

MODEL GSI-110

FLEXIBLE DISK DRIVE

Technical Manual

Volume 2

INSTALLATION

MAINTENANCE

ILLUSTRATED PARTS BREAKDOWN

DIAGRAMS



General Systems International, Incorporated

1440 Allec Street, Anaheim, California 92805 • (714) 956-7183 • Telex 69-2488

MODEL GSI-110

FLEXIBLE DISK DRIVE

Technical Manual

Volume 2

INSTALLATION

MAINTENANCE

ILLUSTRATED PARTS BREAKDOWN

DIAGRAMS

[illegible]

DESCRIPTION

First Issue, new product manual

TABLE OF CONTENTS

Section		Page
1	INTRODUCTION	1-1
	General	1-1
	Scope	1-1
	Description	1-1
	Specifications	1-2
2	INSTALLATION	2-1
	General	2-1
	Inspection	2-1
	Unpacking	2-1
	Mechanical Checks	2-2
	Connecting Cables	2-2
	Ac Power Cable	2-4
	Dc Power Cable	2-5
	Interface Signal Cable	2-6
	Interface Signal Descriptions	2-6
	Logic Levels and Termination	2-8
	Input Signals	2-8
	Output Signals	2-10
	Interface Timing	2-12
	System Configurations	2-13
	Single-Drive Configuration	2-14
	Multi-Drive Configuration	2-14
	Radial Select	2-14
	Daisy-Chained Radial Select	2-14
	Binary Select	2-15
	Interface/Internal Options Installation	2-18
	Radial Select	2-18
	Binary Select	2-20
	Radial Step	2-20
	Radial Ready	2-20

TABLE OF CONTENTS (Continued)

Section		Page
2	INSTALLATION (Continued)	
	Radial Index/Sector	2-21
	Daisy-Chain Radial	2-21
	Auto Head Load	2-22
	Hard Sector	2-22
	16 or 8 Sector	2-23
	Activity Indicator Select	2-23
	Auto Erase	2-23
	Time Domain Filter	2-24
	Data Separator	2-24
	Installation	2-24
	Mounting Dimensions	2-25
	Operational Checks	2-25
	On-Line Checkout	2-25
	Off-Line Checkout	2-26
	Off-Line Checkout Preparation	2-26
	Voltage Checks	2-27
	Index Pulse Detector Check	2-27
	Index and Read Data Synchronization	2-28
	Stepper Motor Check	2-29
3	MAINTENANCE	3-1
	General	3-1
	Preventive Maintenance	3-1
	Visual Inspection	3-1
	Cleanliness	3-1
	Routine Maintenance Schedule	3-1
	Tools and Test Equipment	3-2
	Exerciser	3-2
	Corrective Maintenance	3-5
	Input Power	3-6
	Voltage Check	3-6
	Voltage Adjustments	3-7

TABLE OF CONTENTS (Continued)

Section		Page
3	MAINTENANCE (Continued)	
	Spindle Drive System	3-7
	Drive Motor and Drive Belt Checks	3-7
	Drive Belt Adjustment	3-8
	Drive Belt Replacement	3-8
	Drive Motor Replacement	3-9
	Positioning System	3-9
	Stepper Motor Check and Alignment	3-10
	Stepper Motor Replacement	3-11
	Head Carriage Stop Check and Alignment	3-12
	Read/Write System	3-13
	Head Load Check and Adjustment	3-14
	Electronics	3-15
	Index Pulse Detector Check	3-15
	Index Pulse Detector Alignment	3-16
	Index and Read Data Synchronization	3-16
	Index Pulse Detector Replacement	3-17
	Write-Protect Detector Check	3-18
	Write-Protect Detector Replacement	3-18
	Printed Circuit Board (PCB) Replacement	3-20
4	ILLUSTRATED PARTS BREAKDOWN	4-1
	General	4-1
	Purpose	4-1
	Indentured Parts List	4-1
	Ordering Parts	4-2
	Accessories	4-2
5	DIAGRAMS	5-1

LIST OF ILLUSTRATIONS

Figure		Page
1-1	GSI-110 Flexible Disk Drive	1-1
2-1	Shipping Configuration	2-1
2-2	Principal Parts Location	2-3
2-3	Ac Connector J5	2-5
2-4	Dc Connector J4	2-6
2-5	Interconnecting Diagram	2-7
2-6	Interface Logic Levels	2-8
2-7	Input Signal Termination	2-8
2-8	Interface Diagram, Simplified	2-13
2-9	Single-Drive Configuration	2-14
2-10	Radial Select Configuration	2-15
2-11	Daisy-Chained Radial Select Configuration	2-16
2-12	Binary Select Configuration	2-17
2-13	Interface/Internal Options	2-19
2-14	Rack-Mounted Installations	2-25
2-15	Outline and Mounting Dimensions	2-26
2-16	Index Pulse Period	2-28
2-17	Index Pulse Duration	2-28
2-18	Synchronized Data	2-29
3-1	GSI Model 100 Disk Drive Exerciser	3-3
3-2	Spindle Drive System	3-7
3-3	Track 00 Alignment Tool, Installed	3-11
3-4	Stepper Motor Replacement	3-12
3-5	Head Carriage Outer Stop Position	3-13
3-6	Head Load Adjust, Head Engaged	3-14
3-7	Index Pulse Period	3-15
3-8	Index Pulse Duration	3-16
3-9	Synchronized Data	3-17
4-1	GSI-110 Flexible Disk Drive, Cutaway Side View	4-2
4-2	Deck/Spindle Assy, 215134	4-3
4-3	Chassis Assy, 215141, Top View (Carrier Assy Removed for Clarity)	4-4

LIST OF ILLUSTRATIONS (Continued)

Figure		Page
4-4	Chassis Assy, 215141, Bottom View (PCB Assy Removed for Clarity)	4-6
4-5	Chassis Assy, 215141, Side View (Cutaway View for Clarity)	4-8
4-6	Carrier Assy, 215124, Bottom View	4-10
4-7	Printed Circuit Board Assy, 265029	4-11

LIST OF TABLES

Table		Page
1-1	Principal Specifications	1-2
2-1	Ac Power Requirements	2-5
2-2	Dc Power Requirements	2-5
2-3	Recommended J3 Mating Connectors	2-8
2-4	Interface Input Signals	2-8
2-5	Interface Output Signals	2-11
3-1	Routine Maintenance Schedule	3-1
3-2	Standard Tools and Test Equipment	3-2
3-3	Special Tools and Test Equipment	3-2
3-4	Exerciser Controls, Indicators and Test Points	3-3

SECTION 1

INTRODUCTION

GENERAL

This manual provides information on the installation and maintenance of the Model GS-110 Flexible Disk Drive (Figure 1-1), designed and manufactured by General Systems International of Anaheim, California.

SCOPE

The contents of this manual are intended to be used by technical personnel requiring detailed installation, option modification, and maintenance information. Also included are assembly parts breakdowns. Detailed equipment, options, and theory of operation information are provided in Volume I.

DESCRIPTION

The GSI-110 is a low-cost, random access storage device, which uses a flexible disk as the storage medium. The single, removable disk cartridge will store up to 6.4 megabits of double-density unformatted data, 3.2 megabits of single-density data (optional), or 1.94 megabits using the compatible IBM 3740 data format. The disk drive is also compatible with the IBM System 32 format.

Up to eight units can be interfaced to a single host controller. The controller controls disk drive selection, head loading, track addressing, and read/write data transfers.

Because of its small size and weight, installation can be accomplished in

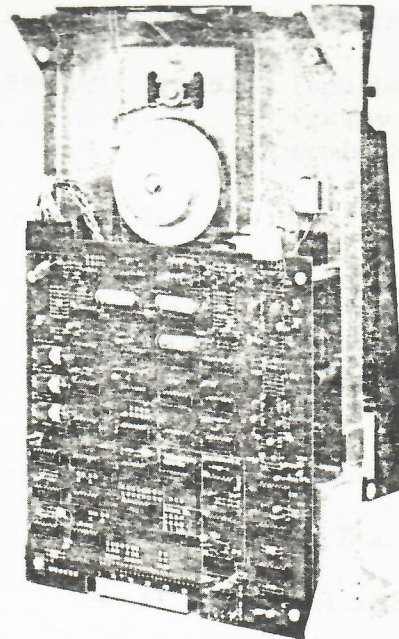


Figure 1-1. GSI-110 Flexible Disk Drive

almost any convenient location or orientation. The disk drive can be provided with or without an enclosure.

SPECIFICATIONS

A list of principal specifications are given in Table 1-1.

Table 1-1. Principal Specifications

Function	Characteristics	
	<u>Single-Density</u>	<u>Double-Density</u>
Disk Type	IBM 3740, or equiv.	IBM 3740, or equiv.
Storage Capacity (Unformatted)		
Per Disk	3.2 megabits	6.4 megabits
Per Track	41.7 kilobits	83.4 kilobits
Tracks	77	77
Track Density	—	48 tracks per inch
Recording Density		
Track 00 (Outside)	1836 bpi (3672 fci)	3672 bpi (3672 fci)
Track 76 (Inside)	3268 bpi (6536 fci)	6536 bpi (6536 fci)
Recording Method	FM	MFM or M ² FM
Rotational Speed	360 rpm $\pm 2.5\%$	360 rpm $\pm 2.5\%$
Rotational Latency		
Average	—	83.33 milliseconds
Maximum	—	171.0 milliseconds
	<u>Single-Density</u>	<u>Double-Density</u>
Access Time		
Track-to-Track	—	6 milliseconds
Track 0 - Track 76	—	456 milliseconds
38-Track Move	—	222 milliseconds
Setting Time	—	14 milliseconds
Head Engage Time		25 milliseconds
Data Transfer Rate	250 kilobits/sec	500 kilobits/sec
Write Recovery Time	—	50 microseconds (reqd for read to stabilize after write completed)

Table 1-1. Principal Specifications (Continued)

