77653520

CONTROL DATA CORPORATION

CONTROL DATA®
FLEXIBLE DISK DRIVE
MODEL 9406-4

GENERAL DESCRIPTION
OPERATION
INSTALLATION AND CHECKOUT
THEORY OF OPERATION
DIAGRAMS
MAINTENANCE
MAINTENANCE AIDS
PARTS DATA
WIRE LISTS

MAGNETIC PERIPHERALS INC.
a subsidiary of CONTROL DATA CORPORATION

HARDWARE MAINTENANCE MANUAL

REVISION RECORD

REV	DATE	SHEETS AFFECTED	MANUAL/SECTION REVISION STATUS 1	2	3	4	5	6	7	8	9	10	11	12	CHANGE AUTHORITY
A	81 MAY 29 JB ISSUE		A	A	A	A	A	A	A	A	A				Magdeburger
B	81 JUL 27 S. Wise	ii	A	A	A	A	B	A	A	A	A				PL 20598
C	81 OCT 13 S. Wise	ii	A	A	A	A	C	A	A	B	A				PL 20644
D	82 FEB 3	ii, vi	A	D	A	D	D	A	A	B	A				PL 20679

Address all comments concerning this publication to the distributor or use the enclosed user comment sheet located in the back of this publication.

PREFACE

This manual provides the information needed to install, operate and maintain the Control Data Corporation Model 9406-4 Flexible Disk Drive (FDD) and is intended to support customer engineers who require detailed information about the Flexible Disk Drive's operation.

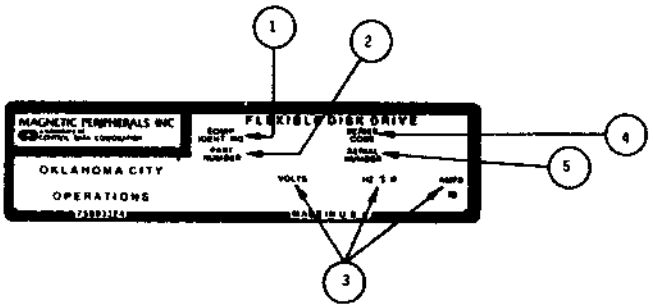
The total content of the manual is comprised of two publications, each having a unique publication number, and is contained in one volume. The Manual's publication number, 77653520, is that of the front matter, Sections One through Seven, and Section Nine. This number should be used when making reference to the Model 9406-4 Flexible Disk Drive Hardware Maintenance Manual.

This manual applies to several configurations of the FDD. Refer to the equipment name plate located on the right hand side of the unit (as viewed from the front) to determine the appropriate Hardware Product Configurator (HPC) and Equipment number as shown in the Flexible Disk Drive Configurator Sheet, page iv.

Sections VIII Parts Data is identified by the unique Publication number 77653522.

EMI NOTICE

NOTICE: This equipment has been designed as a component to high standards of design and construction. The product, however, must depend on receiving adequate power and environment from its host equipment in order to obtain optimum operation and to comply with applicable industry and governmental regulations. Special attention must be given by the host manufacturers in the areas of safety, power distribution, grounding, shielding, audible noise control, and temperature regulation of the device to insure specified performance and compliance with all applicable regulations. This equipment is a component supplied without its final enclosure and therefore is not subject to standards imposed by FCC Rules for Electro-Magnetic Interference (EMI). Federal Docket 20780/FCC 80-148 Part 15.



1. EQUIPMENT IDENTIFICATION NO. (8R8XX-X)
2. HARDWARE PRODUCT CONFIGURATOR (HPC) NUMBER
3. AC POWER REQUIRED (ON UNITS LABELED 50/60 HZ, CHECK CONFIGURATION OF SPINDLE-MOTOR PULLEY FOR FREQUENCY).
4. EQUIPMENT SERIES CODE STATUS NUMBER
5. UNIT SERIAL NUMBER

GG1186

NOTES:

1. PARTS BREAKDOWN IDENTIFICATION - From unit nameplate (see above representation), find HPC number(2). After reading instructions for use of Section 8, Illustrated Parts Catalog, of this manual, use HPC number to determine specific parts configuration for unit in question.

2. EQUIPMENT INQUIRIES - Equipment inquiries should reference the unit's Equipment Identification Number(1) and Series Code, Number(4) from unit nameplate, as represented above.

TABLE OF CONTENTS

SECTION PAGE

SECTION PAGE

WIRE LISTS

1.1 INTRODUCTION

The Model 9406-4 Flexible-Disk Drive (FDD) is a compact, portable, random-access, data-storage device that interfaces with a central processor via a control unit. Input/Output data and control signals are transmitted by means of an I/O cable.

1.2 PURPOSE AND USE OF EQUIPMENT

Data, in the form of magnetized bits, is written on, or read from the tracks of a rotating diskette. The FDD uses a single, flexible, removable diskette enclosed in a sealed jacket. The unit may be configured for hard-sector or soft-sector operation.

1.3 PRODUCT DESCRIPTION

The major FDD components are the spindle, disk drive motor, read/write heads, stepping motor, track-indexing devices and printed-circuit board.

The options include Data/Clock Separation and Sector Separation.

1.3.1 PHYSICAL DESCRIPTION

The physical dimensions for the equipment are as follows:

	9406-4
Height	4.62 inches (117.4 mm)
Width	9.50 inches (241.3 mm)
Depth	14.25 inches (362 mm)
Weight	12 lbs. (5.44 kg)

1.3.2 ELECTRICAL DESCRIPTION

The electrical specifications for the equipment are as follows:

- DC Power Source (Supplied by Host Equipment)

  +24 volts (±10%) @ 0.120A Max when Deselected
  @ 0.70 A Typical when Stepping
  +5 volts (± 5%) @ 0.6 A Typical

- AC Power Source - Refer to the FDD nameplate to determine AC power requirements.

1.3.3 PERFORMANCE CHARACTERISTICS

The equipment specifications for the FDD are as follows:

- ACCESSING TIME

Maximum Access Time	248 ms
Maximum One-Track Access Time	23 ms
Average Access Time	91 ms

- RECORDING

Mode			
Density (nominal)	Double Frequency	MFM	Track
Head 0	1836 BPI (72BPmm)	3672 BPI(145BPmm)	Outer
	3268 BPI (129 BPmm)	6536 BPI (257 BPmm)	Inner
Head 1	1879 BPI (74 BPmm)	3758 BPI (148 BPmm)	Outer
	3408 BPI (134 BPmm)	6816 BPI (268 BPmm)	Inner
Data Transfer Rate	249,984 bits/sec	499, 968 bits/sec	
Bits/Byte	8	8	
Bits/Track	41, 664	83, 328	
Tracks/Surface	77	77	
Sectors	Format Determined	Format Determined	

- DATA CAPACITY

Bytes/Track	5,208	10,416
Bits/Track	41,664	83,328
Bits/Surface	3,208,128	6,416,256

• FLEXIBLE DISKETTE (Optional)	CDC 421 Single-Sided, Single-Density CDC 423 Single-Sided, Double-Density CDC 425 Double-Sided, Double-Density	
Diskette Dimensions	8x8 inches (203.2 x 203.2 mm) (including jacket)	
Useable Diskette Recording Surfaces	2	
Diskette Surface Diameter	7.88 in. (200.1 mm)	
Recording Radii (Nominal)		
Head 0	Track 76 2.0290 in. (51.5 mm) Inner Track 00 3.6123 in. (91.8 mm) Outer	
Head 1	Track 76 1.9457 in. (49.4 mm) Inner Track 00 3.5290 in. (89.6 mm) Outer	
Diskette Surface Coating	Magnetic Oxide	
Diskette Velocity	360 r/min	
• READ/WRITE HEADS		
Heads/Unit	2	
Track Width	0.013 in.	(0.33 mm)
Track Spacing	0.02083 in.	(0.529 mm)
Erase to Read/Write Gap	0.036 in.	(0.914 mm)

2.1 INTRODUCTION

The FDD is under direct control of the input/output and power sources. No special start-up procedure is required. Operation is fully automatic and requires no operator intervention during normal operation.

2.2 OPERATING INSTRUCTIONS

Verify that power and I/O cables are securely attached before operation.

2.2.1 FLEXIBLE DISKETTE LOADING

a. Apply AC/DC power to unit.
b. Open FDD door.
c. Remove diskette from storage envelope as show in Figure 2-1.
d. Be sure the Write-Protect slot in the jacket is open, as shown in Figure 2-1, if the diskette is to be write-protected.
e. If a diskette with a Write-Protect slot is not utilizing the Write Protect, that is, it will be written on, the slot must be covered with a piece of tape which is opaque to infrared.
f. Carefully slide diskette into FDD, as shown in Figure 2-1, until jacket is solidly against stops and sets the ejector mechanism.
g. Carefully close unit door. Ensure that jacket is properly seated, spindle has engaged diskette, and door is closed and latched.
h. Protect the empty envelope from liquids, dust, and metallic materials.

2.2.2 FLEXIBLE DISKETTE REMOVAL

a. Open FDD door to stop diskette rotation and disengage spindle.
b. Remove diskette from FDD and put it in its storage envelope.
c. Close FDD door.

2.3 ERROR RECOVERY

The following paragraphs give information needed to recover from possible errors in equipment operation.

2.3.1 SEEK ERROR

Seek errors will rarely occur unless the stepping rate is exceeded. In the event of a seek error, recalibration of track location can be achieved by repetitive Step Out commands until a Track 00 signal is received.

2.3.2 WRITE ERROR

To guard against degradation from imperfections in the media, no more than four attempts to write a record should be used when read after write errors are encountered. In the event a record cannot be successfully written within four attempts, it is recommended that the sector or track be labeled defective and an alternate sector or track assigned. If more than two defective tracks are encountered, it is recommended that the diskette be replaced.

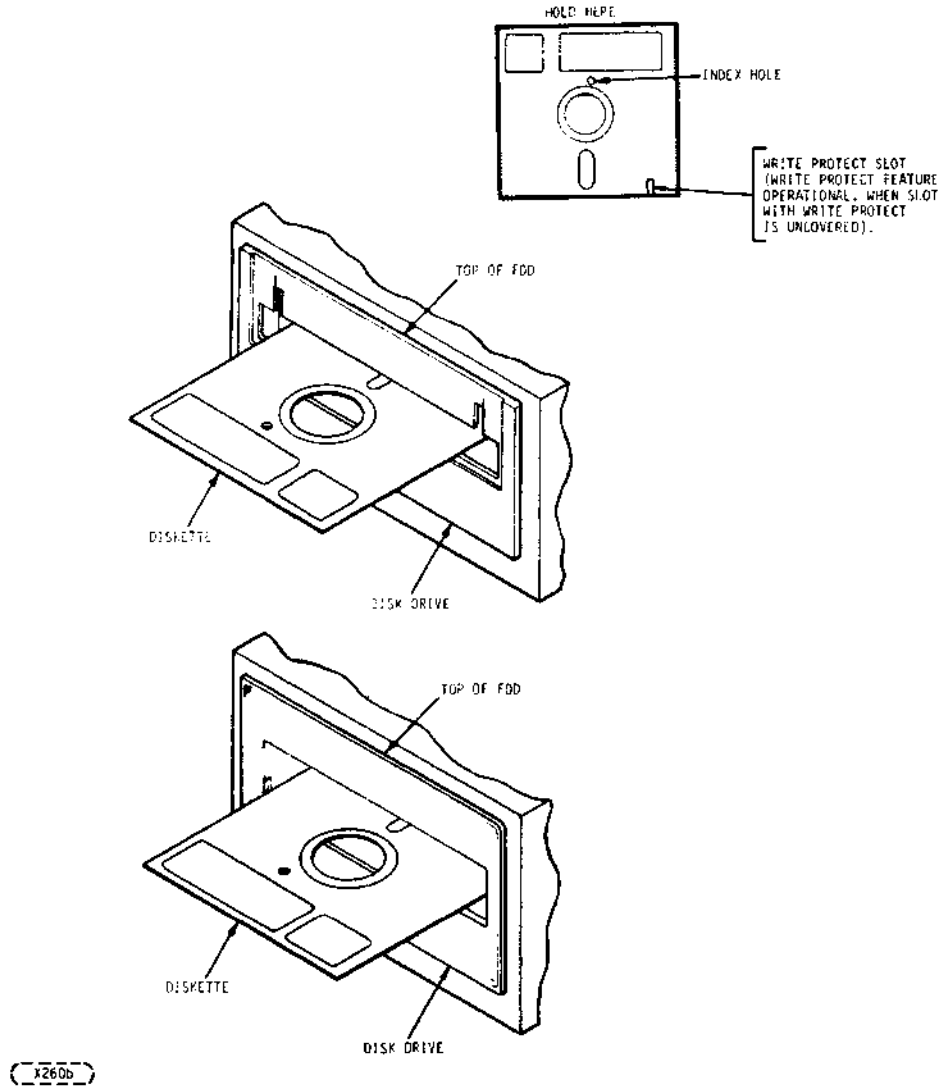


FIGURE 2-1. DISKETTE INSTALLATION

2.3.3 READ ERROR

In the event of a Read error, up to five attempts should be made to recover with rereads. If after five attempts the data has not been recovered, retract the head to Track 00, reseek to the data track and attempt five additional rereads. Unloading the head when data transfers are not imminent will increase the data reliability and extend the diskette life.

2.4 DISKETTE HANDLING RECOMMENDATIONS

Since the recorded diskette contains vital information, reasonable care should be exercised in its handling. Longer diskette life and trouble free operation will result if the following recommendations are followed.

a. Do not use a writing device which deposits flakes e.g., lead or grease pencils, when writing on diskette jacket label.

b. Do not fasten paper clips to diskette jacket edges.
c. Do not touch diskette surface exposed by jacket slot.
d. Do not clean diskette in any manner.
e. Keep diskette away from magnetic fields and from ferromagnetic materials that may be magnetized.
f. Return diskette to envelope when removed from FDD.
g. Protect diskette from liquids, dust, and metallic substances at all times.
h. Do not exceed the following storage environmental conditions:

Temperature:	50° to 125°F (10° to 56.1°C)
Relative Humidity:	8% to 80%
Maximum Wet Bulb:	85°F (29.4°C)

i. Diskettes should be stored in a box or cabinet when not in use.
j. Remove diskette before applying or removing power to the FDD.

3.1 INTRODUCTION

This section provides the information and procedures necessary to put an FDD into operation.

3.2 UNPACKING

Unpack FDD as follows:

a. Cut banding and lift top half of styrofoam shell from unit.
b. Lift unit in polyethylene bag from bottom half of styrofoam shell and remove unit from polyethylene bag.

During unpacking, care must be used so that any tools being used do not inflict damage to the unit. As a unit is unpacked, inspect it for possible shipping damage. All claims for this type of damage should be filed promptly with the carrier involved. If a claim is filed for damages, save the original packing materials.

3.3 INSTALLATION

Install the FDD in the designated location in the host equipment. Remove blank head protective diskette from unit.

3.4 CABLING AND CONNECTIONS

Connect the AC cable, I/O cable, and DC cable if applicable between the FDD and host equipment. Adequate circuit protective devices must be provided by the host equipment to meet applicable safety standards.

3.4.1 INPUT-OUTPUT CABLE

The maximum cable length from connector to connector is 25 feet (7.62 m). The characteristic impedance should be 150 ohms.

The information relative to the I/O connector (J1) and pin/signal assignments are defined in Figures 5-1, 5-3 and 5-4.

The terminating resistor pack RM5 (see Figure 5-4) is to be installed in the end FDD (farthest from the controller) ONLY. Terminators in more than one FDD may result in damage to the controller.

3.4.2 DC POWER CONNECTION

The mating connector cable should consist of 18 AWG minimum. Refer to Figure 3-2 for connector part numbers.

3.4.3 AC POWER CONNECTION

The mating connector cable should consist of stranded wire, 18 AWG minimum with center-pin connection utilized as frame ground. Refer to Figure 3-1 connector part numbers and attachment.

3.5 ENVIRONMENT

Operating and storage environments of the FDD are as follows:

Operating:	40° to 115°F (4.4° to 46.1°C) 12°F (6.6°C)/hr. max. fluctuation 20% to 80% relative humidity (providing there is no condensation)
Non-Operating:	-30° to +150°F (-35° to 65°C) 5% to 95% relative humidity (providing there is no condensation) Max. Wet Bulb 80°F (27°C)

3.6 INITIAL CHECKOUT

This procedure should be used to determine that the FDD is operational. The procedure assumes that the unit is installed and the I/O and power cables are connected.

a. Assure that the shipping insert has been removed before applying power.
b. Apply AC power to unit and visually check that the spindle rotates.
c. Apply DC power to unit.
d. Insert diskette as described in Section 2.
e. Apply a head-load-command signal to the unit and close the access door. Check that the head-load solenoid actuates, and the door-closed switch is actuated.
f. Apply a stepping-command signal to the unit and check that the actuator steps the head as commanded.
g. Remove diskette.
h. Remove the command signals and power from the unit.

3.6.1 OPERATION FREQUENCY

If the required operating frequency is different than that which the unit is configured, a procedure for converting operating frequencies using the dual-diameter reversible pulley is provided in Section 6, "Frequency Conversion".

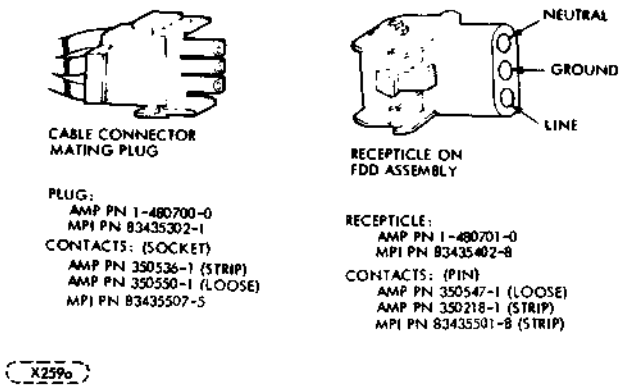
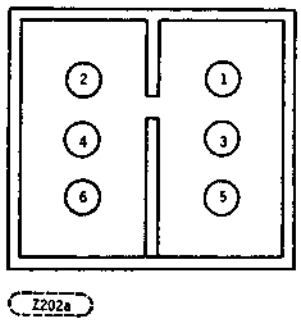


FIGURE 3-1. AC CABLE ASSEMBLY



PIN 8	USE	
1	+24	Mating Connector Amp 1-480270-0
2	+24 Return	Pins Amp 60619-1
3	NC	
4	NC	
5	+5	
6	+5 Return	

FIGURE 3-2. DC CONNECTOR

4.1 INTRODUCTION

The basic functions performed by the FDD are: (1) receive and generate control signals, (2) position the Read/Write heads on selected tracks, and (3) write or read data upon command from the FDD controller. These functions are accomplished upon selection after initial indication to the controller that the FDD is ready to operate and accept commands.

The theory of operation for the FDD is divided into two parts. The first part gives a general theory of operation. The second part gives a detailed functional description of all major components, both electronic and mechanical, and describes all signals exchanged between the FDD and the controller.

Sections 4 and 5, Theory of Operations and Diagrams, respectively, which follow, detail operation of both hard-sector/data-separation configurations, and soft-sector/composite-read-data configuration(s).

Separate PWA's and schematics for both sets of configurations are contained in Section 5.

4.2 GENERAL DESCRIPTION

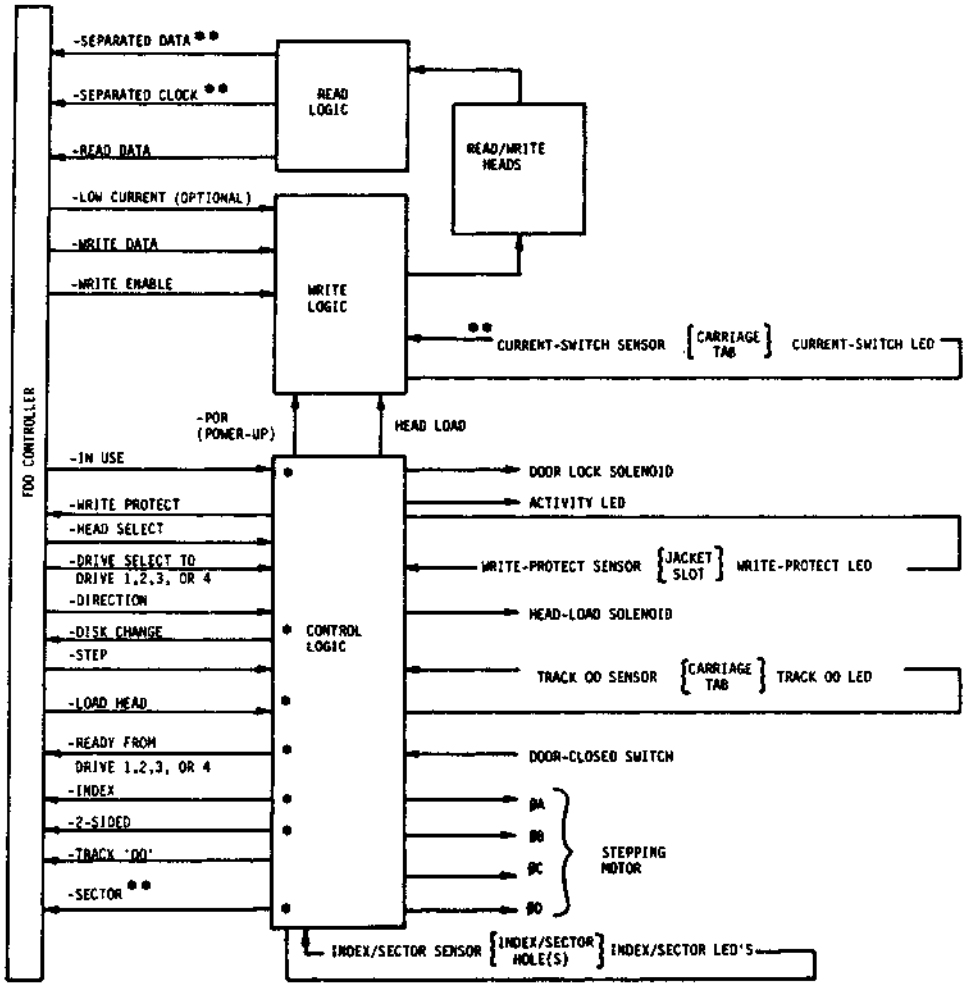
The basic function of the FDD is to indicate to the controller when it is ready to operate, and respond to the commands of the controller to: (1) receive and generate control signals; (2) position the Read/Write heads to selected tracks; and (3) write or read data on the diskette when selected. All of the functions described which are options are switch selectable.

Signals received and transmitted by the FDD are shown in Figure 4-1. Some signals received by the FDD are gated with Drive Select so that no stepping, reading or writing can be performed on an unselected FDD. Also, some signals generated within the FDD are gated with Drive Select so that they can not be transmitted from an unselected FDD.

During the write operation, the selected FDD must have heads loaded, Head Select, Write Enable and Write Data signals. The Write Enable line remaining high implies a read operation. Under these conditions, the FDD will transmit -Read Data signals to the controller. Some models of the FDD which contain a data separator will also transmit -Sep Clock and -Sep Data signals to the Controller.

Controller Step and Direction commands are received initiating a track seek operation on a selected FDD.

Positioning the carriage-mounted Read/Write heads is accomplished by a band-driven stepper motor. Each step command from the user system increments the stepper motor which, in turn, moves the band. The band increments the Read/Write heads one track position for each step command. The selected FDD transmits a Track 00 signal to the controller whenever the Read/Write heads are at Track 00.



* MAY USE OPTIONAL ALTERNATE I/D LINES
** OPTIONAL, AVAILABLE IN SOME DRIVE CONFIGURATIONS

GG119a

FIGURE 4-1. FUNCTIONAL BLOCK DIAGRAM

A reading or writing operation begins by placing the Read/Write heads in contact with the diskette with a Head-Load command and at the desired track. To write on the diskette, Write Enable is sent by the controller to condition the write logic. The write current then in the head, reverses polarity synchronous with the high-to-low transitions of the Write-Data pulses from the controller. The current reversals cause magnetic flux reversals on the desired diskette track. Erasure of previously recorded data is simultaneously accomplished during the writing operation in addition to a delayed-tunnel-erase which ensures disk inter-changeability.

To read from the diskette, magnetized bits in the format of the pre-recorded data are sensed by the Read/Write heads. This signal is amplified, digitized and transmitted to the user system.

4.3 FUNCTIONAL DESCRIPTION

Refer to Figures 4-1, 5-2, and the Schematic Diagram (Section 5) for the following discussion.

The FDD is divided into the following major functional areas:

a. Control Logic
b. Write Logic
c. Stepper Control
d. Read Logic
e. Diskette Drive
f. Read/Write Head
g. Index
h. Door Lock
i. Drive Select

4.3.1 CONTROL LOGIC

The functions of the control logic are to generate the signals that: (a) establish the ready status of the FDD; (b) step the Read/Write heads in or out upon selection and command of the controller; (c) load the heads on the diskette for read/write operations; (d) protect the diskette from writing if the write-protect slot is present; (e) indicate when the Read/Write head is at Track 00; (f) generate the Index and Sector pulses when the diskette is rotating and the FDD is selected; (g) lock the FDD door latch; (h) unit selection of the FDD; (i) select head 0 or 1 for Read/Write operation; (j) indicate that the door has been open while the drive was not selected; (k) indicate single or two-sided diskette; (l) indicate visually that the drive has one or more functions performed by the Activity LED.

a. Drive Ready

This line is used to indicate to the FDD controller that the diskette is inserted correctly, the door is closed, and that two index pulses have been detected. This line is not inhibited by the select line within the drive. This line can be inhibited by Drive Sel at the ready output. Switches R, RR and DR may apply.

If a single-sided diskette is installed when switch DR is closed; READY will be active (logical zero) if head 0 is selected, but false (logical 1) if head 0 is selected, Conversly, if a two-sided diskette is installed, READY will be active when either side of the diskette is selected.

When switch DR is open and a single-sided diskette is inserted, head 0 or head 1 may be selected and READY will not be inhibited.

(1) Radial Ready

This option enables the user to monitor the Ready line of each drive on the interface. This can be useful in detecting when an operator has removed or installed a diskette in any drive. Normally, the Ready line from a drive is only available to the interface when it is selected.

Switch RR must be open on each FDD used on the interface when this option is used. Switch R may be closed on only one FDD on the interface: this FDD will have Ready on output pin 22. The remaining FDDs in the interface must utilize their own Ready lines, each using a different alternate I/O line. These outputs may be wire-wrapped or soldered to the appropriate staked pins with 30-gauge wire. (see Figure 5-4).

b. Power on Reset

At initial voltage application, comparator U18 generates a reset pulse of approximately 70 ms in length. This prevents the drive from writing during power on and resets the Index, In Use, Disk Change and Stepper Motor Logic.

c. Step and Direction

Each step command received causes the Read/Write heads to move with the direction of motion as defined by the Direction Select line.

