

NEC DISK DRIVE

**D2362
9-INCH WINCHESTER DISK DRIVE
MAINTENANCE MANUAL**

**806-520262-0
REV.A**

PRELIMINARY

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NEC Corporation

REVISION HISTORY

REVISION

DESCRIPTION

"A"

PRELIMINARY ISSUE (JUN. '86)

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CHAPTER 1 INTRODUCTION

This manual describes the maintenance procedure for the NEC D2362 Disk Drive. The D2362 disk drive is a compact, highly reliable disk drive that stores 800 megabytes (MB) of unformatted data depending on the model used (see Table 1-1). The disk drive uses fixed disk, Winchester-type technology, which provides the most modern method of recording large amounts of data for high speed, computer operations and accessibility.

Table 1-1 Disk Drive Storage Capacity

Disk Drive Model	Unformatted Capacity (MB)	Number of Disk Platters	Number of Data heads
D2362	800.7	7	23

The details of the functional and performance specifications are described in the Product Description (See Table 1-2).

Table 1-2 Related Documents

Title	NEC Document No.
D2362 9-INCH WINCHESTER DISK DRIVE	
PRODUCT DESCRIPTION	806-520261
THEORY OF OPERATION	806-520263
CIRCUITS DIAGRAM AND PWA ASSY DRAWING	806-520264

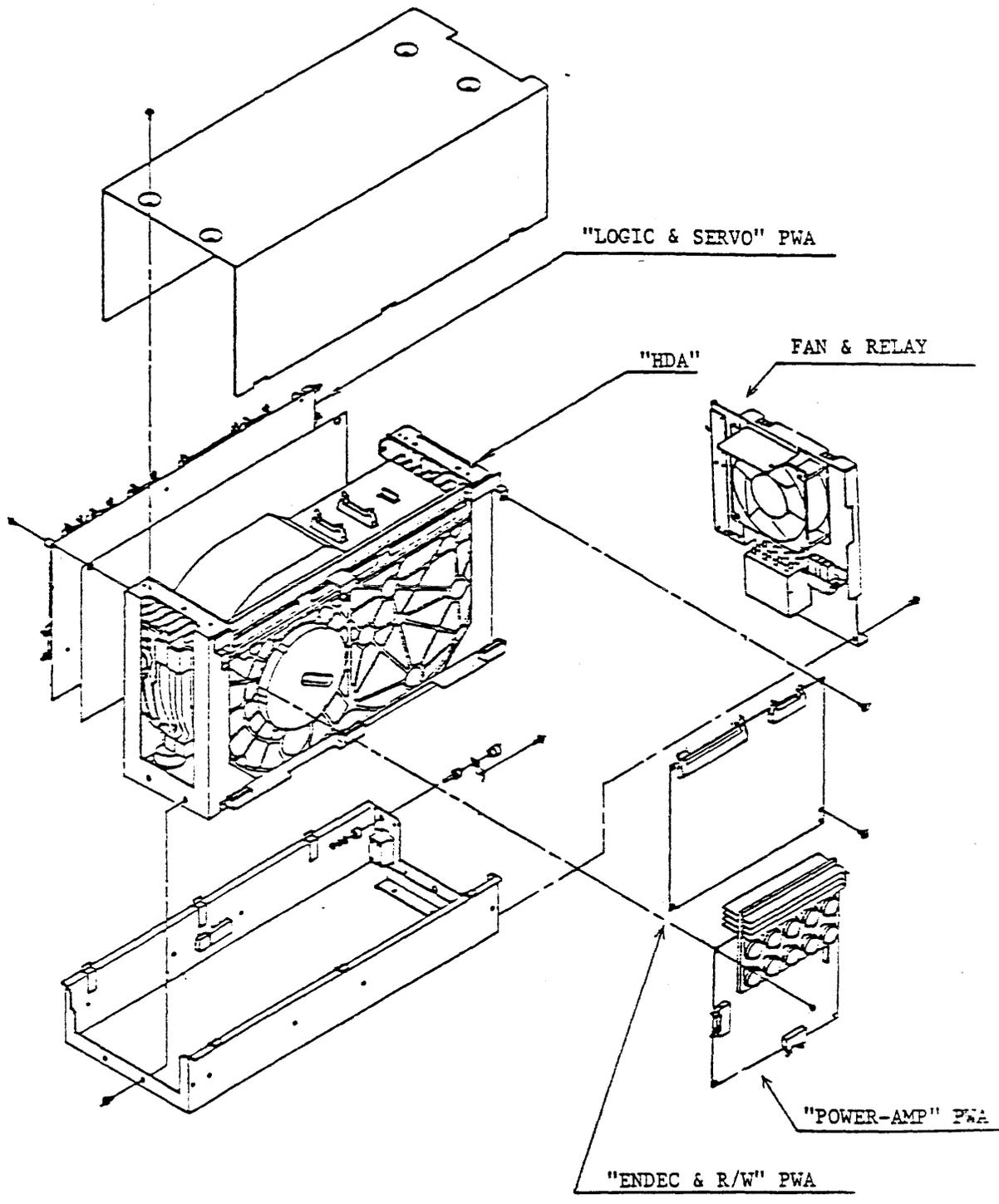


Figure 1-1 D2362 Disk Drive Configuration (Basic Unit)

1.2 THEORY OF OPERATION OVERVIEW

The functional components of the D2362 Disk Drive are the interface and the sequence control, read/write control, servo control, and motor control circuits (see Figure 1-3).

The sequence control circuits control the primary functions of the disk drive. The interface routes data, addresses, device status information, and control signals between the disk drive and the controller.

The read/write control circuits control the reading of data from the disk and the writing of data on the disk. During a write operation, the circuits receive Non-Return to Zero (NRZ) format data from the controller and convert it to 2-7 Run Length Limited (2-7 RLL) format, shift the data to a logic level suitable for the read/write heads, and write the data on the disk. During a read operation, the control circuits read and amplify the data from the disk, convert it from 2-7 RLL to NRZ format, and send this data to the controller.

The servo control circuits read the signal recorded on the servo disk and use this signal to position the read/write heads on the correct cylinder and to maintain the heads in position. The motor control circuits drive the spindle motor and control its speed of rotation.

1.3 MAINTENANCE PHILOSOPHY

The Disk Drive model is designed for long life and maintenance-free operation. Field repair is best achieved at the modular level. For this reason, only replaceable parts are listed as field maintenance items; the sealed module (HDA) in particular, though field replaceable, must not be opened or repaired outside the factory. Replacement and/or repair of defective items that are not included in the list of replacement parts should be performed at the factory or at an equivalent service facility.

The Parts List (FRU level) of the D2362-100 WDD (Basic Unit) are described in Table 1-3.

1.4 MAINTENANCE OVERVIEW

This manual contains general and detailed informations of the installation, maintenance, parts replacement, parts catalog, and the operation of the diagnostic panel.

Details of each items are described in the following chapters;

CHAPTER 2: INSTALLATION
 CHAPTER 3: MAINTENANCE
 CHAPTER 4: PARTS REPLACEMENT
 (APPENDIX A): ILLUSTRATED PARTS CATALOGUE
 (APPENDIX B): POWER SUPPLY

Table 1-3 D2362-100 WDD (Basic Unit) Parts List

FUNCTION (FRU)	DESCRIPTION (Assy. DRAWING No.)	Spare PARTS NUMBER	REMARKS
"POWER AMP" PWA	G9WBU PWA (134-833199)	134-530339-002	Repairable
"ENDEC & R/W" PWA	G9WCK PWA (134-833214)	134-530354-001	Repairable
"LOGIC & SERVO" PWA	G9WCL PWA (134-833215)	134-530355-001	Repairable
└"MPU FIRMWARE"	2764 WCL 02XX PROM	134-530368-001	
"COOLING-FAN"	747 DC-FAN	134-530356-001	
"BRAKING RELAY"	747 RELAY	134-530357-001	
"HDA" (HEAD-DISK Assembly)	752 HDA	134-530365-001	Repairable
└"DISCHARGE PAD"	747 CONTACT PAD	134-530359	
└"MOTOR STATOR"	747 STATOR	134-530360	

2.2 INTERFACE LINE TERMINATION

There are two cabling configurations used in system installation: Daisy chain and Radial connection.

In either case, the Line termination of "A" Cable is required.

In the D2362 Disk Drive, it is possible to use the optional accessory External Terminator.

2.2.1 External Terminator

Illustrated is the LINE TERMINATION of the DAISY CHAIN SYSTEM with 747-ETR EXTERNAL TERMINATOR (OPTION) in Figure 2-1 Example (A).

When using the EXTERNAL TERMINATOR, the Resistor Modules of the locations "1G", "1H", "1J" and "1K" on the "LOGIC & SERVO" PWA must be left.

2.2.2 On-Board-Terminating Resistors (Option)

As shown in Figure 2-2, on the "LOGIC & SERVO" PWA in the D2362 DISK DRIVE, the four DIP sockets are provided to install the DIP-type Terminating resistor on the locations "1G", "1H", "1J" and "1K".

When ON-BOARD-TERMINATING is used, the specified resistor module must be mounted in these DIP sockets. (see Figure 2-1, Example (B))