Function	Characteristics
Read/Write Head	Single-gap with tunnel-erase
Read/Write-to-Erase Gap Spacing	0.035 inch
Track Width	0.012 inch
Tunnel Erase Width	0.006 inch (on either side of track)
Spacing Between Tracks	0.02083 inch
Track Centerline Radius	$2.029 + \frac{76 - N}{48}$, where N = track number (0 to 76)
Logic Levels Disk Drive	Logical 1 (True) = +2.5V to +5.5V Logical 0 (False) = 0.0V to +0.4V
Interface	Logical 1 (True) = 0.0V to +0.4V Logical 0 (False) = +2.5V to +5.5V
AC Input Power Standard Optional	100 to 123 volts, 60 Hz 100 to 123 volts, 50 Hz 200 to 230 volts, 60 Hz 200 to 230 volts, 50 Hz
Voltage Dropout	100%, 10 milliseconds
Motor Current Start	1.0 ampere for 100 volts AC
Run	0.6 amperes for 220 volts AC 0.5 amperes for 110 volts AC 0.3 amperes for 220 volts AC
DC Input Power	+24 volts $\pm 10\%$, 1.6 amperes maximum + 5 volts $\pm 5\%$, 1.0 amperes maximum
- Voltage Standard Optional	-5 volts $\pm 5\%$, 0.08 amperes maximum -7 to -16 volts (with -5V Regulator option installed)
Reliability MTBF MTTR	6000 hours Less than 20 minutes

Table 1-1. Principal Specifications (Continued)

Function	Characteristics	
Read Errors		
Recoverable	Less than 1 in 10^9	
Non-recoverable (after 10 tries)	Less than 1 in 10^{12}	
Environmental	<u>Operating</u>	<u>Non-Operating</u>
Temperature	50° to 100°F (10° to 30°C)	32° to 150°F (0° to 65°C)
Relative Humidity	10% to 80%, without condensation	5% to 90%, without condensation
Altitude	-1000 to +10,000 ft	-1000 to +15,000 ft
Head Sissipation	300 BTU/hour	NA
Dimensions and Weights		
Height	4.33 inches (110 mm)	
Width		
Enclosure	8.66 inches (220 mm)	
Front Panel	10.04 inches (255 mm)	
Depth		
Enclosure	14.19 inches (360 mm)	
Front Panel	1.32 inches (25.4 mm)	
	15.51 inches (61.4 mm) overall	
Weight		
W/Enclosure	16 pounds (7.2 kg)	
W/o Enclosure	11 pounds (4.9 kg)	

SECTION 2

INSTALLATION

GENERAL

This section provides information necessary to prepare the disk drive for operational readiness. Preliminary inspection, mechanical checks and cable fabrication and verification checks are made to ensure operational integrity.

The disk drive may be configured and shipped in one of many ways, depending on customer requirements. For the installation of additional options and multi-drive connecting configurations, all information has been included in this section.

INSPECTION

The disk drive is packaged in a heavy duty container, designed to ensure adequate protection during shipping and handling (see Figure 2-1). When the disk drive is installed, store the container and all packing material for possible future use.

Immediately upon receipt, inspect the container for any signs of possible damage. If the container is damaged, there is a possibility that the disk drive may also be damaged. Notify both the carrier and the manufacturer after inspecting the contents.

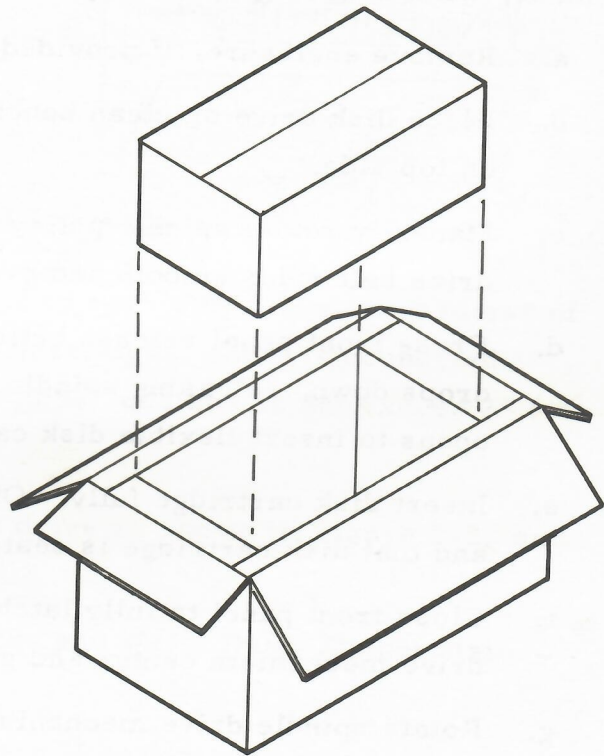


Figure 2-1. Shipping Configuration

UNPACKING

A complete inspection of the disk drive is necessary to ensure equipment acceptability. Unpack the disk drive as follows:

- a. Remove all packing material around disk drive.
- b. Remove disk drive carefully from container and place on bench surface.

- c. Remove all wrapping and internal shipping restraints.
- d. Check all items against shipping list. Report all discrepancies to manufacturer.
- e. Check all items for damage. Report all discrepancies to carrier and manufacturer.

Note

If no damage or shipping discrepancies are evident, continue to Mechanical Checks. Otherwise, hold disk drive for return to manufacturer.

MECHANICAL CHECKS

The disk drive is designed for ease of operation. Most mechanical checks can be made, without having power applied, as follows (see Figure 2-2):

- a. Remove enclosure, if provided.
- b. Place disk drive on clean bench surface with printed circuit board (PCB) on top side.
- c. Manually rotate spindle pulley. Observe that spindle rotates freely and drive belt rides smooth and evenly.
- d. Press front panel release button. Observe that carrier mechanism drops down, releasing spindle cone from drive mechanism. Front panel opens to insert flexible disk cartridge.
- e. Insert disk cartridge fully. Observe that spring-loaded latch is engaged and that disk cartridge is seated properly over drive mechanism.
- f. Close front panel to fully latched position. Observe that spindle cone and drive mechanism center and grasp flexible disk firmly.
- g. Rotate spindle drive mechanism. Observe smooth rotation of flexible disk.

CONNECTING CABLES

The disk drive is connected to the host controller by three connecting cables, the lengths of which are determined at the installation site. The ac and dc cables are

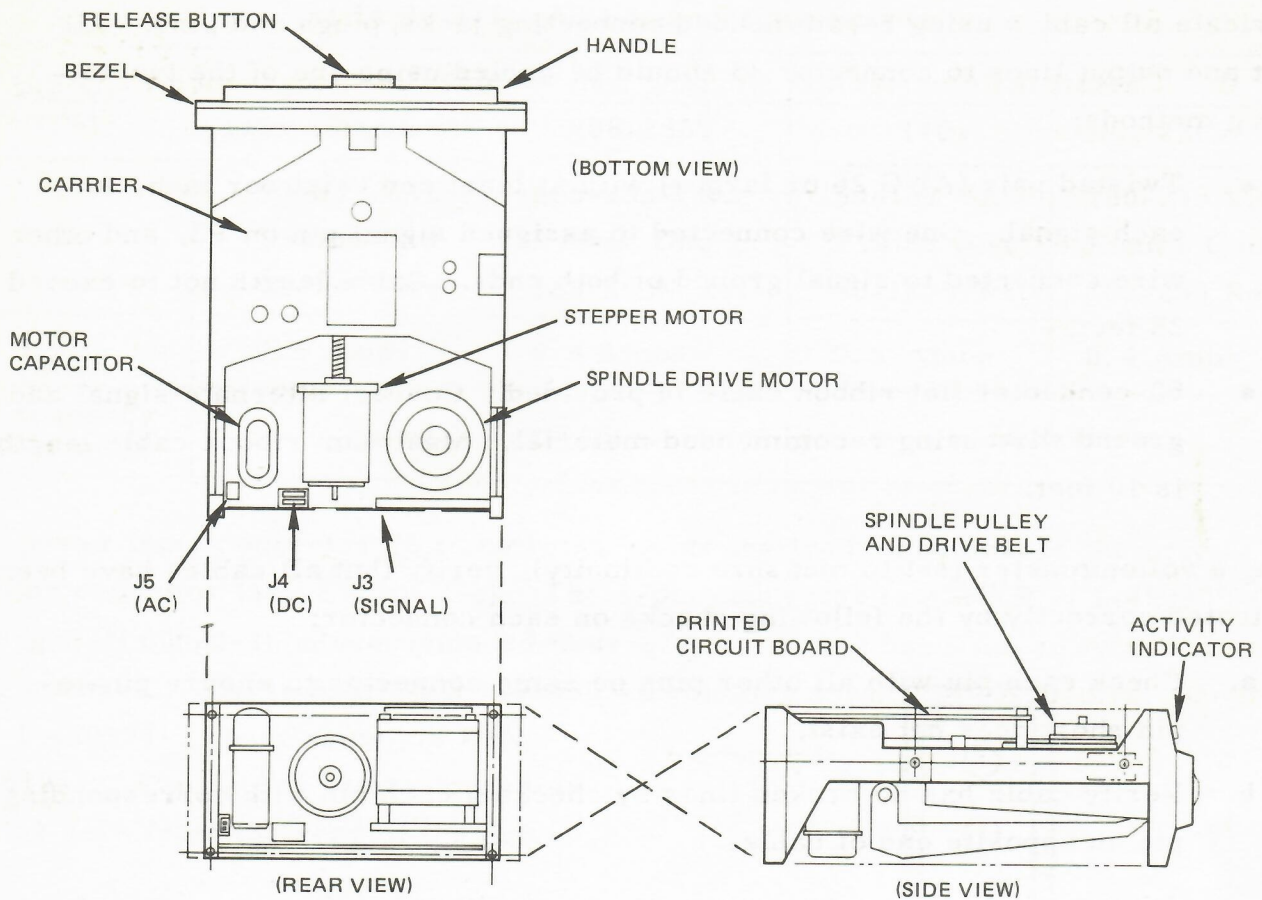


Figure 2-2. Principal Parts Location

independent cables requiring direct connection to each disk drive, regardless of connecting configuration. However, the interface signal cable is connected according to the various connecting configurations, and should not exceed 25 feet in length.

The cables are connected directly to the disk drive as shown in Figure 2-2, and are identified as follows:

- J3, Interface Signals (Input Commands and Write Data, Output Status and Read Data)
- J4, Dc Power (Electronics and Stepper Motor)
- J5, Ac Power (Spindle Drive Motor)

Fabricate all cables using recommended connecting jacks, plugs and pins. All input and output lines to connector J3 should be cabled using one of the two following methods:

- Twisted pair (AWG 26 or larger) with at least one twist per inch, for each signal. One wire connected to assigned signal pin on P3, and other wire connected to signal ground at both ends. Cable length not to exceed 25 feet.
- 50-conductor flat ribbon cable is provided. Connect alternate signal and ground wire using recommended material. Maximum ribbon cable length is 10 feet.