The access motion is initiated on each logical zero-to-one transition, or the trailing edge of the signal pulse. Any change in the Direction Select line must be at least 1 μs before the trailing edge of the step pulse. Refer to Figure 5-2 for these timings.

Step pulses are inhibited during a write operation and movement which would position the Read/Write heads behind Track 0.

d. Head Load and Door Closed

The Read/Write heads of a selected FDD can be loaded only when the disk is fully installed and the front-panel door is closed.

When the controller sends a Head-Load signal, the head-load solenoid is energized causing the load plate to actuate. The actuation of the load plate permits the head arms to load the heads against the diskette surface. The door-closed switch also is used to inhibit the READY signal when the door is opened.

(There are several different options when configuring head load (see Figure 5-3, sheet 1). Shunts C DD, A, D, X and B may apply).

e. Write Protect

The Write-Protect function is accomplished through use of an LED (light-emmiting diode) and a photo-transistor. These are mounted such that the presence of a Write Protect slot in the jacket of the diskette will cause pin 5 of U24 to be driven low. This signal is gated with Drive Select and Write Enable to inhibit writing on any diskette possessing a write-protect slot. Closing switch WP enables write inhibit. CAUTION. If switch WP is off, the drive can write on a protected diskette.

f. Track Zero

Track 00 signal is generated when the carriage-assembly tab is sensed by the Track 00 optical switch. Closing this switch causes U12 Pin 5 to switch high assisted by hysteresis. The output is gated with ØAC and Drive Select to provide the Track 00 signal that is transmitted to the controller from U10 pin 11.

g. Index, Sector and Diskette-Type Circuitry

The beginning of each diskette track is indicated by an Index pulse. The diskette rotates between a light source (LED) and a sensor (photo transistor). When the Index hole in the diskette passes under the light source, light is detected by the sensor. The sensor output is amplified and transmitted to the controller as the Index pulse when the FDD is selected. The drive has two Index detectors, one for two-sided diskettes and one for single-sided diskettes. U16 determines the type of diskette involved. This signal is gated with Drive Select and sent to the interface by U25 pin 3 through switch 2S.

Two-sided and single-sided Index is gated at U11 pins 12 and 13 and is provided to U19 pin 12 for shaping.

An Index/Sector separator is provided on some models of the FDD. Proper operation of the Ready function requires that the Index pulses be separated in the FDD.

Whenever a 32-hole hard-sectored diskette is used, Index/Sector pulses arrive at 5.2 -ms intervals with one Index pulse nested between two sector pulses at 2.6 ms nominally. When using the hard-sector functions, Index and Sector pulse-output widths are 0.4 ± 0.2 ms when switch E is closed.

When using the soft-sector function, the Index output-pulse width if 1.8 $\pm$ 0.4 us. Switches SS, HS, RI, S and I may be applicable (see Figure 5-3, sheet 3).

h. Door Lock and In Use

The Door Lock circuit can be latched on under Drive Select control so that the door can remain locked without maintaining the active state of In Use. To implement this option, close switches D and DL. Then, if the appropriate Drive Select line is activated while In Use is active U28-9 will be set, which holds the door-lock circuit active. To unlock the door, Drive Select is activated again while In Use is inactive. This will reset U28-9.

The Door Lock may also be optioned such that it is only active while the In Use line is active. Switch D is closed; Switch DL is open.

i. Drive Select

The Drive Select function will inhibit command and status signals such as Index, Sector, Head Load, Write Data and Ready unless optioned otherwise. The position of the FDD in a daisy-chain configuration is determined by the activation of Switch 4. Switches DD and A apply. (see Figure 5-3, sheet 1).

4.3.2 WRITE LOGIC

A write operation begins with a Write Enable command from the controller when the FDD is selected. This command simultaneously enables the Write-Data switching drivers (flip flop U28 pins 5 and 6), the Write-Data gate U22 pin 6, blocks the input to the read circuit by reverse-biasing diodes in U3, and after a delay energizes the erase windings. Data applied to the Write-Data input alternately switches a constant write current through the write drivers to the head windings. Low-current operation used when writing on physical track 43 and greater, is selected by switching a shunt resistor R59 into the write-current source. Current source U13 provides current to the emitters of the write transistors U30. Switch LC applies.

4.3.3 HEAD-SELECT LOGIC

Head-Select signal when low selects head 1 by turning on U9 pin 7 causing its collector to be at +12 volts while U9 pin 1 is at ground. When the Head-Select signal goes high, it will cause U9 pin 7 to ground and U9 pin 1 to +12 volts selecting head 0.

In systems containing no more than two drives per controller, each Read/Write head can be assigned a separate drive address. In such cases, the four Drive Select lines can be used to select the four Read/Write heads. To implement this option, close switch S3 and properly set switch S5. For example, the first drive may have switch 4-1 and switch 5-3 closed while the second drive has switch 4-3 and switch 5-1 closed. With this jumper configuration installation, the four Drive Select lines have the following selection functions:

1. Drive Select 1 selects head 0 of first drive;
2. Drive Select 2 selects head 1 of first drive;
3. Drive Select 3 selects head 0 of second drive;
4. Drive Select 4 selects head 1 of second drive.

U13 and U9 pin 8 control the +12 voltage with respect to loss of +5 control voltage. Switch S2 is closed for this option. Head selection may be performed by the direction line if optioned by closing switch S1. When direction is low, head 1 is selected. When direction is high head 0 is selected.

(Refer to Figure 5-3, schematic sheets 2 and 3.)

4.3.4 DISK CHANGE

This customer-selectable option is enabled by closing switch DC. It will provide a true signal (logical zero) to the interface (pin 12) when Drive Select is activated, if while deselected the drive has gone from a Ready to a Not Ready (door open) condition. This line is a reset on the true to false transion of Drive Select if the drive has gone Ready. Timing of this line is illustrated in Figure 5-2. The circuitry is illustrated in Figure 5-3, schematic sheet 4. The output of flip-flop U7 pin 6, goes high when the door is opened, but output gate U10-6 is not enabled until the drive is selected. When the Drive Select line goes false, U7 pin 6 will be clocked high.

4.3.5 READ LOGIC

Read operation is enabled when the Read/Write heads are loaded on the diskette and Write Enable is not commanded. With Write Enable not commanded, the data blocking diodes U3 are forward-biased and data sensed by the Read/Write head is fed to the Read Data circuit. The read signal from the diskette is in the form of a sine wave.

This analog signal is amplified by U1, filtered, differentiated by C6/R11 and C7/R12 amplified by U2, and coupled to a comparator/logic circuit to detect zero crossings and reject noise in the differentiated read signal.

The out-of-phase comparators U5 pins 7 and 12 have rise and fall times whose differences are exaggerated by slow-down capacitor C27. This results in a narrow negative pulse at U11 pin 6 which triggers a one-microsecond retriggerable one-shot U15 pin 9.

Flip flop U7 pins 8 and 9 perform a noise-rejection function in that noise near the zero crossings of the amplified differentiated data only result in retriggering U15 pin 9. This appears as jitter in the clock for the flip flop whose data input, derived from redundant comparator U8 pin 12, has by that time stabilized.

Another slow-down capacitor, C32 causes a negative pulse to appear at the output of U11 pin 8 whenever the flip flop toggles. Although shifted in time by approximately the delay of one-shot U15 pin 9, each pulse corresponds to a zero crossing of the differentiated signal, and a peak of the analog read signal. Jitter at the flip-flop clock input and U9 pin 8, which is due to noise at the zero crossings, will not affect the 200-ns composite-data pulse width (see Figure 5-3, schematic sheet 4).

4.3.6 DISKETTE DRIVE

Diskette drive is accomplished by clamping the diskette between the cone assembly and belt-driven spindle. The spindle is rotated at 360 r/min by the diskette drive motor. A dual pulley permits 50- or 60-Hz operation without a motor change.

4.3.7 READ/WRITE HEADS

The Read/Write heads are in direct contact with the diskette during read or write operation. Head load is achieved by a solenoid-actuated load plate allowing the head arms to load the Read/Write heads against the diskette. The head surfaces are designed for maximum signal transfer to and from the magnetic surface of the diskette with minimum head/disk wear. The tunnel-erase gap DC-erases the intra-track area to improve offtrack signal-to-noise ratio and permit diskette interchange between drives.

4.4 CONTROL AND DATA LINE CHARACTERISTICS

All signal lines must be terminated at the receiver with a characteristic impedance of 150-ohms, typically. Transmission is by 26 AWG (min.), 150-ohm flat cable or twisted pair (one twist per inch) with a maximum line length of 25 feet. Figure 5-1 shows the timing of typicaloperations.

4.4.1 LOGIC LEVELS

The following definitions will be used throughout this manual:

low = Logic 1, Active State	Refers to the low-voltage condition +0.4VDC Max.
high = Logic 0, Inactive State	Refers to the high-voltage condition +2.4VDC Min.

4.4.2 TRANSMITTER CHARACTERISTICS

The FDD uses the TTL 7438 (quad 2-input buffer or driver) or equivalent to transmit all control and data signals. This transmitter is capable of sinking a current of 48 ma with an output voltage of 0.4 volts. The host controller must provide the necessary pull-up resistor.

4.4.3 LINE-RECEIVER CHARACTERISTICS

The FDD uses SN7414 gates or equivalent for line receivers. The input of each

receiver is terminated in 150 ohms.

4.4.4 CONTROL AND DATA LINE FUNCTIONS

The signals that are exchanged are described in Table 4-2 and are shown relative to a point of origin in Figure 4-1.

INPUT LINES

TABLE 4-1. INPUT/OUTPUT LINES

SIGNAL	FUNCTION
-STEP	A 1- microsecond (minimum) logic 1 level pulse on this line causes the head to move one track as determined by the direction line.
-DIRECTION	A logic 1 level on this line and step pulse causes the head to move one track inward toward the center of the diskette. A logic - level on this line and step pulse causes the head to move one track outward from the center of the diskette. (Refer to paragraph 4.3.3, Head-Select Logic for further usage of the line).
-HEAD LOAD (Alternate I/O)*	A logic 1 level on this line loads the heads against the diskette.
-WRITE ENABLE	To enable the FDD write driver, this line is held at a logic 1. To disable the FDD write driver and enable the FDD read circuitry, this line is held at logic zero.
-WRITE DATA	This line contains the composite coded write clock and data information to the FDD.
-LOW CURRENT (Alternate I/O)*	This line reduces write current for physical tracks 43 or greater. A logic 1 level reduces write current. If the FDD includes the Track 43 kit this line will not be applicable.
-DRIVE SELECT (1 of 4 lines)	A logic 1 level on this line with switches DD, A, and one set of switch 1 contacts closed enables the FDD interface. (Refer to paragraph 4.3.3a, Head Selection, for further usage of these lines.)
-IN USE (Alternate I/O)*	A logic 1 level on this line illuminates an LED indicator on the front panel of the FDD and activates a solenoid which locks the door-latch mechanism preventing opening of the door.
-HEAD SELECT	A logic 1 level on this line selects head 0 (lower diskette surface). A logic 0 selects head 1.

*Alternate I/O Unassigned - Unused I/O pins 4, 6 and 8. These may be customer defined.

SIGNAL	FUNCTION
OUTPUT LINES	
-READY	A logic 1 level indicates that the door is closed, a diskette is rotating, and two Index pulses have been sensed. This output may be optioned to use an alternate I/O pin.
-INDEX	This line gives an indication of the rotational position of the diskette by outputting a logic 1 pulse for every Index hole of the diskette. This output may be configured to use an alternate I/O pin if desired.
-DISK CHANGE (Alternate I/O)*	This line gives indication that there was a loss of Ready from the Door Closed signal going false while the drive was not selected. The status of this output can only be monitored when the drive is selected.
-TRACK 00	A logic 1 level indicates that the head is positioned over Track 00.
-WRITE PROTECT	Logic 1 level indicates that the write-protect slot on the diskette is uncovered.
-READ DATA	This line contains the unseparated data and clock information.
-TWO-SIDED (Alternate I/O)*	A logic 1 indicates a two-sided diskette and a logic 0 a single-sided diskette.

Some models of the FDD contain Data/Clock and Index/Sector separators. For these models the following output lines are functional:

-SEPARATED DATA**	This line contains the separated data information.
-SEPARATED CLOCK**	This line contains the separated clock information.
-SECTOR	This line gives an indication of the rotational position of the diskette by outputting a logic 1 pulse for every sector hole of the diskette. (For soft-sector configurations this line is inactive.) This output may be configured to use an alternate I/O pin.

*Alternate I/O Unassigned - Unused I/O pins 4, 6, and 8. These may be customer defined.

**The signals are valid when double-frequency recording without missing clock is used, and switch FS is closed. The signals are valid when double-frequency recording with missing clock is used and switch TS is closed.

4.5 CUSTOMER-SELECTABLE FEATURES

This section details the numerous customer-selectable features available. Standard and optional PWA configurations are presented in the following paragraphs and in Table 4-2.

Part numbers for switches are included below.

SWITCH	CDC PART NUMBER	AMP PART NUMBER
S1 (10-position)	83462207	
S2 (8-position)	83452205	
S3 (8-position)	83452205	
S4 (4-position)	83452201	
S5 (4-position)	83452201	

As shipped from the factory, the PWA's are configured as detailed in Table 4-2.

The following is an alphabetical listing of each feature and its description.

A allows gating of Drive Select with the Head-Load signal to create drive selection.

B allows interactive gating of Drive Select and Head-Load. Without this feature there can be no interaction (gating) at the interface between these two signals.

C brings the Head-Load signal from J1-18 to the Head-Load control logic. CC must be used with C. Also, CC must be off when C is off.

CC brings the Head-Load signal from J1-18 to the Head-Load control logic. CC must be used with C. Also, CC must be off when C is off.

D incorporates the In-Use input control signal on the interface (signal supplied by user's controller). Control of the door-lock solenoid, activity light and Head-Load solenoid can be affected by use of this feature.

DC brings the interface the following information. Ready condition on the drive became inactive (false) either while the drive was selected or deselected. Drive Select must be strobed (toggled) to reset a diskette change "true" condition. It is assumed that the loss of Ready is due to the door on the drive being opened, thereby alerting the system operator to a possible diskette change in the drive.

DD brings the Drive Select input into gating with control logic. Without this feature, all of the Drive Select inputs will be isolated from the FDD logic.

DL allows the low-to-high transition of unit selection to act as a trigger for a D flip-flop. This output status of the flip-flop depends upon the logic status of the In-Use input line which controls the door-lock solenoid, activity LED and Head-Load solenoid to activation with drive deselection and reselection. This is dependent upon the status of the In-Use I/O line at the time of Drive Select (or reselect) with feature IU enabled.

DR — The Ready output from the drive will go false if a single-sided diskette is installed in the drive and head #1 is selected. This feature prevents using the wrong side of a single-sided diskette in a double-sided drive.

E — reduces the pulse width of index/and/or sector pulses from 1.8 to 0.4 milliseconds. This feature is not present on all PWA configurations; it is only available with the Sector/Index feature.

FS — provides Separated Data and Separated Clock if a "missing clock" format is not being utilized with the FM only recording. This feature is not present on all PWA configurations; it is only available with the Sector/Index feature.

HO — allows control of the Head-Load solenoid via the Head-Load or Drive Select inputs on the interface.

HS — with a soft-sector sidkette installed, produces no Index pulses on the interface so no Ready signal will be generated; however it does produce one sector pulse on the sector output. With a 32-hole hard-sector diskette installed, produces separated sector/index at the interface at the designated locations with a 1.8-millisecond pulse width (true) on the sector and index outputs. If feature E is enabled along with HS, produces separated sector/index at the interface with a 0.4-millisecond pulse width (true) on the sector and index outputs. In most hard-sector applications, both features E and HS are installed. This feature is not present on all PWA configurations.

I — brings the Index signal to the drive interface at J1-20.

IU — allows control of the Head-Load solenoid via the In-Use signal on the interface after Drive Select strobing to "latch" activation. Feature DL must be applied for this latching of Head-Load solenoid will not deactivate.

MM — (multi-media) optimizes inner track write current for high resolution media.

R — brings Drive Ready to the interface at J1-22.

RI — gates Drive Select with Index and Sector. The Index and Sector status will be at the interface only while the drive is selected. (Sector is required at the interface only if hard-sector formatting is being utilized.)

RR — gates Drive Select with Ready. The Ready status will be at the interface only while the drive is selected.

S — brings hard sector pulses to the interface at J1-24 if hard-sector formatting is being utilized.) This feature is not present on all PWA configurations.

SS — brings Index to the interface if a soft-sector diskette is installed. If a hard-sector diskette (32-hole) is installed, Index/Sector composite will be on the Index output line and Separated Sector will be on the Sector line if feature S is also implemented. Feature SS is not present on all PWA configurations.

S1 — allows control of head selection by the Direction line input signal after having accessed the desired track (conditional).

S2 allows control of head selection by the Head Select input via the interface at J 1-14.

S3 allows control of head selection by a Drive Select input line. This is a conditional configuration. Only two drives can be addressed on a four-drive daisy-chain system. The standard DIP switch configuration is as follows:

DRIVE	HEAD 0	HEAD 1
1	S4-1 closed. Drive select by J1-26.	S5-3 closed. Drive select by J1-28.
2	S4-3 closed. Drive select by J1-30.	S5-1 closed. Drive select by J1-32.

TS provides Separated Data and Separated Clock outputs at the interface in the FM recording mode only (single density). The data separator will not lose sync when the IBM missing clock format is being utilized (not to be confused with MFM recording) as with Feature FS. Feature TS is not present on all PWA configurations.

WP inhibits writing internally in the drive when a write protected diskette has been inserted in the drive. (I/O is notified.) Allows write if protected when off.

x allows gating of the Head-Load signal with Drive Select to "create" the Head-Load signal.

y allows control of the activity light by the Head-Load signal if In-Use is not being utilized.

z allows control of the activity light by the Drive Select signal if In-Use is not being utilized.

2S brings the status of the diskette in the drive to the interface at J1-10. This signal status indicates that either a single- or double-sided diskette is in the drive after two index holes have been sensed.

LC allows interface pin 2 to switch the FDD write current to a lower level for improved read margins on physical tracks 43 through 77.

TABLE 4-2. CUSTOMER SELECTABLE FEATURES

SWITCH		STANDARD PWA CONFIGURATION	OPTIONAL PWA CONFIGURATION
A	Radial Head Load	X	
B	Radial Head Load	X	
C	Alternate Input-Head Load		
CC	Alternate Input-Head Load		
D	Alternate Input-In-Use		
DC	Disk Change		
DD	Standard Drive Select Enable	X	
DL	Door Lock Latch		
DR	Double Side Ready		
E	0.4 ms Index Pulse	N/A	
FS	False Separation	N/A	
HO	Allow Head Load	X	
HS	Hard Sector Enable	N/A	
I	Index Output	X	
IU	Head Load With In-Use		
MM	Reduced Write Current		
R	Ready Output	X	
RI	Radial Index and Sector	X	
RR	Radial Ready	X	
S	Sector Output	N/A	
SS	Soft Sector Enable	N/A	
S1	Side Select Using Direction Select		
S2	Standard Side Select Input	X	
S3	Side Select Using Drive Select		
TS	True Separation	N/A	
WP	Inhibit Write When Write Protected	X	
X	Radial Head Load	X	
Y	In Use From Head Load		
Z	In Use From Drive Select	X	
2S	Two-Sided Status Output		
LC	Low Current	X	

N/A = Not available on Standard PWA

4.6 ALTERNATE I/O

The Model 9406-4 Flexible Disk Drive can be modified by the user to function differently than the standard method described in paragraph 4.6 and listed in Table 4-2. This paragraph will describe how to achieve alternate functions.

4.6.1 RADIAL READY

This alternate function enables the user to monitor the ready line of the interface of each drive in a radial configuration. The normal function of the drive is to make the ready line available on the interface only when the drive has been selected. When 2, 3, or 4 drives are connected in a radial configuration, the "Radial Ready" function will be available when the drives are modified as follows:

Drive 1

No modifications are required if the user is satisfied with the Radial Ready signal on pin 22 of J1.

Drive 2

1. Open RR (Open SW1-5).
2. Open R (Open SW1-7).
3. With a wire wrap jumper, connect alternate I/O Pin 10 (Figure 4-3) to I/O pin #1. The ready line will now be on pin 12 of J1. Pin 10 can be jumpered to any unused 1 through 5 alternate I/O pin if the user desires.

Drive 3

1. Open RR (Open SW1-5).
2. Open R (Open SW1-7).
3. With a wire wrap jumper, connect alternate I/O Pin 10 (Figure 4-3) to I/O pin #2. The ready line will now be on pin 10 of J1. Pin 10 can be jumpered to any unused 1 through 5 alternate I/O pin if the user desires.

Drive 4

1. Open RR (Open SW1-5).
2. Open R (Open SW1-7).
3. With a wire wrap jumper, connect alternate I/O pin 10 (Figure 4-3) to I/O pin #3. The ready line will now be on pin 8 of J1. Pin 10 can be jumpered to any unused 1 through 5 alternate I/O pin if the user desires.

4.6.2 RADIAL INDEX

This alternative function enables the user to monitor the index line of each drive so that the drive can be selected just prior to the index. When 2, 3, or 4 drives are connected in a radial configuration, the index signal will be available at the interface when the drives are modified as follows:

Drive 1

No modifications are required if the user is satisfied with the Radial Index signal on pin 20 of J1.

Drive 2

1. Open RI (Open SW1-8).
2. Open I (Open SW1-6).
3. With a wire wrap jumper, connect alternate I/O pin 9 (Figure 4-3) to I/O pin #1. The index signal will now be on pin 12 of J1. Pin 9 can be jumpered to any unused 1 through 5 alternate I/O pin if the user desires.

Drive 3

1. Open RI (Open SW1-8).
2. Open I (Open SW1-6).
3. With a wire wrap jumper, connect alternate I/O pin 9 (Figure 4-3) to I/O pin #2. The index signal will now be on pin 10 of J1. Pin 9 can be jumpered to any unused 1 through 5 alternate I/O pin if the user desires.

Drive 4

1. Open RI (Open SW1-8).
2. Open I (Open SW1-6).
3. With a wire wrap jumper, connect alternate I/O pin 9 (Figure 4-3) to I/O pin #3. The index signal will now be on pin 8 of J1. Pin 9 can be jumpered to any unused 1 through 5 alternate I/O pin if the user desires.

4.6.3 RADIAL HEAD LOAD

This alternative function enables the user to load the heads without a unit select signal (i.e., the heads can be loaded without the drive being selected). When 2, 3, or 4 drives are connected in a radial configuration, the heads of any drive can be loaded when desired by modifying the drives as follows:

Drive 1

No modifications are required if the user is satisfied with the Radial Head Load Command on pin 18 of J1.

Drive 2

1. Open C (Open SW2-8).
2. With a wire wrap jumper, connect alternate I/O pin 6 (Figure 4-3) to I/O pin #1. The head load command will be applied on pin 12 of J1. Pin 6 can be jumpered to any unused 1 through 5 alternate I/O pin if the user desires.

Drive 3

1. Open C (Open SW2-8).
2. With a wire wrap jumper, connect alternate I/O pin 6 (Figure 4-3) to I/O pin #2. The head load command will be applied on pin 10 of J1. Pin 6 can be jumpered to any unused 1 through 5 alternate I/O pin if the user desires.

Drive 4

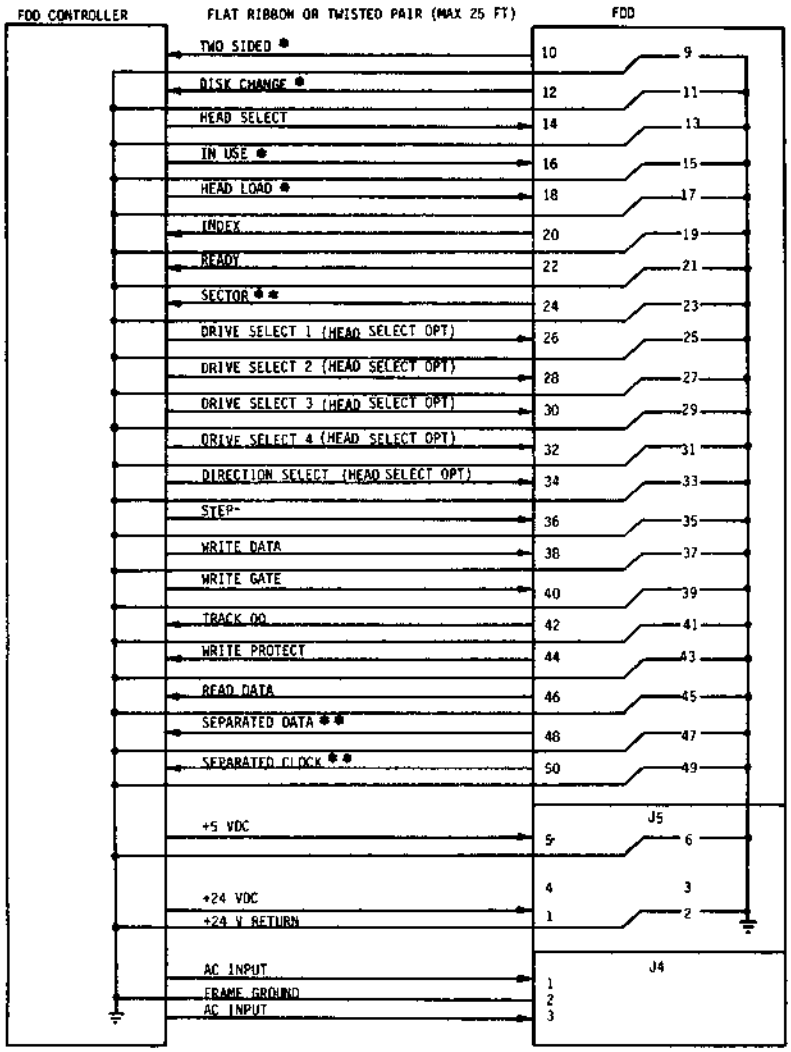
1. Open C (Open SW2-8).
2. With a wire wrap jumper, connect alternate I/O pin 6 (Figure 4-3) to I/O pin #3. The head load command will be applied on pin 8 of J1. Pin 6 can be jumpered to any unused 1 through 5 alternate I/O pin if the user desires.

5.1 INTRODUCTION

This section contains the printed-circuit-board documentation and related timing diagrams.

