794X family of disc/tape drives indefinitely.

The service strategy for the HDC, DDC, and SBCONT may be illustrated as follows:

1) A dual pipeline consisting of the SBCONT and HDC/DDC pair will be supported.
   This means that a SBCONT failure will be repaired by a SBCONT, and a
   defective HDC or DDC will be repaired with the appropriate HDC or DDC.

2) If the HDC or DDC go out of production at some point in time causing service
   inventory of these boards to be depleted, the SBCONT may be used to repair
   a defective HDC or DDC. See service note 9144A-5.

Exchange Assembly	Assembly Name	Repair Part/s
09144-69515	Single Board Controller	09144-69515
09144-69522	Single Board DDC	09144-69522
D9144-68702 (non-exchange)	Dual Board DDC	09144-68702 or 09144-69522 **
07940-69095	HDC	07940-69195 ***
07940-69195	HDC(RFI jumper)	07940-69195

** The 09144-68702 Dual Board DDC has been obsoleted by the 09144-69522
   Single Board DDC. This new board may be used exclusively for any DDC
   failure when all dual DDCs that are in FSI are gone. See service notes
   9144A-1 and 9144A-3.

*** The 07940-69095 is identical to the 07940-69195 with the exception of
    a jumper that has been added to further minimize RFI. The 07940-69195
    replaces the 07940-69095. See service note 7945A-2.

S E R V I C E   N O T E

Supersedes:

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

9144A
Serial Number 2505A02195

FSI Firmware Upgrade

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

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

WARRANTY EXTENDED UNTIL: March 1, 1986

Problem:

9144A 1/4 inch cartridge drives beginning with serial number 2505A02195
will be produced with firmware which finalizes the support of the drive on
3000 computer systems which·have the T MIT or later version of the MPE
operating system. Drives with serial numbers prior to 2505A02195 may contain
versions of firmware which are not supported by this operating system.
The following table illustrates revisions of firmware that may exist in
9144As:

ROM

S/N PREFIX	CHANNEL	UPPER UNIT	LOWER UNIT	DDC PROCESSOR
2418A	07940-89010	09144-89512	09144-89202	09144-89801
2434A	07940-89020	D9144-89513	09144-89203	01944-89802
2435A	07940-89020	09144-89513	09144-89203	09144-89803
2436A	07940-89020	09144-89513	09144-89203	09144-89804
2451A	07940-89030	09144-89514	09144-89204	09144-89805
2505A	07940-89040	09144-89515	09144-89205	09144-89806

SOLUTION:

FSI of Unit and DDC Processor ROMs should be upgraded to the new firmware
using the following upgrade·kits which are available from CPC:

KR/tm   5800-2/22/85

P/N to UPGRADE	NAME	UPGRADE KIT P/N
09144-69515	Single Board Controller	09144-10320
09144-69522	Single Board DDC	09144-10350
09144-68702	Dual Board DDC	09144-10350
09144-10302/3	HDC ROM KIT	09144-10305

Greeley Division will accept .3 hours labor for performing upgrades to FSI.
Return the old ROMs to CPC. See service note 9144A-6 for details on upgrades
done to HP 3000 Series 37's or HP1000's.

S E R V I C E N O T E

Supersedes:

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

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

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

WARRANTY EXTENDED UNTIL:	March 1, 1986

9144A

NEW PART NUMBERS:
09144-89806- ODC processor
09144-89205- Lower unit ROM
09144-89515- Upper unit ROM
07940-89040- Channel ROM

S/N PREFIX 2505A

Firmware Solution for 1000 and 3000 Systems

Symptom:

9144As prior to serial number prefix 2505A contain revisions of firmware which
may cause: 1) hang conditions when used with T MIT on the series 37 computer,and
2) Device Timeout errors while doing a copy in TF on the 1000 A series with
the A.84 operating system.

Solution:

If a 9144A with serial number prefix prior to 2505A is configured into either a
Series 37 or a 1000 A series computer and is exhibiting the errors mentioned
above, then an upgrade to the firmware in the 9144A is necessary. An upgrade kit
P/N 09144-10320 is available at CPC and may be used to upgrade any 9144A that
may be connected to these systems. Follow the appropriate instructions for the
type of system being upgraded.

 Series 37:
 ----
a) The upgrade to these systems will be done concurrently with the upgrade
   being done by CSY for the series 37, not separately. This should involve
   approximately 300 customer and demo units. (See service note 30459-001)

b) Billing Information: CSY and GLD will accept warranty for labor,travel, and
   parts for each upgrade performed but on separate CSOs as follows:

Upgrades	NA-ICON		European	
	Demo/Trng Systems	Customer Systems	Demo/Trng Systems	Customer Systems
Combination PIC/9144A PIC Materials 9144A Materials 1 Hr. Labor Zone Travel	N/A	CSY-R-D500 GLD-5800 GLD-5800 CSY-R-D500	N/A	BCD/B200 GLD/5800 GLD/5800 BCD/B200
PIC Only PIC Materials ½ Hr. Labor Zone Travel	CSY-R/D500 CSY-R/D500 N/A	CSY-R-D500 CSY-R/D500 CSY-R/D500	BCD/B200 BCD/B200 N/A	BCD/B200 BCD/B200 BCD/B200
9144A Only 9144A Materials ½ Hr. Labor Zone Travel	GLD/5800 GLD/5800 N/A	GLD-5800 GLD-5800 GLD-5800	GLD/5800 GLD/5800 N/A	GLD/5800 GLD/5800 GLD/5800

```
Customer Units- 1 CSO to CSY for PIC upgrade materials and travel
               1 CSO to GLD for $100 parts and 1 hour labor

Demo/Training Units- 1 CSO to CSY for PIC upgrade materials and .5 hrs labor
                    1 CSO to GLO for $100 parts and .5 hrs labor
```

Note that two CSOs must be submitted for each upgrade performed, and that
no travel will be accepted for demo and training unit upgrades.

1000 A series with A.84:
----
a) Perform this upgrade immediately on all 9144As connected to 1000 A series
computers using the RTE-A A.84 operating system. Greeley will accept warranty
billing for $100 parts, 1 hour labor, and travel to perform upgrades to these
systems. The repair order must include the system serial number to ensure
proper warranty billing.

Do not perform this upgrade on any systems other than Series 37's or
HP 1000's. Return the old ROMs to CPC.

Note that this firmware does not allow HP 1000A Series computers to support
the 9144A as a boot device.

11-9

S E R V I C E   N O T E

Supersedes:

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

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

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

WARRANTY EXTENDED UNTIL:

9144A
Serial Number Prefix: 2451

Temperature Sensitivity Safeguard

9144A tape drives prior to serial number prefix 2451, which are exposed
to large temperature variations, may experience off track conditions
due to tape shifting with respect to the head. This could potentially
happen in data logging applications in which the drive is subjected to
wide temperature variations (10 degrees C). The off track condition
can only occur if the temperature increases or decreases more than 10
degrees C, and a write operation occurs after the temperature swing without
an intervening read operation. In order to compensate for tape shift under
these extreme conditions the following preventive measures have been
designed into the new 9144A firmware:
1) Any full volume action such as a certify, store, or restore will cause
   the 9144A to do a full edge find before completing the operation.
2) If 32 minutes have transpired since the last command was received
   an "edge-check" will be initiated. If the edge check fails then a full
   edge find will be done.
3) If the tape is positioned at EOT and an edge check is required, the tape
   will be wound to BOT where a full edge find will be done.

The edge find algorithm accomodates differences in tape/head positioning
which can occur from cartridge to cartridge by finding the true edge of
tape and stepping up 15 steps to locate track zero. When extreme temperature
variations cause the tape to shift slightly, re-doing the edge of tape find
restores the original positioning of the tape and the head. This keeps track
zero referenced properly and protects against writing off track.

Note that the problem described above can occur only under rare circumstances.
If a customer is using a drive prior to serial number prefix 2451 under these
extreme conditions and is also experiencing data errors, please contact
Greeley support.

KR/tm   1/17/85 - 5800

S E R V I C E   N O T E

Supersedes:

9144A

AFFECTED SERIAL NUMBERS:

2444A
2451A
2505A

1000/9144A BOOT LATENCY

APPLIES TO:	All Units ☒		Only Units on Agreement ☐
PERFORM:	Immediately ☐		At PM/Normal Call ☐
	On Failure ☒		Information Only ☐
WARRANTY:	EXTENDED	NORMAL	NONE
LABOR:	X		
PARTS:			X
TRAVEL:	X		
SERVICE	Return for update ☐		Use as is ☐
INVENTORY	Return for salvage ☐		See text ☒
WARRANTY EXTENDED UNTIL:		April 1/86	

Problem: A firmware change made to 9144A's beginning with serial number prefix 2451 implemented a temperature safeguard algorithm which caused either an edge-check or a full 30 second edge-find to be performed for certain tape operations. Anytime a full volume action is issued to the tape a 30 second edge-find is done to ensure that the tape hasn't shifted due to an unusually rapid change in temperature (>10 degrees C per hour). The Boot Rom found in 1000 A series computers loads the operating system off of the 9144A by repeatedly issueing full volume read commands and after 1K block of data is read "untalks" the drive off the bus. But each time the full volume read is issued to the drive a full 30 second edge-find is done. This time delay to perform multiple edge-finds introduces an abnormal latency when either loading the diagnostics or the operating system.

Solution: The temperature compensation algorithm will be changed so that only full 30 second edge-finds are performed when the starting address of a full volume read command begins at block 0. This will allow for an adequate temperature safeguard while eliminating unnecessary edge-finds. 9144A's beginning with S/N prefix 2519 will contain new Lower Unit code P/N 09144-89206 and Upper Unit code P/N 09144-89516 correcting the problem.