Using a voltohmmeter (set to measure continuity), verify that all cables have been fabricated correctly by the following checks on each connector:

- a. Check each pin with all other pins on same connector to ensure pin-to-pin short does not exist.
- b. Verify cable has no broken lines by checking each pin with corresponding pin on opposite end of cable.
- c. Adjust voltohmmeter to measure ac line voltage; apply ac power and check disconnected ac connector pins (P5) for correct input voltage. Remove ac power when check complete.
- d. Adjust voltohmmeter to measure dc voltage, apply dc power and check disconnected dc connector pins (P4) for correct input voltages. Remove dc power when check complete.

Ac Power Cable

Ac power is connected to the disk drive through connector J5. The input pin assignments and both standard and optional voltage/frequency requirements are listed in Table 2-1.

Table 2-1. Ac Power Requirements

Pin No. (P5)	60 Hertz		50 Hertz	
	110V (Standard)	208/230V	110V	220V
1	90-127 VAC	180-253 VAC	90-127 VAC	180-253 VAC
2	Frame Gnd	Frame Gnd	Frame Gnd	Frame Gnd
3	90-127V Ret	180-253V Ret	90-127V Ret	180-253 Ret
I_{MAX}	0.5 Amps	0.4 Amps	0.6 Amps	0.4 Amps
Frequency Tolerance	± 0.5 Hertz		± 0.5 Hertz	

Ac power input connector J5 is mounted inside the frame and next to the drive motor capacitor (see Figure 2-2). The 3-pin connector is AMP P/N 1-480305-0 using P/N 60620-1. Recommended mating connector P5, is AMP P/N 1-480303-0 or 1-480304-0, both using pin P/N 60619-1. Figure 2-3 shows connector J4 as seen from the rear of the drive.

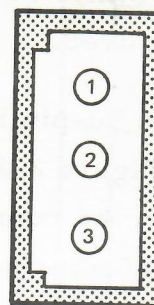


Figure 2-3. Ac Connector J5

Dc Power Cable

Dc power is connected to the disk drive through connector J4. The input pin assignments and voltage requirements are listed in Table 2-2.

Table 2-2. Dc Power Requirements

Pin No. (P4)	Dc Voltage	Tolerance	Current	Maximum Ripple (p-p)
1	+24 VDC	± 1.2 VDC	1.7A Max.	100 mv
2	+24V Ret	—	—	—
3	-5V Ret	—	—	—
4	-5 VDC	± 0.25 VDC	0.07A Max.	50 mv
	-7 to -16 VDC (Optional)	NA	0.10A Max.	NA
5	+5 VDC	± 0.25 VDC	1.0A Max.	50 mv
6	+5V Ret	—	—	—

Dc power input connector J4 is mounted on the noncomponent side of the PCB, just below the drive motor capacitor and the stepper motor (see Figure 2-2). The 6-pin connector is AMP P/N Mate-N-Lock P/N 1-380999-0 and is soldered directly to the PCB. Recommended mating connector P4, is AMP P/N 1-480270-0 using P/N 60619-1. Figure 2-4 shows connector J4, as seen from the rear of the disk drive.

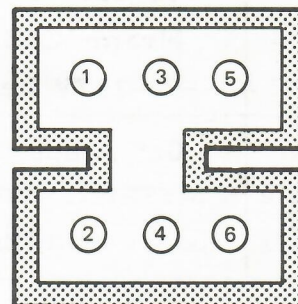


Figure 2-4. Dc Connector J4

Interface Signal Cable

All controller commands, read/write data, and disk drive status signals are transferred through connector J3. Connections are made between the controller and the disk drive in either radial or daisy chain fashion, depending on the installed configuration required.

Connector J3 is a 50-pin PCB edge-card connector, located at the rear of the disk drive (see Figure 2-2). The pins are numbered 1 through 50, with all even-numbered pins on the component side. A key slot is provided between pins 4 and 6 for optional connector keying.

Recommended mating connectors for J3, are listed in Table 2-3.

Figure 2-5 is provided as an interconnecting diagram showing that, except for ac power connector J5, all connections are made directly to or from the PCB. Connector J1 and J2 are for internal disk drive use, and J3, J4 and J5 are from the controller.

INTERFACE SIGNAL DESCRIPTIONS

All interface signal levels are low active (0 volt), inverted by the disk drive line receivers or line drivers, and all input signals are terminated according to the system configuration used; radial or daisy chain.

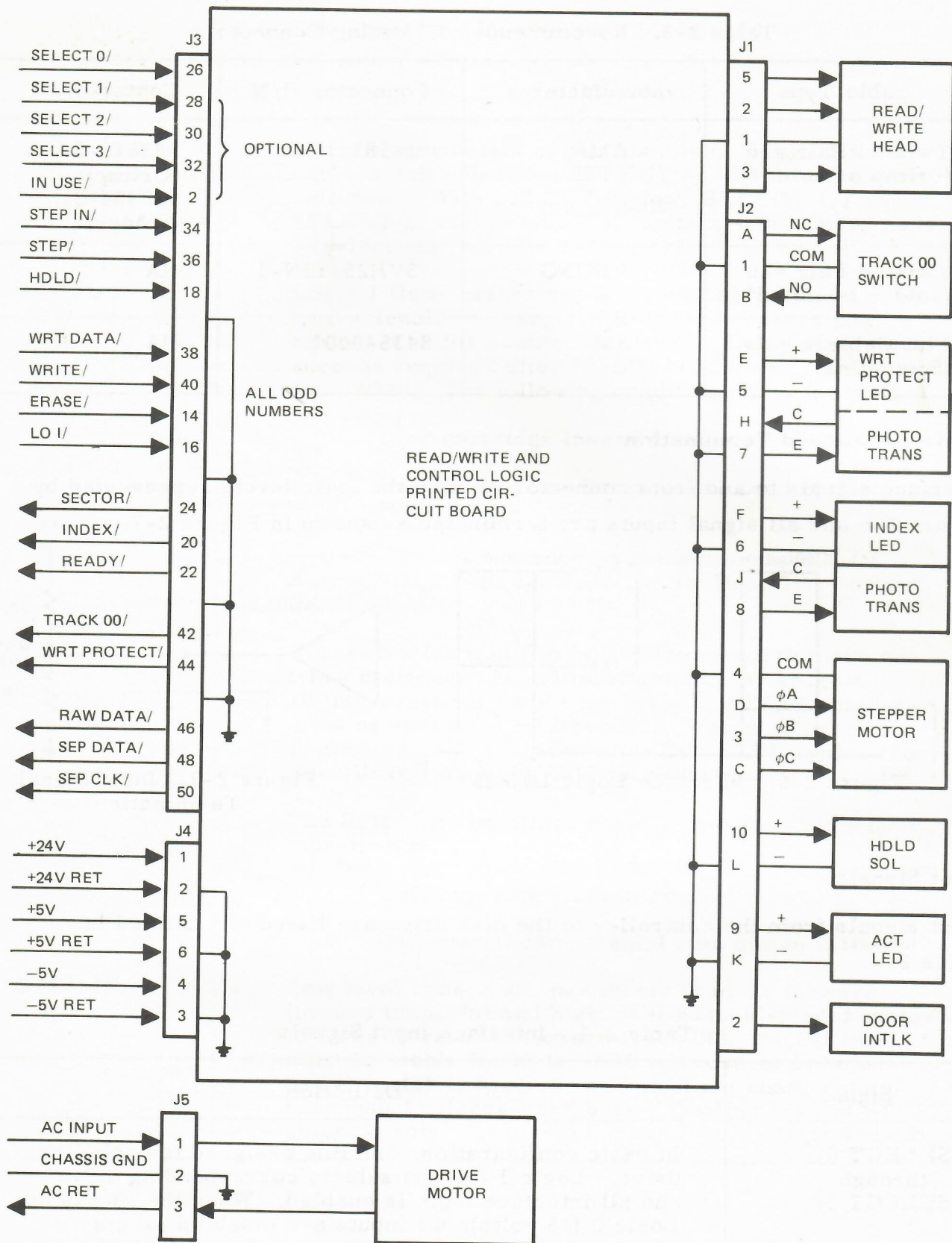


Figure 2-5. Interconnecting Diagram

Table 2-3. Recommended J3 Mating Connectors

Cable Type	Manufacturer	Connector P/N	Contact P/N
Twisted Pair #26 (crimp or solder)	AMP	1-583717-1	583616-5 (Crimp) 583854-3 (Solder)
Twisted Pair #26 (solder terminal)	VIKING	3VH25/1JN-5	NA
Flat Cable (Scotchflex)	3M	3415-0001	NA

Logic Levels and Termination

Interface signals to and from connector J3 have the logic levels represented by Figure 2-6 and all signal inputs are terminated as shown in Figure 2-7.

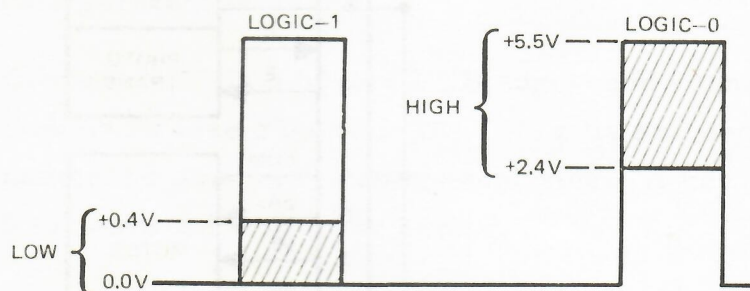


Figure 2-6. Interface Logic Levels

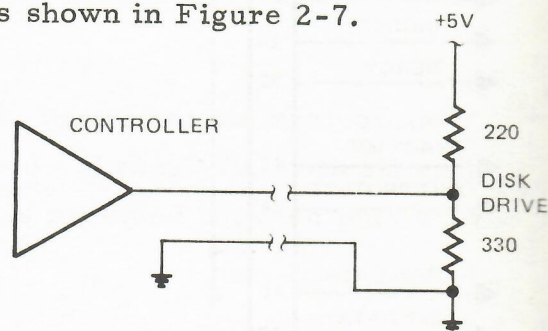


Figure 2-7. Input Signal Termination

Input Signals

Input signals from the controller to the disk drive are listed and defined in Table 2-4.