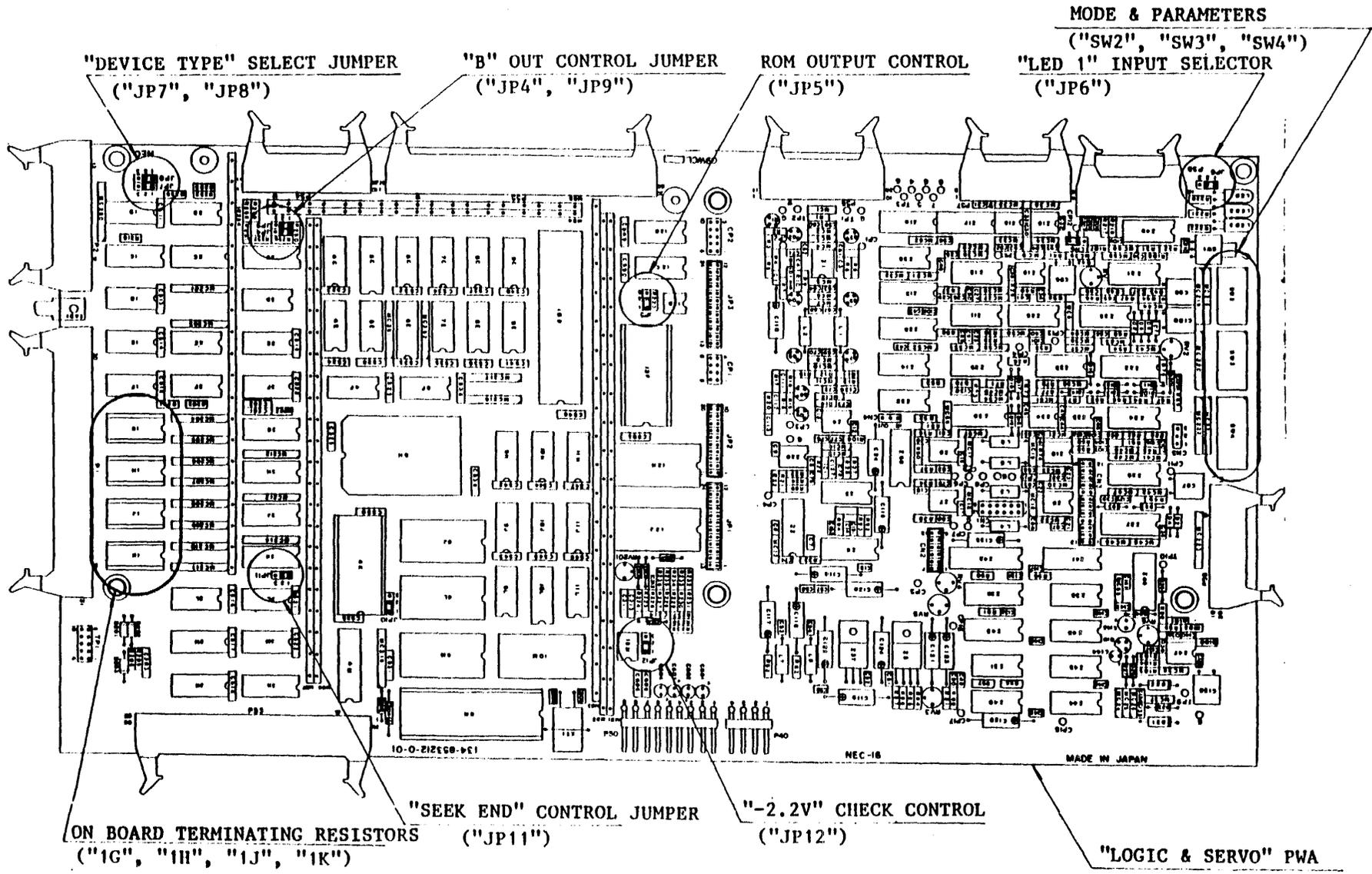


Figure 2-2 "LOGIC & SERVO" PWA

2.4 DIAGNOSTIC MODE SELECTION SWITCHES

2.4.1 Diagnostic Mode 1 (Segment 1 of SW2 DIP Switch)

The Segment 1 of SW2 (8 bit DIP Switch) is assigned for enable/disable control of the INITIAL SEEK AUTO-RETRY MODE function of the Disk Drive.

SEG1-SW2	STATE	DESCRIPTION
SW OPEN	1	NORMAL (ENABLE AUTO-RETRY FUNCTION)
(CLOSE)	0	DIAGNOSTIC (DISABLE AUTO-RETRY FUNCTION)

2.4.2 Diagnostic Mode 2 (Segment 1 of SW3 DIP Switch)

The Segment 1 of SW3 (8 bit DIP Switch) is used to select the Reset Condition against a "Voltage Fault" detected by the Disk Drive.

SEG1-SW3	STATE	DESCRIPTION
OPEN	"1"	NORMAL: An issuing of the combination commands by the "Fault Clear (Tag 3 with Bit 4)" and Return to Zero (Tag 3 with Bit 6) may be effective to reset the "Voltage Fault" status if no more fault exists.
(CLOSE)	"0"	DIAGNOSTIC MODE: Only the power restart sequence (once completely drop the Input +5 Volt DC) is the Fault Clear condition for a "Voltage Fault" condition.

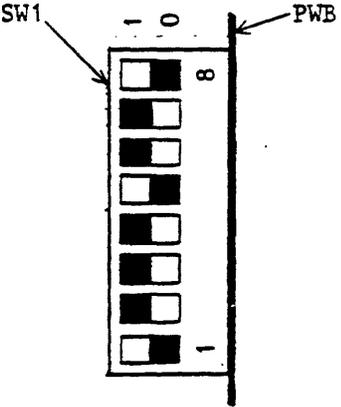
DRIVE TYPE	D2362 STANDARD
SPINDLE ROTATION	3,600 rpm
CN1 JUMPER TERMINAL	

Figure 2-4 Spindle Rotation

Table 3-1 Maintenance Tools

Part Number	Description	Class
	Common Tools	
	Phillips Screwdriver No. 1	*
	Phillips Screwdriver No. 2	*
	Special Tools	
134-530649-001	Diagnostic Panel	Requested Recommended
	Oscilloscope	
* Can be obtained through local vendors.		

3.2 PREVENTIVE MAINTENANCE

Preventive maintenance (sometimes called routine or schedules maintenance) is limited to occasionally cleaning any dust on the surface of the disk drive. No other cleaning is recommended. No lubrication is required, and there are no components requiring scheduled adjustment or replacement. Not especially that the air filter in the sealed disk cannot be replaced or cleaned.

If desired, routine performance checks are able to run, using either system-designed diagnostic programs or the offline test procedures described in Section 3.6.

3.3 TROUBLESHOOTING

If a fault occurs, first determine whether the fault is in the host controller, disk drive, or other interconnecting units. A fault in the disk drive can be isolated by temporarily disconnecting the drive from the system and substituting the Diagnostic Panel (DP) to conduct an offline performance check described in Section 3.6. When the fault isolation is achieved on the disk drive, the operational information in the flowchart in Figure 3-1 and the status information in Section 3.4 will help one to localize the fault in the disk drive.

Refer to Table 1-3 for each spare parts number of FRUs (ex. "LOGIC & SERVO" PWA) in Figure 3-1.

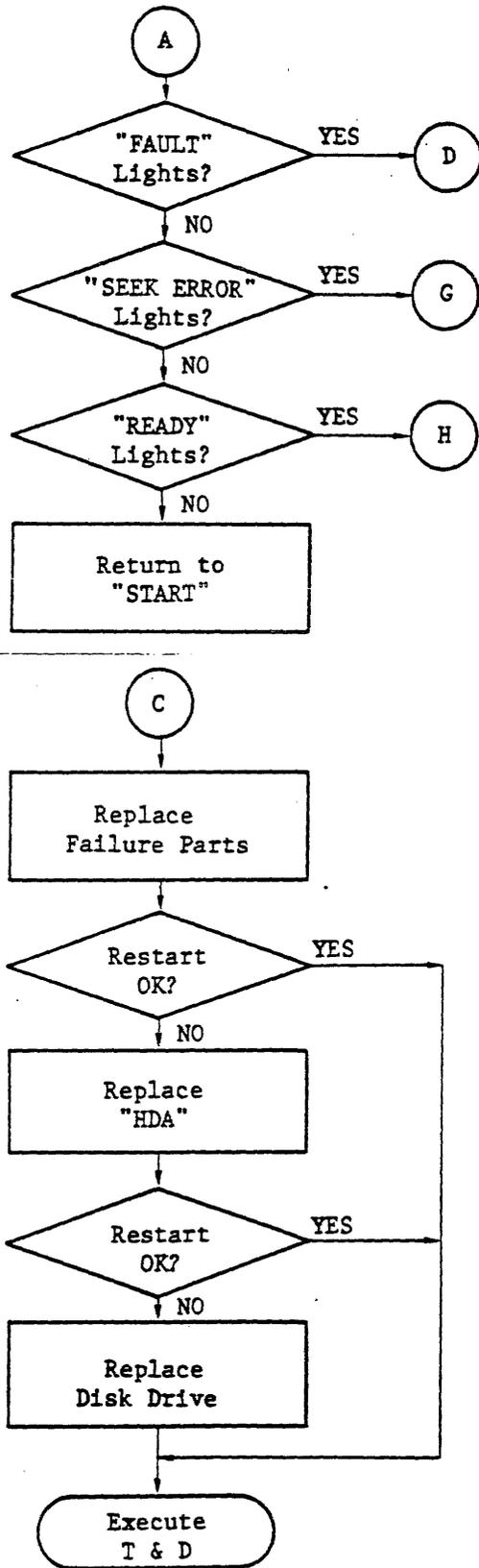


Figure 3-1 Troubleshooting Flowchart (Sheet 2 of 6)

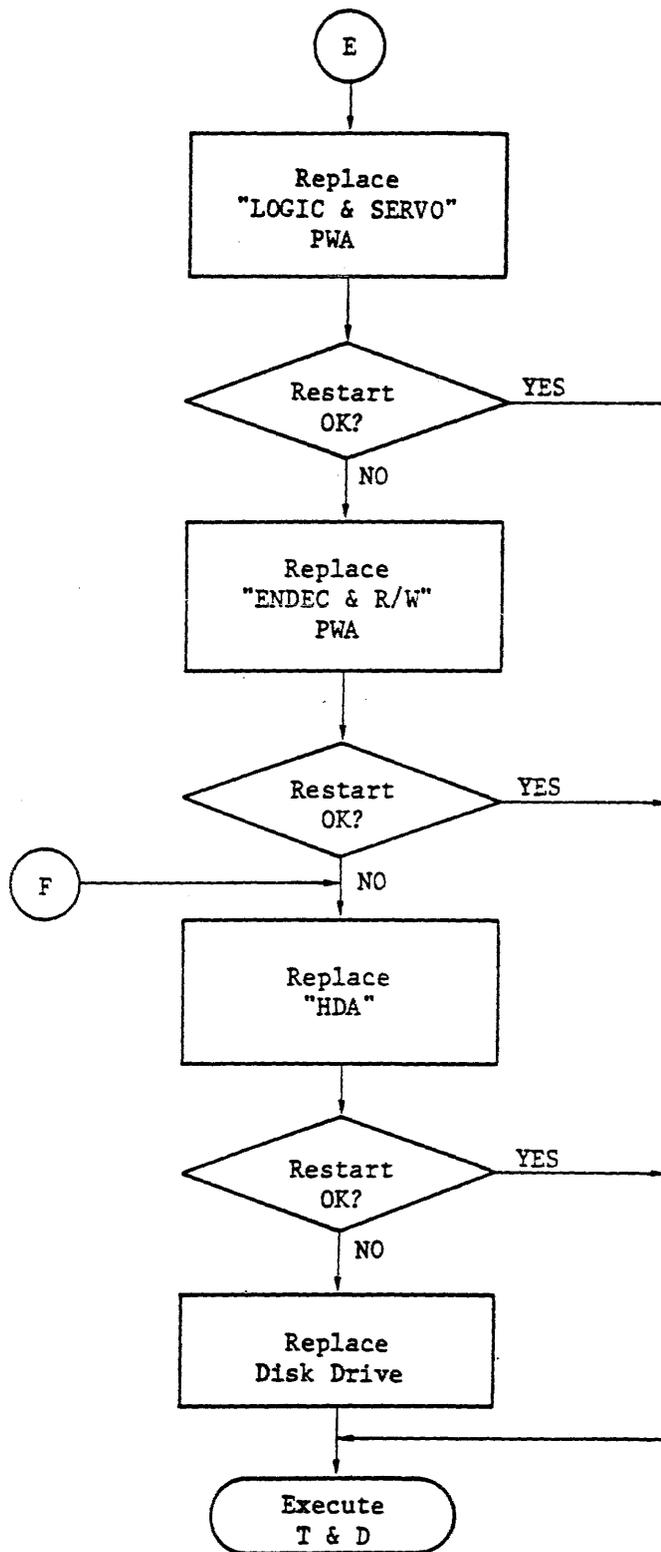


Figure 3-1 Troubleshooting Flowchart (Sheet 4 of 6)