If a 9144A is encountered on a 1000 A series computer using either RTE-A A.84 or A.85 and experiencing this abnormal latency when loading either the operating system or the diagnostics, the Upper and Lower unit code should be replaced using the HDC ROM kit P/N 09144-10306. Warranty billings for .5 hours labor and travel will be accepted when the CSO includes the system serial number. Order the 09144-10306 HDC ROM KIT from CPC and return the old ROMs for credit.

Computer Museum

11-11

S E R V I C E   N O T E

Supersedes:

9144A

S/N PREFIX
2505A03300 TO
2519A03567

INCORRECT FIRMWARE PART NUMBER

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

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

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

WARRANTY EXTENDED UNTIL:

Problem: 9144A tape drives manufactured between S/N's 2505A03300 and 2519A03567
         may have an incorrect part number label on the Channel Rom, which is
         inserted in location U142 on the Single Board Controller assembly P/N
         09144-69515.

         INCORRECT PART NUMBER: 09144-89050

         CORRECT PART NUMBER: 07940-89050

Solution: Since the improperly labeled ROMs will not affect the performance
          of the drive, no specific field action is necessary. This error
          has affected production units only. Field inventory of 09144-69515
          Single Board Controllers are unaffected.

KR/tm   05/09/85 - 5800

S E R V I C E   N O T E

Supersedes:

9144A

S/N 2519A03764

Old Part Number: 09144-60094
New Part Number: 09133-67120

NEW POWER SUPPLY

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

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

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

WARRANTY EXTENDED UNTIL:

9144As beginning with serial number 2519A03764 will be manufactured with
a new power supply assembly P/N 09133-67120. This new assembly replaces
the 09144-60094 supply and improves performance and reliability. Both power
supplies may be used to repair power supply failures in the 9144A. Existing
inventory of 09144-60094 assemblies may be used until gone.

The 09133-67120 and the 09144-60094 power supplies are not exchange assemblies
and are thrown away on failure.

KR/tm   05/22/85 - 5800

S E R V I C E   N O T E

	Supersedes:	None

9144A

1/4 INCH TAPE DRIVE

Serial number:
New Prefix: 2522A

9144A/3000 Mount-Dismount

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

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

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

WARRANTY EXTENDED UNTIL:	8/1/86

Situation:

Mount and Dismount messages on 3000 computer systems may not be returned to the user console when doing STOREs and RESTOREs to a 9144A prior to S/N prefix 2522A

Cause:

Whenever the 9144A receives a command to do an Immediate Report/Read Ahead, the commands which enable the drive to stream, the Release Request bit in the status field is being masked out. This prevents the host from being aware of a user request for unload. Consequently, the system would not see that the 9144A has loaded or unloaded a cartridge and the appropriate Mount or Dismount message would not be sent to the console. Multiple REPLY commands will also have to be issued before the host will respond. Doing a DSTAT to the device would clear the condition and allow the host to once again recognize the drive.

Solution:

A change in 9144A Unit code and DDC processor modifies the way status information is returned to the Host Dependent Controller (HDC) from the Device Dependent Controller (DDC). This change keeps the Request Release information intact during Immediate Report/Read Ahead command phases allowing the Mount/Dismount message to be issued to the console.

If a user of a 3000 system with a 9144A determines that the Mount/Dismount message returns are unsatisfactory, then the Unit code and DDC processor may be upgraded. Warranty billings for $131 parts and .5 hours labor will be accepted by GLD. Travel will only be paid for those systems that have on-site warranty only. The CSO must include the system serial number. Order upgrade kits 09144-10352 (DDC Rom) and 09144-10307 (Unit Roms) and discard the old Roms.

KR/5800   6/13/85

S E R V I C E   N O T E

9144A

1/4 INCH TAPE BACKUP

Serial number:
2522A

9144A/791X INTERCHANGEABILITY

	Supersedes: 9144A-12		
APPLIES TO:	All Lines ■	Only Lines on Agreement ❑	
PERFORM:	Immediately ❑	At PM/Normal Call ❑	
	On Failure ■	Information Only ❑	
WARRANTY:	**EXTENDED**	**NORMAL**	**NONE**
LABOR:	X		
PARTS:	X		
TRAVEL:	X		
SERVICE	Return for update ❑		Use as is ❑
INVENTORY	Return for salvage ❑		See text ■
WARRANTY EXTENDED UNTIL:	06/01/86		

Situation:
   9144A and 791X 1/4 inch tape drives may experience interchange problems when
   9144As prior to S/N prefix 2522A are involved.

Cause:
   Although compatability exists in most cases between the two drives, certain drive
   parameters may cause data cartridge interchangeability to be marginal.

Solution:
   Increasing the gain of the read channel in the 9144A has shown to significantly
   improve interchange problems between the 9144A and 791X tape drives. Under cer-
   tain conditions, the DDC processor firmware will double the gain of the read
   channel and re-attempt a read if difficulty was encountered reading a block due
   to low amplitude.