Table 2-4. Interface Input Signals

Signal	Definition
SELECT 0/ through SELECT 3/	In basic configuration, one line assigned to each disk drive. Logic 1 (0 volt) selects corresponding drive and all interface logic is enabled. When the line is at Logic 0 (+5 volts), all inputs are disabled except SELECT/ lines, and all outputs (except READY) are disabled.

Table 2-4. Interface Input Signals (Continued)

Signal	Definition
SELECT 0/ through SELECT 3/ (Continued)	<p>When Binary Select option installed, SELECT 0/ low enables unit selection; SELECT 0/ high disables unit selection. With SELECT 0/ low, SELECT 1/, SELECT 2/ and SELECT 3/ contain 3-bit binary code to select unit.</p>
HDLD/	<p>Logic 1 (low) causes read/write head to "load". Head load solenoid is energized to force pressure pad against disk for contact with head. Delay of 40 milliseconds required after HDLD/ before data can be read or written. The following conditions must be met:</p> <ol style="list-style-type: none"> 1. Disk cartridge inserted and access door closed 2. Unit selected or Radial Head Load option installed. <p>Activity indicator turned on if monitoring HDLD/. Active HDLD/ not required if Auto Head Load option installed.</p>
STEP/	<p>Transition from low to high raises head to move one track distance. Signal must remain for at least 10 microseconds, and time between STEP/ pulses must be at least 8 milliseconds. Stepping time of 12 milliseconds required after last STEP/ pulse transition, before data can be read or written.</p> <p>The following conditions must be met to initiate head movement:</p> <ol style="list-style-type: none"> 1. Write operation inhibited. 2. Unit selected or, Radial Step option installed.
STEP IN/	<p>Low level causes stepper motor to move forward (toward track 76) and high level causes stepper motor to move in reverse (toward track 00). Signal level must be stable for at least 10 microseconds before STEP/ pulse is applied, and must not change state less than 1 microsecond before trailing edge of STEP/ pulse.</p>

Table 2-4. Interface Input Signals (Continued)

Signal	Definition
WRITE/	<p>Low input disables read logic and causes write current to be turned on within 1 microsecond of first active WRT DATA/ pulse. High input turns off write current within 1 microsecond from last WRT DATA/ pulse. When in Write Mode, unit does not respond to STEP/ commands.</p> <p>If Auto Erase option installed, erase current turns on after 200 microsecond delay from WRITE/ low, and turns off 530 microseconds after WRITE/ goes high.</p>
ERASE/	<p>This line not used if Auto Erase option installed. Low input causes tunnel erase current to turn on 200 microseconds after write current is turned on. Low to high transition turns off erase current 530 microseconds after write current is turned off.</p> <p>Erase gap trails read/write gap by 260 microseconds for outside tracks and 450 microseconds for inside tracks.</p>
LO I/	<p>Low input causes reduced write current on inside tracks 44 through 76, to compensate for higher bit packing density.</p>
WRT DATA/	<p>Transition from high to low input causes write current to change polarity (flux reversal). Low remains low for 180 to 275 nanoseconds to establish nominal data/ clock pulse duration. Time between clock to data transitions is 2 microseconds and 4 microseconds between clock to clock.</p>

Output Signals

Output signals from the disk drive to the controller are listed and defined in Table 2-5.

Table 2-5. Interface Output Signals

Signal	Definition
READY/	<p>Low active status indicating disk drive is ready for controller operations when the following conditions are met:</p> <ol style="list-style-type: none"> 1. Ac and dc power are applied. 2. Disk cartridge inserted properly and door is closed. 3. Disk has reached 60 percent of full operating speed. 4. Disk drive selected or, Radial Ready option installed.
WRT PROTECT/	<p>Low active status indicating Write Protect disk cartridge in use and all write logic is disabled. Signal present only when unit is selected.</p>
TRACK 00/	<p>Low active status indicating read/write head positioned at track 00 and step operation is not in progress. Signal present only when unit is selected.</p>
INDEX/	<p>Low active pulse indicating disk rotational speed is at 60 percent of full operating speed. Pulse duration is 1.7 milliseconds occurring once per disk revolution; 167 milliseconds. If Hard Sector option is installed, pulse duration is reduced to 0.4 milliseconds.</p> <p>The index pulse timing is used to synchronize controller data format transfers.</p>
SECTOR/	<p>This line used only if Hard Sector option installed. Low active pulse indicating start of next sector of 32 sectors. Pulse duration is 0.4 milliseconds. If 16/8 Sector option is installed, a low level pulse occurs at every other sector hole (16 sectors) or at every fourth sector hole (8 sectors) as determined by sector selection.</p>
RAW DATA/	<p>Low active pulse produced for each flux reversal read from disk. Pulse train is restored data transferred to controller. Each pulse width is 200 nanoseconds duration.</p>

Table 2-5. Interface Output Signals (Continued)

Signal	Definition
SEP DATA/	<p>This line and SEP CLK/ line used only if FM Data Separator option installed.</p> <p>Low active data pulse produced for each data transition detected in RAW DATA/ pulse train. Pulse duration is 200 nanoseconds.</p>
SEP CLK/	<p>This line and SEP DATA/ line used only if FM Data Separator option installed.</p> <p>Low active clock pulse produced for each clock transition detected in RAW DATA/ pulse train. Pulse duration is 200 nanoseconds.</p>

INTERFACE TIMING

The timing for interface input/output signals is shown in Figure 2-8.

Disk drive operations begin when the disk cartridge is inserted and the access door is closed. The flexible disk begins rotating and, during the "ready" delay, the unit is selected by the controller to check the ready status.

At completion of the ready delay, READY/ becomes active to the controller and the controller makes HDLD/ active in return. After a 25 millisecond head load time the unit is in the Read mode and read data is present on the RAW DATA/ line.

The controller issues two STEP/ pulses, causing the read/write head to be moved two tracks from its initial position. During the 14 milliseconds after the second STEP/ pulse, the head has settled on the track and WRITE/ is made active, placing the disk drive in the Write mode.

After a maximum delay of 1 bit time (4 microseconds for single-density, 2 microseconds for double-density), write data is input on the WRT DATA/ line. Approximately 200 microseconds after WRITE/ goes active, ERASE/ is made active.

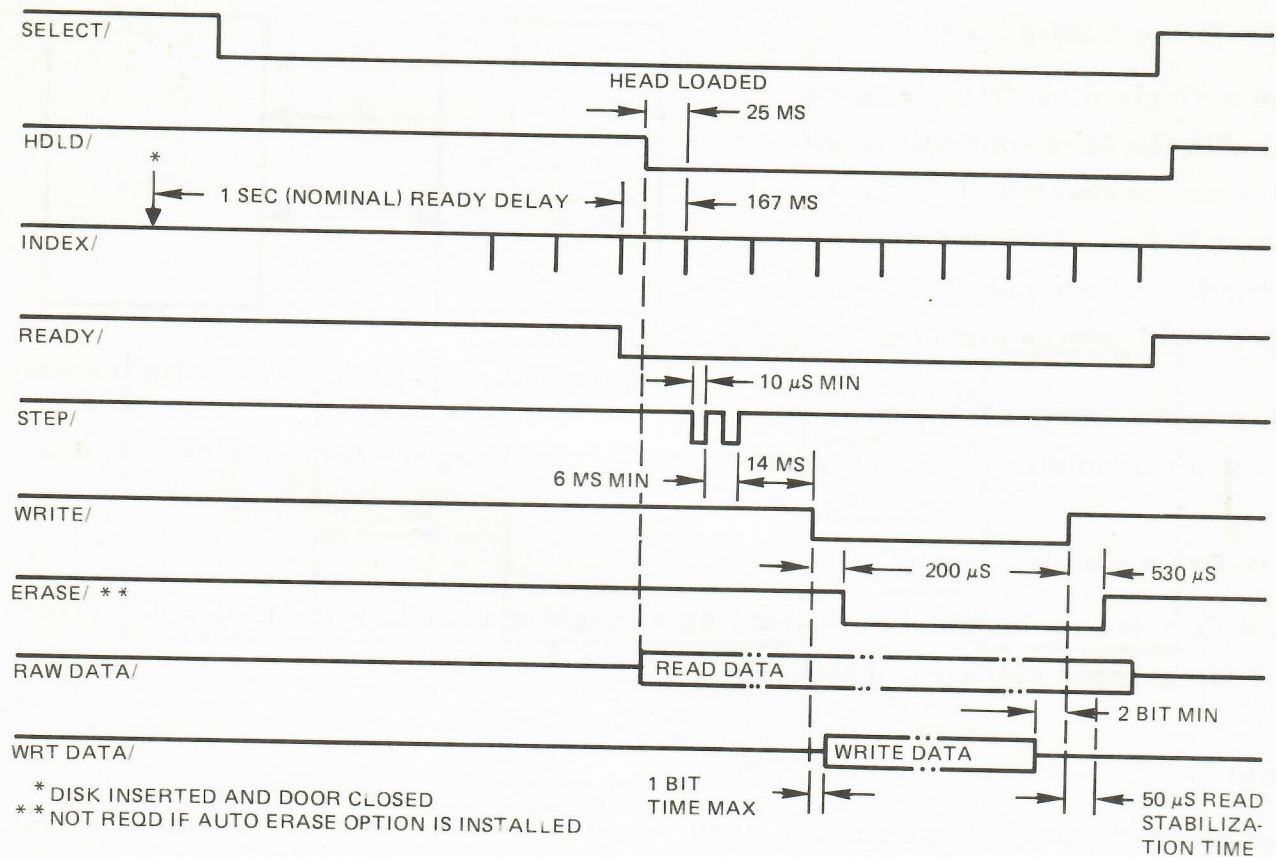


Figure 2-8. Interface Timing Diagram, Simplified

After the last write bit has been transferred to the disk drive, WRITE/ becomes inactive 2 bit times later. ERASE/ is made inactive 530 microseconds after the trailing edge of WRITE/.

A 50 microsecond read stabilization delay is required following a write operation, before valid read operations can be performed.

SYSTEM CONFIGURATIONS

The disk drive can be used in single-drive applications or can be connected in a multi-drive configuration, such as:

- Radial Select
- Radial Select with Daisy Chain
- Binary Select

Single-Drive Configuration

When a single disk drive is to be used with the host controller, all cables are connected directly to the disk drive. The unit must be selected to accept commands and respond with status signals.