Figure 5.1 shows interface connections of all AC, DC and I/O lines applicable to the FDD.

Figure 5-2 shows timing diagrams which illustrate signal/time relationships during read, write, step-in and step-out operations. Figure 5-3 is the printed-circuit board schematic and Figure 5-4 contains the assembly drawing.



* These lines are alternate input/output lines and they are enabled by shunts. Not shown are pins 2, 4, 6 and 8 which are alternate I/O pins.
** Universal Configurations only.

ZZ03a

* Reference Section 4 for uses of these lines.

FIGURE 5-1. INTERFACE CONNECTIONS

TABLE 5.1. PWA ASSEMBLIES

HPC 77618---	PWA ASSY. 7768---- 8 8 3 1 1 5 0 4 0 0 0 0	HPC 77618---	PWA ASSY. 7768----
101	X		
102	X		
103	X		
104	X		
105	X		
106	X		
107	X		
108	X		
109	X		
110	X		
111	X		
112	X		
113	X		
114	X		
115	X		
116	X		
117	X		
118	X		
119	X		
120	X		
121	X		
122	X		
123	X		
124	X		
125	X		
126	X		

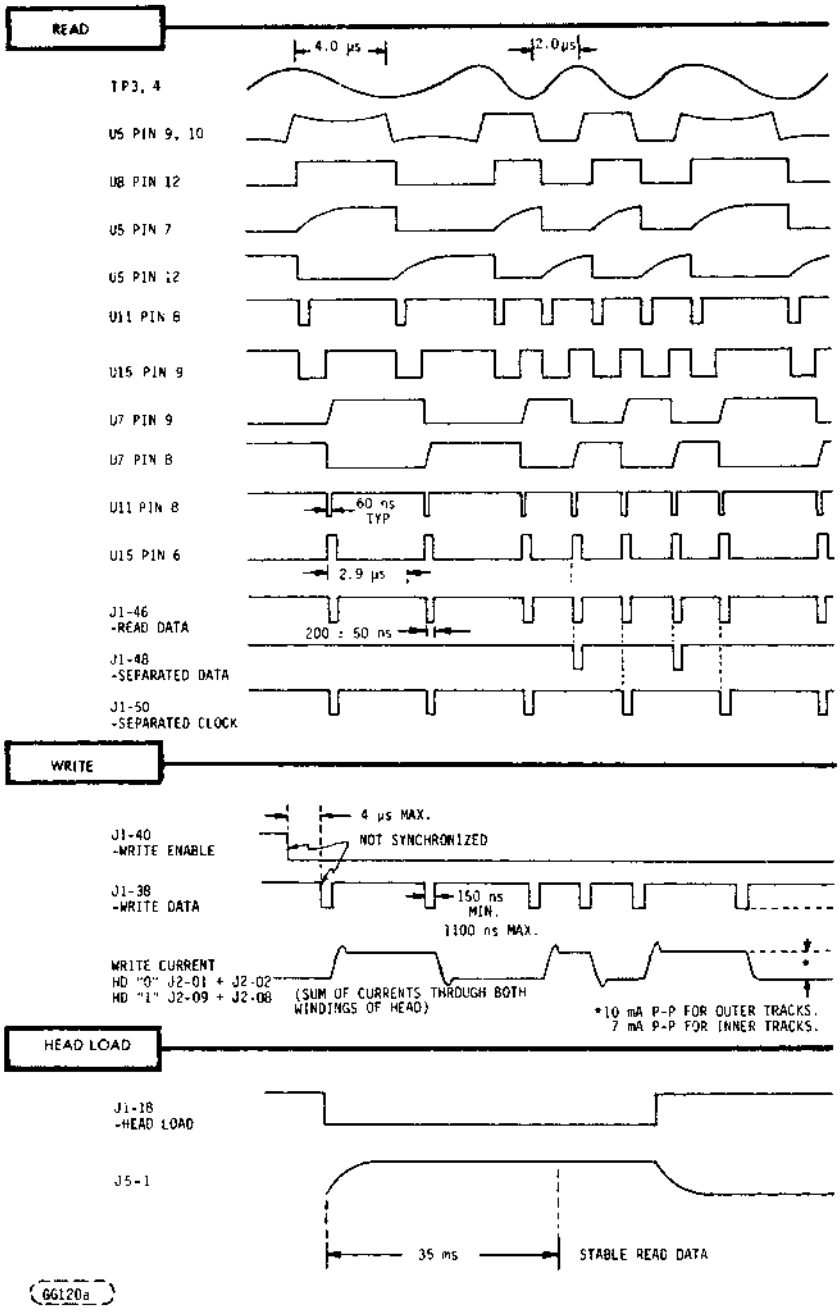


FIGURE 5-2A. TIMING (SHEET 1 OF 2)

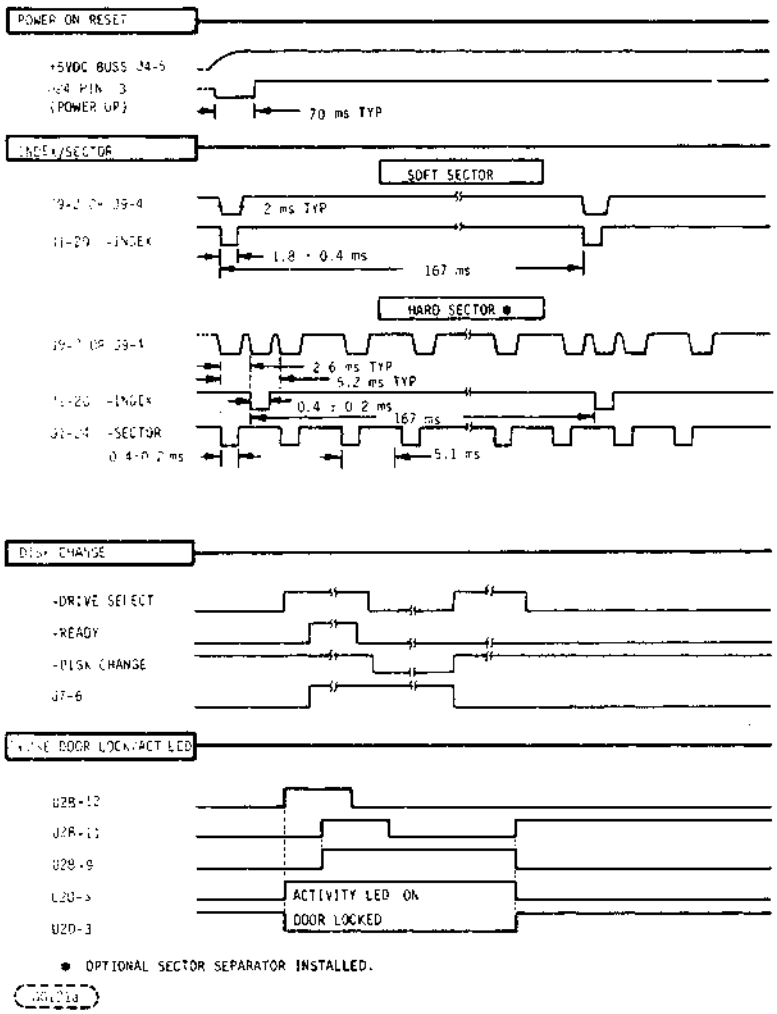


FIGURE 5-2A. TIMING (SHEET 2 OF 2)

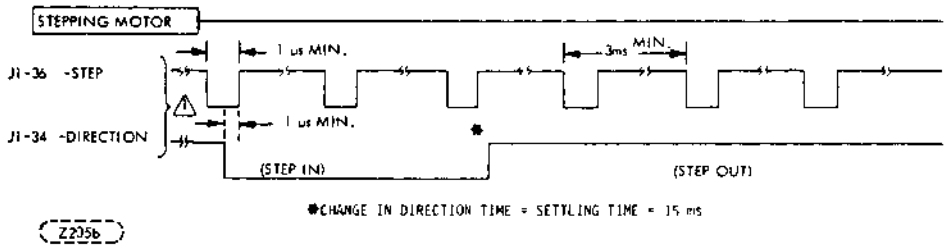
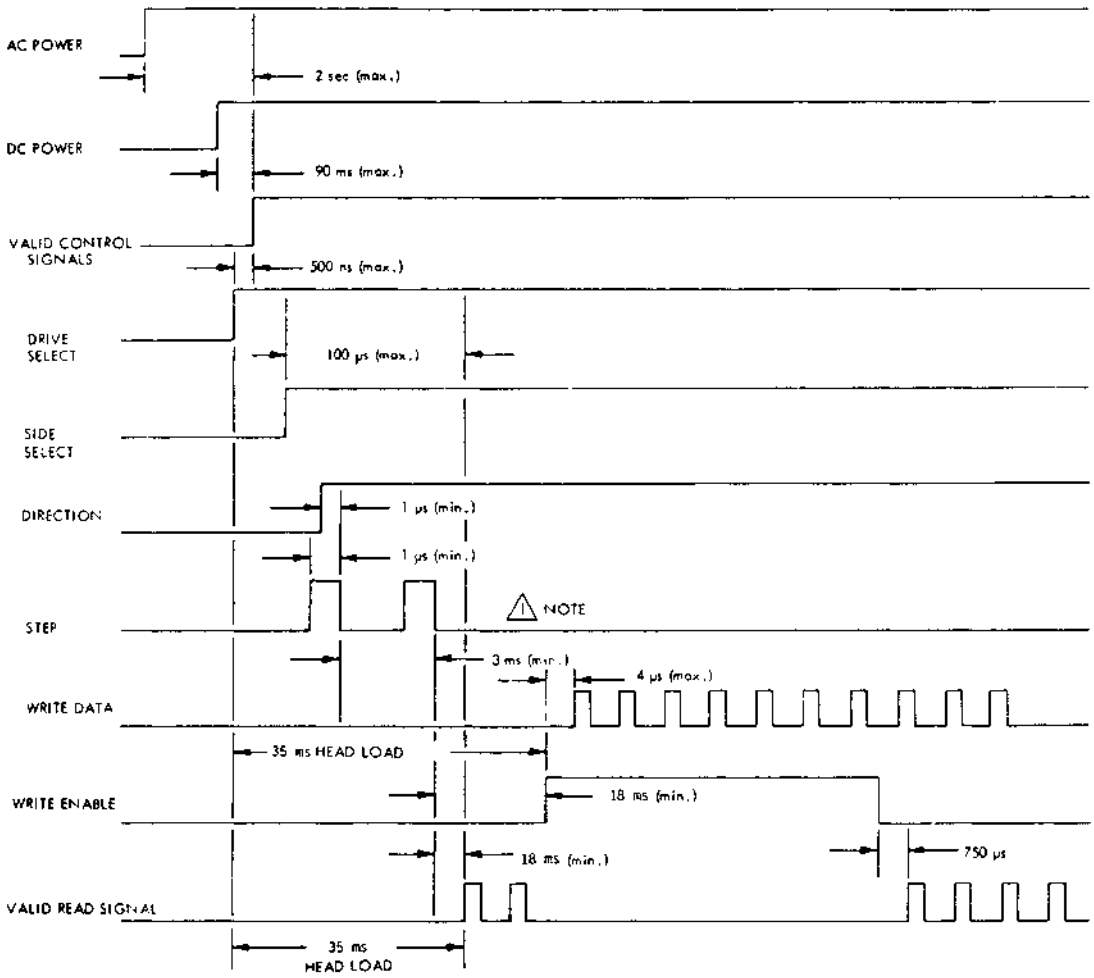


FIGURE 5-2B. STEP/DIRECTION OPERATION



GG122a

1 A MINIMUM 18-MILLISECOND DELAY IS REQUIRED BETWEEN STEP PULSES, IF A DIRECTION CHANGE HAS TAKEN PLACE AND NO READ/WRITE OPERATION WAS PERFORMED.

1 A minimum 18-millisecond delay is required between step pulses, if a direction change has taken place and no read/write operation was performed.

FIGURE 5-2E. GENERAL CONTROL AND DATA TIMING COMBINED

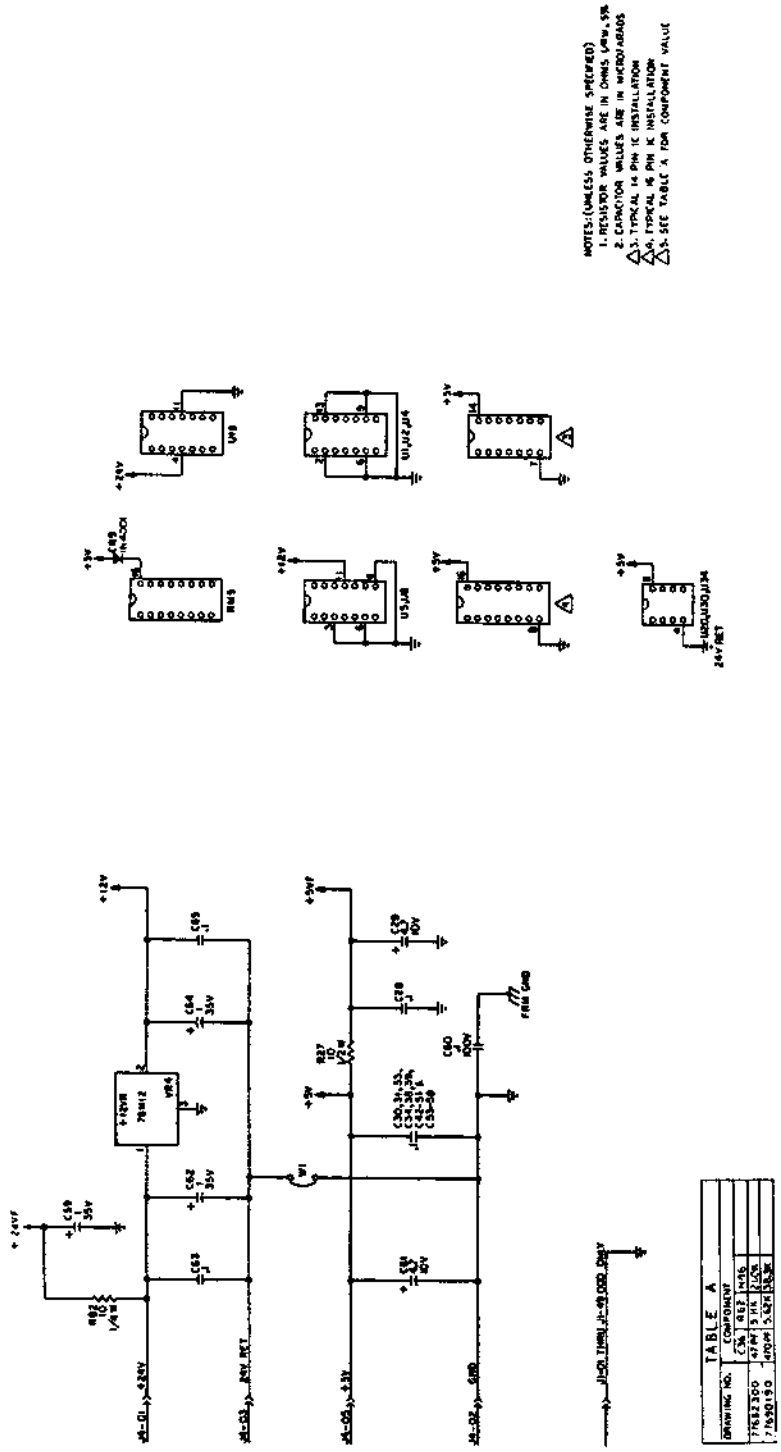


FIGURE 5-3. SCHEMATICS (SHEET 1 OF 9)
(SOFT-SECTOR CONFIGURATION)

SIGNAL NAME	SHEET
(PGR)	4
+24V	6
+READY	7
+UNIT-SEL	7
+UNIT-SEL	4
-2-SIDED	7
-DIRECTION	8
-DISK-CHANGE	4
-DOOR-LOCK	5
-DOOR-LOCK	4
-DRIVE-SEL-1	4
-DRIVE-SEL-2	4
-DRIVE-SEL-3	4
-DRIVE-SEL-4	4
-HEAD-LOAD	4
-HEAD-SEL	8
-IN-USE	5
-INDEX	7
-LOW-CURRENT	6
-PGR	8
-READ	8
-READ	5
-READ-DISABLE	9
-READY	7
-SINGLE-SIDED-&-HD1-SEL	7
-SINGLE-SIDED-AND-HD1-SE	5
-STEP	6
-TRK0	6
-UNIT-SEL	4
-WRITE-PROTECT	9
-WRT-DATA	8
CT-ERASE+0	9
CT-ERASE+0	8
CT-ERASE+1	8
CT-ERASE+1	9
CT-ERASE+1	8
DOOR-CLOSED	7
ERASE+0	8
ERASE-1	8
HD-1-SEL	9
HD-SEL(DIR)	6
HD-SEL(DIR)	9
HD-SEL(UNIT-SEL)	4
HEAD-SEL(UNIT)	9
PULL-UP-1	5
PULL-UP-2	4
R/W+0	8
R/W+1	8
R/W-0	8
R/W-1	8
READ	8
READ	5
READ-DATA	5
SHIELD-0	8
SHIELD-1	8
U28-09	5
U5-07	5
U5-12	5
U8-02	9

I/O PIN		SHEET	SIGNAL NAME
J102	1	6	-LOW-CURRENT
J110	0	7	-2-SIDED
J112	0	4	-DISK-CHANGE
J114	1	8	-HEAD-SEL
J116	1	5	-IN-USE
J118	1	4	-HEAD-LOAD
J120	0	7	-INDEX
J122	0	7	-READY
J126	1	4	-DRIVE-SEL-1
J128	1	4	-DRIVE-SEL-2
J130	1	4	-DRIVE-SEL-3
J132	1	4	-DRIVE-SEL-4
J136	1	8	-WRT-DATA
J134	1	8	-DIRECTION
J138	1	6	-STEP
J142	0	6	-TRK0
J144	0	9	-WRITE-PROTECT
J146	0	5	READ-DATA
J201	0	8	R/W+0
J202	0	8	R/W-0
J203	0	8	SHIELD-0
J204	0	6	CT-ERASE+0
J205	0	6	CT-ERASE+0
J207	0	6	ERASE+0
J208	0	8	R/W-1
J209	0	8	R/W+1
J210	0	8	CT-ERASE+1
J211	0	8	CT-ERASE+1
J212	0	8	SHIELD-1
J214	0	8	ERASE-1
J308	0	6	+24V
J140	1	9	WRT-ENABLE

FIGURE 5-3. SCHEMATIC (SHEETS 2/3 OF 9)

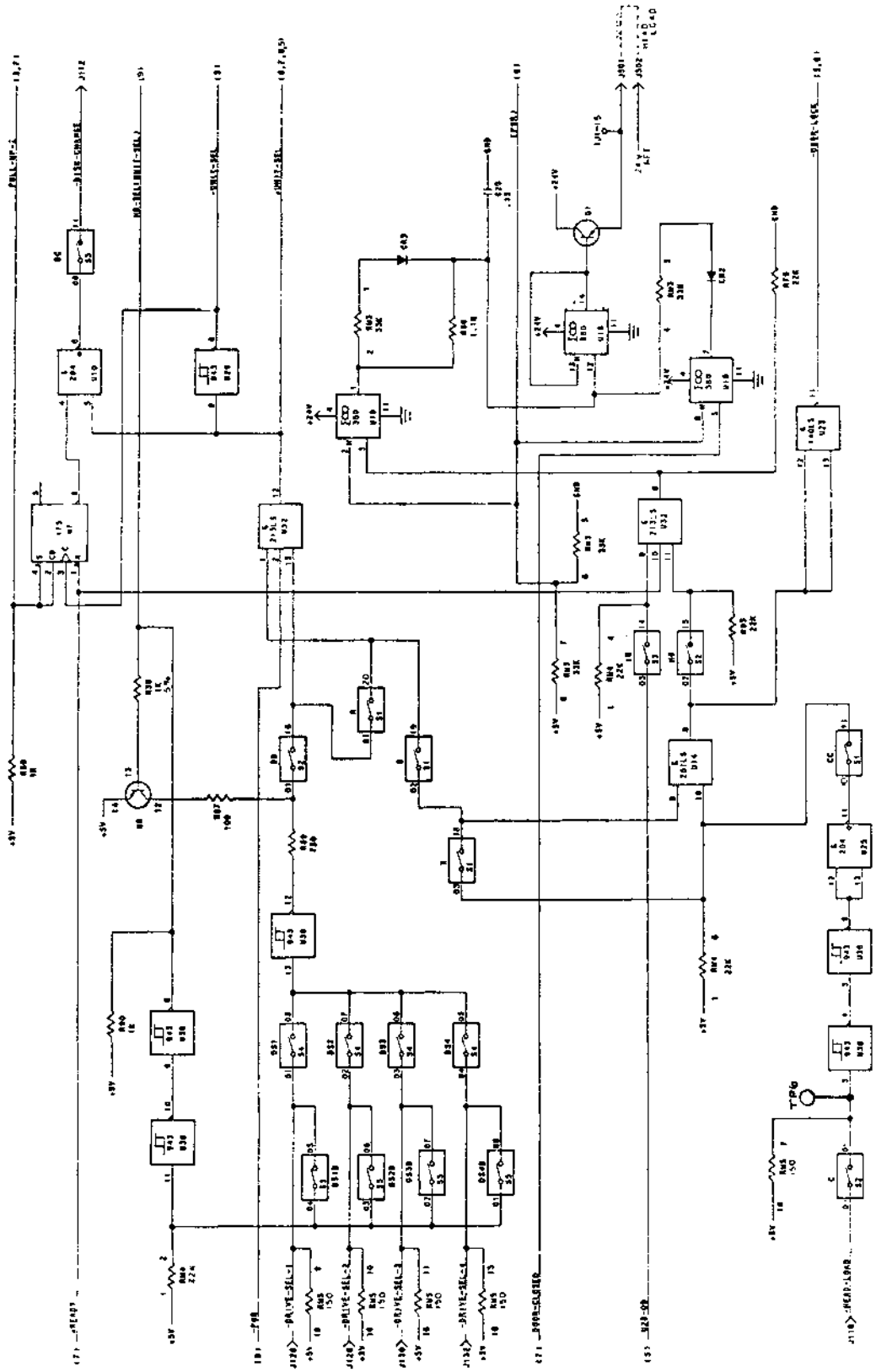


FIGURE 5-3. SCHEMATIC (SHEET 4 OF 9)

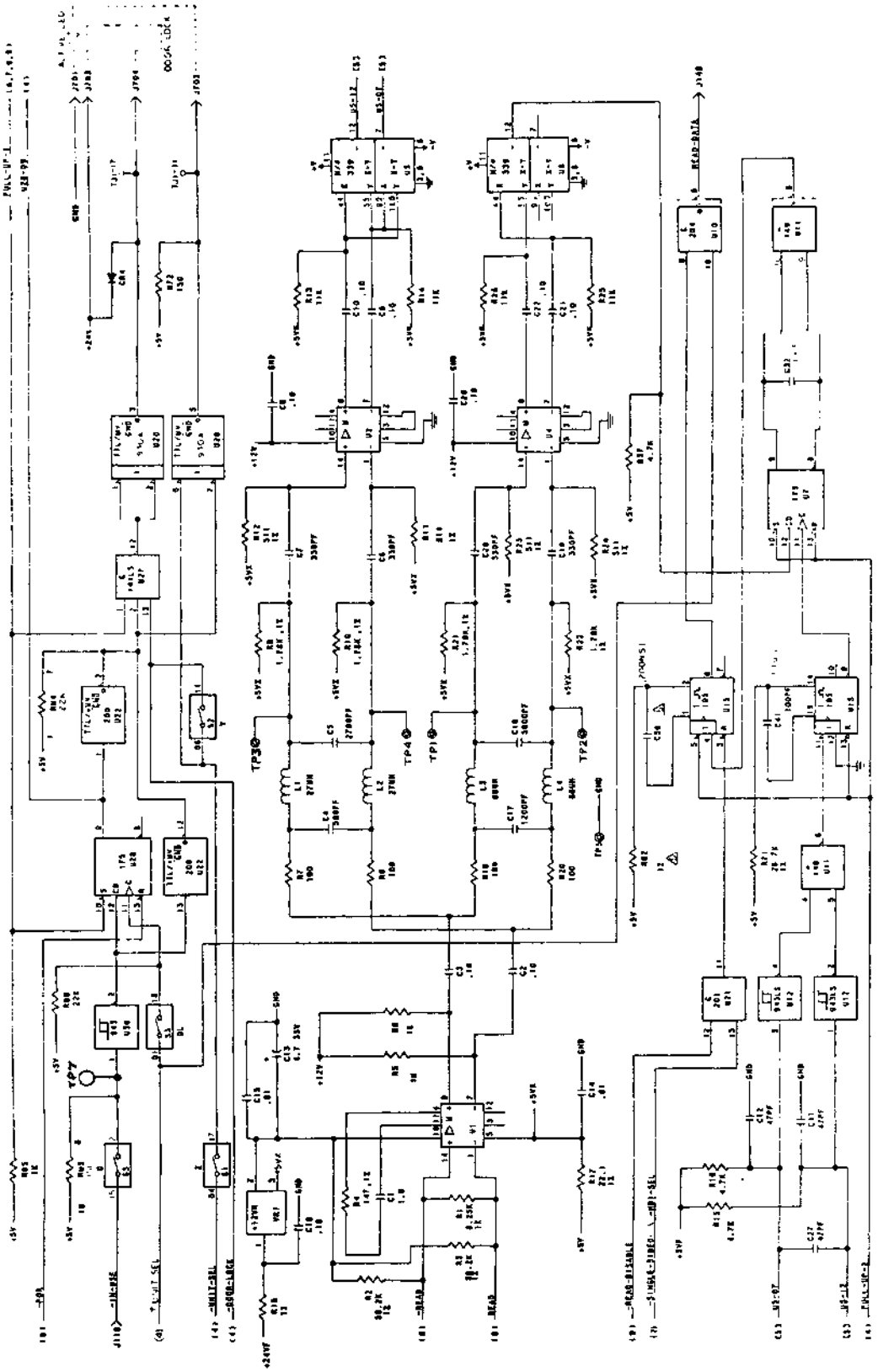


FIGURE 5-3. SCHEMATIC (SHEET 5 OF 9)