   If a clear interchange problem exists between a 9144A and a 791X tape drive, then
   upgrading the DDC processor AND UNIT ROMS in the 9144A may be helpful. Extended
   warranty for PARTS and .3 hours labor will be accepted. Order P/Ns 09144-103S3
   and 09144-103O8 from CPC and discard the old parts.

   NOTE: In ALL cases when interchangeability is suspected, the data cartridge must
         be eliminated as a source of the problem. To do this the failure should be
         repeated on more than one known good data cartridge.

KR   11/7/85 - 5800

9144A

1/4 inch tape backup

Serial number:
S/N PREFIX 2522A

Rev. 7 Firmware Part Numbers

Supersedes:

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

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

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

WARRANTY EXTENDED UNTIL:	N/A

Situation:

Firmware in the 9144A has been changed to revision 7 in 9144As beginning with
serial number prefix 2522A. The code changes have been made to incorporate en-
hancements to several modules within the firmware structure and to provide the
capability for hardware reductions on the 09144-69515 Single Board Controller in
the future.

NAME	OLD P/N	NEW P/N
Lower Unit Rom	09144-89516	09144-89517
Upper Unit Rom	09144-89206	09144-89207
DOC Processor	09144-89807	09144-89808

Note that only the above Roms were modified for this firmware revision and that
no field action is necessary. All Roms reside on the Single Board Controller
assembly.

KR
7/12/85

S E R V I C E   N O T E

Supersedes: NONE

9144A

1/4" Tape Drive

NEW PART NUMBERS:

09144-89208 Lower HDC ROM
09144-89518 Upper HDC ROM
09144-89211 DDC Processor

S/N PREFIX 2541A
         2541E

FIRMWARE CHANGES

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

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

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

WARRANTY EXTENDED UNTIL:

Beginning with serial number prefix 2541A and 2541E, 9144A 1/4" tape drives will be manufactured with new firmware. The new ROMs are all located on the Single Board Controller PCA (09144-66515).

The changes were made for a data corruption problem seen on the 7942A and 7946A products (see Service Note 7942/6-05).

TL/vn   8/11/85

S E R V I C E   N O T E

Supersedes: None

HP 9144A ¼-inch Tape Drive

New Part Numbers: 09144-66518

Read/Write Servo PCA

09144-61612
Drive Cable Assembly

S/N Prefix: 2542A
         2542E

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

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

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

WARRANTY EXTENDED UNTIL: N/A

Beginning with serial number prefix 2542A and 2542E, HP 9144A tape drives will
be manufactured with a Read/Write Servo PCA, P/N 09144-66518 (exchange P/N
09144-69518). The new PCA incorporates both the read/write and servo functions,
lowering manufacturing costs and increasing reliability.

The new assembly will replace the Read/Write and Servo PCAs in production of
9144A tape drives, but does not obsolete them. The separate Read/Write and
Servo PCAs will remain in production with the 794X family of disc/tape drives
indefinitely.

The service strategy for the separate Read/Write, Servo and combined Read/Write/
Servo PCAs is as follows:

A dual pipeline consisting of the combined Read/Write Servo (09144-69518) and the
Servo/Read/Write pair (09144-69517 and 09144-69513) will be supported. This means
that a combined Read/Write/Servo failure will be repaired with a 09144-69518 and
a defective Read/Write or Servo will be repaired with the appropriate Read/Write
or Servo PCA.

The new drive cable 09144-61614 links the Single Board Controller (09144-66515)
with the new PCA. It is available from CPC/PCE.

TL/VN - C600   25 October 1985

9144A ½-Inch Tape Drive

Part Number: 3140-0696

HEAD-STEPPER MOTOR

	Supersedes:	None	
APPLIES TO:	All Units ■		Only Units on Agreement ◻
PERFORM:	Immediately ◻		At PM/Normal Call ◻
	On Failure ◻		Information Only ■

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

SERVICE	Return for update ◻	Use as is ◻
INVENTORY	Return for salvage ◻	See text ■

WARRANTY EXTENDED UNTIL:

The Head-Stepper Motor (part number 3140-0696) is no longer available as a Field Replaceable Assembly. Investigation into Read/write head positioning accuracy has determined that the Drive Mechanism may not meet its specification after the Head-Stepper Motor has been replaced.

Drive mechanisms that have had a Head-Stepper Motor changed may have trouble reading previously written tape cartridges. As this part has a low failure rate any future failures should be repaired by replacing the Drive Mechanism.

All field inventory of 3140-0696 should be returned to CPC/PCE for credit.

S E R V I C E   N O T E

	Supersedes:

HP 9144A ¼-Inch Tape Drive

New Part Numbers:

09144-89209   Lower HDC ROM
09144-89519   Upper HDC ROM

S/N Prefix   2550A
             2550E

FIRMWARE CHANGES

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

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

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

WARRANTY EXTENDED UNTIL: N/A

Beginning with serial number prefix 2550A and 2550E, 9144A 1/4 inch
tape drives will be manufactured with new firmware. The new ROMs are
all located on the Single Board Controller (part number 09144-66515,
exchange part number 09144-69515).