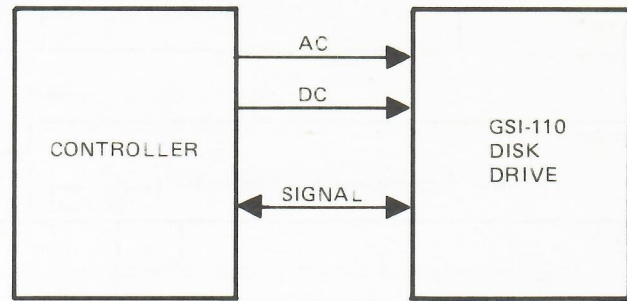


Figure 2-9. Single-Drive Configuration

In this application, all input signal lines are terminated by an integrated circuit containing the terminating networks.

Multi-Drive Configurations

The disk drive is designed to operate as a single unit or in a multi-drive environment for greater storage capabilities.

Radial Select

When multi-drive applications are required, one method used is the radial select (Figure 2-10). The purpose of this type operation is to allow the disk drive to accept commands and send status signals, without having been selected. The basic disk drive can be field-modified for this type operation. Spare pins are provided.

Daisy-Chained Radial Select

The radial select configuration may be daisy-chained to allow a multi-drive system both select and non-select operations. This configuration is shown in Figure 2-11.

All signal lines are daisy-chained. However, the differences are:

- ① Select lines and optional dedicated radial lines not under select control
- ② Undedicated lines under select control

Select lines plus additional dedicated radial option lines may be daisy-chained. The following Radial combinations are possible with four disk drives:

- Radial STEP/ and STEP IN/
- Radial HDLD/ and READY/

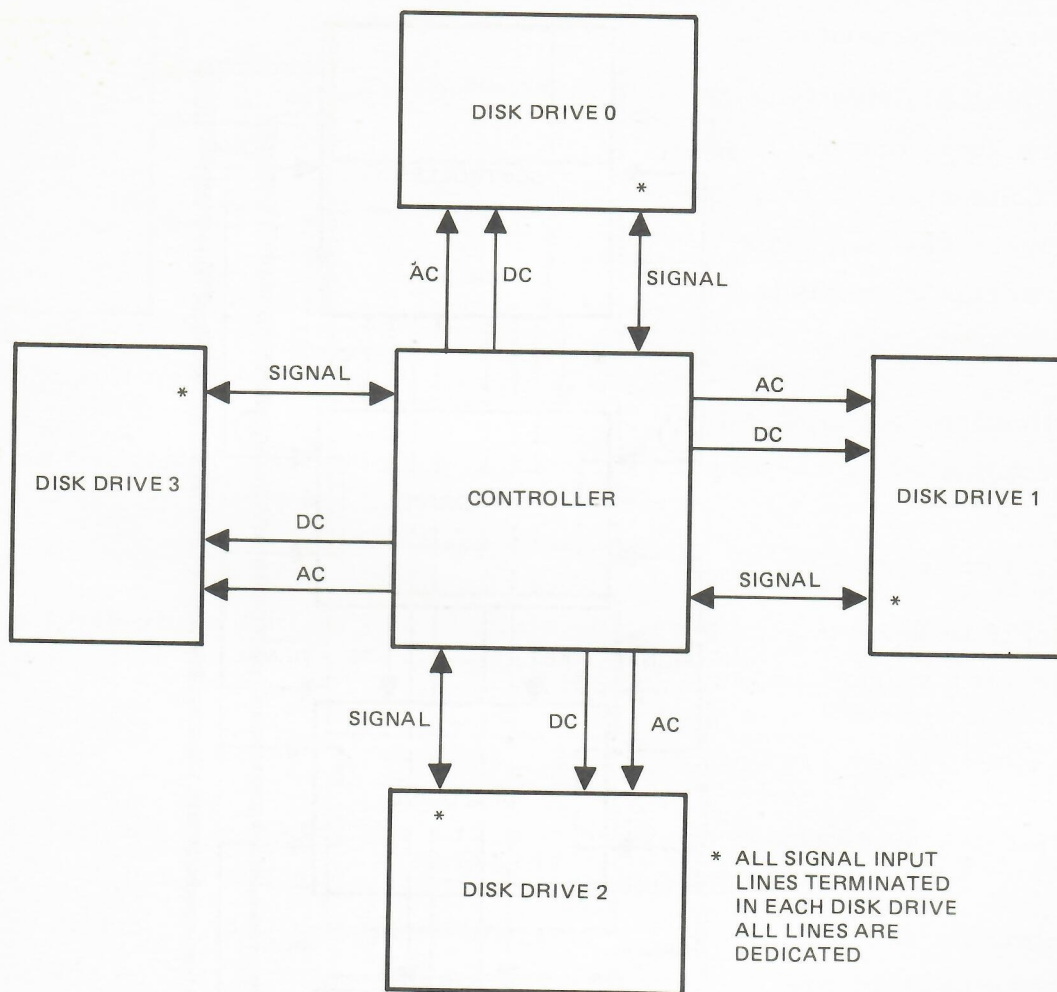


Figure 2-10. Radial Select Configuration

With two disk drives, STEP/, STEP IN/, HDLD/, READY/, INDEX/ and SECTOR/ can all be dedicated Radial lines.

Binary Select

The binary select configuration allows up to eight disk drive to be used with selection by a binary code. This configuration is shown in Figure 2-12.

To select one of eight disk drives when using only four select lines the following scheme is used:

SELECT 0/	=	Decoder Enable
SELECT 1/	}	Binary coded from 0 through 7 to produce only one select signal
SELECT 2/		
SELECT 3/		