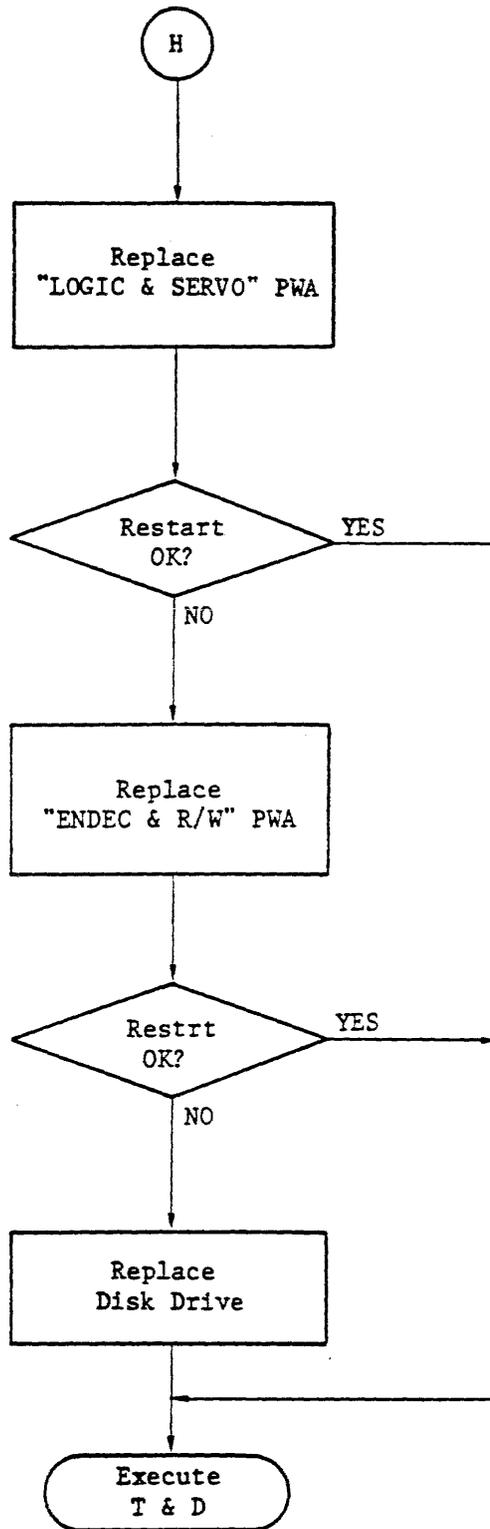


Figure 3-1 Troubleshooting Flowchart (Sheet 6 of 6)

Table 3-2 Fault Code Summary

Data Field Display Code		Event	Cause
State (X)	Fault (Y)		
1	1	Voltage fault	±5V, ±12V FOM (2732) Fault
1	2	ROM fault	
1	4	Fault latch	
2	1	Voltage fault	
3	1	Voltage fault	
4	1	Voltage fault	
4	3	Motor not up to speed	Speed 90%
4	4	No rotation	
5	1	Voltage fault	
5	2	Motor speed too slow	Speed < 97%
5	3	Motor speed too high	Speed > 102%
6	1	Voltage fault	
6	2	Motor speed loss	
6	3	Motor over speed	
7	1	Voltage fault	
7	2	Motor speed loss	
7	4	Lost index	
7	5	Inner guard band (IGB) Not found	
8	1	Voltage fault	
8	4	Lost index	
8	5	Outer Guard Band (OGB) Not found	
8	6	No N linearity found	
8	7	No half track found	
8	8	No Q linearity found	
8	9	No difference found	
8	A	Not at target velocity	
8	B	Too slow not found	
8	C	Over shoot check	
8	D	Over shoot check (Time out)	
9	1	Voltage fault	
9	4	Lost index	
9	5	OGB not found	
9	9	No linearity found	
9	C	Over shoot check	
9	D	Over shoot check (Time out)	

Table 3-3 further defines the type of disk operation with an (A) through (E) character in the lower right corner of the CONTENT column. The definition of each character follows.

- (A) - Stops the sequence. The interface is not enabled.
- (B) - Stops the sequence as a fault occurs. The interface is not enabled.
- (C) - Stops the motor, resets unit ready, and causes a fault status.
- (D) - Assumes a seek error and causes a home seek operation. (Causes a return to the respective Inner Guard Band (IGB) on the disk.)
- (E) - Causes a fault status.

NOTE: In all A through E character code activity, the Write Protect is set.

Table 3-3 Detail Status Information

Data Field Display Code		Name	Content	Remedy
State (X)	Fault (Y)			
0	0	CPU FAULT	Does not operate normally when power is turned on. (A)	(1) Verify that Control PROM is inserted in position 4K on the "LOGIC & SERVO" PWA. (2) Replace "LOGIC & SERVO" PWA.
1	1	VOLTAGE FAULT	Abnormal source voltage. (B)	(1) Check the source voltage.
1	2	ROM FAULT	Error in Control PROM at position 4K on the "LOGIC & SERVO" PWA. (B)	(1) Replace "LOGIC & SERVO" PWA.

Table 3-3 Detail Status Information (Cont'd)

Data Field Display Code		Name	Content	Remedy
State (X)	Fault (Y)			
5	3	MOTOR SPEED TOO HIGH	The motor speed exceeds 102% ⓐ	See fault "5-2".
6	1	VOLTAGE FAULT	Abnormal source voltage. ⓐ	(1) Check the source voltage.
6	2	MOTOR SPEED LOSS	The motor rotation frequency dropped below 90%. ⓐ	(1) Restart the motor and if a fault 4-3 or 4-4 occurs, replace "POWER AMP" PWA. (2) Replace "LOGIC & SERVO" PWA. (3) Replace "HDA".
6	3	MOTOR SPEED OVER	The motor speed exceeds 110%	See fault "5-2".
7	1	VOLTAGE FAULT	Abnormal source voltage.	(1) Check the source voltage.
7	2	MOTOR SPEED LOSS	The motor rotation frequency dropped below 90%. ⓐ	See fault "6-2".
7	4	LOST INDEX MARK	Index cannot be detected. ⓐ	(1) Check the di-pulse output. (2) No di-pulse after replacement of "LOGIC & SERVO" PWA, replace "HDA". (3) Replace "HDA".
7	5	NO IGB FOUND	The inner guard band pattern is not found. ⓐ	(1) Replace "LOGIC & SERVO" PWA. (2) Replace "HDA".

Table 3-3 Detail Status Information (Cont'd)

Data Field Display Code		Name	Content	Remedy
State (X)	Fault (Y)			
8	A	NO TARGET VELOCITY FOUND	The target velocity is not obtained. (D)	Replace "LOGIC & SERVO" PWA.
8	B	NO TOO SLOW FOUND	The servo circuit does not follow. (D)	Replace "LOGIC & SERVO" PWA.
8	C	OVER SHOOT CHECK	± 1 Cylinder range exceeded in position mode. (D)	See fault "8-B".
8	D	OVER SHOOT CHECK (TIME OUT)	The heads are not within $\pm 1/2$ CYL continuously for 3 ms within 20 ms after entry into the position mode. (D)	See fault "8-B".
9	1	VOLTAGE FAULT	Abnormal source voltage. (D)	(1) Check the source voltage.
9	4	LOST INDEX	The index is not found. (D)	See fault "7-4".
9	5	OGB NOT FOUND	The outer guard Band pattern does not disappear. (D)	(1) Replace "LOGIC & SERVO" PWA. (2) Replace "HDA".
9	9	NO LINEARITY FOUND	N LIN=1 is not obtained. (D)	See fault "8-6".
9	C	OVER SHOOT CHECK	± 1 cylinder range exceeded in position mode. (D)	See fault "8-B".

Table 3-3 Detail Status Information (Cont'd)

Data Field Display Code		Name	Content	Remedy
State (X)	Fault (Y)			
A	C	OFF TRACK	The positioner mover more the $\pm 1/2$ cylinder during the ON CYLINDER.	(1) Check the servo circuit (2) Replace "LOGIC & SERVO" PWA. (3) Replace "HDA".
B	1	VOLTAGE	Abnormal source voltage. $\text{\textcircled{D}}$	(1) Check the source voltage.
B	4	LOST INDEX MARK	The index is lost during the ON CYLINDER. $\text{\textcircled{D}}$	See fault "A-4".
B	9	NO DIFFERENCE=0 FOUND	The contents of the difference register is not zero. $\text{\textcircled{D}}$	(1) Replace "LOGIC & SERVO" PWA.
B	C	OVER SHOOT CHECK	± 1 cylinder range exceeded in position mode. $\text{\textcircled{D}}$	See fault "8-C".
B	D	OVER SHOOT CHECK (TIME OUT)	Heads not in 20 ms range after entry into position mode. $\text{\textcircled{D}}$	See fault "8-C".
B	E	OVER TRAVEL (OGB)	OGB is detected during a seek. $\text{\textcircled{D}}$	See fault "8-C".
B	F	OVER TRAVEL (IGB)	IGB is detected during a seek. $\text{\textcircled{D}}$	See fault "8-C".
C	1	OVER CYLINDER	More than 760 cylinder detected. $\text{\textcircled{D}}$	

Table 3-3 Detail Status Information (Cont'd)

Data Field Display Code		Name	Content	Remedy
State (X)	Fault (Y)			
E	2	SEEK SPEED TOO HIGH	Seek speed too high with minimum speed data ⓓ	Replace "LOGIC & SERVO" PWA.
E	3	SEEK SPEED TOO LOW	Seek speed too low with maximum speed data ⓓ	Replace "LOGIC & SERVO" PWA.
E	4	NOT PLO GOOD	Not PLO good in offset seek ⓓ	Replace "LOGIC & SERVO" PWA.
E	5	OFF TRACK	Off track in offset seek ⓓ	Replace "LOGIC & SERVO" PWA.
E	6	OFFSET COMMAND ERROR	Offset command received while not on cylinder ⓔ	Replace "LOGIC & SERVO" PWA.
E	7	RTZ UNSUCCESSFUL	Speed adjustment seek error after RTZ ⓓ	Replace "LOGIC & SERVO" PWA.
F	1	PROTECT VIOLATION	Write gate detected during write protect. ⓔ	(1) Defective interface.
F	2	WRT NOT READY/WRT NOT ON CYL	Write gate is detected while not-Ready or not-on Cylinder. ⓔ	(1) Defective interface. (2) Replace "LOGIC & SERVO" PWA. (3) Replace "HDA".

3.5 SERVO SYSTEM SIGNALS

The servo system signals of D2362 are considered abnormal when they do not satisfy the specifications in Table 3-4. In addition, Table 3-5 summarizes the output from each test point on the G9WCL PWA.

Each test point location is shown in Figures 3-2, and 3-3.