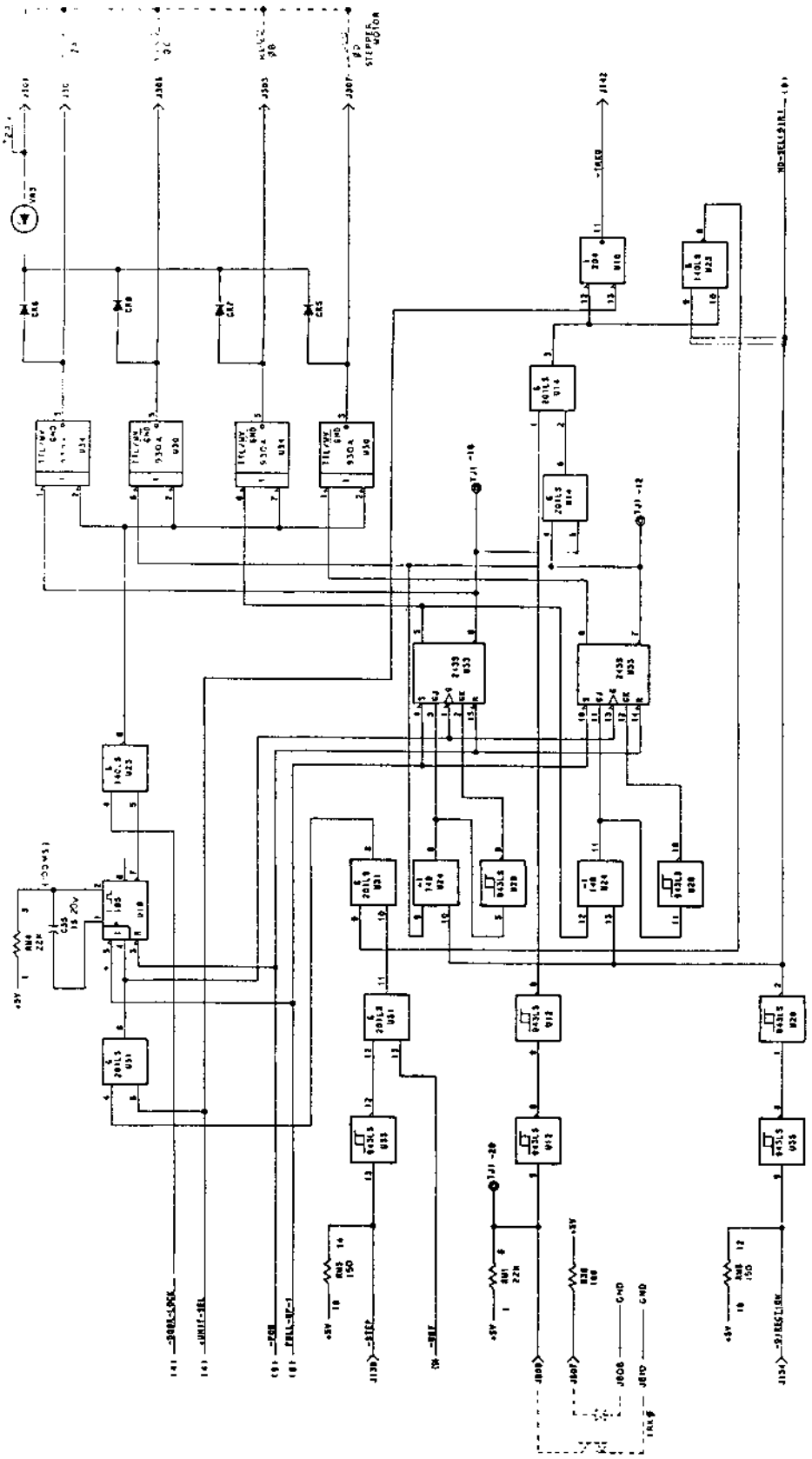


FIGURE 5-3. SCHEMATIC (SHEET 6 OF 9)

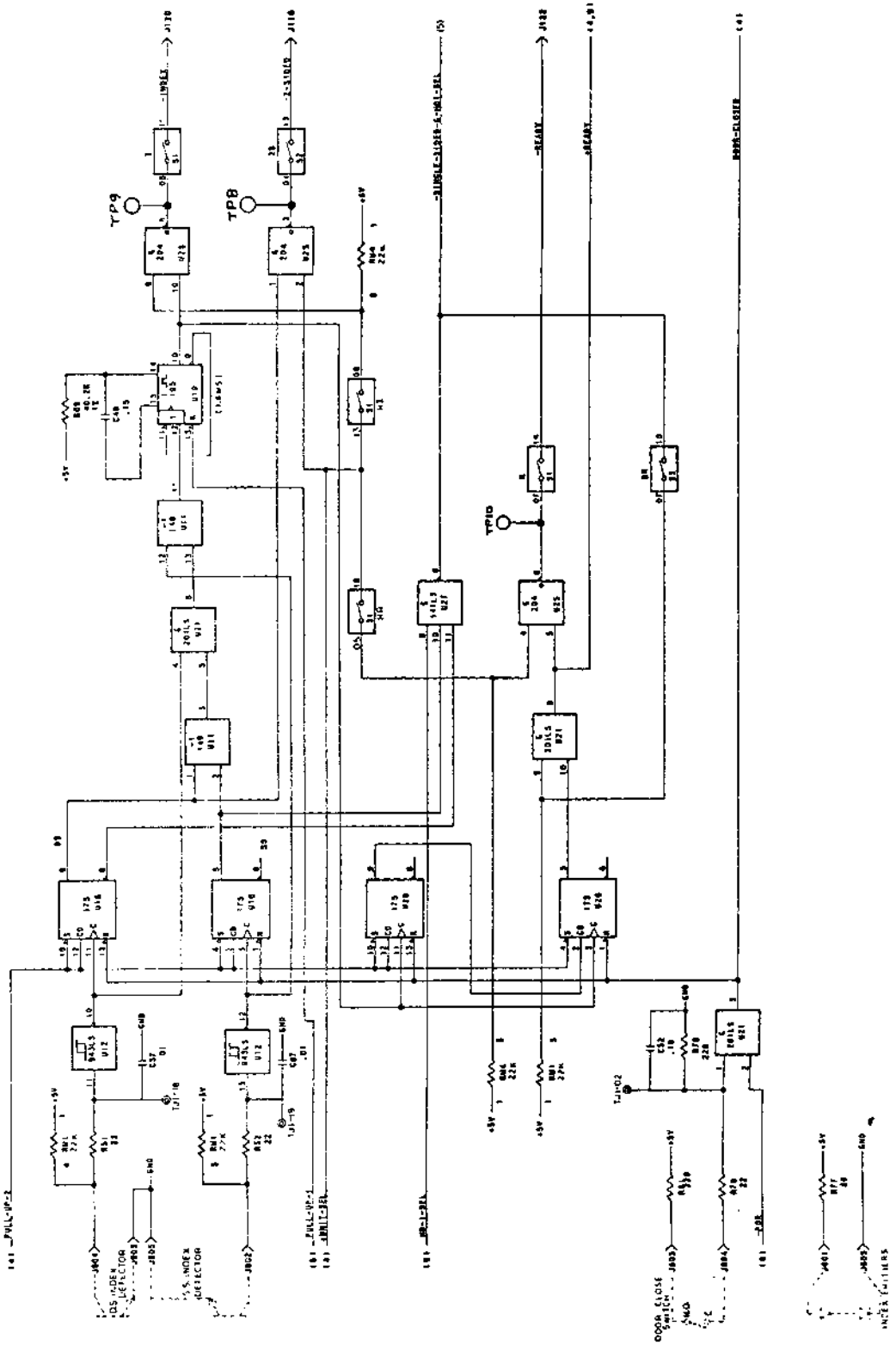


FIGURE 5-3. SCHEMATIC (SHEET 7 OF 9)

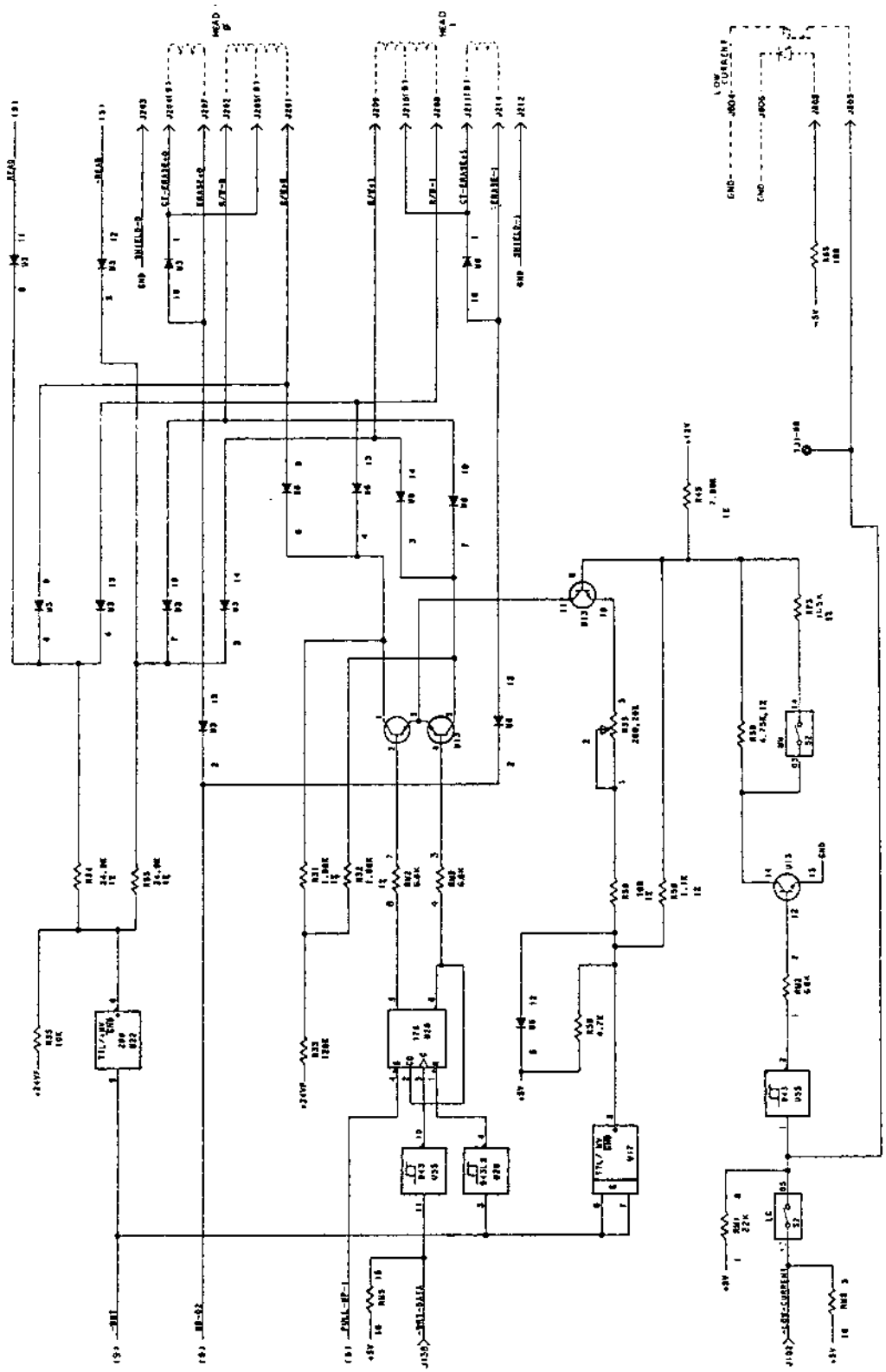


FIGURE 5-3. SCHEMATIC (SHEET 8 OF 9)

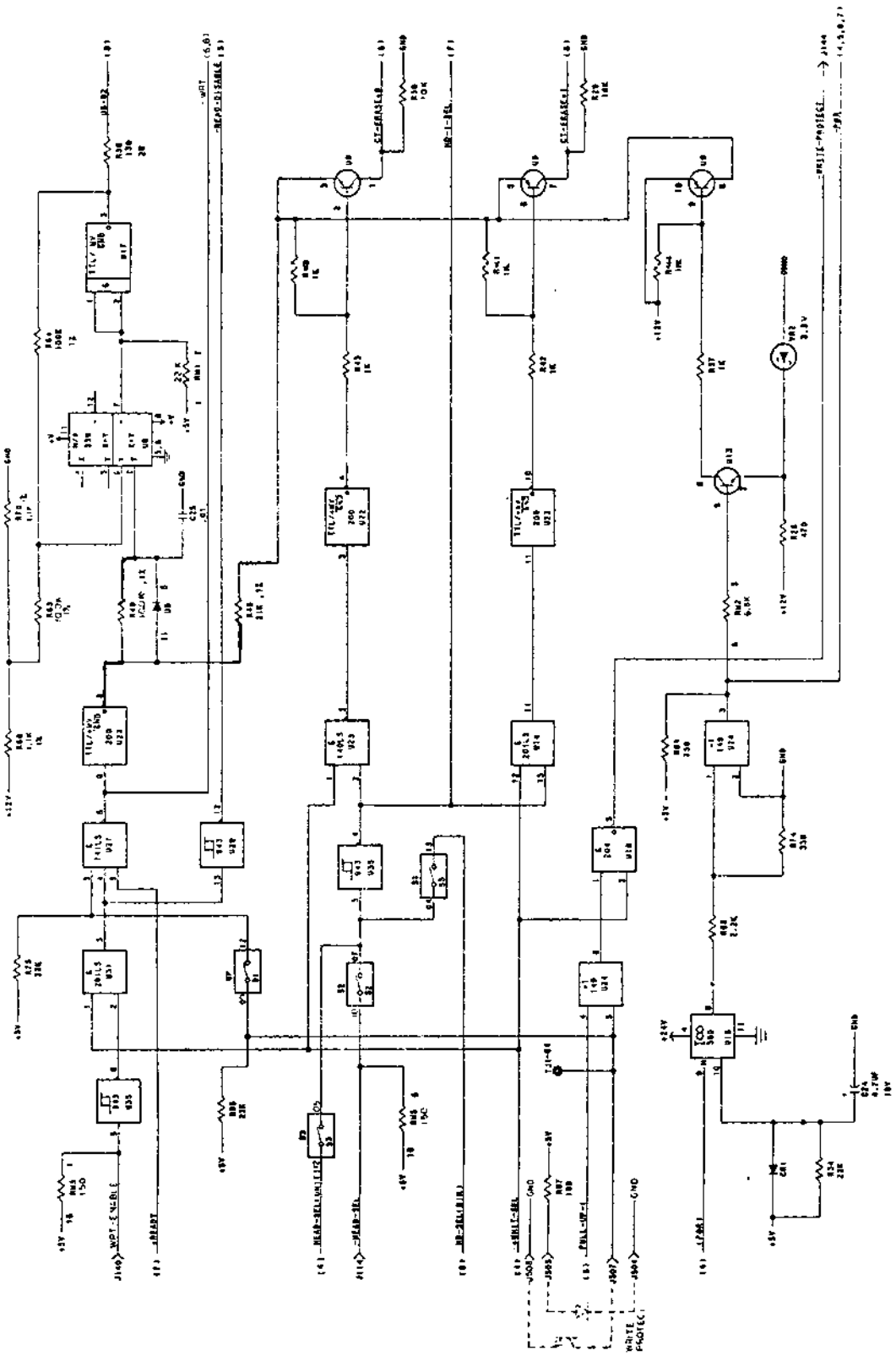


FIGURE 5-3. SCHEMATIC (SHEET 9 OF 9)

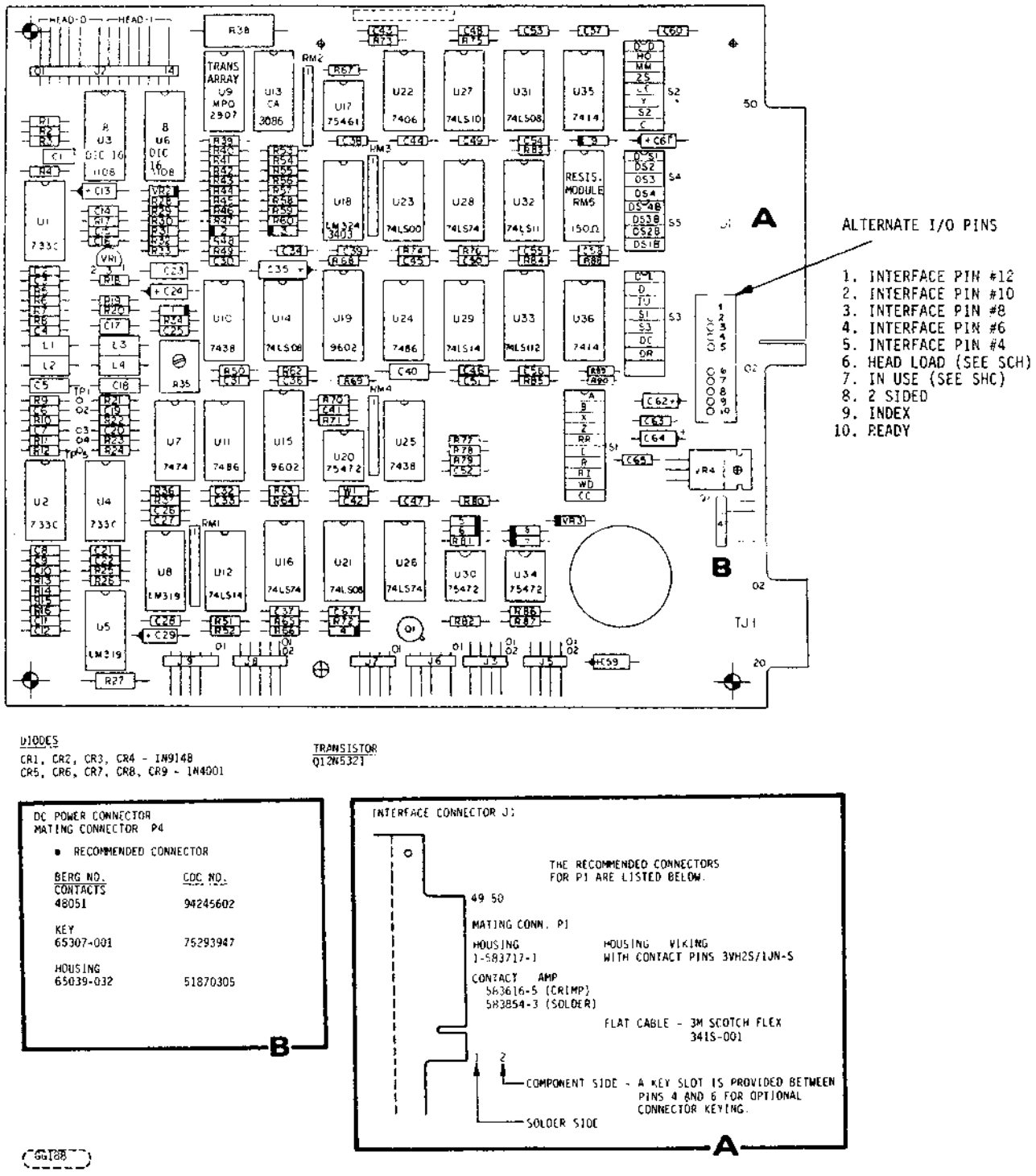


FIGURE 5-4. ASSEMBLY, INTERFACE AND DC POWER MATING CONNECTORS

6.1 INTRODUCTION

This section contains the instructions required to maintain the FDD. The information is provided in the form of preventive maintenance, troubleshooting and corrective maintenance.

6.2 MAINTENANCE TOOLS

The Special tools (or equivalent) required to maintain an FDD are as follows:

DESCRIPTION	CDC MODEL NO.
Alignment Diskette (Single-Side)	421-51W*
Alignment Diskette (Two-sided)	425-51W*

6.3 TROUBLESHOOTING

An improperly adjusted FDD may exhibit symptoms of one that has a malfunction; therefore, the Adjustment Procedures (paragraph 6.4) should be performed before assuming that the drive has failed.

TABLE 6-1. ADJUSTMENT REFERENCE

Adjustment Paragraph No.	Adjustment Identification
6.4.1	Write-Splice Check and Adjustment
6.4.2	Actuator Alignment
6.4.3	Clamshell-Closed Switch Adjustment
6.4.4	Track 00 Stop Adjustment
6.4.5	Diskette Ejector Adjustment
6.4.6	Diskette Load-Pad Adjustment
6.4.7	Head-Unload Clearance Adjustment
6.4.8	Low-Current-Switch Optical-Sensor Adjustment
6.4.9	Azimuth Adjustment

*Available through local CDC sales office or distributor.

6.3.1 DC VOLTAGE AND SIGNAL CHECK

a. Input power should be +5VDC ±5% and +24VDC ±10% measured at the input to the FDD (refer to paragraph 3.4.2).

b. Test Points: The signals at the test points should conform to the various diagrams and waveforms as listed in Table 6.2.

3. Signals should conform to Figure 5-1 and Figure 6-1 through 6-3.

TABLE 6-2. TEST POINTS

Test Point No.	Refer to Fig. No.	Comments
3	5-2, 6-2, 6-3	Analog Read Data High Resolution
4	5-2, 6-2, 6-3	(Differential)
1		Analog Read Data Low Resolution
2		(Differential)
5		Ground
TJ-2		Door Close
TJ-4		Write Protect
TJ-8		Trk 43 Sensor
TJ-12		Phase C
TJ-16		Phase A
TJ-18		D. S. Index Sensor
TJ-20		Trk 0 Sensor
TJ-11		Head-Load Output
TJ-15		LED Driver
TJ-17		Door Lock Driver
TJ-19		SS Index Sensor

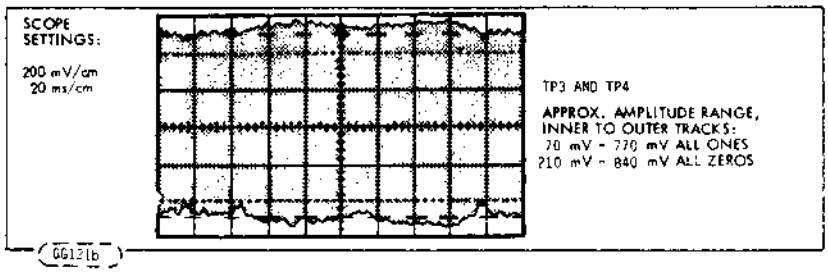


FIGURE 6-1. DIFFERENTIAL READ SIGNAL FOR ENTIRE TRACK

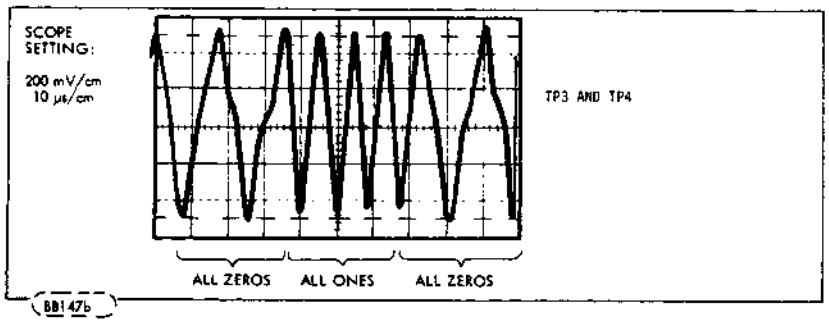


FIGURE 6-2. DIFFERENTIAL READ SIGNAL FOR PORTION OF OUTER TRACK

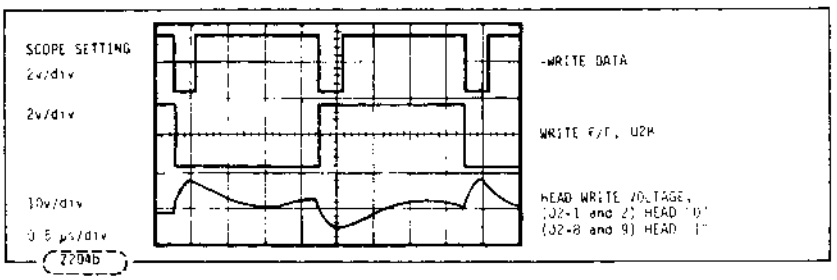


FIGURE 6-3 WRITE DATA, WRITE F/F OUTPUT, AND HEAD WRITE VOLTAGE FOR OUTER TRACK

6.4 ADJUSTMENT PROCEDURES

6.4.1 WRITE-SPLICE CHECK AND ADJUSTMENT

Alignment Diskette 421-51W and 425-51W are used to perform this procedure.

a. Precondition the alignment diskette by allowing it to reach room temperature for one hour.

b. Install the alignment diskette.

CAUTION

The Alignment Diskette is for read only. Extreme caution should be used to assure this diskette is not written on.

c. Seek to Track 00, then seek to Track 01 and Read on head 0. (No data is recorded on Track 1.)

d. Connect Channel 2 of scope to TP3 on the PWA, Channel 1 to Index J1-20 of the PWA. Set up the scope as follows:

Chan 2 Volt/Div to:	0.1 volt/div		
Chan 1 Volt/Div to:	2 volt/div		
Chan 2 voltage to:	AC	Source to:	Chan 1
Chan 1 voltage to:	DC	Coupling to:	Low Freq. (High Freq. Reject)
Vert. Mode to:	Add	Trig Mode to:	Channel 1
Slope (Sync) to:	Pos	Time Base to:	50 µs/div

e. Adjust the time of the write-splice bit until it measures per 200 µs ± 100 µs. Refer to Figure 6-4a to adjust the time, loosen the single-sided sensor set screw holding the (single-sided-sensor) phototransistor located on the bottom of the chassis toward the front of the unit, (Figure 6-4b). Using the adjustment tab protruding through the casting, move the phototransistor until the specification is met. Tighten the set screw while observing the scope signal. Verify that the adjustment did not change.

f. All scope settings are to remain as defined in the original setup in Step 1, but it may be necessary to slightly adjust the sync. Seek to Track 00 then seek to Track 01 and perform a read. While observing the signal on the scope, remove and reinsert the diskette three times.

After each insertion, verify that the change in the time from Index to write splice is less than 50 µs.

Repeat Steps b through f using Alignment Diskette 425-51W for the two-sided sensor adjustment tab and its associated set screw, as required.