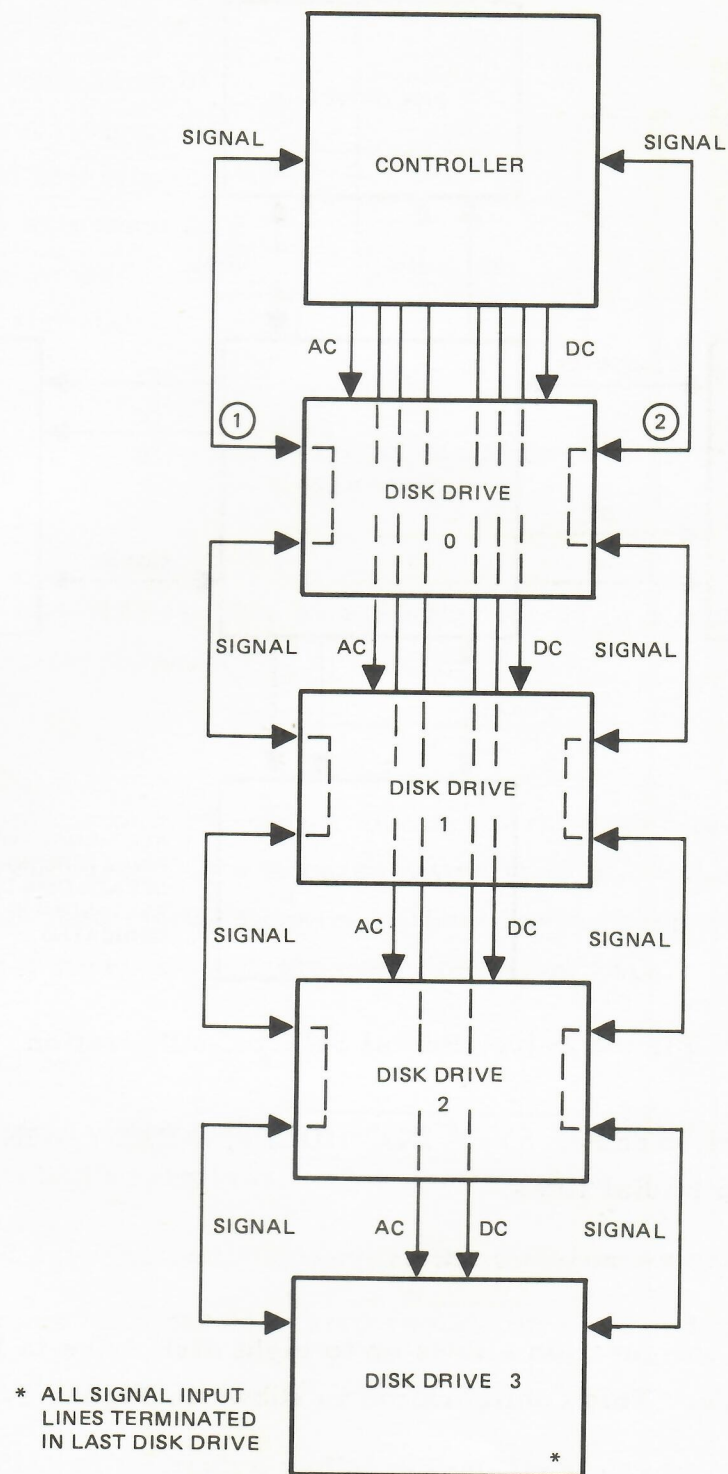


Figure 2-11. Daisy-Chained Radial Select Configuration

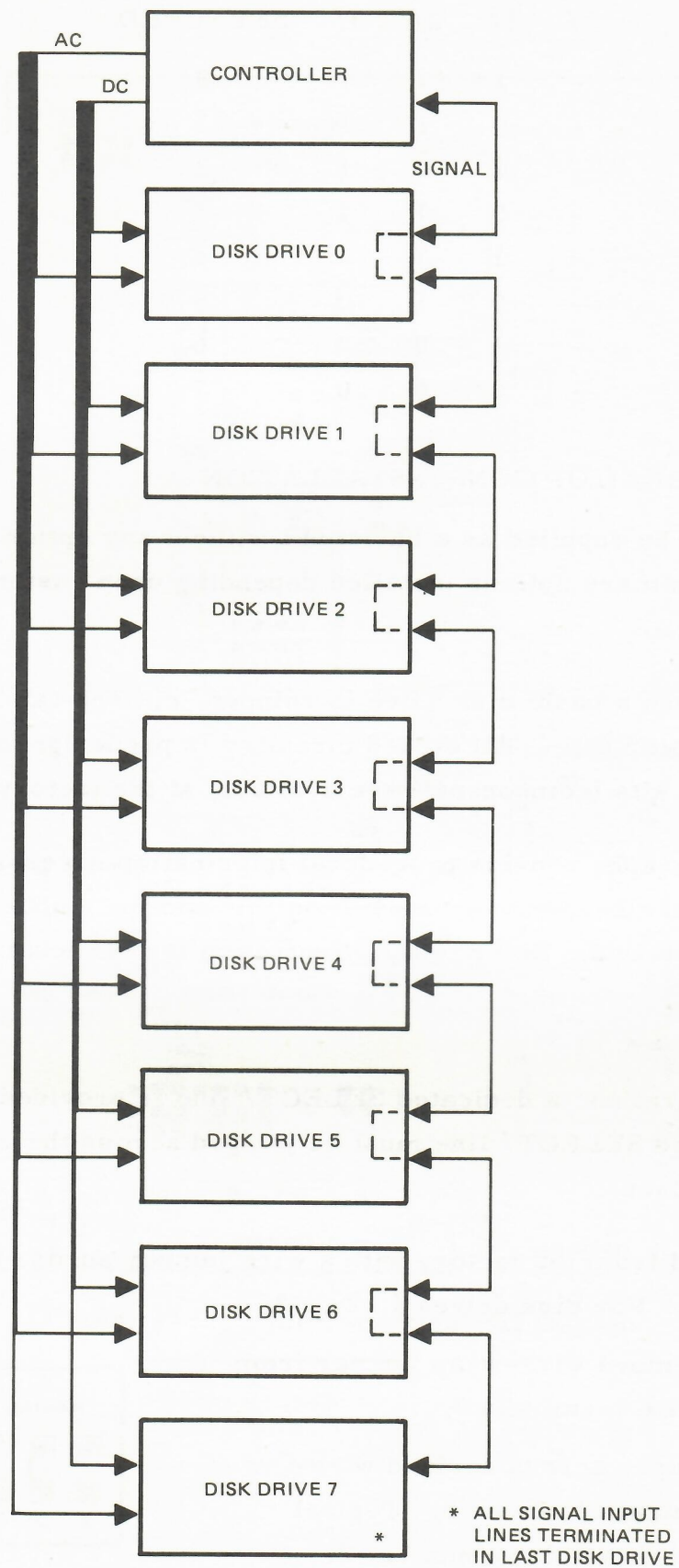


Figure 2-12. Binary Select Configuration

<u>0/</u>	<u>1/</u>	<u>2/</u>	<u>3/</u>	<u>SELECTED</u>
-	1	1	1	0
-	0	1	1	1
-	1	0	1	2
-	0	1	1	3
-	1	1	0	4
-	0	1	0	5
-	1	0	0	6
-	0	0	0	7

INTERFACE/INTERNAL OPTIONS INSTALLATION

The disk drive may be supplied as a basic unit without any options installed or can be supplied with many options installed depending upon customer requirements at the time of order.

However, even though a basic disk drive is shipped, options can be installed by the customer at a later date. All etched circuitry is predesigned into the PCB and low-cost option kits (components) are available at the factory.

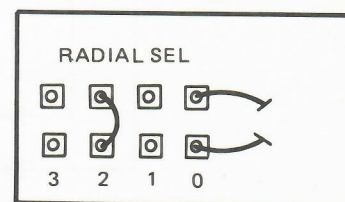
The following paragraphs provide procedural information necessary to install most options. Figure 2-13 shows the PCB outline and the unique manner by which an option can be installed. Refer to the illustration for the location of each option.

Radial Select

In the basic configuration, a dedicated SELECT/ line is provided for each disk drive. The assigned SELECT/ line must be jumped across the etch pads for connection to the interface.

The unit is supplied from the factory with a wire jumper across the 0 wire-wrap pads (disk drive 0). For disk drives 1, 2 or 3:

- Cut and remove wire-wrap jumper from RADIAL SEL terminals 0.
- Install jumper across desired wire-wrap terminals 1, 2, or 3. Typical connection shows drive number 2.



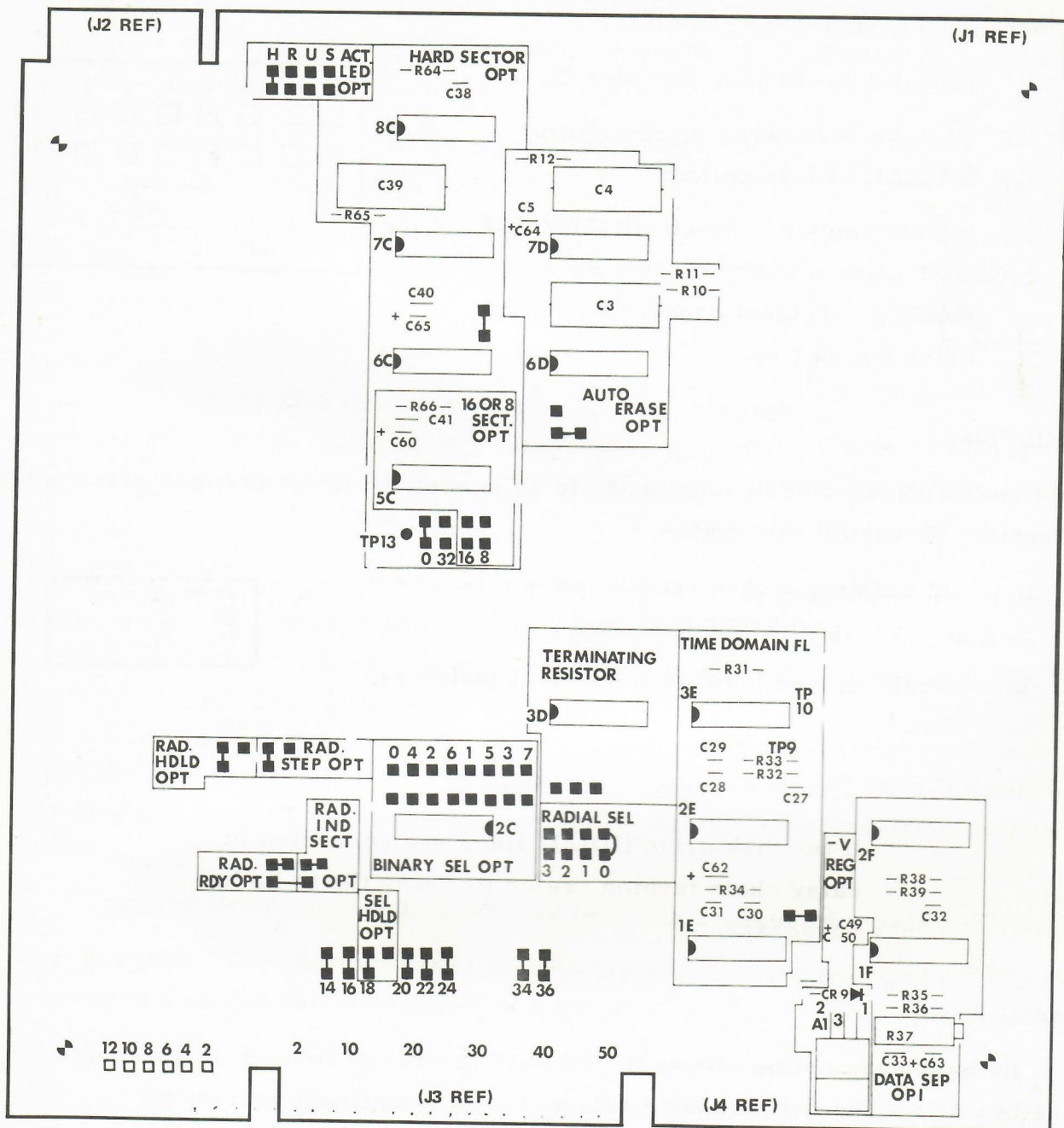
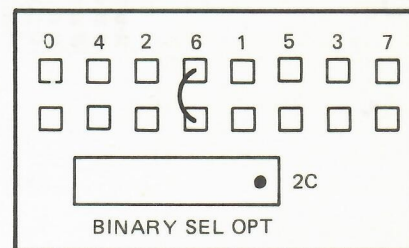


Figure 2-13. Interface/Internal Options

Binary Select

To install the Binary Select option:

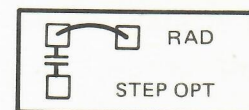
- a. Install 4-to-10 Line Decoder IC, 2C
- b. Remove wire-wrap jumper from RADIAL SEL terminals
- c. Install jumper between BINARY SEL OPT pads of assigned disk drive number. Typical connection shows drive number 6.



Radial Step

This option allows STEP/ commands to be accepted without the disk drive being selected. To install this option:

- a. Cut existing etched circuit jumper between vertical RAD STEP OPT pads.
- b. Install jumper between horizontal pads, as shown.



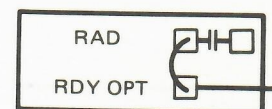
Note

If the disk drive HDLD/ lines are connected in daisy chain fashion, refer to Daisy Chain Radial paragraph.

Radial Ready

The Radial Ready option allows the READY/ status to be sent to the controller, whether or not the unit has been selected. To install this option:

- a. Cut existing etched circuit jumper between top RAD RDY OPT pads.
- b. Install jumper between vertical pads, as shown.



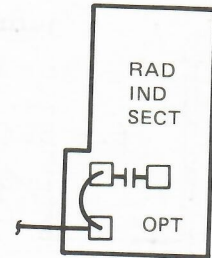
Note

If the disk drives are connected in daisy-chain fashion, refer to Daisy-Chain Radial paragraph.

Radial Index/Sector

The Radial Index/Sector option allows INDEX/ and SECTOR/ pulses to be sent to the controller whenever the unit is READY/, regardless of whether or not the unit is selected. To install this option:

- a. Cut existing etched circuit jumper between top RAD IND SECT OPT pads.
- b. Install jumper between vertical pads, as shown.



Note

If the disk drives are connected in daisy-chain fashion, refer to the Daisy-Chain Radial paragraph.

Daisy-Chain Radial

Predesigned etch circuit pads are provided for the STEP/, STEP IN/, and HDLD/ input interface lines. Etch circuit pads are also provided for READY/, INDEX/, and SECTOR/ output interface lines.