Changes have been made to detect the insertion of the HP Cleaning
Cartridge (product number 92193E) available in March '86. These
changes do not affect the cartridge load sequence but will change the
cleaning procedure in current use. To raise the Read/write head for
cleaning it is only necessary to depress the Cartridge-in-place switch
ONCE. The Read/write head will first move to it's lowest position and
make a ratcheting noise (as occurs after unloading a tape), then be
raised for cleaning. If the switch is depressed again the cycle is
repeated. To use the Cleaning Cartridge refer to the Operating
Instructions supplied with the Cleaning Cartridge.

N.B. Earlier versions of the 9144A can be upgraded to detect the HP
Cleaning Cartridge as follows:-

Serial No. Prefix	Action
2538 and earlier	Replace DDC Processor ROM with 09144-89811 or later. Replace Lower HDC ROM with 09144-89209. Replace Upper HDC ROM with 09144-89519.
2541 and earlier	Replace Lower HDC ROM with 09144-89209. Replace Upper HDC ROM with 09144-89519.

TL/vn   08/08/86   PCO #   C600

Supersedes: NONE

HP 9144A ½-inch Tape Drive

NEW PART NUMBER:

 09144-89812 DDC Processor

SERIAL NUMBER PREFIX: 2606E

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

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

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

WARRANTY EXTENDED UNTIL:

FIRMWARE CHANGES

Beginning with serial number prefix 2606E, 9144A ½-inch tape drives will be manufactured with new firmware. The new ROM is located on the Single Board Controller PCA (09144-66515).

Improvements have been made to the effectiveness of the self-test algorithm. System operation and the way that self-test results are displayed have not changed. The new firmware is backwards compatible but it is not necessary to update earlier tape drives.

TL - C600   2/86

SERVICE NOTE

Supersedes: 9144A-20

9144A 1/4" TAPE DRIVE

SERIAL NUMBER 2550E03523
TO SERIAL NUMBER 2620E05271

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

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

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

WARRANTY EXTENDED UNTIL: August 1987

HEAD CABLE SHIELDING PROBLEM

SYMPTOM
9144A drive mechanisms incorporated into drives manufactured between the above serial numbers may exhibit the following symptoms:

1) Read performance OK

2) Poor error rate during write operations with an excessive number of retries

3) Improvement to write performance will be noticed if the head cables are separated as shown in drawing 1.

CAUSE
The head cable shielding on some heads stops short of the main head block. This gives rise to cross-talk problems which become worse if the cables are close together, as shown in drawing 2. The symptoms are due to the cross-talk corrupting the read data during the read-after-write operation. There is no question of the drive writing corrupt data.

SOLUTION
If the drive is within the serial number range shown above and is exhibiting the symptoms described above, the mechanism
(P/No 09144-69501) should be changed as the head is not a field replaceable part.

Charge CPB (Div C600) 1.0 Hr labour, parts and travel only, quoting this service note as authority.
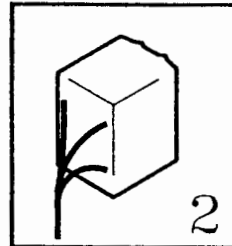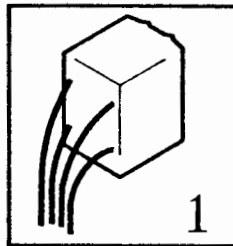
TR - C600   30/6/86

S E R V I C E   N O T E

Model(s) Affected:

9144A

APPLIES TO:	All Units

NEW PART NUMBERS

PERFORM:	FOR INFORMATION ONLY

09144-89251

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

09144-89324
09144-89524

SERVICE INVENTORY	RETURN FOR UPDATE

REPLACES PART NUMBERS RESPECTIVELY

WARRANTY EXTENDED UNTIL:	N/A

09144-89221

DATE ISSUED:	1/10/88	BY: CGR

09144-89209
09144-89519

FIRMWARE CHANGE TO REV 10.

Purpose:

To notify the field of a firmware change.

Problem:

It has been identified during the manufacturing process of the 9144A
mechanisms, that while loading a tape in the mechanism occassionally the tape
will despool. This problem has no concern to the customer after the tape has
loaded.

Solution:

The problem has been fixed by changing the firmware code of the 9144A. The most
likely combination of drive that might exhibit this fault is the single pca
version of the 9144A (p/n 09144-66519) used with old tapes. The problem is un-
likely to occur with the 2 board version ** (see below) or greater. If this
problem is seen in the field, the firmware should be updated to p/n
09144-89251. The new firmware has been incorporated into the drives with
serial prefix 2721E onwards and hence these drives should not exhibit the
problem of despooling.

S E R V I C E   N O T E

** For 2 or greater board versions please note that there are two firmware roms
(p/n 09144-89324 and -89524 which replace 09144-89209 and -89519.)