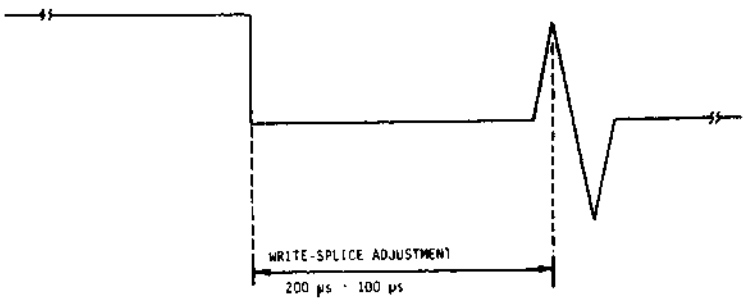


FIGURE 6-4A. WRITE-SPLICE-TIMING

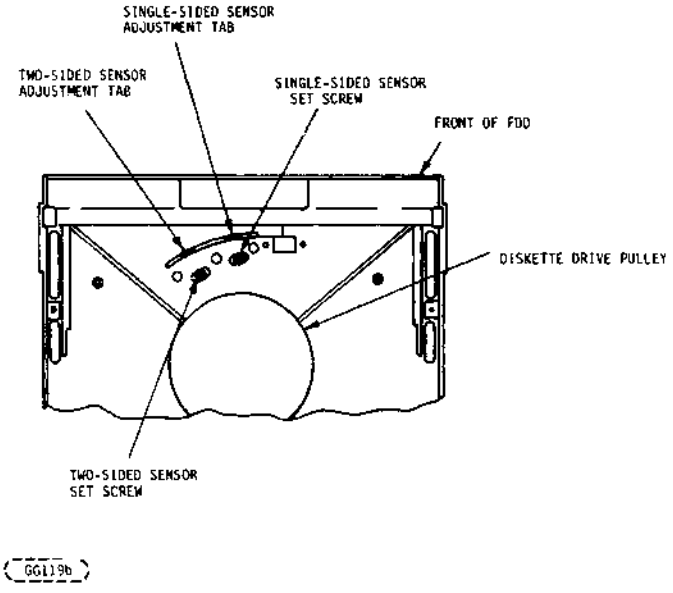


FIGURE 6-4B. SINGLE-AND TWO-SIDED SENSOR ADJUSTMENT MEANS

6.4.2 ACTUATOR ALIGNMENT

a. The alignment diskette shall be preconditioned by allowing it to reach room temperature for one hour.

b. Install the alignment diskette.

CAUTION

The Alignment Diskette is for read only. Extreme caution should be used to assure this diskette is not written on.

c. Connect Channel 1 of scope to TP3 on the PWA and Channel 2 to TP4 on the PWA.

d. Connect the external sync probe to index at J1-20 on PWA.

e. Set up the scope as follows:

Channel 1: volts/div to:	0.1 volts/div
Channel 2: volts/div to:	0.1 volts/div (Inverted)
Channel 1: input to:	AC
Channel 2: inputs to:	AC

Vertical Mode to: Add
Slope (Sync) to: Negative
Trigger Source to: External
Trigger Coupling to: Low Frequency (High Frequency Reject)
Trigger Mode to: Normal
Time Base to: 20 ms/div

f. Apply DC power to the drive.

g. Step to Track 38 (00100110) and perform a read on head 0.

NOTE

The trigger level is adjusted for repetitive display of data "Cateyes" consisting of two lobes (refer to Figure 6-6).

h. Change the volts/div of Channel 1 and Channel 2 to 0.02 volts/div. For an acceptable aligned unit, the voltage ratio of the smaller lobe to the larger lobe should exceed 80%.

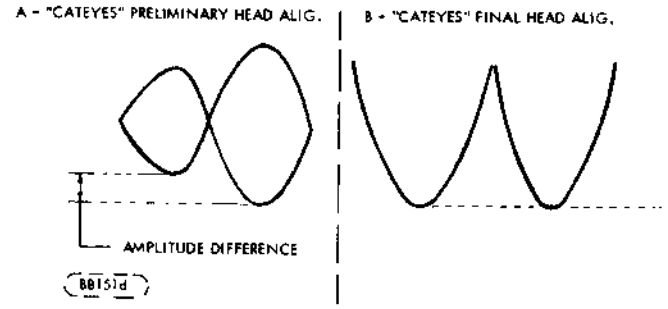


FIGURE 6-5. HEAD-ALIGNMENT AMPLITUDE

i. If not in alignment, slightly loosen the stepper-motor mounting screws, (see Figure 6-9), slowly rotate the stepper motor until the amplitudes of both lobes are the same, and tighten the hardware. If there is insufficient adjustment range of the motor, perform the following:

   i. Return the carriage to Track 0 and remove DC power.
   ii. Loosen the stepper-motor hardware and rotate the stepper motor to each end of its adjustment range, leaving it approximately centered. Snug the hardware.
   iii. Ensure that the pulley clamping screw is loose.
   iv. With the probes and scope set per Steps c and d above, apply DC power.
   v. Reading with Head 0, move the carriage back and forth in the vicinity of Track 0 to maximize the signal obtained (ensure that the pulley is slipping relative to the motor shaft). Tighten the pulley clamp hardware carefully so as not to move the carriage off Track 0.
   vi. Seek to Track 38, again reading on Head 0.
   vii. Using the adjustment tool, slowly rotate the motor until the amplitudes of both lobes is the same, and tighten the stepper-motor hardware.

j. Return to Track 0, then seek back to Track 38. Verify the adjustment. If the specification is not met, readjust the stepper motor, return to zero and seek back to Track 38. Repeat the adjustment until the specification is met.

k. Perform Track 0 Stop Adjustment.

l. Remove alignment diskette.

6.4.3 CLAMSHELL-CLOSED SWITCH ADJUSTMENT

Close the clamshell and check that it is latched. Turn the setscrew clockwise until the switch makes contact. Turn the setscrew one additional turn and a half. Open

and close the clamshell several times while observing the door-closed signal.

6.4.4 TRACK 0 STOP ADJUSTMENT

a. After applying DC power to the drive, return the carriage to Track 0.

b. Loosen Track 0 stop/cover hardware and slide the stop to the rear of the adjustment slot in the motor adapter.

c. Place a 0.030-in. (0.76mm) shim through the adjustment slot and between the cover stop and the carriage stop.

d. Slide the cover stop forward until contact is made with the 0.030-in. (0.76mm) shim, and tighten the hardware.

e. After adjustment, the gap between the cover stop and the carriage stop should be greater than 0.20 in. (0.51mm) and less than 0.035 in. (0.89mm).

6.4.5 DISKETTE EJECTOR

Insert a diskette fully and note a clicking noise as the ejector engages a pin on the clamshell.

While observing the ejector, latch and latch block (Figure 6-6) through the 1/2 in. (12.7mm) hole in the sidewall, close the clamshell. Note that closing the clamshell moved the ejector further to the rear allowing the latch to rotate counterclockwise until the tip drops over the step in the latch block.

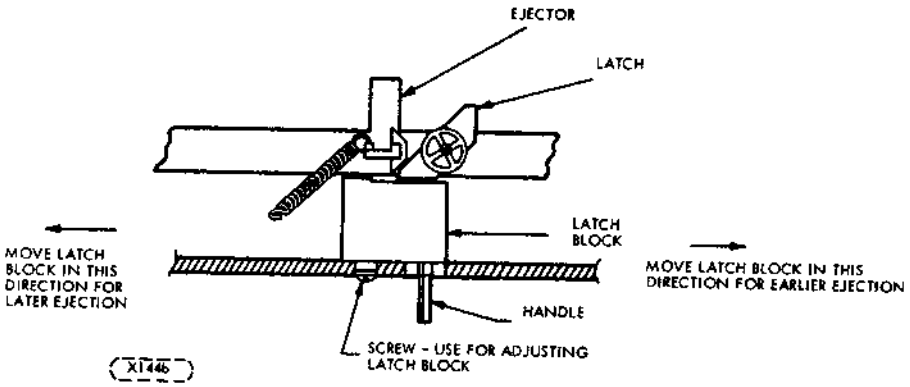


FIGURE 6-6. EJECTOR, LATCH AND LATCH BLOCK

With the clamshell closed, adjust the latch block (Figure 6-6) so the tip of the latch just clears the step.

Check by opening the clamshell slowly and observing the clamshell position when the diskette is ejected. To avoid damage, it is to be ejected when the clamshell is 1/4 in. (6.35mm) max. from the fully opened position. If further adjustments is required, move the latch block as indicated by the arrows and instruction in Figure 6-6.

Operate several times and observe that the diskette ejection is within the 1/4 in. (6.35mm) max. described above.

6.4.6 DISKETTE-LOAD-PAD ADJUSTMENT

a. Refer to Figure 6-7.

b. Energize Solenoid

c. Loosen Solenoid mounting screws (2x).

d. Move solenoid down on bracket to obtain a clearance of 0.010 to 0.015 in. (0.254 to 0.381 mm) between the load plate and the lift extension of the upper-head arm at the location of minimum clearance. Move the carriage through its full travel manually to determine the location of minimum clearance.

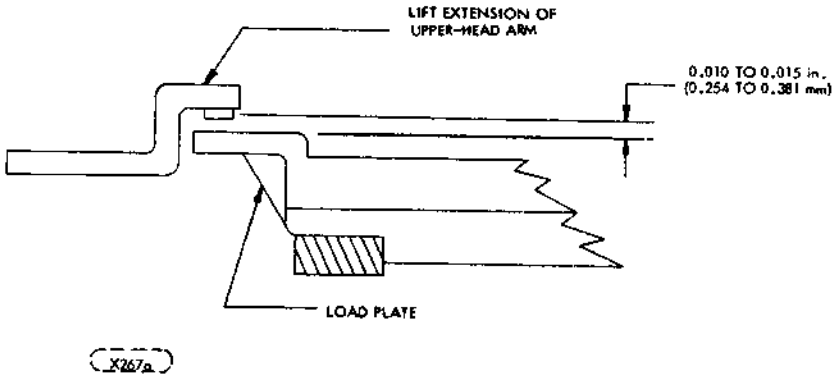


FIGURE 6-7. LOAD PAD ADJUSTMENT

6.4.7 HEAD-UNLOAD CLEARANCE

Adjust set screw on clamshell for 0.100 in. to 0.125 in. (2.54 to 3.175 mm) clearance per Figure 6-8 between flyer pads with head-load solenoid de-energized and clamshell closed.

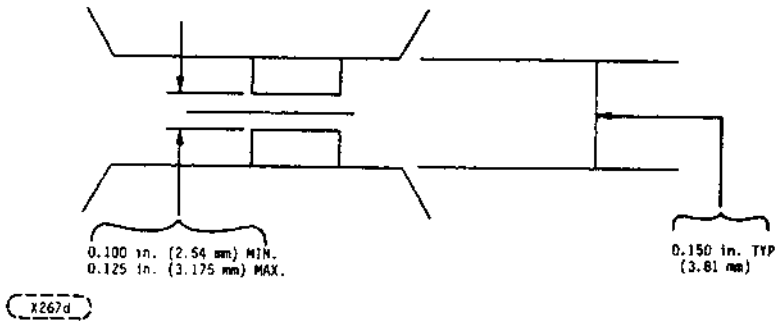


FIGURE 6-8. HEAD UNLOAD CLEARANCE AS VIEWED FROM THE FRONT OF THE CARRIAGE

6.4.8 LOW CURRENT SWITCH OPTICAL-SENSOR ADJUSTMENT

Some models may contain an internal Track 43 switch.

Verify adjustment 6.4.2 before beginning this adjustment.

Adjust the Low-Current-Switch optical sensor (on top of Track "0" bracket) for the proper output when positioned between Physical Tracks 42 or less and Physical Track 43 or greater.

a. Set up the scope as follows:

   Channel Probe: TJ-14 or J8-2
   Channel 1: volts/div to 1 V/div (0.1/div for X 10 Probe)
   Channel 1: input to DC
   Vertical Mode to: Channel 1
   Scope (sync) to: Positive
   Trigger Source to: Internal
   Trigger Coupling to: DC
   Trigger Mode to: Auto
   Time Base to: 20 ms/div

b. Perform a seek to Physical Track 42.
c. Adjust the optical sensor for +2.4 V min.
d. Perform a seek to Physical Track 43.

e. Verify the scope reads +0.5 V max.
f. Repeat b, c and d if necessary until the DC levels in Steps c and e are met.

6.4.9 AZIMUTH ADJUSTMENT

Using an alignment diskette, seek to Track 76 and adjust azimuth by turning the azimuth set screw in the guide-rod boss. The set screw should be adjusted in such a way that the azimuth pattern is optimized between head "0" and head "1." See Figure 6-10.1 for optimum azimuth alignment. The azimuth of both heads must be less than ±12 minutes from nominal.

6.5 REMOVAL AND REPLACEMENT PROCEDURES

The following procedures give the proper sequence for removal and replacement of major assemblies. To avoid damage to parts, the procedure must be performed in sequence.

6.5.1 PRINTED-CIRCUIT BOARD (PWA)

a. Disconnect I/O Cable from J1 (refer to Figure 5-3).
b. Disconnect harnesses from connectors on printed-circuit board.
c. Remove screw from printed-circuit board adjacent to connector J1.
d. Remove PWA by detaching it from the push-in clips.
e. To replace printed-circuit board, push clips through printed-circuit board.
f. Replace screw adjacent to connector J1.
g. Reconnect harness and I/O cable.
h. Set dipswitches.
i. Perform write-splice check and adjust as necessary (par. 6.4.1).

6.5.2 CARRIAGE REPLACEMENT

Refer to Figures 6-9 and 6-10.

a. Remove clamshell and front panel.
b. Disconnect head and stepper-motor cables from PWA.
c. Remove head cables from wire guide. Remove Track "0" cover/stop.
d. Loosen hardware securing pulley to stepper-motor shaft.
e. Remove hardware securing stepper motor to motor adapter.
f. Hold pulley and carefully remove stepper motor from pulley and adapter.
g. Slide carriage out (to approximately Track 0), and loosen guide bar clamp screw closest to spindle.
h. Slide carriage in (to approximately Track 76), and remove the other guide bar clamp screw.
i. Carefully remove the carriage, pulley and guide bar.
j. After removing guide bar from carriage, unhook band spring from pin on carriage and remove spring.
k. Remove pulley clip and screw from pulley.
l. Remove band clip and nut from end of carriage.
m. Reverse above procedure to install new carriage, except:

i. Replace band with new band assembly;
ii. Leave pulley and band clips loose before installing band spring;
iii. After band spring is installed, rotate pulley the length of the foam pad to verify proper alignment. A misaligned pulley can be detected by either hearing a scraping or scratching noise, or a careful examination

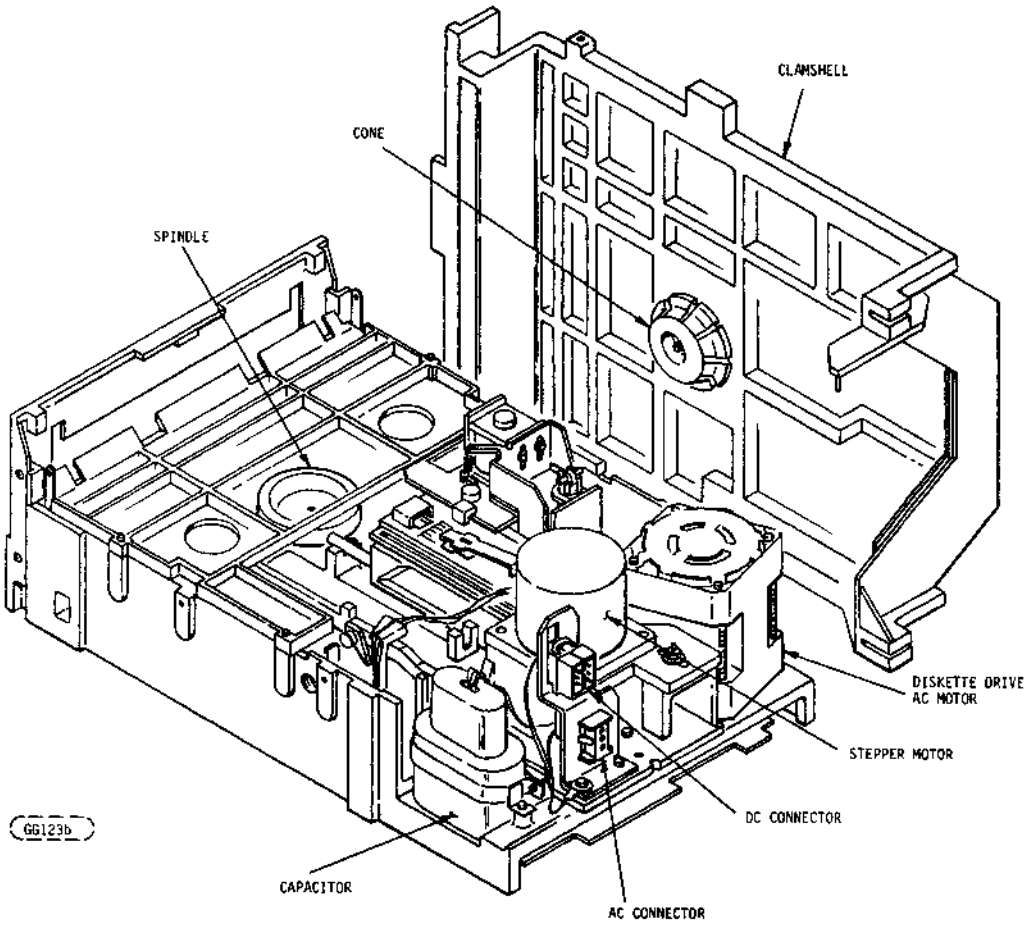


FIGURE 6-9. POSITIONING AND HEAD-LOAD MECHANISM, CLAMSHELL COVER RAISED.

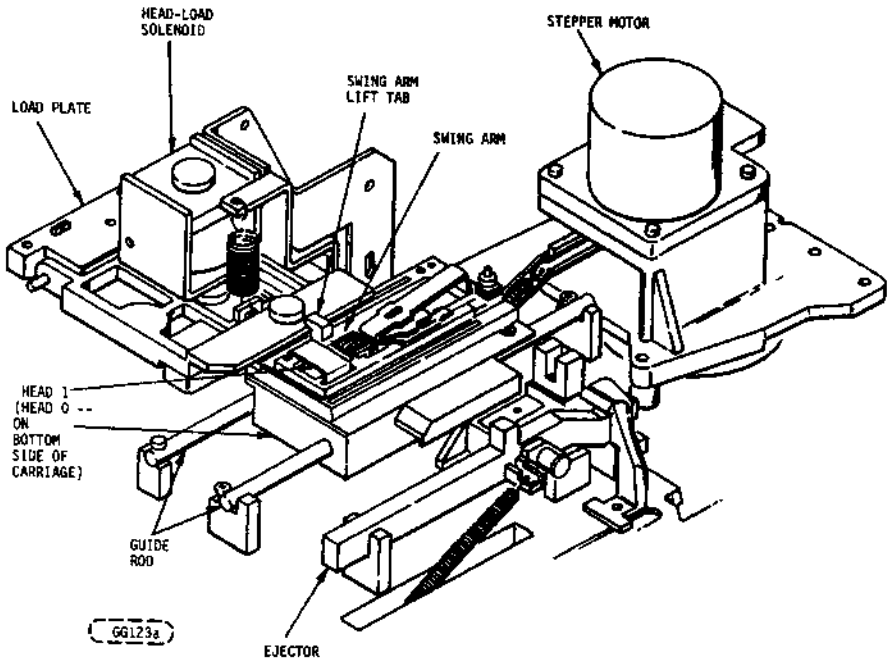


FIGURE 6-10. HEAD-LOAD CARRIAGE AND STEPPER MOTOR DETAILS

6.5.2 -contd.

of the gap between the split portion and the inner solid portion of the band. If the pulley is not exactly aligned, insert a small tool (screwdriver), into the spring hook closest to the band and apply sufficient force to relieve tension on the band. While holding the spring with hand, twist the pulley relative to the band in an effort to realign the band and pulley, and release the spring. Check for exact alignment. Repeat this procedure until the band and pulley are exactly aligned, and then tighten band and pulley clip hardware.

iv. After carefully reinstalling the carriage assembly (ensuring that the swing arm tab is positioned above the load plate), and securing the guide bar, place the drive in a vertical position (motor up) so that the pulley is below the tail end of the carriage. At this point, check that the pulley is still properly aligned. If the pulley is misaligned, the carriage must be removed and the alignment procedure repeated. After ensuring the alignment is correct, with one hand position and hold the pulley in the approximate center of the locating hole in the motor adapter and carefully slide the motor shaft through the pulley bore, and seat the motor in the motor adapter. Use at least one screw at this point to hold the motor in place, ensuring that the screw is centered in the motor mount hole to facilitate later adjustment. Run the carriage back and forth by hand a few times so that the pulley is oriented properly on the shaft, and resume reassembly.

n. Perform the Actuator Alignment (6.4.2) after completing mechanical assembly.
o. Reinstall Track - cover/stop and perform Track 0 Stop Adjustment (6.4.4).
p. Perform azimuth adjustment (6.4.9).

6.5.3 DRIVE MOTOR ASSEMBLY

a. Perform removal procedure for printed-circuit board (paragraph 6.5.1).
b. Remove screws securing drive-motor cable clamps.
c. Remove AC connector from bracket.
d. Remove spindle drive belt.
e. Remove three (3) nuts or screws securing drive motor.
f. Remove drive-motor assembly (drive motor, capacitor, and AC connector).
g. To replace drive-motor assembly perform in reverse Steps f through a.

6.5.4 STEPPER-MOTOR REPLACEMENT

a. Disconnect stepper-motor cables from PWA and cut cable ties as required.
b. Loosen hardware securing pulley to stepper-motor shaft.
c. Remove hardware securing stepper motor to motor adapter.
d. Hold pulley and carefully remove stepper motor from pulley and motor adapter.
e. Reverse above procedure to install new motor, except:
Check pulley alignment and installation per paragraph 6.5.2.m (iv).
f. Perform Actuator Alignment, 6.4.2.

6.6 FREQUENCY CONVERSION

6.6.1 OPERATING FREQUENCIES CONVERSION PROCEDURE

This procedure is to be used to convert the FDD unit from 60 Hz operation to 50 Hz operation, or vice versa. This is accomplished by reversing the dual-diameter reversible pulley on the spindle-motor shaft using the following steps:

a. Remove AC power.
b. Remove printed-circuit board assembly per paragraph 6.5.1.
c. Remove the belt from the spindle-motor pulley. (Accessible from the under side of unit.)
d. Loosen setscrew and remove pulley.
e. Reserve pulley and replace on motor shaft.
f. Position pulley allowing tolerance of 0.039 in. (0.99 mm) $\pm$ 0.10 in. (0.254 mm) between shoulder of motor mounting screws and pulley (Figure 6-11).
g. Tighten down setscrew.
h. Replace belt and printed-circuit board.

CAUTION

It is IMPORTANT that the new operating frequency be marked on the unit's rating nameplate.

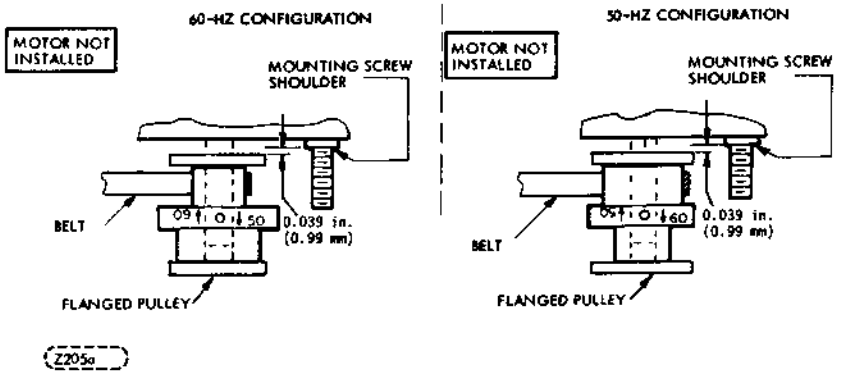


FIGURE 6-11. DRIVE-PULLEY REVERSAL

NOTE: When converting from 60 Hz to 50 Hz, the same belt may be used. When converting from 50 Hz to 60 Hz, a new belt must be installed.

7.1 INTRODUCTION

This section contains detailed information on the logic circuits used in the FDD. The logic consists of two types of circuits: discrete component and integrated circuits (IC). Integrated circuits are contained within a single chip and discrete component circuits contain individually identifiable resistors, capacitors, transistors, etc.

7.2 PHYSICAL DESCRIPTION (LOGIC)

All components are mounted on one side of the printed circuit board. The board is 7.0 x 8.0 inches (178 mm X 203 mm) and contain both IC and discrete component circuits.

7.3 USE OF RELATIVE LEVEL INDICATORS

The relative level indicator is a small triangle located on the input or output to a logic block. The presence or absence of this indicator indicates the conditions that are necessary to satisfy the function of the logic block. The presence of the triangle indicates a 0 logic level on that line is needed to satisfy the function. The absence of the triangle indicates a logical 1 is needed to satisfy the function.

The relative level indicator depicts the occurrence of inversion. Figure 7-1 shows some representative examples of the relative level indicator being used in this manner.

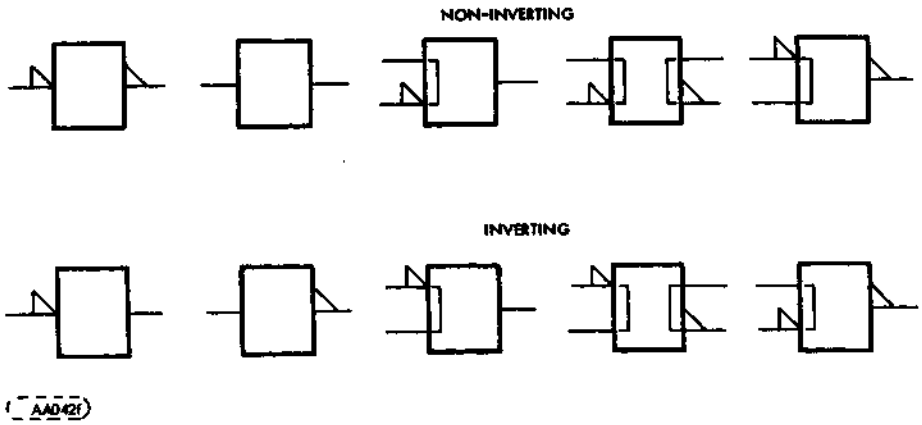


FIGURE 7-1. INVERSION CONVENTIONS

7.4 INTEGRATED CIRCUITS

Figure 7-2 shows an example of a schematic block and the information that it contains. The first line gives the function symbol which identifies the logic function that the block performs. Refer to Figure 7-3 for a summary of function symbols. The second line gives the CDC element number. The third line on the schematic block gives the circuit reference designation.