When connections to two or more disk drives are made in daisy-chain fashion, and any of these lines are radial lines, the following additional modifications must be made:

- a. For disk drive number 0, no change in the input or output pads are required.
- b. For disk drive number 1 and up, the input and output etch pad for the dedicated signal must be changed as follows:
 1. STEP/ - Cut existing etched circuit jumper between pads 36. Install jumper from assigned input pin on connector J3 (pin 2, 4, 6, 8, 10 or 12) to pad 36B (lower).
 2. STEP IN/ - Cut existing etched circuit jumper between pads 34. Install jumper from assigned input pin on connector J3 (pin 2, 4, 6, 8, 10 or 12) to pad 34B (lower).
 3. HDLD/ - Cut existing etched circuit jumper between SEL HDLD OPT pads (number 18). Install jumper from assigned input pin on connector J3 (pin 2, 4, 6, 8, 10 or 12) to pad 18B (lower).

4. READY/ - Cut existing etched circuit jumper between pads 22. Install jumper from assigned input pin on connector J3 (pin 2, 4, 6, 8, 10 or 12) to pad 22B (lower).
5. INDEX/ - Cut existing etched circuit jumper between pads 20. Install jumper from assigned input pin on connector J3 (pin 2, 4, 6, 8, 10 or 12) to pad 20B (lower).
6. SECTOR/ - Cut existing etched circuit jumper between pads 24. Install jumper from assigned input pin on connector J3 (pin 2, 4, 6, 8, 10 or 12) to pad 24B (lower).

Auto Head Load

The Auto Head Load option allows the read/write head to be loaded as soon as the disk drive is selected. If automatic head loading is desired, install the option as follows:

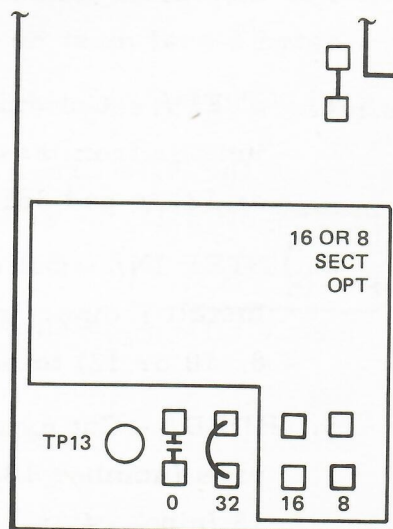
- a. Cut existing etched circuit jumper between SEL HDLD OPT pads (number 18).
- b. Install jumper from pin 1 of connector J3 to pad 18B (lower).

Hard Sector

The Hard Sector option allows the use of a 32-sector flexible disk. The 32 holes in the disk are sensed by the index hole photosensing circuit and are used to synchronize timing of write data to assigned sectors of the disk.

To install the option in the field:

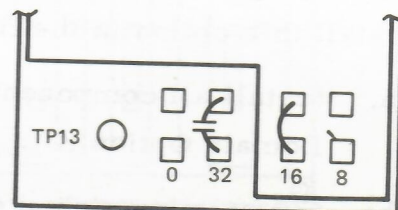
- a. Install all components in Hard Sector Option Kit.
- b. Cut existing etched circuit jumper between HARD SECTOR OPT pads, as shown.
- c. Cut existing etched circuit jumper between pads 0.
- d. Install jumper between pads 32, as shown.



16 or 8 Sector

The 16 or 8 Sector option allows the 32 sector pulses detected in the hard sector flexible disk, to be used for dividing down to 16 sectors or 8 sectors. The Hard Sector option must be previously installed. To install the Sector Select option:

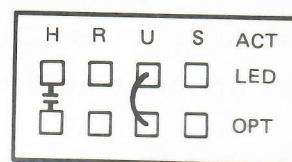
- a. Cut existing jumper from between HARD SECTOR OPT pads 32.
- b. Install jumper from either pads 16 or 8, as shown.



Activity Indicator Select

In the basic configuration of the disk drive, the front panel activity indicator is turned on when the read/write head is loaded. The purpose of the Activity Indicator Select option is to allow three additional uses for the indicator, only one of which can be used at a time. If a different use is desired, install the option as follows:

- a. Cut existing etched circuit jumper between ACT LED OPT pads H (HDLD/).
- b. Install jumper across desired signal for activity indicator, as shown:



1. R - READY/
2. U - IN USE/*
3. S - SELECT/

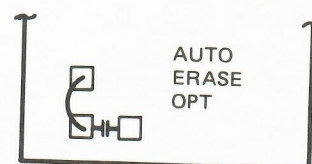
*Note

When IN USE/ is used, connect additional jumper from pin 2 of connector J3 to the U pads.

Auto Erase

The purpose of the Auto Erase option is to automatically initiate an erase turn-on delay and turn-off delay by activating the auto erase logic when the controller activates WRITE/. To install this option:

- a. Install all components in Auto Erase Option Kit.
- b. Cut existing etched circuit jumper between AUTO ERASE OPT pads.



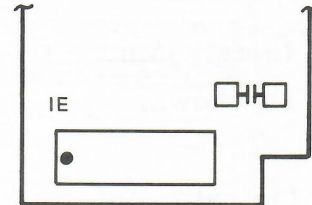
- c. Install jumper from top to bottom pads, as shown.

Time Domain Filter

The purpose of this filter is to detect and filter out of the RAW DATA/, all false zero crossings that may cause an error in the data transferred to the controller.

To install this option in the field:

- a. Install all components in the Time Domain Option Kit.
- b. Cut existing etched circuit jumper between TIME DOMAIN FL pads.



Data Separator (FM)

There are two Data Separator options available; one is installed on the lower right-hand corner of the PCB and is used to provide the controller with SEP DATA/ and SEP CLOCK/ signals of double-density FM encoding. The second Data Separator option is contained on a small independent PCB, and is installed in a convenient area in the controller. This option is used to produce the same signals, however, the option is used only when single-density MFM encoding is used.

To install the FM Data Separator in the field, simply install all components in the FM Data Separator Option Kit.

INSTALLATION

The disk drive can be supplied and installed with or without the enclosure. As shipped, the unit can be installed in the upright position (IBM 3740 fashion) without any adjustments. The unit can also be installed in a desk top or in any one of many positions, depending on operator access and available space; such as:

- Vertical - with access door opening to left or right
- Horizontal - with access door opening up or down
- Upright - with access door opening towards front or rear

Four disk drives can be vertically installed in a standard 19-inch RETMA rack (see Figure 2-14), and two-disk drives can be horizontally installed.

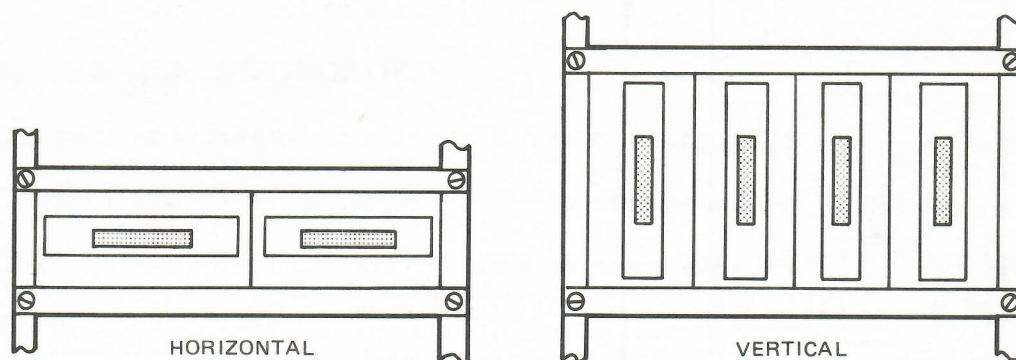


Figure 2-14. Rack-Mounted Installations

Mounting Dimensions

The disk drive outline and mounting dimensions are shown in Figure 2-15. Available as an optional accessory is a Chassis Slide Kit, P/N . The kit contains two slides (one locking) and necessary hardware to install each slide on the disk drive.

OPERATIONAL CHECKS

When the physical installation is complete, and all cables have been electrically checked and connected, the disk drive is ready to be checked for operational readiness. The check may be performed using either of two methods:

- On-line with controller
- Off-line with exerciser

On-Line Checkout

The disk drive may be connected into the system and checked out with controller programs. However, to be certain that all operations of the newly-installed disk drive are thoroughly checked independent of interaction with other equipment, it is recommended that the unit first be operated off-line by an exerciser.