09144-89251   U128

09144-89209   U133

09144-89519   U150

We do not believe that this problem will be seen in the field but if it is
please call Technical Marketing at CPB on 44 272 799910

2

S E R V I C E   N O T E

SUPERSEDES:	NONE		

Model(s) Affected:

9144A

NEW PART NUMBER

09144-69518   R/W/S BOARD

REPLACES PART NUMBERS

09144-69513   READ/WRITE BOARD
09144-69517   SERVO BOARD

APPLIES TO:	All Units		
PERFORM:	INFORMATION ONLY		
WARRANTY:	EXTENDED	NORMAL	NONE
LABOR:			X
PARTS:			X
TRAVEL:			X
SERVICE INVENTORY	USE AS IS		
WARRANTY EXTENDED UNTIL: N/A			
DATE ISSUED:	1/14/88	BY: CGR	

Purpose:

To notify the field of a change in the support strategy for the read/write (09144-69513) and servo (09144-69517) boards.

If a read/write and/or a servo board are replaced in the field, a R/W/S board (09144-69518) should be used in their place. When all stock of 513 and 517 is gone.

Through this program it will be possible to return a read/write and servo boards in exchange for a R/W/S board via the Exchange Program.

Action:

To replace the read/write and servo boards with a R/W/S take the following steps:

Remove the two defective boards. Screw the 4 spacers that were located between the boards on to the 4 outermost legs of the mechanism casting. Attach the cables on the R/W/S board and with the components facing down towards the casting, screw the board to it. The flat cable connecting the 2 boards to either the SBController or the DDC is replaced by the cable 09144-61614 which connects the R/W/S to the SBController.

1

S E R V I C E   N O T E

NOTE: When performing this conversion you will need in addition to the R/W/S
board, the cable p/n 09144-61614 (connecting the SBCONT and the R/W/S.)

The Cable 09144-61614 should be purchased separately from CPC/PCE.

2

S E R V I C E   N O T E

Model(s) Affected:

9144A

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

NEW SERIAL PREFIX: 2808E

SERVICE INVENTORY	SEE TEXT

WARRANTY EXTENDED UNTIL: N/A

DATE ISSUED:	5/11/88	BY: CGR

Purpose:

To notify the field of a change in configuration of the 9144A.

Solution:

From Serial Prefix 2808E the 9144A Tape Drive will be manufactured with a Single Board Controller (SBCONT) p/n 09144-69515 and a Read/Write and Servo pca (R/W/S) p/n 09144-69518.

CPB are re-introducing the SBCONT and R/W/S due to it being consistent with the tape drive configuration that is being integrated into the new HP MICRO 3000LX (32520A) and 3000GX (32536A).

NOTE:

With this re-introduction, a problem has been encountered with the layout of the self test and display results switches on the SBCONT with respect to the base assembly. The switches do not line up with the holes at the back of the base assembly. Until the board is revised the switches will be shorter and capped so that a larger surface area will be visible. All exchange boards will have the shortened switches to ensure that if they are fitted into current chassis the holes will align.

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Supersedes:			
APPLIES TO:	All Units ■		Only Units on Agreements/Warranty ☐
PERFORM:	Immediately ☐		At PM/Normal Cos ☐
	On Failure ☐		Information Only ■

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

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

WARRANTY EXTENDED UNTIL:	N/A

`Model(s) Affected:

9144A
9144AR
9144S

Purpose:

To inform of a firware upgrade on 9144.

Problem:

With the introduction of the 9145 32 track 1/4" drive, a new 32 track XTD cartridge is to be used. These cartridges cannot be used in 16 track drives. This change ensures that the hardware fault flag is set in the drive if a 32 track cartridge load is attempted.

On less than 1% of 3000 systems booting with 1/4" tape, drive message sequence errors or watchdog timer errors have occured. This can be overcome by reloading the tape. By implementing this firmware change, the transfer length is prevented from being altered during the freeload thus eliminating the problem.

Solution:

All drives manufactured with a serial number prefix from 2823E will have upgraded Unit code firmware that resolves both the above problems. This firmware is located on the Single Board Controller pca (SBCONT). Parts for upgrade will be available. This upgrade will also be available for drives fitted with HDC pca's and Beefeater II pca's . The affected parts are:

9320-4766 (1/83)

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09144-10338        ROM UPGRADE KIT

this contains  1820-4899        DDC uPROC
               09144-89325   ) UNIT
               09144-89525   ) CODE
               07940-89060      EXEC CODE

This is an upgrade of the previous kit  09144-10337.


09144-10311        HDC ROM KIT

               09144-89325   ) HDC ROM REV 11
               09144-89525   ) HDC ROM REV 11

'This is an upgrade of the previous kit  09144-10310.
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S E R V I C E   N O T E

Model(s) Affected:

HP9144A

1/4 INCH Tape Drive

P/N 09144-69501

DATE CODE: 2843E

SUPERSEDES:	NONE		
APPLIES TO:	Only Units Agreed On – see text		
PERFORM:	ON FAILURE		
WARRANTY:	EXTENDED	NORMAL	NONE
LABOR:			X
PARTS:	X		
TRAVEL:			X
SERVICE INVENTORY	USE AS IS		
WARRANTY EXTENDED UNTIL:	NONE		
DATE ISSUED:	10/14/88	BY:	CGR

Purpose:

Introduction of a new tape mechanism casting in the 9144A Tape Drive.