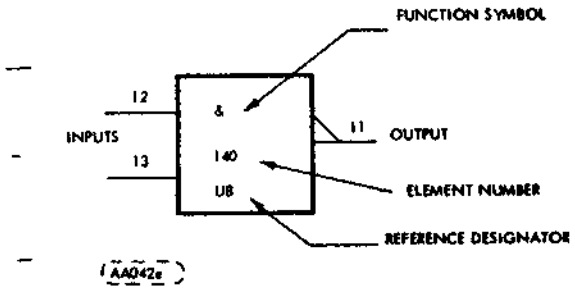


FIGURE 7-2. INTEGRATED CIRCUIT

FUNCTION SYMBOLS	
&	AND GATE OR INVERTER
1	OR GATE OR INVERTER
=1	EXCLUSIVE OR
1 ⎍	ONE SHOT
Σ	SUMMING CIRCUIT. NUMBER FOLLOWING (EXAMPLE 100) INDICATES GAIN OF 100
X/Y	LEVEL CONVERSION - TRANSMISSION LINE TO LOGIC LEVEL, SWITCH STATE TO LOGIC LEVEL OR LOGIC LEVEL TO POWER OUTPUT
	SCHMITT TRIGGER (LOWER TRIP POINT ADJUSTABLE)
GENERAL SYMBOLS	
	INDICATES NON STANDARD LOGIC LEVEL
	INDICATES ANALOG SIGNAL
	TEST POINTS
	INHIBITING INPUT

BB151b

FIGURE 7.3. SCHEMATIC SYMBOLS

8.1 INTRODUCTION

This section contains an illustrated parts breakdown that describes and illustrates all variations of the (band-driven) Model 9406-4 Flexible Disk Drive (FDD). In general, parts are in disassembly sequence but do not necessarily indicate the maximum recommended disassembly of parts in this field.

8.2 ILLUSTRATIONS

Item numbers within a circle (1) indicate an assembly (group of parts). Item numbers without a circle, 1, indicate a single part; a group of parts that are pinned or press fitted together; or a group of parts which is normally replaced as an assembly.

8.3 PARTS LIST

In addition to the accompanying parts list on each illustration, two additional Parts Lists are available; the Top-Down Assembly/Component Parts List and the Cross Reference Index. Instruction for the use of all Parts Lists is given in para. 8.6.

8.4 PRODUCT CONFIGURATIONS

In conjunction with Table 8-1, Figure 8-1 serves two purposes;

1. When used with Table 8-1, it identifies all unique parts and assemblies for each FDD variation.
2. It identifies by sheet location where all major assemblies are broken down.

8.4.1 HARDWARE PRODUCT CONFIGURATOR (HPC)

To determine what parts are used on a particular model, find the applicable HPC number in Table 8-1. The item numbers at the top of Table 8-1 corresponds with the item numbers in Figure 8-1. All parts and assemblies that apply to the HPC number will be identified with an 'X' ('0' means not applicable). NOTE: The HPC Number is identical to the Equip. Ident. No. shown on the label.

8.5 REPLACEMENT PARTS

When ordering replacement parts for the FDD, the inclusion of the following information for each part ordered will ensure positive identification:

1. Equip. Ident. No.
2. Publication Number 77653522
3. Figure and Item Number
4. Identification Number and and Description
5. Equip. Series Code No.

NOTE:
Before ordering parts however, refer to paragraph 8.5.1 Spare Parts.

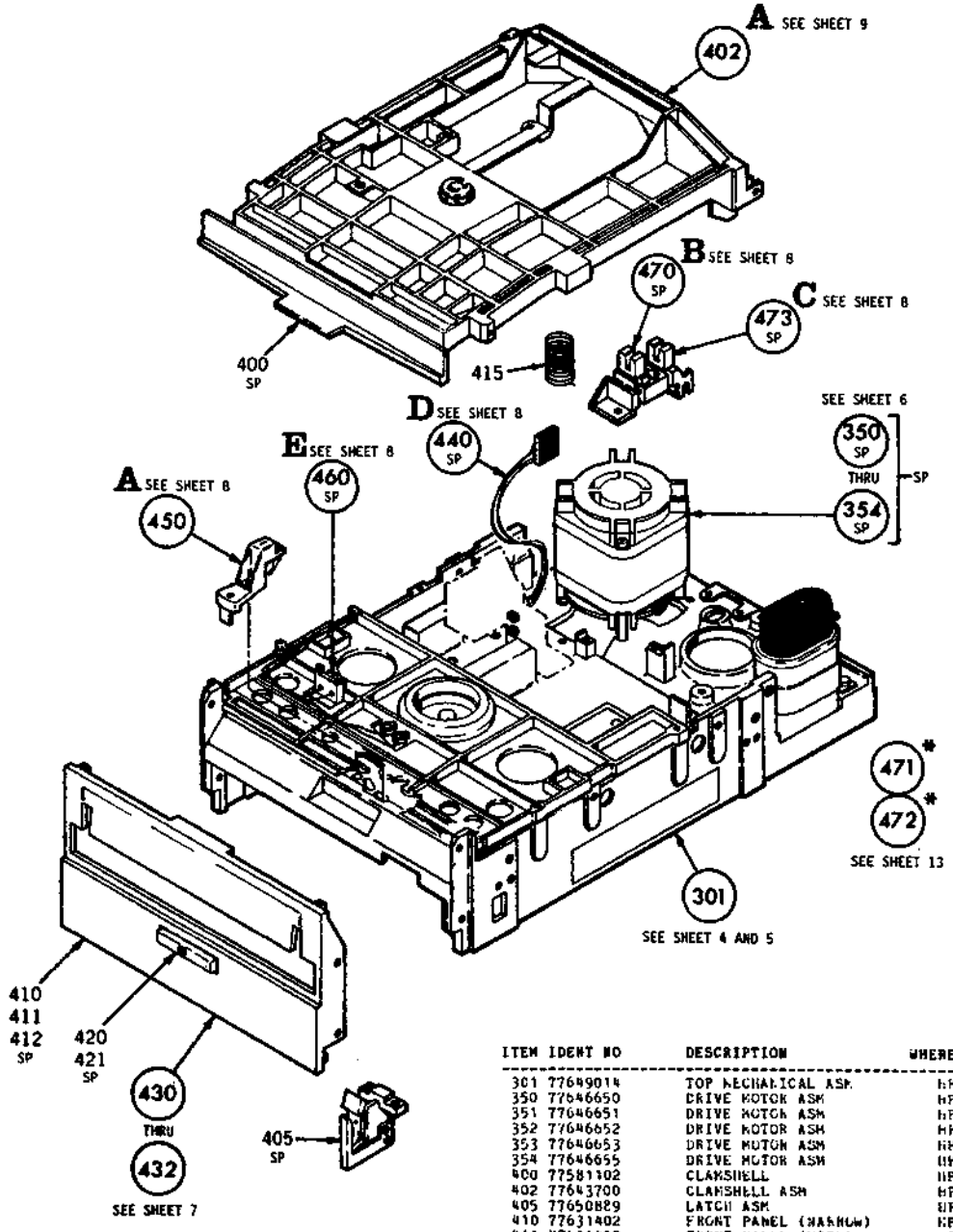
8.5.1 SPARE PARTS

This Illustrated Parts Breakdown is complete to the extent that all parts and assemblies are depicted and identified. Replacement part availability depends on the materials and provisioning operation of the supplier.

To assist the service representative in selecting replacement parts with minimum requisitioning lead times, engineering-recommended spare parts which reflect the intended service level of the device are identified with the letters SP adjacent to the item number on the face of each illustration. Replaceable non-spared items will require longer requisitioning lead times.

TABLE 8-1. PRODUCT CONFIGURATION

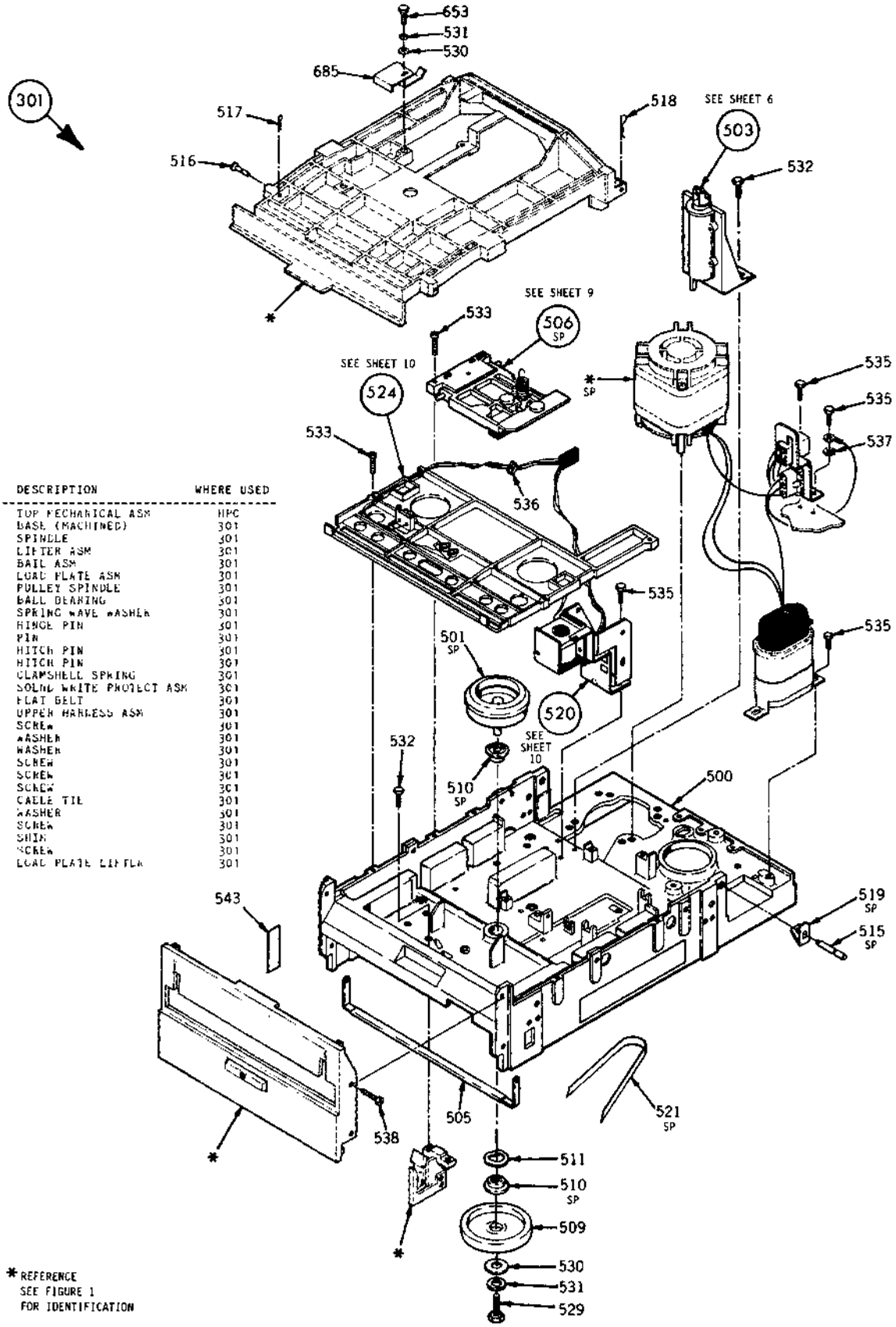
	ITEM NUMBERS						
	3333333333	3333333333	3444444444	4444444444	4444444444	4444444444	4444444444
	0000000001	5555555555	9000000000	0111111111	2222222222	3333333333	4455667777
HPC	1234567890	0123456789	9012345678	9012345678	0123456789	0123456789	0101010123
77618101	X000000000	X000000000	0X0X00X000	0X0000X000	X000000000	00X0000000	X0X0X000XX
77618102	X000000000	0X00000000	0X0X00X000	0X0000X000	X000000000	00X0000000	X0X0X000XX
77618103	X000000000	X000000000	0X0X00X000	0X0000X000	X000000000	X000000000	X0X0X000XX
77618104	X000000000	0X00000000	0X0X00X000	0X0000X000	X000000000	X000000000	X0X0X000XX
77618105	X000000000	X000000000	0X0X00X000	0X0000X000	X000000000	00X0000000	X0X0X0X0X0
77618106	X000000000	0X00000000	0X0X00X000	0X0000X000	X000000000	00X0000000	X0X0X0X0X0
77618107	X000000000	X000000000	0X0X00X000	0X0000X000	X000000000	X000000000	X0X0X0X0X0
77618108	X000000000	0X00000000	0X0X00X000	0X0000X000	X000000000	X000000000	X0X0X0X0X0
77618109	X000000000	X000000000	0X0X00X000	00X000X000	X000000000	0X00000000	X0X0X00X00
77618110	X000000000	X000000000	0X0X00X000	000X00X000	0X00000000	X000000000	X0X0X000XX
77618111	X000000000	X000000000	0X0X00X000	0X0000X000	X000000000	00X0000000	X0X0X000XX
77618112	X000000000	0X00000000	0X0X00X000	0X0000X000	X000000000	00X0000000	X0X0X000XX
77618113	X000000000	00X0000000	0X0X00X000	0X0000X000	X000000000	X000000000	X0X0X000XX
77618114	X000000000	X000000000	0X0X00X000	0X0000X000	X000000000	X000000000	X0X0X000XX
77618115	X000000000	000X000000	0X0X00X000	0X0000X000	X000000000	00X0000000	X0X0X000XX
77618116	X000000000	0X00000000	000X00X000	000000X000	0000000000	X000000000	X0X0X000XX
77618117	X000000000	000X000000	0X0X00X000	0X0000X000	X000000000	X000000000	X0X0X000XX
77618118	X000000000	00X0000000	0X0X00X000	0X0000X000	X000000000	X000000000	X0X0X0X0X0
77618119	X000000000	X000000000	0X0X00X000	0X0000X000	X000000000	00X0000000	X0X0X000XX
77618120	X000000000	0X00000000	0X0X00X000	0X0000X000	X000000000	00X0000000	X0X0X000XX



* NOT SHOWN

ITEM	IDENT NO	DESCRIPTION	WHERE USED
301	77649014	TOP MECHANICAL ASM	HPC
350	77646650	DRIVE MOTOR ASM	HPC
351	77646651	DRIVE MOTOR ASM	HPC
352	77646652	DRIVE MOTOR ASM	HPC
353	77646653	DRIVE MOTOR ASM	HPC
354	77646655	DRIVE MOTOR ASM	HPC
400	77581102	CLAMSHELL	HPC
402	77643700	CLAMSHELL ASM	HPC
405	77650829	LATCH ASM	HPC
410	77631402	FRONT PANEL (NARROW)	HPC
411	77631302	FRONT PANEL (WIDE)	HPC
412	77631406	FRONT PANEL (NARROW)	HPC
415	75881576	SPRING	HPC
420	75897201	BUTTON	HPC
421	75897206	BUTTON	HPC
430	77643501	FRONT PANEL ASM (NARROW)	HPC
431	77643502	FRONT PANEL ASM (WIDE)	HPC
432	77643503	FRONT PANEL ASM (NARROW)	HPC
440	75882037	WRITE PROTECT	HPC
450	75882185	INDEX DETECTOR KIT	HPC
460	75885979	DOOR INTERLOCK KIT	HPC
470	77649000	TRACK 43 KIT	HPC
471	75883336	MOUNTING KIT, SIDE	HPC
472	75894197	MOUNTING KIT, BOTTOM	HPC
473	77649046	TRACK '0' DETECT ASM	HPC

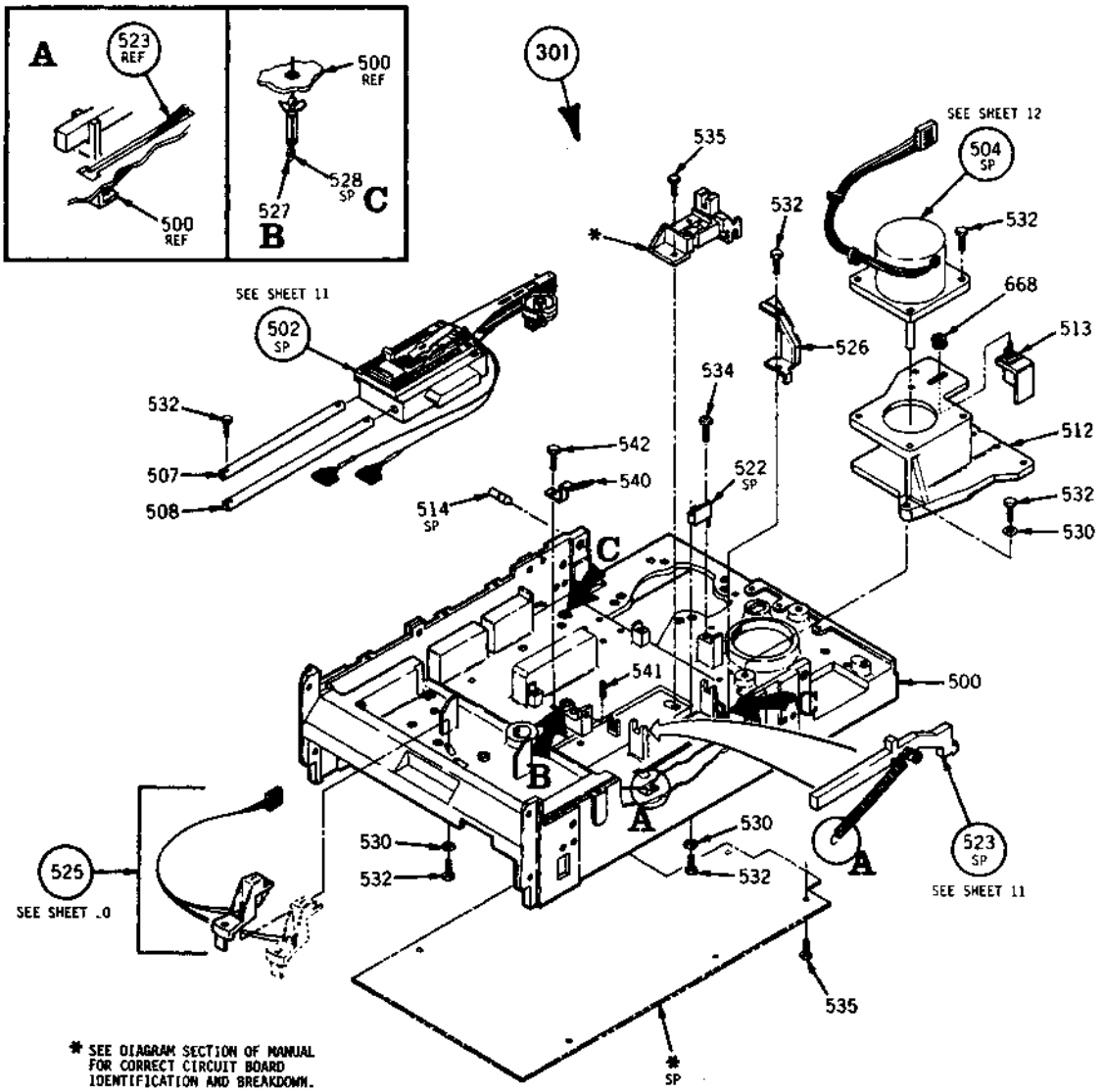
FIGURE 8-1. PRODUCT CONFIGURATION



ITEM	IDENT NO	DESCRIPTION	WHERE USED
301	77649014	TOP MECHANICAL ASM	HPC
500	75883128	BASE (MACHINED)	301
501	75881591	SPINDLE	301
503	75882895	LIFTER ASM	301
505	75888075	BAIL ASM	301
506	77647148	LOAD PLATE ASM	301
509	77646606	PULLEY SPINDLE	301
510	77013697	BALL BEARING	301
511	93529005	SPRING WAVE WASHER	301
515	75888591	HINGE PIN	301
516	75888595	PIN	301
517	75890210	HITCH PIN	301
518	75890211	HITCH PIN	301
519	75888570	CLAMSHELL SPRING	301
520	77649294	SOLNO WRITE PROTECT ASM	301
521	75293203	FLAT BELT	301
524	77649284	UPPER HARNESS ASM	301
529	10127334	SCREW	301
530	10125605	WASHER	301
531	10125003	WASHER	301
532	93592164	SCREW	301
533	15004800	SCREW	301
535	93592162	SCREW	301
536	94277400	CABLE TIE	301
537	10126401	WASHER	301
538	10125712	SCREW	301
543	77648216	SHIM	301
653	10127134	SCREW	301
685	77643437	LOAD PLATE LIFTER	301

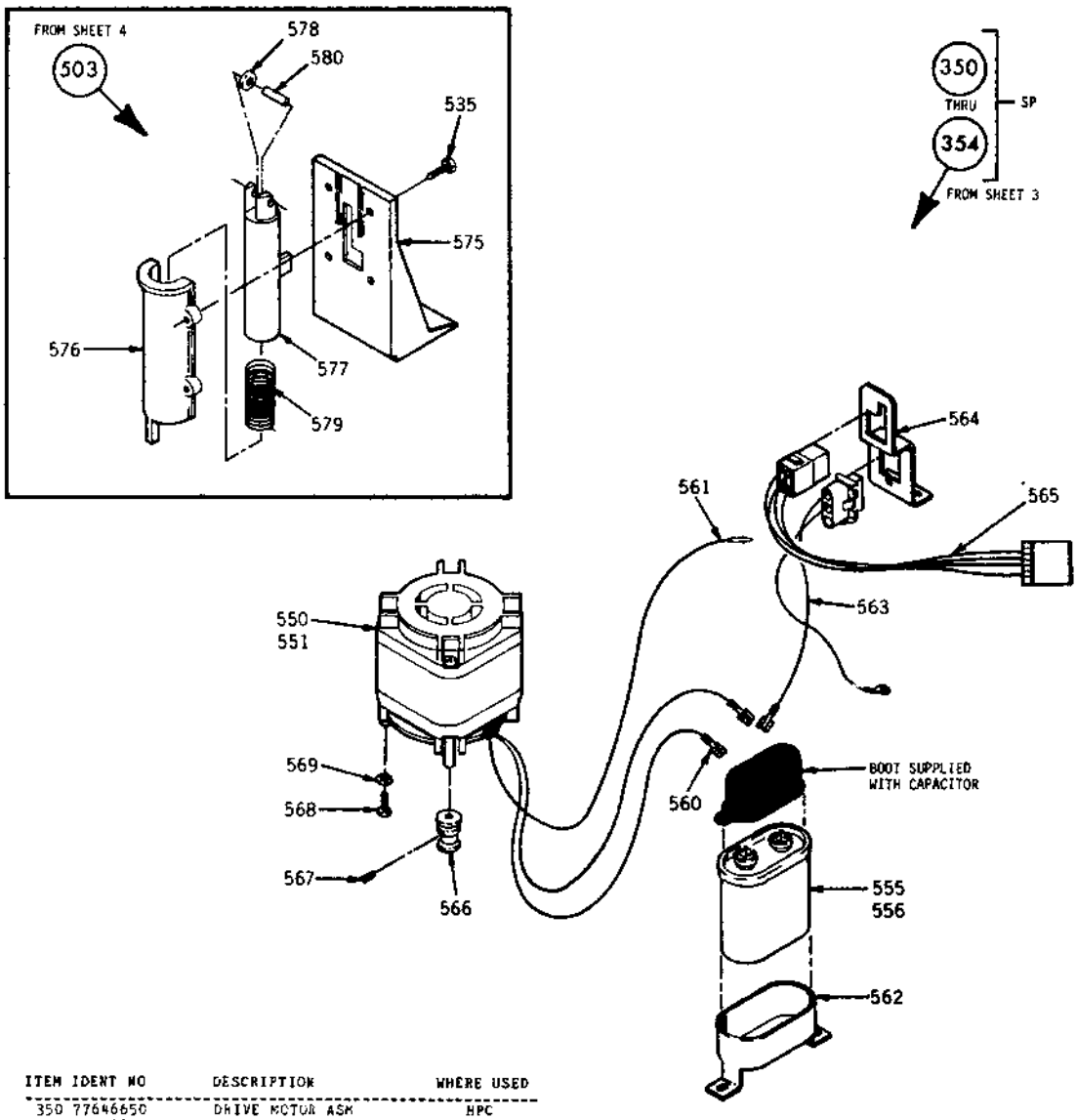
*REFERENCE
SEE FIGURE 1
FOR IDENTIFICATION

FIGURE 8-2. TOP MECHANICAL ASSEMBLY (SHEET 1 OF 2)



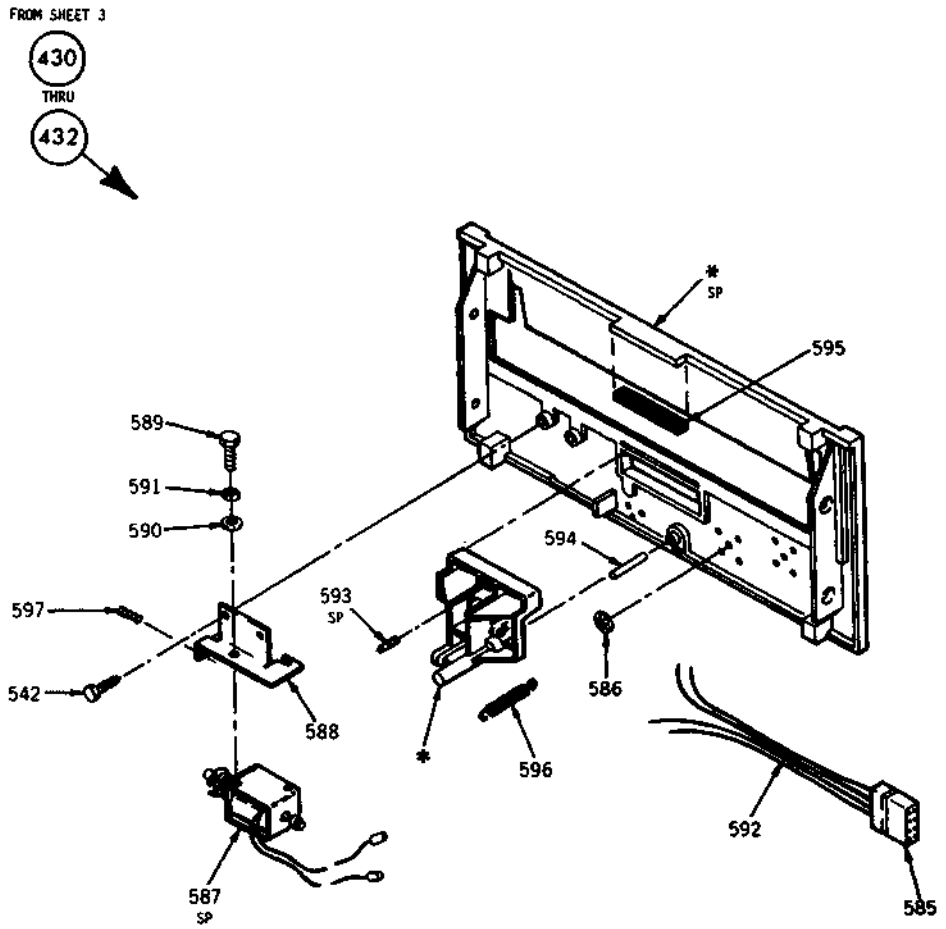
ITEM	IDENT NO	DESCRIPTION	WHERE USED
301	77649014	TOP MECHANICAL ASM	HPC
500	75883128	BASE (MACHINED)	301
502	77649278	ACTUATOR ASM	301
504	77649030	STEPPER BRAKE ASM	301
507	75881326	CARRIAGE GUIDE	301
508	75881275	ROD GUIDE	301
512	77649255	MOTOR ADAPTER	301
513	77646890	COVER STOP	310
514	75888590	HINGE PIN	301
522	75883240	LATCH BLOCK	301
523	75889396	EJECTOR ASM	301
525	77649221	LOWER HARNESS ASM	301
526	77648151	WIRE GUIDE	301
527	75774732	PUSH IN CLIP	301
528	75774736	PUSH IN CLIP	301
530	10125605	WASHER	301
532	93592164	SCREW	301
534	18862916	SCREW	301
535	93592162	SCREW	301
540	77648215	GUIDE ROD SPRING	301
541	93819246	SCREW	301
542	93592158	SCREW	301
668	53777900	NUT	301