Table 3-4 G9WCL PWA (Servo) Specifications

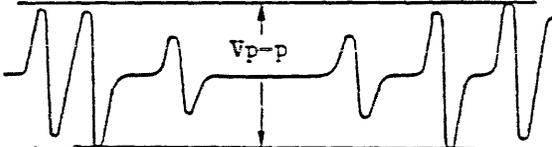
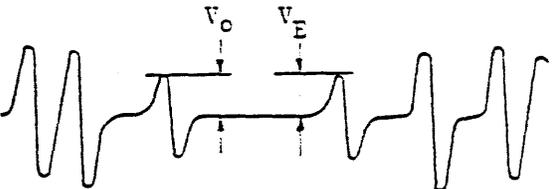
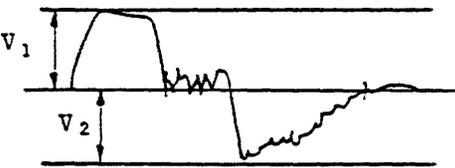
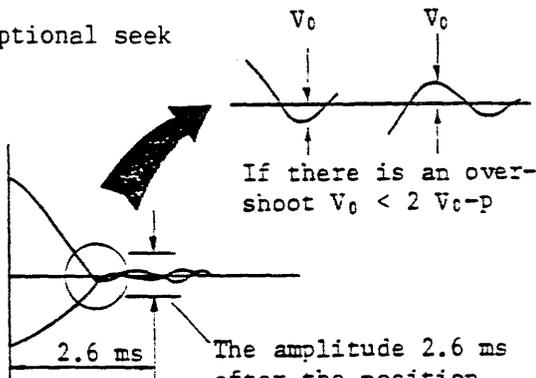
Function	Test Point	Comments
Dipulse input amplitude	TP1, TP2	 <p>50 mVpp \leq Vpp \leq 215 mVpp at Cylinder 000 and Cylinder 849</p>
AGC output amplitude	CP3	 <p>$V_O, V_E = 0.8 \sim 1.2 V_{O-p}$</p>
AGC standard Voltage	CP4	DC About 1.0 V

Table 3-4 G9WCL Servo PWA Specifications (Cont'd)

Function	Test Point	Comments
<p>Current waveform</p>	<p>TP 8</p> <p>The trigger is TP1-4 and TP1-3 of G9WCL.</p>	<p>000 → 849 CYLINDER REPEAT SEEK</p>  <p>$V_1 = 2.1 \sim 2.7 \text{ V}$ $V_2 = 1.3 \sim 2.4 \text{ V}$</p> <p>(The polarity changes according to the seek direction.)</p>
<p>Position transient response</p>	<p>TP7</p> <p>The trigger is TP1-5 of G9WCL.</p>	<p>Optional seek</p>  <p>If there is an overshoot $V_0 < 2 V_{c-p}$</p> <p>The amplitude 2.6 ms after the position mode is set shall be less than $0.5 V_{op}$.</p>

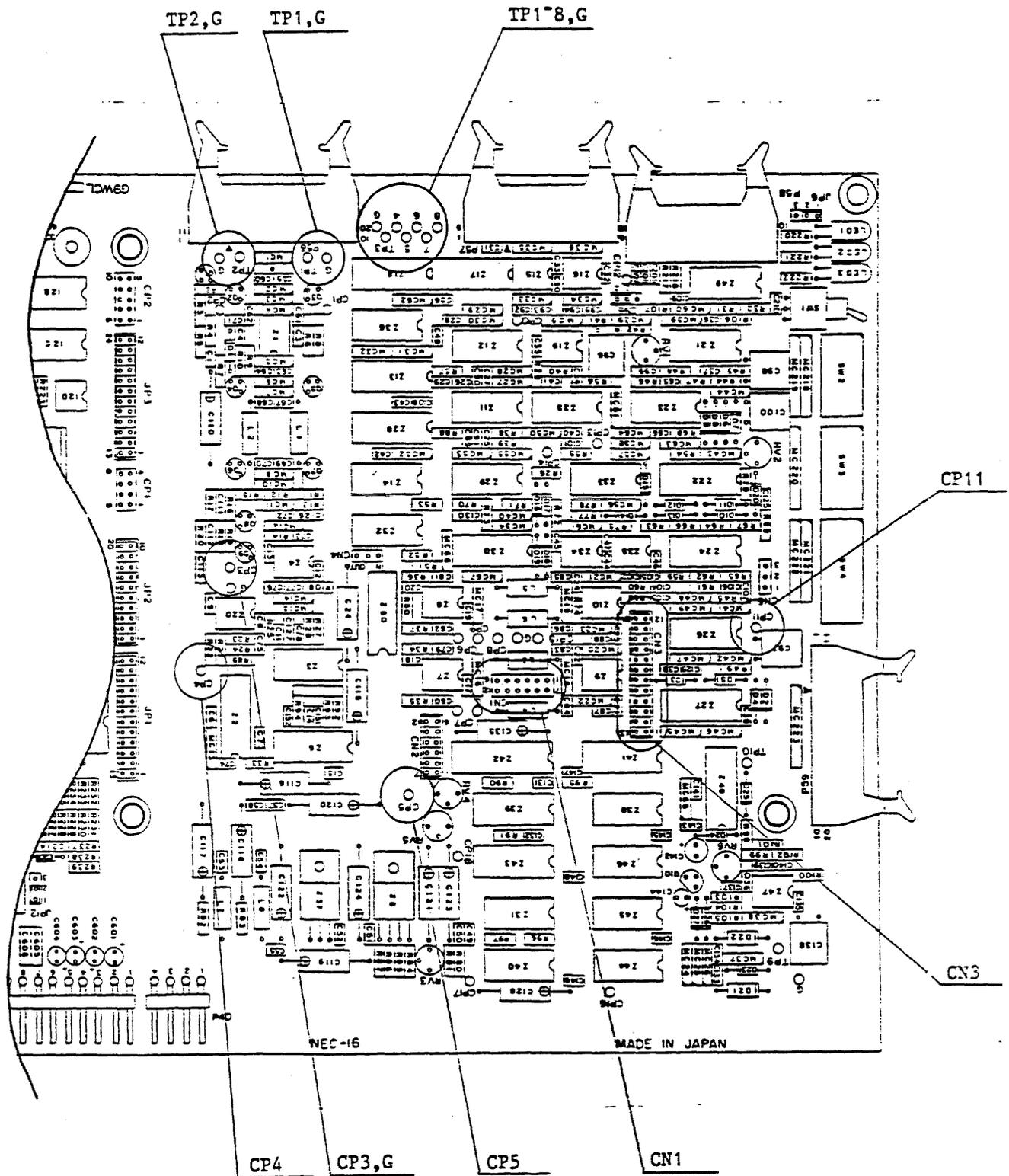
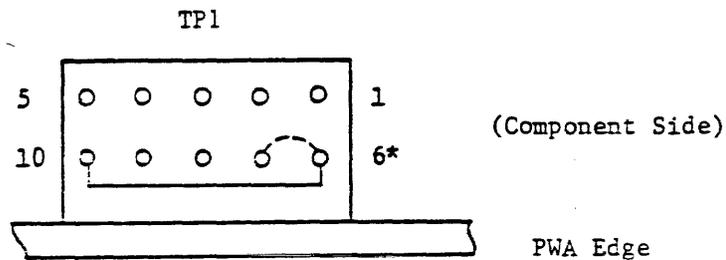


Figure 3-2 Test Point Locations ("LOGIC & SERVO" PWA) (1/2)

3.6 SEEK OPERATIONS WITHOUT DIAGNOSTIC PANEL

This procedure can be used when a diagnostic panel is not available. It is limited in the type and number of seek and type disk drive functions but will generally verify the basic operations.

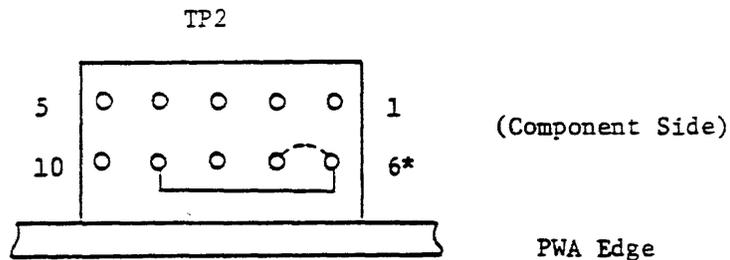
- a. To perform a repeat seek operation between cylinder zero and the Max connect TP1 on the Logic Servo PWA as shown below.



* If pins 6 and 7 are connected, the seek interval time is 100 ms.

NOTE: At start-up, disconnect jumpers 6 and 7. This jumper, if in, prolongs the seek interval time and does not allow the first seek.

- b. To perform a sequential seek operation, connect TP1 as shown below.



* If pins 6 and 7 are connected, the seek interval time is 1.5 seconds.

4.1.2 Replacement

- (1) Going to the equipment cabinet, pull the intermediate slides to fully extended positions.
- (2) Lift the drive into position in front of the cabinet and guide the inner slides into intermediate slides. Push until the lock buttons engage, then pull the drive to fully extended position.
- (3) Connect I/O cables to the drive connectors.
- (4) Push the drive into the cabinet until it is fixed by the stopper, and secure the drive with the screw **B**.
- (5) Reconnect the ac power connector to the power supply, and tighten the cable clamp with the screw **A**.

4.2 TOP COVER REMOVAL AND REPLACEMENT - SEE FIGURE 4-2

4.2.1 Removal

- (1) Extend the drive to fully extended position by performing the steps described in Section 4.1.1 (1) to (3).
- (2) Remove the four screws **A** securing the top cover to the drive.
- (3) Lift off the top cover.

CAUTION: The top cover must be carefully lifted from the drive to avoid possible damage to adjacent components on the printed wiring assemblies.

4.2.2 Replacement

- (1) Place the top cover on the drive.

CAUTION: When replacing the top cover, be careful not to damage the adjacent components.

- (2) Verify that the six bent tabs of the deck **B** engage the dents **C** at lower edge of the top cover **C**.
- (3) Fasten the four screws **A**.

4.3 FRONT PANEL REMOVAL AND REPLACEMENT - SEE FIGURE 4-3
(Note: If FRONT PANEL option is available)

4.3.1 Removal

- (1) Perform Top Cover Removal Procedure (Section 4.2.1).
- (2) Disconnect the cable connector J58 of the operator panel cable from P58 on "LOGIC & SERVO" PWA.
- (3) Remove the two screws **A** securing the Front Panel on both right and left side of the deck.
- (4) Remove the Front Panel by pulling it downward.

4.3.2 Replacement

- (1) Pass the operator panel cable through the top opening of the protect cover.
- (2) Connect the cable-connector J58 to P58 on the "LOGIC & SERVO" PWA.
- (3) Engage the upper hook **B** of the Front Panel into the slot of the protect cover **C**.
- (4) Fasten the two screws **A**.
- (5) Perform the top cover replacement procedure (Section 4.2.2).

4.4 PROTECT COVER REMOVAL AND REPLACEMENT - SEE FIGURE 4-4.

4.4.1 Removal

- (1) Perform the Top Cover removal procedure (Section 4.2.1 (1)-(3)).
- (2) Perform the Front Panel removal procedure (Section 4.3.1 (1)-(4)).
- (3) Remove the two screws **A** and the two screws **B** securing the Protect Cover to the drive, and remove the Protect Cover.

4.4.2 Replacement

- (1) Attach the Protect Cover by reversing the above steps.

4.5 POWER SUPPLY REMOVAL AND REPLACEMENT - SEE FIGURE 4-5
(Note: If POWER SUPPLY option is available)

4.5.1 Removal

- (1) Perform the entire drive removal procedure (Section 4.1.1 (1) to (5)).
- (2) Remove the screw **A** securing the FG terminal of the dc power cable.
- (3) Disconnect the dc power cable connector from P1 of the drive.
- (4) Remove the two screws **B** securing the connecting plate to the rear panel, and lift off the power supply unit.

4.5.2 Replacement

- (1) Remove the connecting plate from the power supply by removing the two screws **C**.
- (2) Install the connecting plate to the new power supply and fasten with the two screws **C**.
- (3) Install the power supply by inserting the raised edges of the rear panel into the two rectangular slot at the bottom of the power supply, and secure it to the rear panel with the two screws **B**.
- (4) Reconnect the dc power cable connector to P1 of the drive and fasten the FG terminal with the screw **A**.
- (5) Perform the entire drive replacement procedure (Section 4.1.2 (1) to (5)).