Description:

With the new casting the spacers which attach to the legs have been incorporated into the casting. This means that old units which still have the read/write and servo configuration board will not fit to this new casting, all other configurations are compatible.

Action:

If the mechanism is defective in a unit with the dual R/W and Servo board p/n 09144-69513 and 09144-69517 and the situation arises that there is not a short legged casting in the kit with which to repair the unit, the long legged casting should be used and the dual boards should be replaced with a single R/W/S board (09144-69518).

Note: Performing this modification will require not only the R/W/S board but also the flat cable P/N 09144-61614.

The single R/W/S board and cable should be billed to Extended Warranty, information on how to bill should be obtained from CPB. Please call Technical Marketing at CPB Tel 44 272 799910 or by desk message to CPB SUPPORT. HPC600/06.

Warranty:

CONTACT CPB Technical Marketing

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S E R V I C E   N O T E

NOTE:

With the introducion of this casting, a new style of microswitches are being used. The new style switches are protected by a plate and are activated by a plunger. These switches have an increased reliability over the existing switches since the actual switches themselves are protected by a plate.

The NEW P/N is 09144-61619

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11-2. HARDWARE/FIRMWARE CONFIGURATION

The following charts summarize the changes that have been made to the hardware/firmware of the HP 9144A.

5-BOARD HARDWARE CONFIGURATION

Serial No. DATE CODE	PCA CONFIGURATION	
2418A	PSU	(09144-60094)
(Original Release)	DUAL DDC	(09144-68702)
	HDC	(07940-60195)
	R/W PCA	(09144-66513)
	SERVO	(09144-66517)
	DRIVE MECH	(09144-66501)

Firmware Matrix

DRIVE S/No PREFIX	CHANGE DESCRIPTION	DDC μPROC 09144-	SERVO μPROC 09144-	HDC PCA 07940-	HDC PCA 09144-	REF SERV NOTE
2418	ORIGINAL RELEASE	89801	89302	89010	89202 89512	
2434	Code change,fixes data problem,TMIT hang HDC test fail read-out	89802	"	89020	89203 89513	
2435	Code change to ensure keys are not erased	89803	"	"	"	
2436	As above	89804	"	"	"	

4-BOARD HARDWARE CONFIGURATION

Serial No. DATE CODE	PCA CONFIGURATION
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2440 (introduction of single board DDC)	PSU (09144-60094) SINGLE DDC (09144-66512) HDC (07940-60195) R/W PCA (09144-66513) SERVO (09144-66517) DRIVE MECH (09144-66501)
2445	SINGLE DDC (09144-66522)

Firmware Matrix

DRIVE S/No PREFIX	CHANGE DESCRIPTION	DDC µPROC 09144-	SERVO µPROC 09144-	HDC PCA 07940-	HDC PCA 09144-	REF SERVICE NOTE
2440	Single Board DDC introduction	89804	89302	89020	89203 89513	9144A-1

NOTE

The single board DDC was introduced to reduce the manufacturing cost and simplify FSI (Field Stock Inventory). All defective DUAL DDCs may be replaced with single DDCs on failure.

The single board DDC was modified to prevent a hang during high temperatures. All FSI should now be rolled over to the 69522 board.

3-BOARD HARDWARE CONFIGURATION

Serial No. DATE CODE   **PCA CONFIGURATION**

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2444                                PSU        (09144-60094)
                                    SBCONT     (09144-66515)
                                    R/W PCA    (09144-66513)
                                    SERVO      (09144-66517)
                                    DRIVE MECH (09144-66501)
2519                                NEW PSU    (09133-67120)
```

Firmware Matrix

DRIVE S/No PREFIX	CHANGE DESCRIPTION	SB CONT 09144-	SB CONT 07940-	SERVO µPROC 09144-	REF SERVICE NOTE
2444	Single Board Controller	89804 U13 89203 U133 89513 U150	89020 U142	89302	9144A-4
2447E	CPB startup configuration	"	"	"	
2451	Edge find algorithm on full vol read. Delay on amigo clear fixed. End of vol error fixed.	89805 U13 89204 U133 89514 U150	89030 U142	"	9144A-7
2505	S37 PIC problem fixed. 7942/46 copy sequence altered. Device timeout (TF on RTE-A) fixed.	89806 U13 89205 U133 89515 U150	89040 U142	"	9144A-5 9144A-6

Firmware Matrix (continued)

DRIVE S/No PREFIX	CHANGE DESCRIPTION	SB CONT 09144-	SB CONT 07940-	SERVO µPROC 09144-	REF SERVICE NOTE
2514E 2519A	7942/46 hang (offline) fixed. 1000 boot latency problem fixed.	89806 U13 89206 U133 89516 U150	89050 U142	"	9144A-8
2522	Read chan algo-rithm altered. 3000 mount/ dismount problem fixed.	89807 U13 89207 U133 89517 U150	"	"	9144A-11 9144A-12 9144A-13
2523	7942/46 key/ no data found problem fixed.	89808 U13 89207 U133 89517 U150	"	"	
2531	Fixes inter-mittent load failures. Removes S/Test error 23/4 on old linus tapes.	89809 U13 89208 U133 89518 U150	"	"	

NOTE

The HDC and DDC are combined onto a single board controller (SBCONT). A dual pipeline of both HDC/DDC and SBCONT PCAs is being maintained.

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2-BOARD HARDWARE CONFIGURATION

Serial No. DATE CODE

2540

PCA CONFIGURATION