FIGURE 8-2. TOP MECHANICAL ASSEMBLY (SHEET 2 OF 2)



ITEM	IDENT NO	DESCRIPTION	WHERE USED
350	77646650	DRIVE MOTOR ASM	HPC
351	77646651	DRIVE MOTOR ASM	HPC
352	77646652	DRIVE MOTOR ASM	HPC
353	77646653	DRIVE MOTOR ASM	HPC
354	77646655	DRIVE MOTOR ASM	HPC
503	75882895	LIFTER ASM	301
535	93592162	SCREW	503
550	75726925	MOTOR	350-353
551	75726924	MOTOR	351-352
555	75738402	CAPACITOR	350-353
556	75738400	CAPACITOR	351-352
560	6212110E	TERMINAL	350-353
561	83435604	CONTACT	350-353
562	16439600	CAPACITOR BRACKET	350-353
563	77649003	AC CABLE	350-353
564	77647990	AC CONNECTOR BRACKET	350-353
565	77646209	DC CABLE	350-353
566	75896006	DRIVE PULLEY	350-353
567	83413405	SCREW	350-353
568	93592202	SCREW	350-353
569	10126104	WASHER	350-353
575	75882740	COVER	503
576	75882735	CYLINDER	503
577	77658915	PISTON	503
578	75882725	ROLLER	503
579	77658910	SPRING	503
580	92021009	DOWEL PIN	503

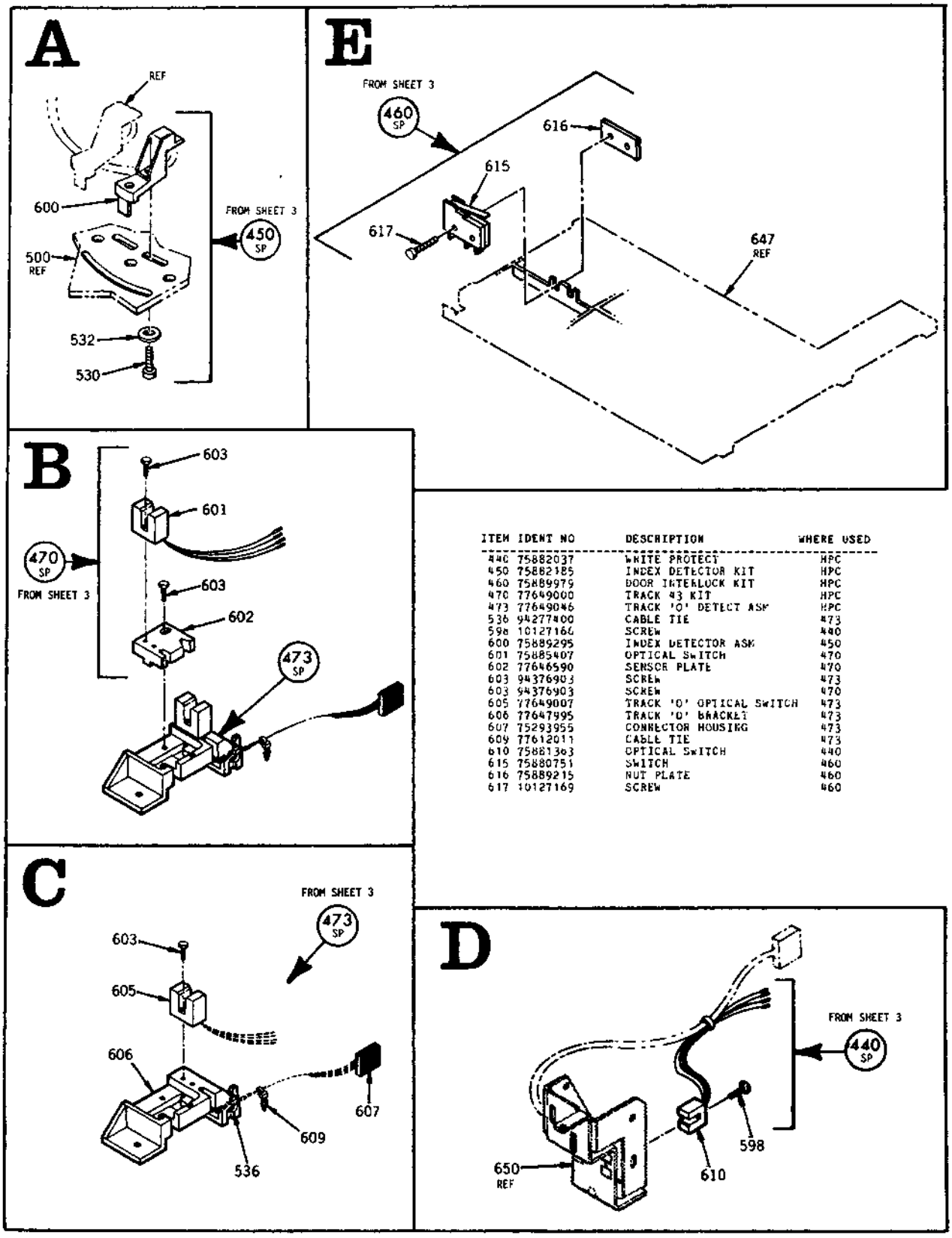
FIGURE 8-3. DRIVE MOTOR AND LIFTER ASSEMBLIES



*REFERENCE
SEE FIGURE 1 FOR
INFORMATION

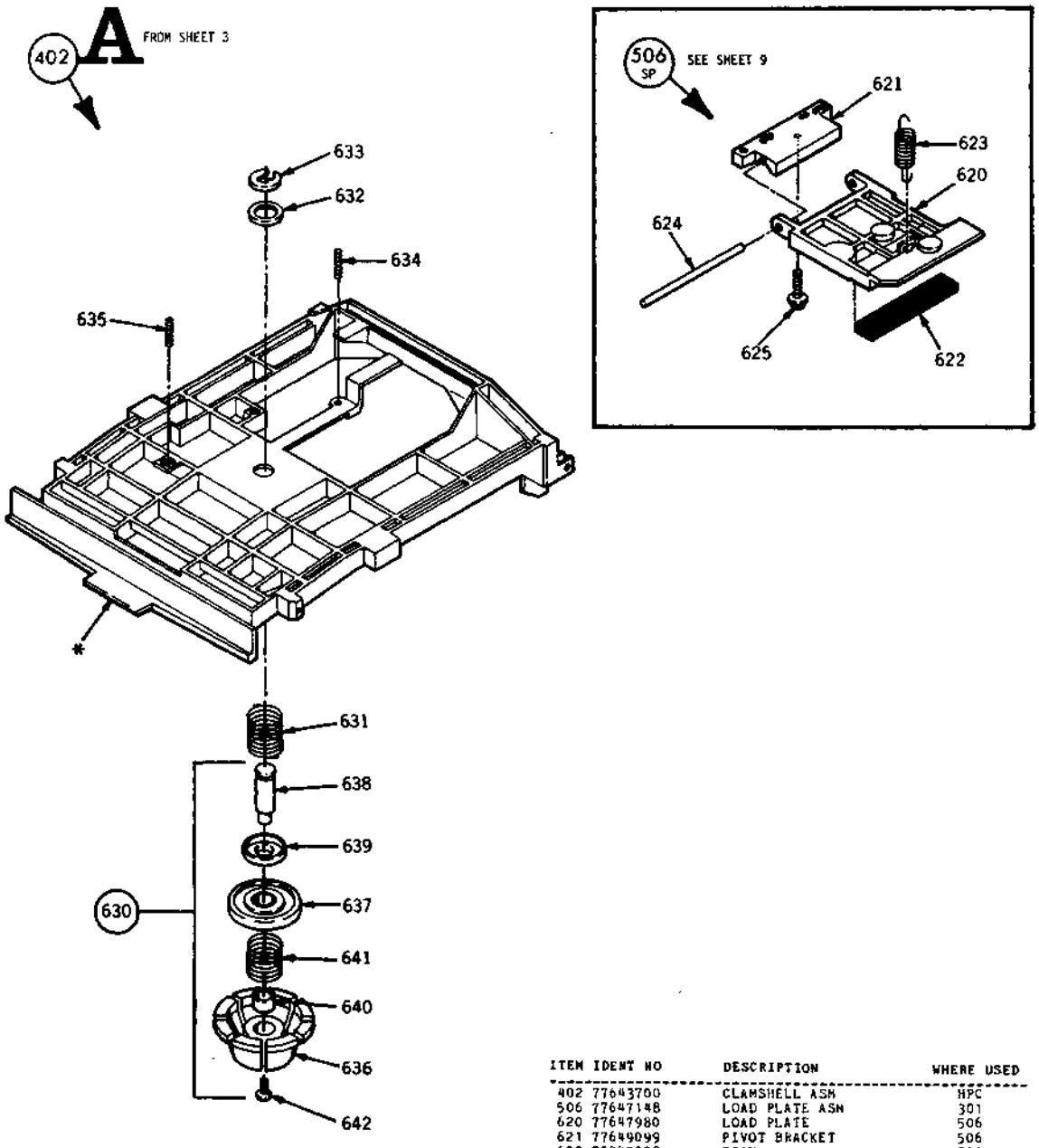
ITEM	IDENT NO	DESCRIPTION	WHERE USED
430	77643501	FRONT PANEL ASM (NARROW)	HPC
431	77643502	FRONT PANEL ASM (WIDE)	HPC
432	77643503	FRONT PANEL ASM (NARROW)	HPC
542	93592158	SCREW	430
585	75293954	CONNECTOR HOUSING	430-432
586	00848201	RETAINING RING	430-432
587	75882333	SOLENOID ASM	430
588	77636695	SOLENOID MOUNT	430
589	10127102	SCREW	430
590	75806502	WASHER	430
591	10125801	WASHER	430
592	77648205	CABLE	430-432
593	77612981	DIODE	430-432
594	77610030	DOWEL PIN	430-432
595	77646804	BUMPER	430-432
596	75899166	LATCH SPRING	430-432
597	92820166	SCREW	430-432

FIGURE 8-4. FRONT PANEL ASSEMBLY



ITEM	IDENT NO	DESCRIPTION	WHERE USED
440	75882037	WRITE PROTECT	HPC
450	75882185	INDEX DETECTOR KIT	HPC
460	75889979	DOOR INTERLOCK KIT	HPC
470	77649000	TRACK 43 KIT	HPC
473	77649046	TRACK '0' DETECT ASM	HPC
536	94277400	CABLE TIE	473
598	10127166	SCREW	440
600	75889295	INDEX DETECTOR ASM	450
601	75885407	OPTICAL SWITCH	470
602	77646590	SENSOR PLATE	470
603	94376903	SCREW	473
603	94376903	SCREW	470
605	77649007	TRACK '0' OPTICAL SWITCH	473
606	77647995	TRACK '0' BRACKET	473
607	75293955	CONNECTOR HOUSING	473
609	77612011	CABLE TIE	473
610	75881363	OPTICAL SWITCH	440
615	75880751	SWITCH	460
616	75889215	NUT PLATE	460
617	10127169	SCREW	460

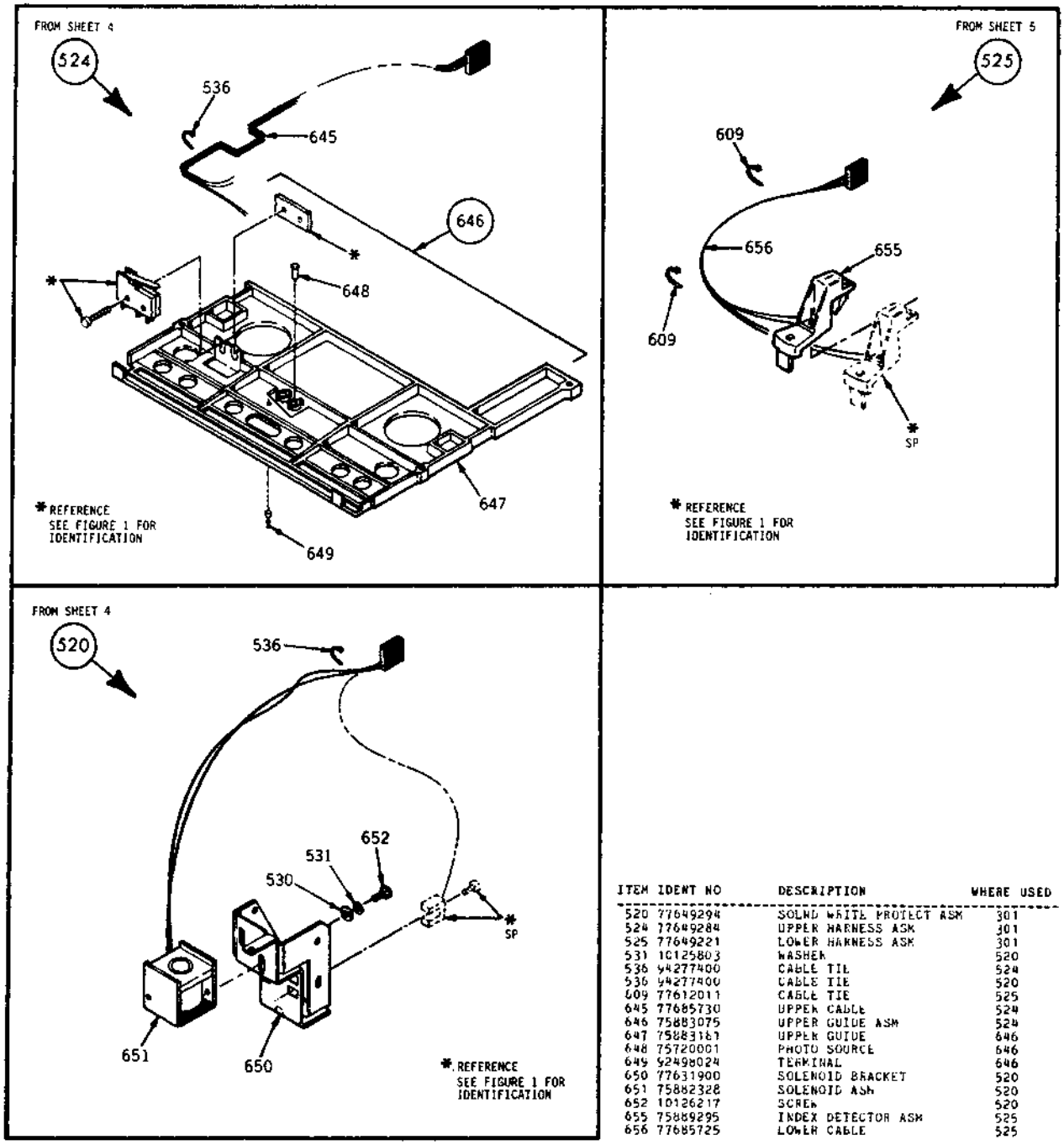
FIGURE 8-5. FEATURE KITS



ITEM	IDENT NO	DESCRIPTION	WHERE USED
402	77643700	CLAMSHELL ASM	HPC
506	77647148	LOAD PLATE ASM	301
620	77647980	LOAD PLATE	506
621	77649099	PIVOT BRACKET	506
622	75882038	FOAM	506
623	77647147	SPRING	506
624	77646623	PIVOT PIN	506
625	94376916	SCREW	506
630	75881895	CONE ASM	402
631	75882017	SPRING	402
632	93564057	WASHER	402
633	92033087	RETAINING RING	402
634	93820782	SCREW	402
635	93820248	SCREW	402
636	75881715	CONE	630
637	75881892	BEARING	630
638	75888607	SHAFT	630
639	75888610	RETAINER	630
640	75881710	SPACER	630
641	75882016	COMPRESSION SPRING	630
642	77610637	SCREW	630

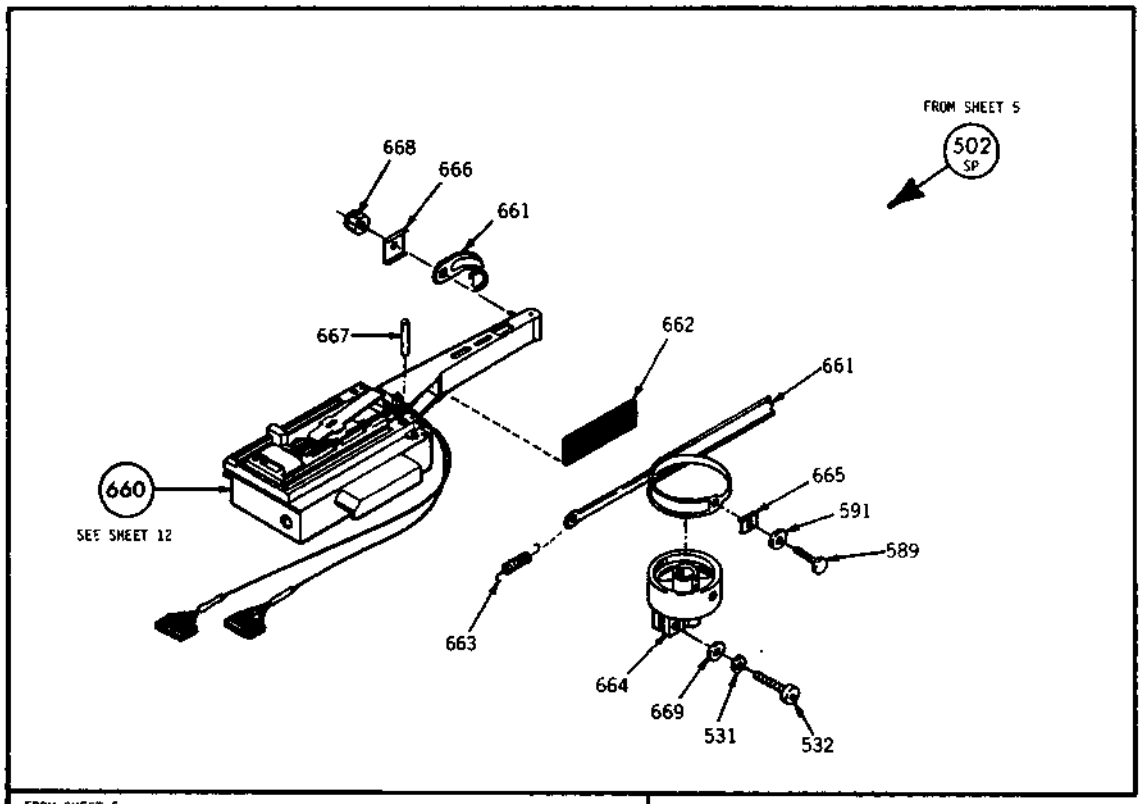
* REFERENCE
SEE FIGURE 1 FOR IDENTIFICATION

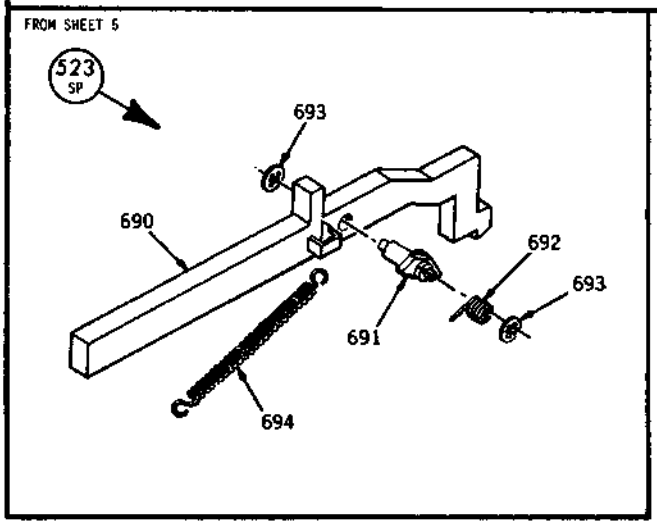
FIGURE 8-6. CLAMSHELL AND LOAD PLATE ASSEMBLIES



ITEM	IDENT NO	DESCRIPTION	WHERE USED
520	77649294	SOLND WAITL PROTECT ASM	301
524	77649284	UPPER HARNESS ASM	301
525	77649221	LOWER HARNESS ASM	301
531	10125803	WASHER	520
536	94277400	CABLE TIE	524
536	94277400	CABLE TIE	520
609	77612011	CABLE TIE	525
645	77685730	UPPER CABLE	524
646	75883075	UPPER GUIDE ASM	524
647	75883161	UPPER GUIDE	646
648	75720001	PHOTO SOURCE	646
649	92498024	TERMINAL	646
650	77631900	SOLENOID BRACKET	520
651	75882328	SOLENOID ASM	520
652	10126217	SCREW	520
655	75889295	INDEX DETECTOR ASM	525
656	77685725	LOWER CABLE	525

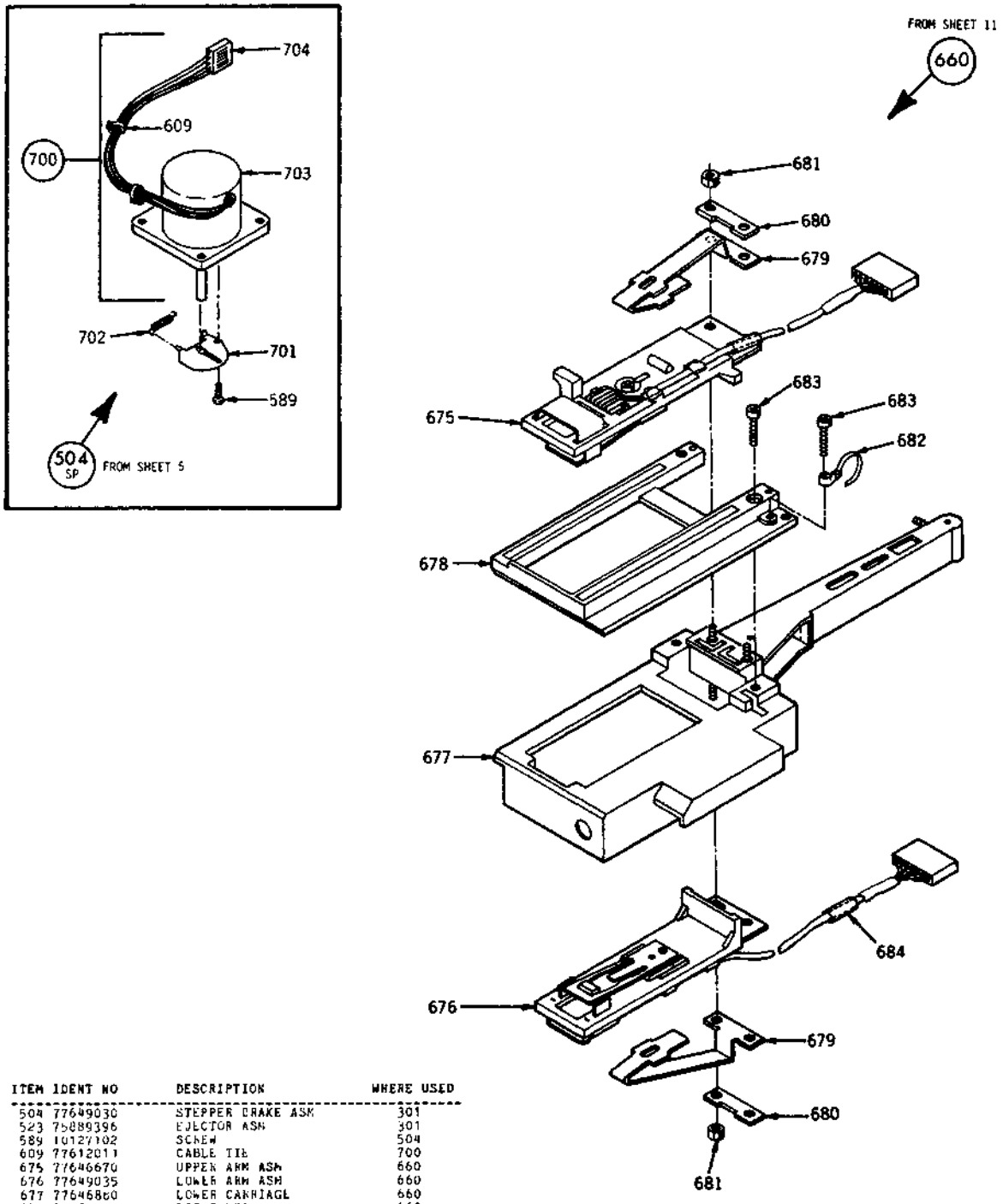
FIGURE 8-7. HARNESS ASSEMBLIES





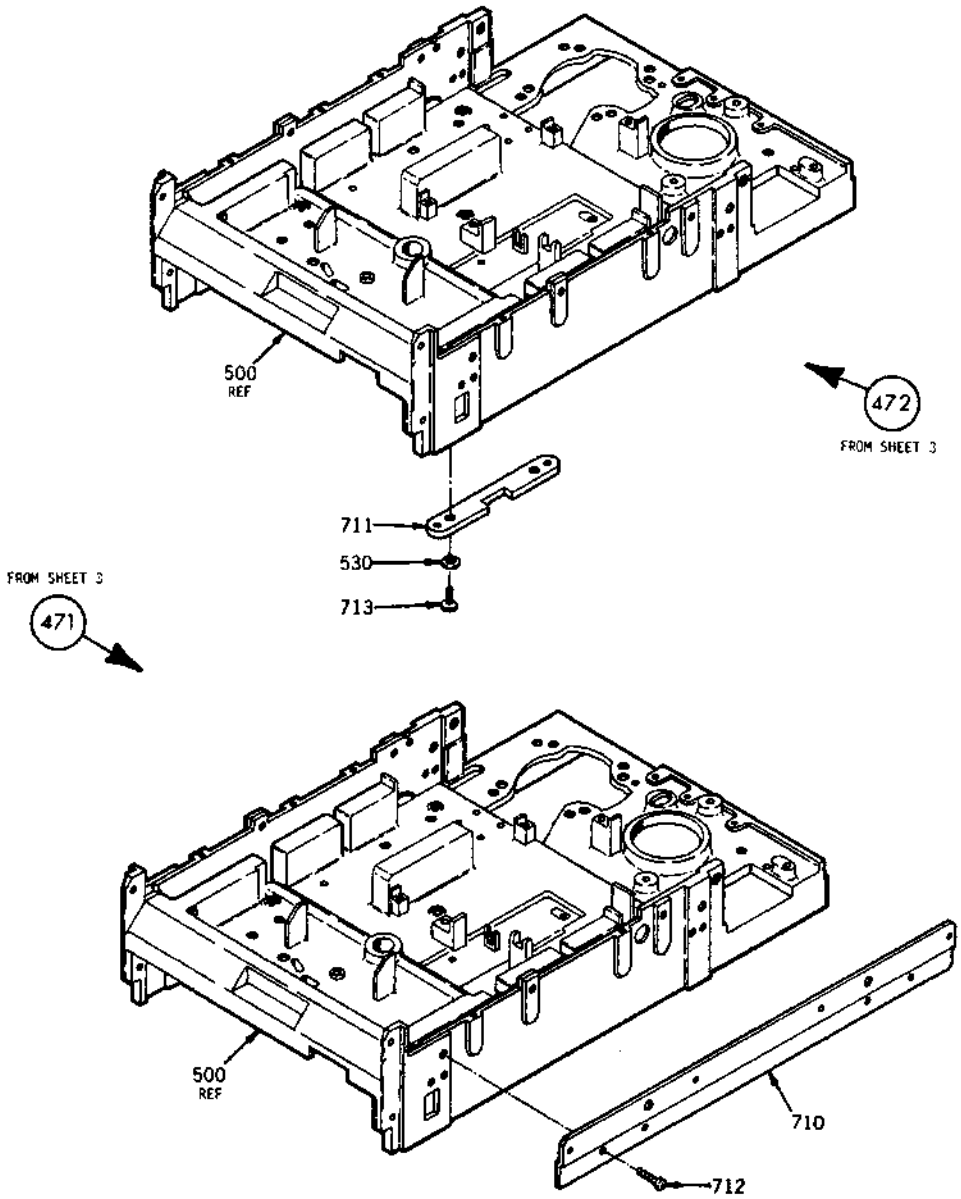
ITEM	IDENT NO	DESCRIPTION	WHERE USED
502	77649278	ACTUATOR ASM	301
531	10125803	WASHER	502
532	93592164	SCREW	502
589	10127102	SCREW	502
591	10125801	WASHER	502
660	77643425	CARRIAGE ASM	502
661	77649281	BAND ASM	502
662	77649282	FOAM PAD	502
663	77649283	BAND SPRING	502
664	77646618	PULLEY	502
665	77646362	PULLEY CLIP	502
666	77661198	BAND CLIP	502
667	09035006	ROLL PIN	502
668	53777900	NUT	502
669	75806503	WASHER	502
690	75890861	EJECTOR	523
691	75890856	LATCH	523
692	75893550	SPRING TORSION	523
693	00848201	RETAINING RING	523
694	75861575	EJECTOR SPRING	523