4.6 FAN/RELAY REMOVAL AND REPLACEMENT - SEE FIGURE 4-6, FIGURE 4-7

The following procedure describes how to remove and replace the fan and the relay that are mounted on the rear panel.

4.6.1 Rear Panel Removal (Figure 4-6)

- (1) Perform Power Supply Removal Procedure (Section 4.5.1 (1) to (4)).
- (2) Perform Top Cover Removal Procedure (Section 4.2.1).
- (3) Disconnect the cable connectors J51 and J52 from "LOGIC & SERVO" PWA.
- (4) Disconnect the grounding cable terminal from TAB1 on "LOGIC & SERVO" PWA.
- (5) Remove the four screws A and B securing the rear panel to the drive.
- (6) Disconnect the dc power cable connectors J05 and J06, and remove the rear panel.

4.6.2 Fan Removal and Replacement (Figure 4-7)

- (1) Remove the two mounting screws C and remove the fan from the rear panel. Keep the screws, washers, nuts and finger guard for reinstallation.
- (2) Position the new fan with the air flow arrow directing toward the rear of the drive, and fasten the new fan and the finger guard. (See Figure 4-7)

CAUTION: Installing the fan backwards will result in improper airflow, which will cause overheating and premature component failure.

4.6.3 Relay Removal and Replacement (Figure 4-7)

- (1) Remove the four mounting screws D.
- (2) Replace the cables connected to the relay terminals one by one with the new relay.
- (3) Check up the wiring referring to Table 4-1.

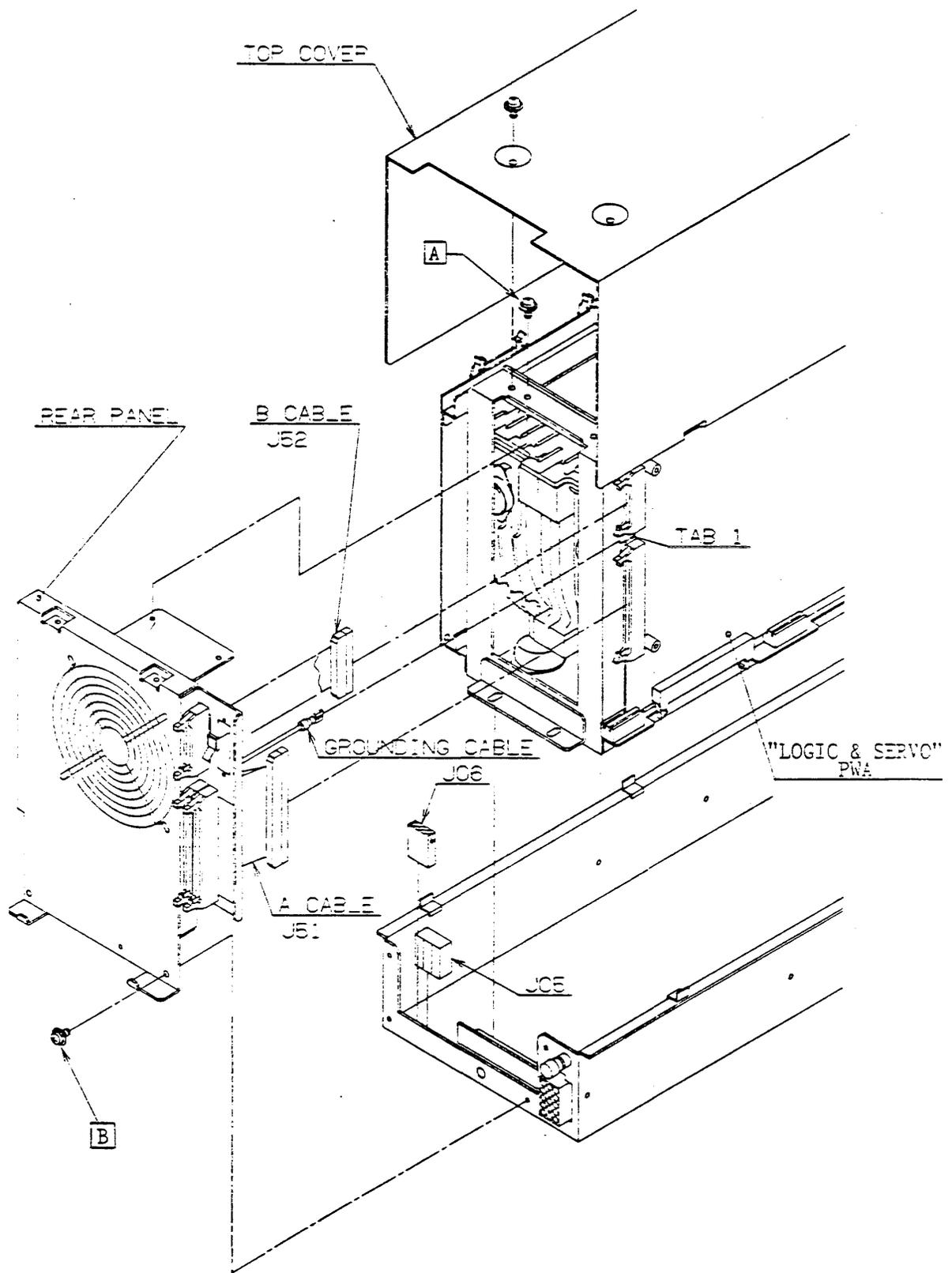


Figure 4-6 Rear Panel Removal and Replacement

4.7 "LOGIC & SERVO" PWA REMOVAL AND REPLACEMENT - SEE FIGURE 4-8

4.7.1 Removal

- (1) Perform Top Cover Removal Procedure (Section 4.2.1)
- (2) Disconnect the cable connectors J51, J52, J55, J56, J57 and J58 from "LOGIC & SERVO" PWA.
- (3) Remove the four grounding wires at SG51, SG52, SG53 and TAB1 of the PWA.
- (4) Remove the two screws A securing the PWA to the frame (F) and frame (R).
- (5) Disengage the PWA from the grooves of the PKG guides by pulling it upwards.
- (6) Disconnect the DC power cable connectors J40 and J50 connected to the lower part of the PWA, and remove the PWA.

4.7.2 Replacement

- (1) Connect the dc power cable connectors J40 to P40 and J50 to P50 on the new "LOGIC & SERVO" PWA.
- (2) Position the PWA so that the lower edge of it is engaged by the groove of PKG guides (three provided).
- (3) Verifying that the two holes on the insulator are positioned into the bosses on the frame (F) and frame (R), tighten the two screws A.
- (4) Connect the cable connectors J51, J52, J55, J56, J57 and J58 to the PWA.
- (5) Connect the four grounding wires to TAB1, SG51, SG52 and SG53 on the PWA.
- (6) Set the diagnostic mode selection switches SW2, SW3 and SW4. Refer to Section 2.4.1, 2,4,2 and 2.4.3.
- (7) Perform Top Cover Replacement Procedure (Section 4.2.2).

4.8 "POWER AMP" PWA REMOVAL AND REPLACEMENT - SEE FIGURE 4-9

4.8.1 Removal

- (1) Perform Top Cover Removal Procedure (Section 4.2.1).
- (2) Disconnect the cable connectors J20, J22, J23 and J25 from "POWER AMP" PWA.
- (3) Remove the two screws A securing "POWER AMP" PWA to the PKG support bracket.
- (4) Disengage the PWA from the grooves of the PKG guides by pulling it upwards.
- (5) Disconnect the cable connector GJ4 from the PWA and remove the PWA.

4.8.2 Replacement

- (1) Connect the cable connector GJ4 to GP4 on the new "LOGIC & SERVO" PWA.
- (2) Position the PWA so that the lower edge of it is engaged by the groove of the PKG guides (two places), and tighten the two screws A.
- (3) Reconnect cable connectors J20 to P20, J22 to P22, J23 to P23 and J25 to P25.
- (4) Perform Top Cover Replacement Procedure (Section 4.2.2).

4.9 "ENDEC & R/W" PWA REMOVAL AND REPLACEMENT - SEE FIGURE 4-9

4.9.1 Removal

- (1) Perform Top Cover Removal Procedure (Section 4.2.1).
- (2) Disconnect the cable connectors J31 and J34 from the PWA.
- (3) Remove the screw **A** securing the ground cable to SG31 on the PWA.
- (4) Remove the two screws **B** securing the PWA to the PKG support bracket.
- (5) Disengage the PWA from the grooves of the PKG guides by pulling it upwards.
- (6) Disconnect the DC power cable connector J30 from the PWA.

4.9.2 Replacement

- (1) Install the new "ENDEC & R/W" PWA by reversing the above steps.
- (2) Perform Top Cover Replacement Procedure (Section 4.2.2).

4.10 "DUAL-PORT" PWA REMOVAL AND REPLACEMENT - SEE FIGURE 4-11

"DUAL-PORT" PWA is an optional dual-port board, and is attached to the drive together with the "LOGIC & SERVO" board.

4.10.1 Removal

- (1) Perform Top Cover Removal Procedure (Section 4.2.1)
- (2) Disconnect the I/O cable connectors J61 from P61 and J62 from P62 on the "DUAL-PORT" PWA.
- (3) Disconnect the terminal of the grounding wire at TAB1 on the PWA.
- (4) Remove the screw **A** securing grounding wire and the PWA to "LOGIC & SERVO" PWA.
- (5) Remove the two screws **B** securing the PWA and "LOGIC & SERVO" PWA to the drive.
- (6) Disconnect the cable connectors J63 from P63 and J64 from P64 on the PWA.
- (7) Remove the three screws **C** connecting the PWA and "LOGIC & SERVO" PWA, and remove the PWA.

4.10.2 Replacement

- (1) Install the new "DUAL-PORT" PWA by reversing the above steps.
- (2) Perform Top Cover Replacement Procedure (Section 4.2.2).

4.11 "HDA" MODULE REMOVAL AND REPLACEMENT - SEE FIGURE 4-12, FIGURE 4-13

Except for the contact pad (see Section 4.13) and the motor stator (see Section 4-13), the HDA Module cannot be repaired and must be replaced as an assembly. The following describes removal and replacement of the entire HDA Module Assembly.

4.11.1 Removal

- (1) Perform Top Cover Removal Procedure (Section 4.2.1).
- (2) Perform Front Panel Removal Procedure (Section 4.3.1).
- (3) Perform Protect Cover Removal Procedure (Section 4.4.1)
- (4) Perform Power Supply Removal Procedure (Section 4.5.1).
- (5) Perform Rear Panel Removal Procedure (Section 4.6.1.).
- (6) Perform "LOGIC & SERVO" PWA Removal Procedure (Section 4.7.1.).
- (7) Perform "POWER AMP" PWA Removal Procedure (Section 4.8.1.).
- (8) Perform "ENDEC & R/W" PWA Removal Procedure (Section 4.9.1).
- (9) Disconnect the dc power cable connector EJ4 from EP4. (See Figure 4-12)
- (10) Remove the two screws **A** securing the frame (F) to the deck.
- (11) Remove the screws securing the grounding cables to the "HDA" module at SG11, SG12, SG13 and SG14.
- (12) Remove the two screws **B** securing the bracket to the deck.
- (13) Lift "HDA" module assembly from the deck.