```
NEW PSU      (09133-67120)
SBCONT       (09144-66515)
R/W SERVO    (09144-66518)
DRIVE MECH   (09144-66501)
```

Firmware Matrix

DRIVE S/No PREFIX	CHANGE DESCRIPTION	SB CONT 09144-	SB CONT 07940-	SERVO µPROC 09144-	REF SERVICE NOTE
2540	Introduction of chips board.	89809 U13 89208 U133 89518 U150	89050 U142	89112	
2541	Fixes false EOF Intermittent S/Test 4 and false EOF 7942/46	89811 U13 89208 U133 89518 U150	"	"	9144A-14
2551A 2550E	New cleaning procedure. Support of HP92193E HP cleaning cartridge.	89811 U13 89209 U133 89519 U150	"	89113	9144A-17
2606E	Improvements made to self-test algorithm.	89812 U13 89209 U133 89519 U150	"	"	9144A-18

NOTES

The R/W and SERVO boards are combined to make the R/W SERVO. This **does not** obsolete the individual R/W and SERVO PCAs. However, the new board requires a new drive cable (P/N 09144- 61614) to link it to the SBCONT.

09144-89209 has been replaced by 09144-89324.
09144-89519 has been replaced by 09144-89524.

1-BOARD HARDWARE CONFIGURATION

Serial No. DATE CODE	PCA CONFIGURATION	
2613E	NEW PSU	(09133-67120)
	DE PCA	(09144-66519)
	DRIVE MECH	(09144-66501)

Firmware Matrix

DRIVE S/No PREFIX	CHANGE DESCRIPTION	DRIVE ELECTRONICS PCA	REF SERVICE NOTE
2613E	Introduction of drive electronics pca.	09144-89812 U33 09144-89113 U305 07940-89050 U132 09144-89221 U128	
2641E	Fixes buffer problem in 7942/46 during task switching.	09144-89812 U33 09144-89113 U305 07940-89060 U132 09144-89221 U128	7946-6
2641E	Package changes only. No firmware changes (to ROMs U33 & U305)	1820-4899 U33 1820-4898 U305 07940-89060 U132 09144-89221 U128	

Firmware Matrix (continued)

DRIVE S/No PREFIX	CHANGE DESCRIPTION	DRIVE ELECTRONICS PCA		REF SERVICE NOTE
2721E	Fixes despooling problems.	1820-4899 1820-4898 07940-89060 09144-89241	U33 U305 U132 U128	9144A-21
2722E	Fixes despooling problem and updates the REV command in CS80DIAG to REV 10.	1820-4899 1820-4898 07940-89060 09144-89251	U33 U305 U132 U128	9144A-21

NOTES

All new tape drives are manufactured with the DRIVE ELECTRONICS board, which replaces the R/W SERVO and SB CONT PCAs. If these boards are replaced with the DE PCA, two additional extension cables may be needed.

    09144-61615 Servo Extension Cable
    09144-61616 Head Extension Cable

Due to typographical errors in production, part numbers:

                09144-89241
                09144-89251

              may appear as

                89144-89241
                89144-89251

REVERSION TO 2-BOARD CONFIGURATION

Serial No. DATE CODE

2808E

PCA CONFIGURATION

PSU	(09133-67120)
SBCONT	(09144-66515)
R/W SERVO	(09144-66518)
DRIVE MECH	(09144-66501)

Firmware Matrix

DRIVE S/No PREFIX	CHANGE DESCRIPTION	SB CONT 09144-	SB CONT 1820-	SERVO μPROC 1820-	REF SERVICE NOTE
2808	Re-introduction of the SBCONT and R/W/S	89060 U142 89324 U133 89524 U150	4899 U13	4898	9144A-23
2823	Introduction of 32 XTD cartridges.	89060 U142 89325 U133 89525 U150	"	"	9144A-24

11-3. FIRMWARE KITS

The following upgrade kits are available:

09144-10338	this contains	1820-4899 09144-89325 09144-89525 07940-89060	DDC μPROC) UNIT) CODE EXEC CODE
09144-10311	this contains	09144-89325 09144-89525	) UNIT) CODE
09144-10355	this contains	1820-4899	DDC μPROC
07940-10106	this contains	07940-89060	EXEC CODE
09144-89252	this contains	09144-89252	UNIT CODE FOR 09144-69519 ONLY

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