FIGURE 8-9. ACTUATOR AND EJECTOR ASSEMBLIES



ITEM	IDENT NO	DESCRIPTION	WHERE USED
504	77649030	STEPPER BRAKE ASM	301
523	75889396	EJECTOR ASM	301
589	10127102	SCREW	504
609	77612011	CABLE TIE	700
675	77646670	UPPER ARM ASM	660
676	77649035	LOWER ARM ASM	660
677	77646860	LOWER CARRIAGE	660
678	75880531	TOP COVER	660
679	75888785	ARM SPRING	660
680	75888790	SPRING RETAINER	660
681	10125103	SCREW	660
682	94277410	CABLE TIE	660
683	10127104	SCREW	660
684	75894186	CABLE PROTECT	660
700	77649025	STEPPER ASM	504
701	77646395	BRAKE	504
702	77649293	SPRING	504
703	77619675	STEPPER MOTOR	700
704	75293954	CONNECTOR HOUSING	700

FIGURE 8-9. STEPPER BRAKE AND CARRIAGE ASSEMBLIES



ITEM	IDENT NO	DESCRIPTION	WHERE USED
471	75883336	MOUNTING KIT, SIDE	HPC
472	75884197	MOUNTING KIT, BOTTOM	HPC
530	10125605	WASHER, FLAT	472
710	75883001	MOUNTING ADAPTER	471
711	75881607	ADAPTER	472
712	10127131	SCREW	471
713	10127121	SCREW	472

FIGURE 8-10. FEATURE KITS

8.6 PARTS LIST INSTRUCTIONS

8.6.1 ILLUSTRATION PARTS LISTS

The parts list for each illustration is an extract from the Top-Down Assembly/ Component Parts list and contains only those parts depicted. Refer to paragraph 8.6.2 for explaination of parts list.

8.6.2 TOP-DOWN ASSEMBLY/COMPONENT PARTS LIST

a. Starts at HPC level and lists all parts in Item Number sequence.
b. Correlates Item numbers with part Identification numbers and the Description of each.
c. Identifies where each part is used (where used column) within the device by listing the item number(s) of the next higher assembly.

NOTE

The same part may be used in any number of assemblies or sheet locations.

8.6.3 CROSS REFERENCE INDEX

a. Lists all parts in numeric sequence (by Identification Number).
b. In conjunction with the referenced sheet number (third column) and illustrations, defines the physical location of each item identified.

8.6.4 SHEET NUMBER REFERENCING

Sheet numbers referenced on Parts Lists and Illustrations refers to sheet locations in this section. Example: Sheet reference 3 represents sheet 8-3, sheet 4 represents sheet 8-4, etc.

TOP-DOWN ASSEMBLY/COMPONENT PART LIST

ITEM	IDENT NO	DESCRIPTION	WHERE USED	SHEET
301	77649014	TOP MECHANICAL ASM	HPC	S03
301	77649014	TOP MECHANICAL ASM	HPC	S05
301	77649014	TOP MECHANICAL ASM	HPC	S04
350	77646650	DRIVE MOTOR ASM	HPC	S06
350	77646650	DRIVE MOTOR ASM	HPC	S03
351	77646651	DRIVE MOTOR ASM	HPC	S06
351	77646651	DRIVE MOTOR ASM	HPC	S03
352	77646652	DRIVE MOTOR ASM	HPC	S06
352	77646652	DRIVE MOTOR ASM	HPC	S03
353	77646653	DRIVE MOTOR ASM	HPC	S06
353	77646653	DRIVE MOTOR ASM	HPC	S03
354	77646655	DRIVE MOTOR ASM	HPC	S03
354	77646655	DRIVE MOTOR ASM	HPC	S06
400	77581102	CLAMSHELL	HPC	S03
402	77643700	CLAMSHELL ASM	HPC	S09
402	77643700	CLAMSHELL ASM	HPC	S03
405	77650869	LATCH ASM	HPC	S03
410	77631402	FRONT PANEL (NARROW)	HPC	S03
411	77631302	FRONT PANEL (WIDE)	HPC	S03
412	77631406	FRONT PANEL (NARROW)	HPC	S03
415	75681578	SPRING	HPC	S03
420	75897201	BUTTON	HPC	S03
421	75897206	BUTTON	HPC	S03
430	77643501	FRONT PANEL ASM (NARROW)	HPC	S07
430	77643501	FRONT PANEL ASM (NARROW)	HPC	S03
431	77643502	FRONT PANEL ASM (WIDE)	HPC	S07
431	77643502	FRONT PANEL ASM (WIDE)	HPC	S03
432	77643503	FRONT PANEL ASM (NARROW)	HPC	S07
432	77643503	FRONT PANEL ASM (NARROW)	HPC	S03
440	75882037	WRITE PROTECT	HPC	S08
440	75882037	WRITE PROTECT	HPC	S03
450	75882185	INDEX DETECTOR KIT	HPC	S08
450	75882185	INDEX DETECTOR KIT	HPC	S03
460	75889979	DOOR INTERLOCK KIT	HPC	S08
460	75889979	DOOR INTERLOCK KIT	HPC	S03
470	77649000	TRACK 43 KIT	HPC	S03
470	77649000	TRACK 43 KIT	HPC	S08
471	75863336	MOUNTING KIT, SIDE	HPC	S13
471	75863336	MOUNTING KIT, SIDE	HPC	S03
472	75894197	MOUNTING KIT, BOTTOM	HPC	S13
472	75894197	MOUNTING KIT, BOTTOM	HPC	S03
473	77649046	TRACK '0' DETECT ASM	HPC	S08
473	77649046	TRACK '0' DETECT ASM	HPC	S03
500	75883128	BASE (MACHINED)	301	S05
500	75883128	BASE (MACHINED)	301	S04
501	75881591	SPINDLE	301	S04
502	77649278	ACTUATOR ASM	301	S05
502	77649278	ACTUATOR ASM	301	S11
503	75882895	LIFTER ASM	301	S04
503	75882895	LIFTER ASM	301	S06
504	77649030	STEPPER BRAKE ASM	301	S05
504	77649030	STEPPER BRAKE ASM	301	S12
505	75886675	RAIL ASM	301	S04
506	77647148	LOAD PLATE ASM	301	S09
506	77647148	LOAD PLATE ASM	301	S04
507	75881326	CARRIAGE GUIDE	301	S05
508	75881275	ROD GUIDE	301	S05
509	77646600	PULLEY SPINDLE	301	S04
510	77613697	BALL BEARING	301	S04
511	93529005	SPRING WAVE WASHER	301	S04
512	77649255	MOTOR ADAPTER	301	S05
513	77646890	COVER STOP	310	S05
514	75868590	HINGE PIN	301	S05
515	75888591	HINGE PIN	301	S04
516	75888595	PIN	301	S04
517	75890210	HITCH PIN	301	S04
518	75890211	HITCH PIN	301	S04
519	75888570	CLAMSHELL SPRING	301	S04
520	77649294	SOLND WRITE PROTECT ASM	301	S04
520	77649294	SOLND WRITE PROTECT ASM	301	S10
521	75293203	FLAT BELT	301	S04
522	75883240	LATCH BLOCK	301	S05
523	75889396	EJECTOR ASM	301	S05
523	75889396	EJECTOR ASM	301	S12
524	77649284	UPPER HARNESS ASM	301	S04
524	77649284	UPPER HARNESS ASM	301	S10
525	77649221	LOWER HARNESS ASM	301	S05
525	77649221	LOWER HARNESS ASM	301	S10
526	77648151	WIRE GUIDE	301	S05
527	75774732	PUSH IN CLIP	301	S05
528	75774736	PUSH IN CLIP	301	S05
529	10127334	SCREW	301	S04
530	10125605	WASHER	301	S04
530	10125605	WASHER	301	S05
530	10125605	WASHER, FLAT	472	S13
531	10125803	WASHER	301	S04
531	10125803	WASHER	502	S11
531	10125803	WASHER	520	S10
532	93592164	SCREW	502	S11
532	93592164	SCREW	301	S05
532	93592164	SCREW	301	S04
533	15004800	SCREW	301	S04
534	18862916	SCREW	301	S05
535	93592162	SCREW	301	S04
535	93592162	SCREW	301	S05
535	93592162	SCREW	503	S06
536	94277400	CABLE TIE	301	S04
536	94277400	CABLE TIE	473	S08
536	94277400	CABLE TIE	520	S10
536	94277400	CABLE TIE	524	S10
537	10126401	WASHER	301	S04
538	10125712	SCREW	301	S04

ITEM	IDENT NO	DESCRIPTION	WHERE USED	SHEET
540	77648215	GUIDE ROD SPRING	301	S05
541	93819248	SCREW	301	S05
542	93592158	SCREW	301	S05
542	93592158	SCREW	430	S07
543	77648216	SHIM	301	S04
550	75726925	MOTOR	350-353	S06
551	75726924	MOTOR	351-352	S06
555	75738402	CAPACITOR	350-353	S06
556	75738480	CAPACITOR	351-352	S06
560	62121108	TERMINAL	350-353	S06
561	83435504	CONTACT	350-353	S06
562	16439600	CAPACITOR BRACKET	350-353	S06
563	77649003	AC CABLE	350-353	S06
564	77647990	AC CONNECTOR BRACKET	350-353	S06
565	77648209	DC CABLE	350-353	S06
566	75896006	DRIVE PULLEY	350-353	S06
567	83413405	SCREW	350-353	S06
568	93592202	SCREW	350-353	S06
569	10126104	WASHER	350-353	S06
575	75882740	COVER	503	S06
576	75882735	CYLINDER	503	S06
577	77658915	PISTON	503	S06
578	75882725	ROLLER	503	S06
579	77658910	SPRING	503	S06
580	92021009	DOWEL PIN	503	S06
585	75293954	CONNECTOR HOUSING	430-432	S07
586	00848201	RETAINING RING	430-432	S07
587	75882333	SOLENOID ASM	430	S07
588	77636695	SOLENOID MOUNT	430	S07
589	10127102	SCREW	430	S07
589	10127102	SCREW	502	S11
589	10127102	SCREW	504	S12
590	75806502	WASHER	430	S07
591	10125801	WASHER	430	S07
591	10125801	WASHER	502	S11
592	77648205	CABLE	430-432	S07
593	77612981	DIODE	430-432	S07
594	77610030	DOWEL PIN	430-432	S07
595	77646804	BUMPER	430-432	S07
596	75899166	LATCH SPRING	430-432	S07
597	92820166	SCREW	430-432	S07
598	10127166	SCREW	440	S08
600	75889295	INDEX DETECTOR ASM	450	S08
601	75885407	OPTICAL SWITCH	470	S08
602	77646590	SENSOR PLATE	470	S08
603	94376903	SCREW	470	S08
603	94376903	SCREW	473	S08
605	77649007	TRACK '0' OPTICAL SWITCH	473	S08
606	77647995	TRACK '0' BRACKET	473	S08
607	75293955	CONNECTOR HOUSING	473	S08
609	77612011	CABLE TIE	473	S08
609	77612011	CABLE TIE	525	S10
609	77612011	CABLE TIE	700	S12
610	75881363	OPTICAL SWITCH	440	S08
615	75880751	SWITCH	460	S08
616	75889215	NUT PLATE	460	S08
617	10127169	SCREW	460	S08
620	77647980	LOAD PLATE	506	S09
621	77649099	PIVOT BRACKET	506	S09
622	75882038	FOAM	506	S09
623	77647147	SPRING	506	S09
624	77646623	PIVOT PIN	506	S09
625	94376916	SCREW	506	S09
630	75881895	CONE ASM	402	S04
631	75882017	SPRING	402	S09
632	93564057	WASHER	402	S09
633	92033087	RETAINING RING	402	S09
634	93820782	SCREW	402	S09
635	93820248	SCREW	402	S09
636	75881715	CONE	630	S09
637	75881892	BEARING	630	S09
638	75888607	SHAFT	630	S09
639	75888610	RETAINER	630	S09
640	75881710	SPACER	630	S09
641	75882016	COMPRESSION SPRING	630	S09
642	77610037	SCREW	630	S09
645	77685730	UPPER CABLE	524	S10
646	75883075	UPPER GUIDE ASM	524	S10
647	75883181	UPPER GUIDE	646	S10
648	75720001	PHOTO SOURCE	646	S10
649	92498024	TERMINAL	646	S10
650	77631900	SOLENOID BRACKET	520	S10
651	75882328	SOLENOID ASM	520	S10
652	10126217	SCREW	520	S10
653	10127114	SCREW	301	S04
655	75889295	INDEX DETECTOR ASM	525	S10
656	77685725	LOWER CABLE	525	S10
660	77643425	CARRIAGE ASM	502	S11
661	77649281	BAND ASM	502	S11
662	77649282	FOAM PAD	502	S11
663	77649283	BAND SPRING	502	S11
664	77646618	PULLEY	502	S11
665	77646362	PULLEY CLIP	502	S11
666	77661198	BAND CLIP	502	S11
667	09035006	ROLL PIN	502	S11
668	53777900	NUT	502	S11
668	53777900	NUT	301	S05
669	75806503	WASHER	502	S11
675	77646670	UPPER ARM ASM	660	S12
676	77649035	LOWER ARM ASM	660	S12
677	77646880	LOWER CARRIAGE	660	S12
678	75880531	TOP COVER	660	S12

TOP-DOWN ASSEMBLY/COMPONENT PART LIST

ITEM	IDENT NO	DESCRIPTION	WHERE USED	SHEET
679	75886785	ARM SPRING	660	S12
680	75886790	SPRING RETAINER	660	S12
681	10125103	SCREW	660	S12
682	94277410	CABLE TIE	660	S12
683	10127104	SCREW	660	S12
684	75894186	CABLE PROTECT	660	S12
685	77643437	LOAD PLATE LIFTER	301	S04
690	75890861	EJECTOR	523	S11
691	75890856	LATCH	523	S11
692	75893550	SPRING TORSION	523	S11
693	00648201	RETAINING RING	523	S11
694	75861575	EJECTOR SPRING	523	S11
700	77649025	STEPPER ASM	504	S12
701	77646395	BRAKE	504	S12
702	77649293	SPRING	504	S12
703	77619675	STEPPER MOTOR	700	S12
704	75293954	CONNECTOR HOUSING	700	S12
710	75883001	MOUNTING ADAPTER	471	S13
711	75881607	ADAPTER	472	S13
712	10127131	SCREW	471	S13
713	10127121	SCREW	472	S13

CROSS REFERENCE INDEX

ITEM	IDENT NO	SHEET
693	00848201	S11
586	00848201	S07
667	09035006	S11
681	10125103	S12
530	10125605	S13
530	10125605	S05
530	10125605	S04
538	10125712	S04
591	10125801	S07
591	10125801	S11
531	10125803	S04
531	10125803	S11
531	10125803	S10
569	10126104	S06
652	10126217	S10
537	10126401	S04
589	10127102	S07
589	10127102	S11
589	10127102	S12
683	10127104	S12
653	10127114	S04
713	10127121	S13
712	10127131	S13
598	10127166	S08
617	10127169	S08
529	10127334	S04
533	15004800	S04
562	16439600	S06
534	18862916	S05
668	53777900	S11
668	53777900	S05
560	62121108	S06
521	75293203	S04
704	75293954	S12
585	75293954	S07
607	75293955	S08
648	75720001	S10
551	75726924	S06
550	75726925	S06
555	75738402	S06
556	75738480	S06
527	75774732	S05
528	75774736	S05
590	75806502	S07
669	75806503	S11
678	75880531	S12
615	75880751	S08
508	75881275	S05
507	75881326	S05
610	75881363	S08
694	75881575	S11
415	75881578	S03
501	75881591	S04
711	75881607	S13
640	75881710	S09
636	75881715	S09
637	75881892	S09
630	75881895	S09
641	75882016	S09
631	75882017	S09
440	75882037	S03
440	75882037	S08
622	75882038	S09
450	75882185	S08
450	75882185	S03
651	75882328	S10
587	75882333	S07
578	75882725	S06
576	75882735	S06
575	75882740	S06
503	75882895	S06
503	75882895	S04
710	75883001	S13
646	75883075	S10
500	75883128	S04
500	75883128	S05
647	75883181	S10
522	75883240	S05
471	75883336	S03
471	75883336	S13
601	75885407	S08
519	75888570	S04
514	75888590	S05
515	75888591	S04
516	75888595	S04
638	75888607	S09
639	75888610	S09
505	75888675	S04
679	75888785	S12
680	75888790	S12
616	75889215	S08
655	75889295	S10
600	75889295	S08
523	75889396	S05
523	75889396	S12
460	75889979	S08
460	75889979	S03
517	75890210	S04
518	75890211	S04
691	75890856	S11
690	75890861	S11
692	75893550	S11
684	75894186	S12
472	75894197	S13
472	75894197	S03
566	75896006	S06
420	75897201	S03
421	75897206	S03
596	75899166	S07
400	77581102	S03
594	77610030	S07
642	77610637	S09
609	77612011	S12
609	77612011	S08
609	77612011	S10
593	77612981	S07
510	77613697	S04
703	77619675	S12
411	77631302	S03
410	77631402	S03
412	77631406	S03
650	77631900	S10
588	77636695	S07
660	77643425	S11
685	77643437	S04
430	77643501	S07
430	77643501	S03
431	77643502	S07
431	77643502	S03
432	77643503	S07
432	77643503	S03
402	77643700	S09
402	77643700	S03
665	77646362	S11
701	77646395	S12
602	77646590	S08
509	77646600	S04
664	77646618	S11
624	77646623	S09
350	77646650	S06
350	77646650	S03
351	77646651	S06
351	77646651	S03
352	77646652	S06
352	77646652	S03
353	77646653	S06
353	77646653	S03
354	77646655	S06
354	77646655	S03
675	77646670	S12
595	77646804	S07
677	77646880	S12
513	77646890	S05
623	77647147	S09
506	77647148	S09
506	77647148	S04
620	77647980	S09
564	77647990	S06
606	77647995	S08
526	77648151	S05
592	77648205	S07
565	77648209	S06
540	77648215	S05
543	77648216	S04
470	77649000	S08
470	77649000	S03
563	77649003	S06
605	77649007	S08
301	77649014	S04
301	77649014	S03
301	77649014	S05
700	77649025	S12
504	77649030	S12
504	77649030	S05
676	77649035	S12
473	77649046	S08
473	77649046	S03
621	77649099	S09
525	77649221	S10
525	77649221	S05
512	77649255	S05
502	77649278	S05
502	77649278	S11
661	77649281	S11
662	77649282	S11
663	77649283	S11
524	77649284	S10
524	77649284	S04
702	77649293	S12
520	77649294	S04
520	77649294	S10
405	77650889	S03
579	77658910	S06
577	77658915	S06
666	77661198	S11
656	77685725	S10
645	77685730	S10
567	83413405	S06
561	83435504	S06
580	92021009	S06
633	92033087	S09
649	92498024	S10
597	92820166	S07
511	93529005	S04
632	93564057	S09
542	93592158	S05
542	93592158	S07
535	93592162	S04
535	93592162	S05
535	93592162	S06
532	93592164	S04
532	93592164	S11
532	93592164	S05
568	93592202	S06
541	93819248	S05
635	93820248	S09
634	93820762	S09
536	94277400	S08
536	94277400	S10
536	94277400	S10
536	94277400	S04
682	94277410	S12
603	94376903	S08
603	94376903	S08
625	94376916	S09

9.1 INTRODUCTION

The following paragraphs contain the following wire lists: Upper-Harness Assembly; Lower-Harness Assembly; Stepper Motor; DC Harness; Sensor Assembly Track 43; Door-Lock-Solenoid Activity LED and Head Assemblies.

9.2 UPPER-HARNESS ASSEMBLY

Wire Color	Origin	Destination	Approximate Length, Inches
Violet	S/S Index Anode	J6-1	15 (381mm)
Gray	D/S Index Cathode	J6-5	15 (381mm)
Brown	Common Door Switch	J6-3	15 (381mm)
Yellow	N/O Door Switch	J6-4	15 (381mm)

9.3 LOWER-HARNESS ASSEMBLY

Wire Color	Origin	Destination	Approximate Length, Inches
Yellow	D/S Index Collector	J9-4	13 (330 mm)
Brown	D/S Index Emitter	J9-5	13 (330mm)
Orange	S/S Index Collector	J9-2	13 (330mm)
Black	S/S Index Emitter	J9-3	13 (330mm)

9.4 STEPPER MOTOR

Wire Color	Origin	Destination	Approximate Length, Inches
Orange	ØA	J3-1	8 (203mm)
Brown	ØB	J3-3	8 (203mm)
Yellow	ØC	J3-5	8 (203mm)
Red	ØD	J3-7	8 (203mm)

9.5 DC HARNESS

Wire Color	Origin	Destination	Approximate Length, Inches
Red	J4-5 +5V	J10-5	8 (203.2mm)
Black	J4-2 GND	J10-6	8 (203.2mm)
Orange	J4-1 +24V	J10-1	8 (203.2mm)
Brown	J4-3 +24V Return	J10-2	8 (203.2mm)

9.6 SENSOR ASSEMBLY TRACK 43, TRACK 00 HARNESS ASSEMBLY

Wire Color	Origin	Destination	Approximate Length, Inches
Red	Current-Switch Collector	J8-3	7.3 (185.4mm)
White	Current-Switch Cathode	J8-6	7.3 (185.4mm)
Blue	Current-Switch Emitter	J8-4	7.3 (185.4mm)
Green	Current-Switch Anode	J8-5	7.3 (185.4mm)
Brown	Anode Track 0	J8-7	7.3 (229mm) 185.4
Yellow	Cathode Track 0	J8-8	7.3 (229mm) 185.4
Orange	Emitter Track 0	J8-10	7.3 (229mm) 185.4
Black	Collector Track 0	J8-9	7.3 (229mm) 185.4

9.7 DOOR-LOCK SOLENOID ACTIVITY LED

Wire Color	Origin	Destination	Approximate Length, Inches
Black	Door-Lock Solenoid+	J7-3	16 (406mm)
Black	Door-Lock Solenoid-	J7-4	16 (406mm)
Brown	Activity LED Anode	J7-2	16 (406mm)
Blue	Activity LED Cathode	J7-1	16 (406mm)

9.8 HEAD ASSEMBLIES

Head 0

Wire Color	Origin	Destination
Black	Read/Write	J2-1
White	Read/Write	J2-2
White (large wire)	Shield	J2-3
Green	Erase+	J2-4
Red	Center Tap	J2-5
-	Key	J2-6
Yellow	Erase-	J2-7

Head 1

Wire Color	Origin	Destination
Black	Read/Write	J2-8
White	Read/Write	J2-9
Red	Center Tap	J2-10
Green	Erase+	J2-11
White (large wire)	Shield	J2-12
-	Key	J2-13
Yellow	Erase-	J2-14

9.9 SOLENOID HARNESS ASSEMBLY

Wire Color	Origin	Destination	Approximate Length, Inches
Black	Head-Load Solenoid+	J5-1	9 (229mm)
Black	Head-Load Solenoid-	J5-2	9 (229mm)
Green	Write-Protect Anode	J5-5	9 (229mm)
Red	Write-Protect Collector	J5-7	9 (229mm)
Blue	Write-Protect Emitter	J5-8	9 (229mm)
White	Write-Protect Cathode	J5-4	9 (229mm)