<p>CAUTION: The "HDA" module assembly has a weight of 20 kilograms. Be certain to have a firm grip on the frame (F) and the frame (R) before lifting it from the deck. Also, take care not to damage cables.</p>

- (14) Disconnect the cable connectors J11, J12 and J13 from "HDA" module assembly.

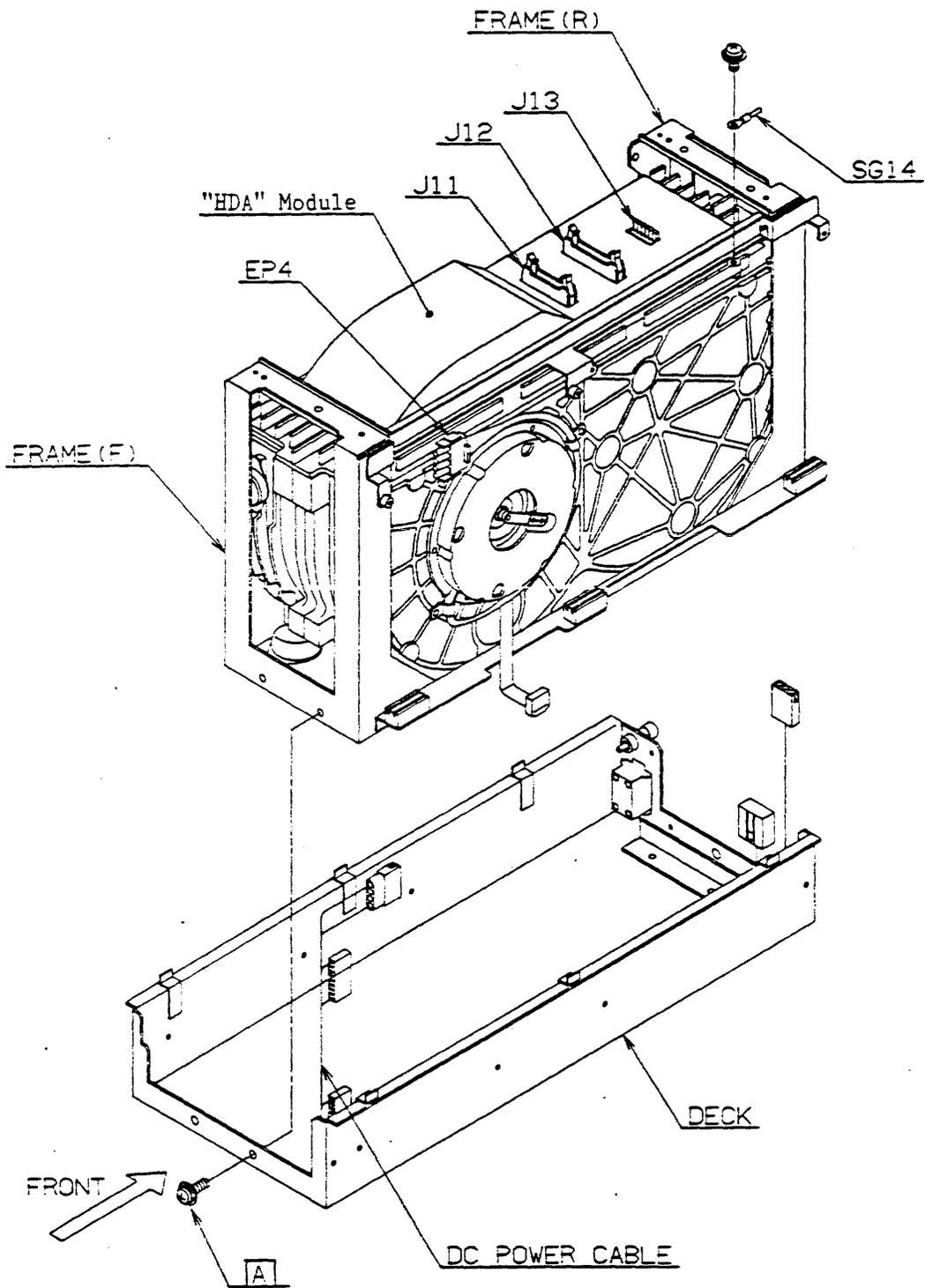


Figure 4-12 "HDA" Module Removal and Replacement (1/2)

4.12 "DISCHARGE PAD" REMOVAL AND REPLACEMENT - SEE FIGURE 4-14

4.12.1 Removal

- (1) Perform "POWER AMP" PWA Removal Procedure (Section 4.8.1).
- (2) Remove the two screws A securing the "DISCHARGE PAD" and the clamp plate to the motor cover.

4.12.2 Replacement

- (1) Attach the new "DISCHARGE PAD" with the Clamp Plate and the two screws A.
- (2) Perform "POWER AMP" PWA Replacement Procedure (Section 4.8.2).

4.13 "MOTOR STATOR" REMOVAL AND REPLACEMENT - SEE FIGURE 4-15

4.13.1 Removal

- (1) Perform "POWER AMP" PWA Removal Procedure (Section 4.8.1).
- (2) Remove the six screws **A** securing the Motor Cover, and remove the Motor Cover.
- (3) Remove the two screws **B** securing the Cable Clamps to the "HDA" module.
- (4) Disconnect the dc power cable connector EJ4 from EP4 of the Motor Stator Lead **C**.
- (5) Remove the motor stator by pulling it.

4.13.2 Replacement

- (1) Position the new "MOTOR STATOR" so that the stator lead **D** (10-pin ribbon flat cable) locates at the bottom of the "MOTOR STATOR".
- (2) Place the "MOTOR STATOR" in position over the Motor Rotor by inserting it into the "HDA" module.
- (3) Guiding the Motor Stator Lead **C** into the cable guide **E**, secure the Motor Cover with the six screws **A**.
- (4) Connect the DC power cable connector EJ4 to EP4.
- (5) Secure the Motor Stator Lead **C** with the Cable Clamps and the screws **B**.
- (6) Perform "POWER AMP" PWA Replacement Procedure (Section 4.8.2).

APPENDIX-B

752 POWER SUPPLY

B-1 GENERAL DESCRIPTION

The 752 Power Supply receives its input from the site ac power source, and uses it to produce the dc voltage necessary for drive operation.

The Power Supply operates at the following power source:

100 V - 120 Vac }
 200 V - 240 Vac } at 50/60 Hz

The voltage selector operates the change of input power voltage.

B-2 POWER REQUIREMENT

The ac power requirements with disk drive are shown in Table B-1.

Table B-1 Power Requirements

Input Voltage	100 - 120 Vac Single Phase	200 - 240 Vac Single Phase
Voltage Range	90 to 132 V	180 to 264 V
Frequency Range	47 to 63 Hz	47 to 63 Hz
Power Consumption		
Start-up	500 VA	500 VA
* Operating	350 VA	330 VA
Line Current		
Start-up	6.0 Arms	4.0 Arms
* Operating	4.0 Arms	2.6 Arms

* When disks are rotating and carriage is moving.

B-5 POWER SUPPLY VOLTAGE CONVERSION

When the power supply is shipped, its input is set to operate in 100 - 120 V.

The power supply has voltage selector located on the side of a cooling fan to conform to each site power.

CAUTION

Voltage Selector should be necessarily changed to the desired input-range before an ac power cord is connected.

If this operation is neglected, the power supply will be broken.

Procedure of Voltage Conversion (see Figure B-2)

- (1) Release Voltage Selector Cover fixed with two screws.
- (2) When adapting to the 100 - 120 V AC range, the connector is connected to P1.
When adapting to the 200 - 240 V AC range, the connector is connected to P2.
- (3) Fix the Voltage Selector Cover with two screws.
- (4) The set voltage range is indicated on or under the Voltage Selector.

B-6 INPUT AND OUTPUT CONNECTORS

(1) AC Power Inlet

The input power is provided by an AC Power Inlet.
(see Figure B-3)

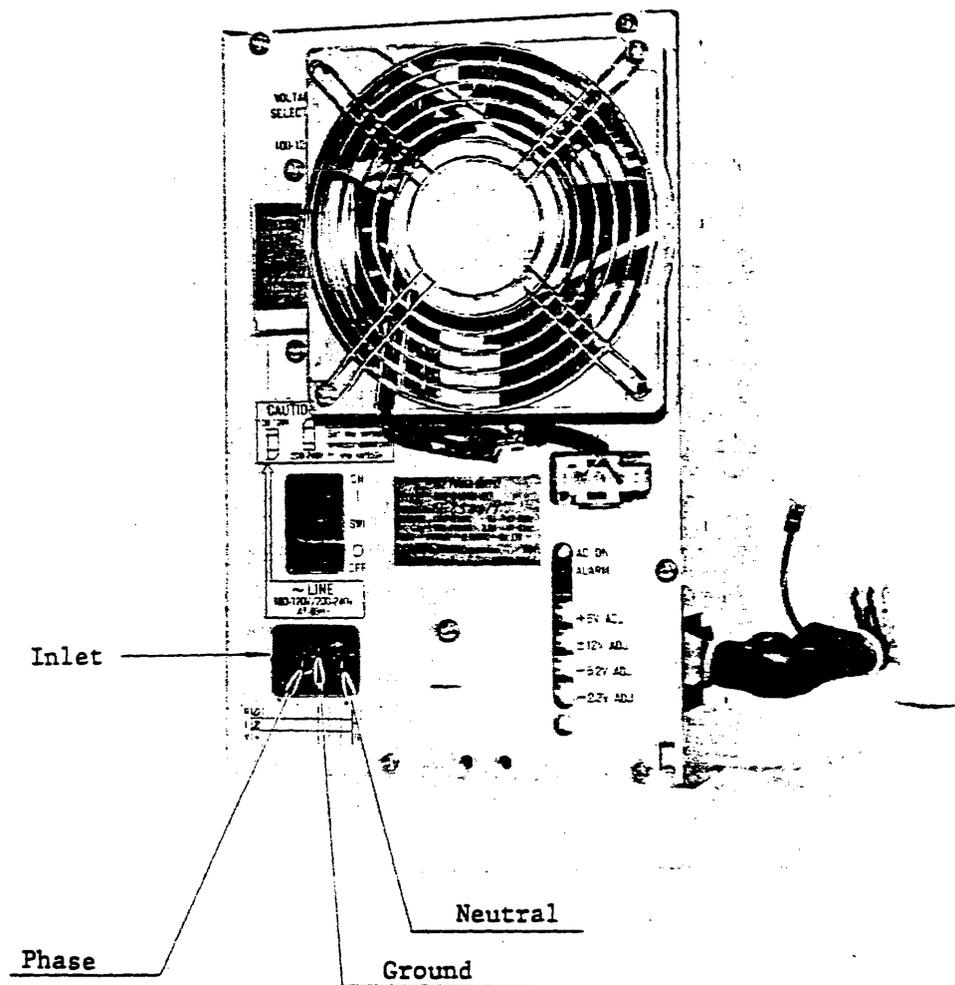


Figure B-3 Inlet

B-7 THEORY OF OPERATION

The Block Diagram is shown in Figure B-5.

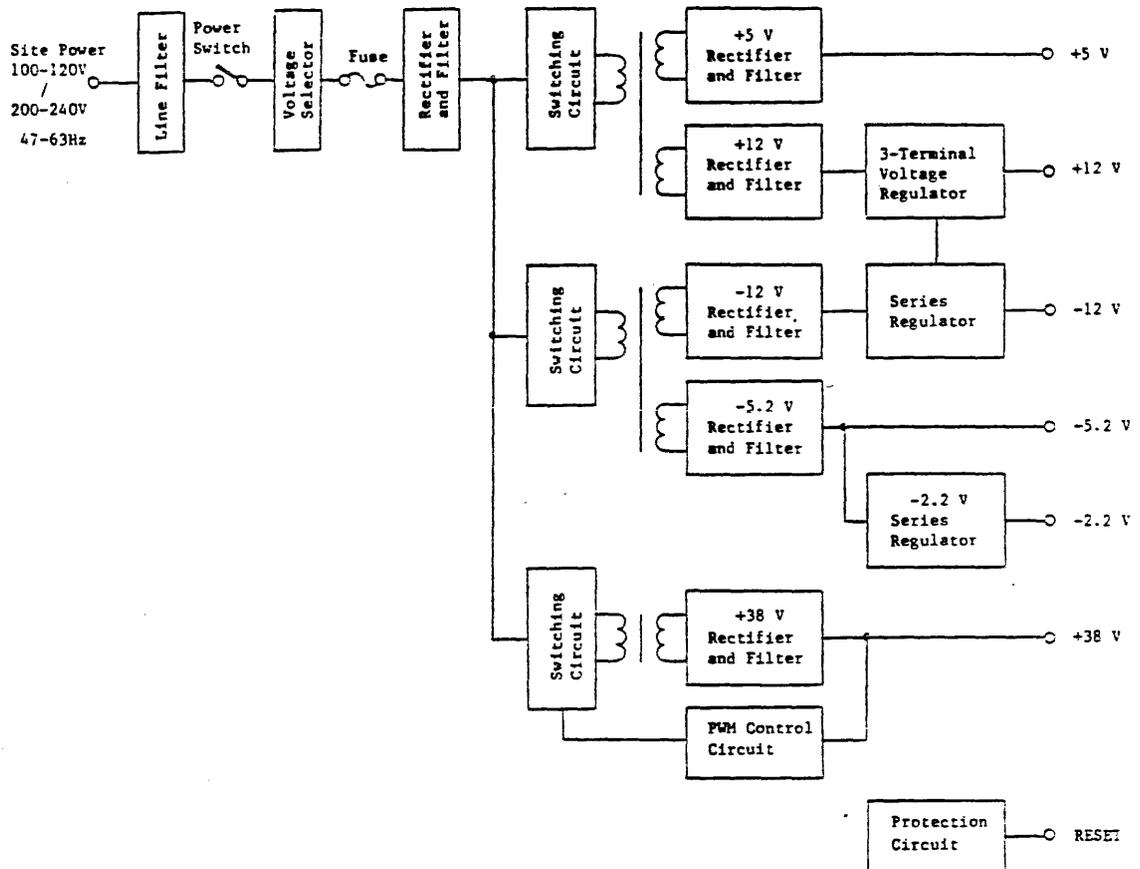


Figure B-5 Block Diagram

B-7.1 Primary Circuit

The ac power filtered by Line Filter is controlled by the Power Switch (SW1) on the rear of the drive.

Filtered ac power is supplied to the Voltage Selector.

The switch SW2 of the Voltage Selector exchanges the two ranges: 100 - 120 V range (100, 115, 120 V) and 200 - 240 V range (200, 208, 220, 230, 240 V).

The ac power is protected from overload or short circuit by the fuse on the printed circuit board.

- Overvoltage Protection

In case the output voltage rises above normal, overvoltage is detected at more than 115 to 135% of the rated voltage and the output voltage is cut off. (except +38 V circuit)

- Undervoltage Protection

When the output voltage goes low, undervoltage is detected at less than 10 to 80% of the rated voltage and the switching circuits stops oscillating.

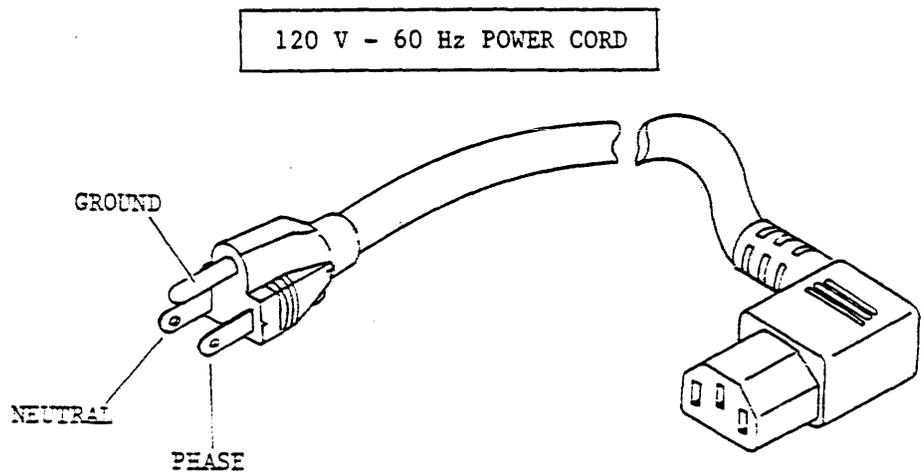


Figure B-6 120 V - 60 Hz Power Cord

APPENDIX-C

747-HLOG DIAGNOSTIC PANEL

C-1 GENERAL DESCRIPTION

This diagnostic panel functions as a seek exerciser and fault logger when the DKU7XX is offline and as a status monitor and fault logger when the DKU7XX is online. The logged data are retained for about 80 hours after the power supply is turned off.

C-2 CONNECTION

Connect P59 of the LOGIC package to P1 of HLOG with the 20-conductor flat cable, as follows:

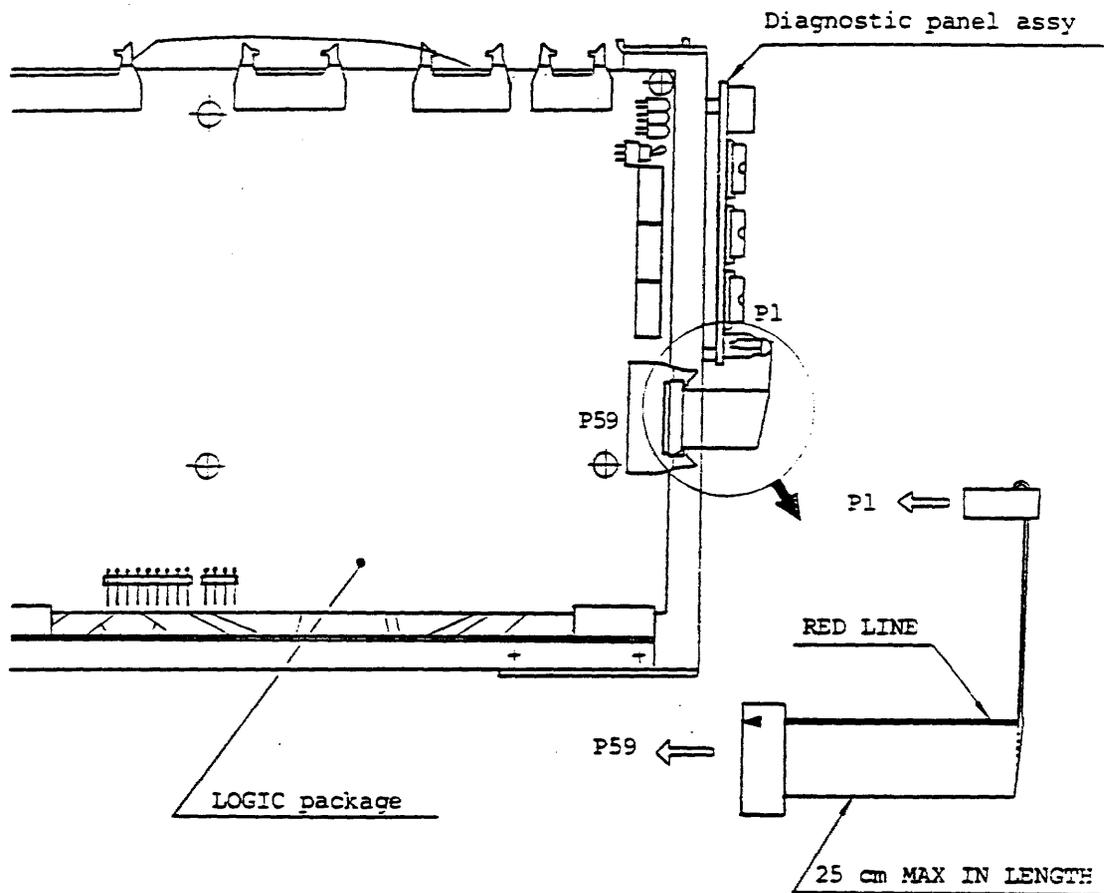


Figure C-1 Interface

Table C-1 Display Code

	0		8
	1		9
	2		A
	3		B
	4		C
	5		D
	6		E
	7		F

Regarding the seek, the operator can set the CYLINDER LOW, CYLINDER HI, seek mode, and seek interval time.

C-3.3 Log Read Mode

The fault and seek error taken in during the status or test mode are displayed on the 7-segment light-emitting diode.

The data to be displayed come in five types as follows:

- 1) Total error count : Maximum 255
- 2) Total power-on count : Maximum 255
- 3) Individual error count : Maximum 15
- 4) Error count by similar type : Maximum 15
- 5) Sequential error record

For 1) through 4), the increment is stopped when the maximum number is reached.

C-4 KEYBOARD OPERATION AND DISPLAY

The HLOG has 16 numerical keys, ten functional keys, six 7-segment displays, and six binary displays.

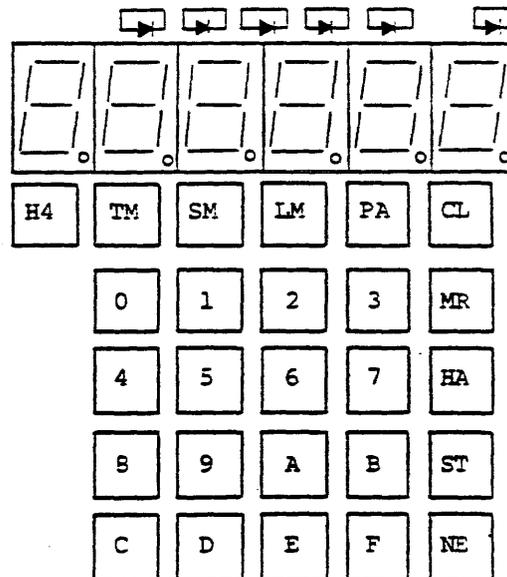


Figure C-4

C-4.2 Key Operation and Display in Test Mode

(1) Starting the mode

For this mode, a safety code is provided to prevent a move from online to offline caused by a typing error. The actual procedure is shown below. (Figure C-6)

However, as in the status mode, the procedure above may not be operational unless the operation in the other mode is complete.

C-4.3 Execution of the Mode

This mode is subdivided into four modes as follows:

(1) Seek parameter input mode

Started by pressing **PA**, this mode sets up CYLINDER 1, CYLINDER 2, SEEK INTERVAL TIME, SEEK MODE NO. The seek mode is related to CYLINDER 1 and CYLINDER 2 as shown below. (Table C-2)

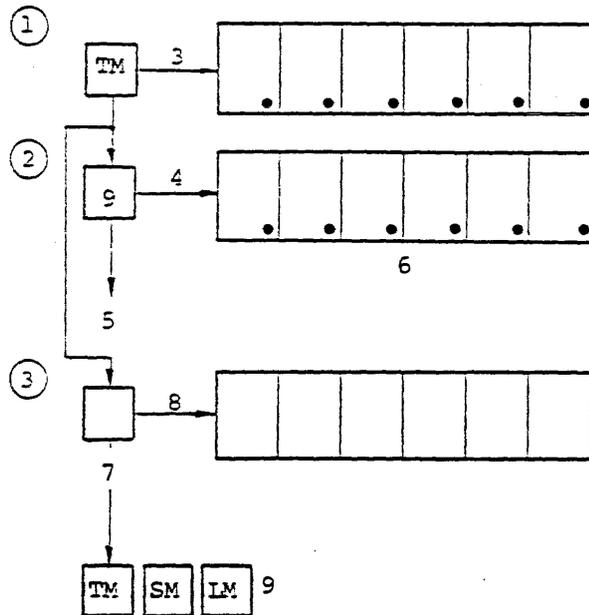


Figure C-6

SEEK INTERVAL TIME is in units of "m sec".

The procedure for input of parameters is shown next.

a) Input of CYLINDER 1

After pressing **PA**, the display shows the following:

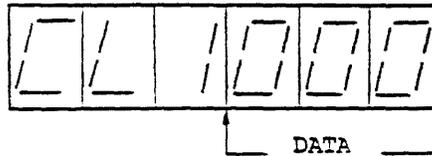


Figure C-7

Pressing a NUMERICAL key in this status causes the displayed data to be left-shifted.

Pressing **NE** causes the value displayed in the data part to be read as data, and the operation goes to b). If the input value does not satisfy the restrictions, the value is read and the operation moves to the next step, too.

After pressing **NE**, pressing another FUNCTION key enables the operation to be moved to another mode within the TEST MODE, or to STATUS MODE or LOG READ MODE.

b) Input of CYLINDER 2

The following display is shown.

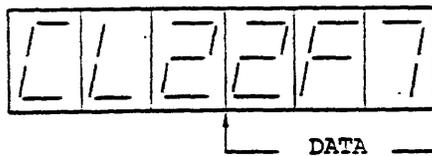


Figure C-8

After pressing **NE**, the operation moves to c). In other respects, the description in a) is applicable.

The end of seek mode occurs in two ways:

- 1) When **[ST]** is pressed.
- 2) When a seek error or fault occurs while not in the retry mode.

When the seek mode ends, the "RUN" display goes out and the unit waits for the input of a function key in the TEST MODE, the **[SM]**, or **[LM]** key.

(3) CE reset mode

Pressing the **[MR]** key causes a **[CE]** reset instruction to be given to the device. At this time, the 7-segment display operates in the same way as in the STATUS MODE.

Regardless of the result of the Return To Zero, this mode ends and the unit waits for the input of a function key within the TEST MODE, the **[SM]**, or **[LM]** key.

(4) Head advance mode

Pressing the **[HA]** key causes the Head Advance instruction to be given to the device (Head Address 0-15). At this time, the 7-segment display operates in the same way as in the STATUS MODE.

Regardless of the outcome of head advance, this mode ends, and the unit waits for input of a function key under the TEST MODE, the **[SM]**, or **[LM]** key.

Note: The logging in the TEST MODE is limited to the duration of the seek, Head Advance, or **[CE]** reset operation.

(5) Head Bit 4 mode

Head Bit 4 key must be pushed to select Head Address over 15. By this action, Head Address Bit 4 is set to high, and indicates HD-4 binary display. Then pushing **[MR]** key resets Head Address Bit 4.

C-4.4 Key Operation and Display in Log Read Mode

(1) Starting the mode

Pressing **[LM]** starts the log read mode. However, if the operation is not complete in another mode, the change to this mode may not be made.

(2) Execution of the mode

After the LED of the "LOG READ MODE" is lit of the six binary displays, ADDRESS and DATA are displayed as shown below. (Figure C-11)

If there is no address with a NON-00 DATA part between the next address and the address $0FF_H$, the operation returns to the address 000.

Pressing **NE** in this way permits successive search of the addresses for which the DATA part is other than 00.

The addresses 100_H through $27F_H$ in the logging memory are assigned to the sequential error record. The sequential error record not only records the errors sequentially, but also records no occurrence of errors when this happens between the power-on and power-off. An example is shown below.

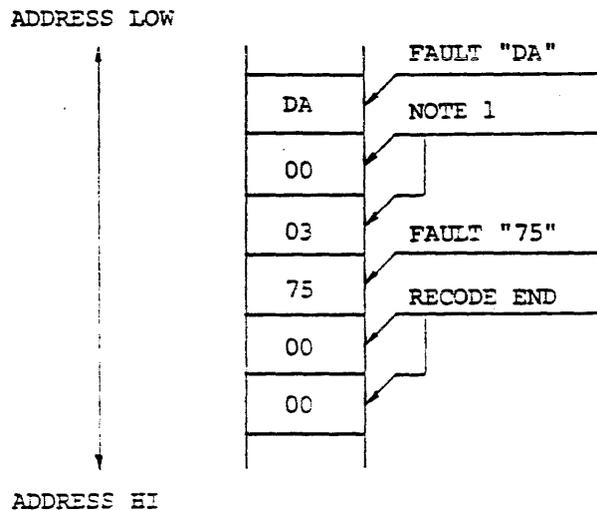


Figure C-13

NOTE 1. Indicates that power on-off is repeated three times without error.

As shown in the figure, two consecutive 00s leads to the record end. If 00 is followed by a NON-00 code, it indicates the power on-off without error occurred as many times as shown by the code.

The procedure for selecting an address after 100_H is shown next.

- a) After pressing the **PA** key, pressing a numerical key causes the display on the ADDRESS part to be left-shifted and the display on the DATA part to disappear.

Table C-4 Association between Addresses 000 to 0FFH and Errors

		16 ² 16 ¹ 16 ⁰	DESCRIPTION			DESCRIPTION	
0	1	0	INITIALIZE	0	9	0 RECALIBRATE IN	
		1	VOLTAGE FAULT			1	VOLTAGE FAULT
		2	ROM			2	MOTOR SPEED LOSS
		Σ	-			-	-
	4	FAULT LATCH		4	LOSS OF INDEX		
					5	NO OGB FOUND	
2	0	STOP			-	-	
	1	VOLTAGE FAULT		9	NO N LIN FOUND		
3		START WAIT		A	NOT TRAGET VEL		
	1	VOLTAGE FAULT		-	-		
4	0	MOTOR START		C	OVER SHOOT CHECK		
	1	VOLTAGE FAULT		D	OVER SHOOT CHECK (TIME OUT)		
	-	-		A	0 READY (ON CYL)		
	3	NOT MOTOR SPEED UP			1	VOLTAGE FAULT	
	4	NOT ROTATION			2	MOTOR SPEED LOSS	
					3	MOTOR SPEED OVER	
					4	LOSS OF INDEX	
5	0	MOTOR SPEED UP			-	-	
	1	VOLTAGE FAULT		C	OFF TRACK		
	2	MOTOR SPEED TOO SLOW		B	0 MOVE OUT		
	3	MOTOR SPEED TOO HIGH			1	VOLTAGE FAULT	
6	0	MOTOR SPEED OK			-	-	
	1	VOLTAGE FAULT		9	NO DIFF = 0 FOUND		
	-	-		A	NO TARGET VEL FOUND		
	3	MOTOR SPEED OVER		-	-		
				C	OVER SHOOT CHECK		
7	0	LOCK PLO		D	OVER SHOOT CHECK (TIME OUT)		
	1	VOLTAGE FAULT		E	OVER TRAVEL (OGB)		
	2	MOTOR SPEED LOSS		F	OVER TRAVEL (IGB)		
	-	-					
	4	LOSS OF INDEX		C	0 INTF CHECK		
	5	NO IGB FOUND			1	OVER CYL	
8	0	RECALIBRATE OUT			2	TAG 1 WHILE NOT ON CYL	
	1	VOLTAGE FAULT			3	TAG 1 WHILE NOT READY	
	2	MOTOR SPEED LOSS					
	-	-					
	4	LOSS OF INDEX					
	5	NO OGB FOUND					
	6	NO N LIN FOUND					
	7	NO HALF TRACK FOUND					
	8	NO Q LIN FOUND					
	9	NO DIFF-0 FOUND					
	A	NOT TARGET VEL					
	B	NO TOO SLOW FOUND					
	C	OVERSHOOT CHECK					
	D	OVERSHOOT CHECK (TIME OUT)					

(to be cont'd)

Table C-5

DISPLAY CODE		EVENT	CAUSE
STATE	FAULT		
F		POWER ON SEQ	
	F	POWER ON SEQ. FAULT	CPU FAULT
1		INITIALIZE	
	1	VOLTAGE FAULT	5V, 12V
	-		24V
	2	ROM FAULT	ROM (2764)
	4	FAULT LATCH	FAULT
2		STOP	
	1	VOLTAGE FAULT	
3		START WAIT	0-30 SEC
	1	VOLTAGE FAULT	
4		MOTOR START	
	1	VOLTAGE FAULT	
	-		
	3	NOT MOTOR SPEED UP	SPEED 90%
	4		
5		MOTOR SPEED UP	
	1	VOLTAGE FAULT	
	2	MOTOR SPEED TOO SLOW	SPEED<97%
	3	MOTOR SPEED TOO HIGH	SPEED>102%
6		MOTOR SPEED OK	
	1	VOLTAGE FAULT	
	-		
	3	MOTOR SPEED OVER	
7		LOCK PLO	
	1	VOLTAGE FAULT	
	2	MOTOR SPEED LOSS	
	-		
	4	LOSS OF INDEX	
	5	NO IGB FOUND	

Table C-5 (Cont'd)

DISPLAY CODE		EVENT	CAUSE
STATE	FAULT		
C		INTF CHECK	
	1	OVER CYL	
	2	TAG 1 WHILE NOT ON CYL	
	3	TAG 1 WHILE NOT READY	
D		MOVE IN	
	1	VOLTAGE FAULT	
	4	LOSS OF INDEX	
	9	NO DIFF=0 FOUND	
	A	NO TARGET VEL FOUND	
	-		
	C	OVER SHOOT CHECK	
	D	OVER SHOOT CHECK (TIME OUT)	
	E	OVER TRAVEL (OGB)	
	F	OVER TRAVEL (IGB)	
E		FAULT (NOT READY)	
	1	SEEK UNSUCCESSFUL	
	2	SEEK SPEED TOO HIGH	
	3	SEEK SPEED TOO LOW	
	4	NOT PLO GOOD	
	5	OFF TRACK	
	6	OFFSET COMMAND ERROR	
	7	RTZ UNSUCCESSFUL	
F		FAULT	
	1	PROTECT VIOLATION+R/W	
	2	RDY WRT+ON CYL WRT	
	3	WRIT CLOCK FAULT	
	4	OFF TRACK WRITE	
	5	WRITE MARS USAFR	
	6	READ MARS UNSAFE	