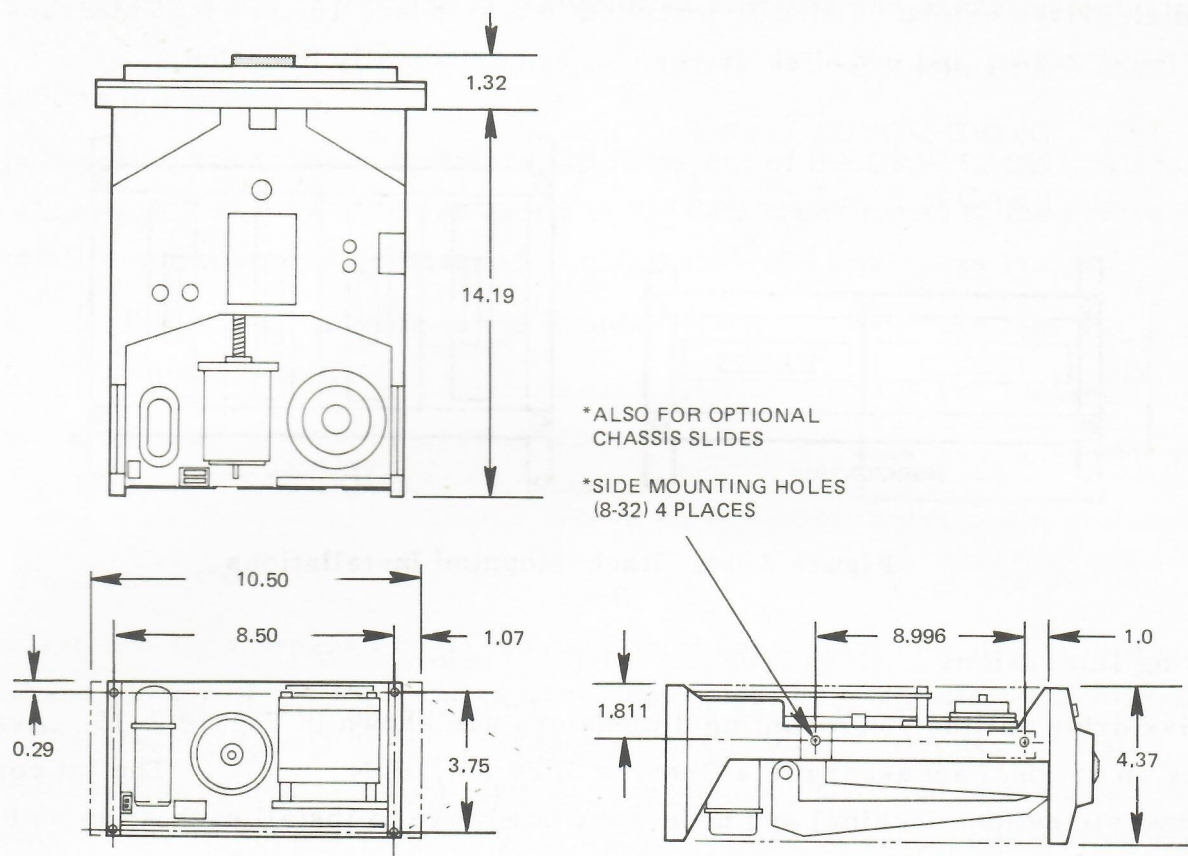


Figure 2-15. Outline and Mounting Dimensions

Off-Line Checkout

The Model 100 Disk Drive Exerciser is used to operate the disk drive in an off-line mode. The purpose of the exerciser is to simulate, under operator control, all functions originated by the controller in order to operate the disk drive through each mode of operation. The exerciser contains logic circuits, manual controls, status indicators and test points to test and monitor every function. Refer to Maintenance, Section 3, for detailed description of exerciser controls, indicators and test points.

Off-Line Checkout Preparation

Prepare the exerciser and the disk drive for off-line checks as follows:

- a. Remove controller interface cable from disk drive.
- b. Remove controller ac power cable from disk drive

- c. Preset exerciser controls as follows:
 - 1. AC to OFF
 - 2. DRIVE MOTOR to OFF
 - 3. HEAD to DISENGAGED
- d. Connect exerciser interface cable to connector J3.
- e. Connect exerciser dc power cable to connector J4.
- f. Connect exerciser ac power cable to connector J5.
- g. Connect exerciser ac input cable to ac line power.
- h. Insert a scratch flexible disk in disk drive.

Note

Extensive on-line and off-line performance tests were made at the factory. The following simplified off-line checks are provided in sequence to verify that all major functions are operational. Prior to making any checks, reading and understanding the continuity of all checks is recommended.

Voltage Checks

Using a voltohmmeter, verify that ac and dc input voltages are correct as follows:

- a. Set voltohmmeter to read ac voltage and measure ac input line voltage according to information listed in Table 2-1.
- b. Set voltohmmeter to read dc voltage and measure dc input line voltage according to information listed in Table 2-2.

Index Pulse Detector Check

The INDEX pulse occurs once per disk revolution. Check the index detector circuit as follows:

- a. Set exerciser AC switch to ON.
- b. Set DRIVE MOTOR switch to ON.

- c. Set oscilloscope as follows to monitor INDEX pulse period, as shown in Figure 2-16.

SYNC: INT POS
 HORIZ: 20 MS/cm
 VERT: 2V/cm
 CHAN 1: INDEX (exerciser TP)

OBSERVE: Pulse period of
 167 ± 6 ms

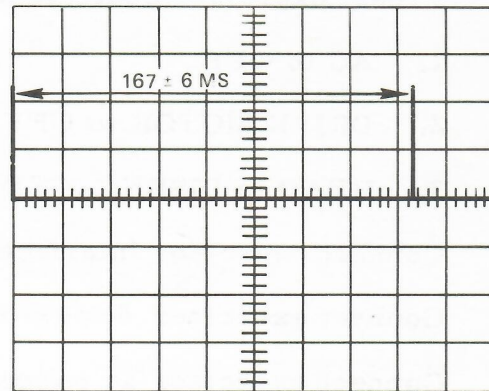


Figure 2-16. Index Pulse Period

- d. Observe that INDEX indicator comes on when INDEX is detected.
- e. Set oscilloscope as follows to monitor INDEX pulse duration, as shown in Figure 2-17.

SYNC: INT POS
 HORIZ: 2 ms/cm,
 0.1 ms/cm
 VERT: 2V/cm
 CHAN 1: INDEX (exerciser TP)

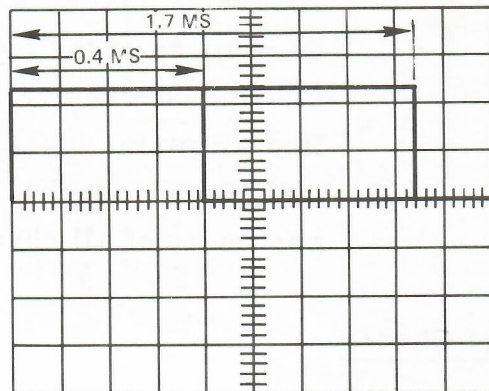


Figure 2-17. Index Pulse Duration

OBSERVE: Pulse duration of
 1.7 ms (Index Disk)
 0.4 ms (Sectored Disk)

Index and Read Data Synchronization

The stored RAW DATA is synchronized to start at the leading edge of the INDEX pulse. Check the synchronization as follows:

- Remove scratch disk and insert sectored alignment disk.
- Set exerciser AC switch to ON.
- Set DRIVE MOTOR switch to ON.

- d. Set HEAD switch to ENGAGE. Observe that exerciser HEAD ENGAGE indicator and disk drive indicator both come on.
- e. Press and release spring-loaded SINGLE STEP IN switch to step read/write head to track 00. At track 00, exerciser TRACK 0 indicator comes on. Exerciser INDEX indicator comes on each time INDEX is detected.
- f. Set oscilloscope as follows, to monitor leading edge of INDEX pulse and RAW DATA, as shown in Figure 2-18.

SYNC: INT (INDEX TP)
 HORIZ: 0.1 MS/cm
 VERT: 2V/cm
 CHAN 1: INDEX (exerciser TP)

CHAN 2: RAW DATA (TP 11,
 Disk Drive)

OBSERVE: Synchronized data

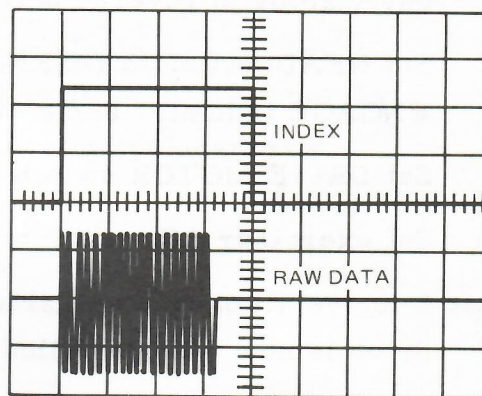


Figure 2-18. Synchronized Data

Stepper Motor Check

The stepper motor steps the read/write head in or out, over the flexible disk surface. Check the stepper motor operation as follows:

- a. Remove sectored alignment disk and insert scratch disk.
- b. Set exerciser AC switch to ON.
- c. Set DRIVE MOTOR switch to ON.
- d. Set HEAD switch to ENGAGE. Observe that exerciser HEAD ENGAGE indicator and disk drive indicator both come on.
- e. Press and release spring-loaded SINGLE STEP OUT switch until exerciser TRACK 0 indicator comes on.
- f. Set AUTO STEP DISTANCE rotary switch to 16.
- g. Press AUTO STEP switch up. Observe read/write head steps 16 steps forward (in) and 16 steps reverse (out) for as long as switch is pressed. Release switch.

- h. Set AUTO STEP DISTANCE rotary switch to 32 and repeat step g. Observe 32-step movement, in and out.
- i. Press SLEW IN switch up. Observe that read/write head continuously steps forward until switch is released.
- j. Press SLEW OUT switch down. Observe that read/write head continuously steps in reverse until switch is released.
- k. Set HEAD switch to DISENGAGED. Observe that exerciser HEAD ENGAGE indicator and disk drive indicator both go out.
- l. Set DRIVE MOTOR switch to OFF.
- m. Set exerciser AC switch to OFF.
- n. Remove all exerciser cables and connect all controller cables. The disk drive is now fully installed, checked out and ready for on-line operation.

SECTION 3

MAINTENANCE

GENERAL

This section contains preventive and corrective maintenance information necessary to maintain the disk drive. The procedural information is provided for operational checks, adjustments or alignments, and removal and replacements.

PREVENTIVE MAINTENANCE

Preventive maintenance of the disk drive is minimal due to the efficient design, reliability, and manner in which the unit is operated.

The operating environment of the disk drive and the flexible disks must be kept clean and within required temperature and humidity limits. The single read/write head must be kept free from contamination by dust, smoke, or moisture.

Visual Inspection

During normal operating conditions, periodically inspect the unit for signs of dirt, wear, or loose latching hardware on the handle. When servicing the unit, check all areas for signs of loose connections, abnormal wear, and dirt accumulation on the flexible disk guide.

Cleanliness

A clean disk drive, external and internal, will extend the operating life of the equipment and enhance the appearance. The importance of periodic visual inspection and normal cleanliness of the unit cannot be over-emphasized.

Routine Maintenance Schedule

A systematic routine operating check is recommended. The checks should be performed in accordance with Table 3-1.

Table 3-1. Routine Maintenance Schedule

Inspect	Check	Frequency
R/W Head	For Dirt	} Every six months
Head Pad	For Wear	
Drive Belt	For Tension	

TOOLS AND TEST EQUIPMENT

To perform proper maintenance of the disk drive, certain tools, test equipment and supplies are required. A list of standard tools and test equipment is provided in Table 3-2. A list of special tools and test equipment is provided in Table 3-3.

Standard

Table 3-2. Tools and Test Equipment

Oscilloscope
Voltohmmeter
Common Hand Tools
Flashlight
Inspection Mirror
Cotton-Tipped Swabs
Isoprophyl Alcohol, 91%
Freon TP (or Arkalone P)
Lint-Free Cloths

Special

Table 3-3. Tools and Test Equipment

Exerciser Model 100 P/N 215100
Track 0 Alignment Tool P/N 205004
Track 36 Alignment Tool P/N 205033

EXERCISER

The GSI Model 100 Disk Drive Exerciser (Figure 3-1) is a portable testing device designed to operate the Model GSI-110 Disk Drive off-line.

The exerciser is provided with controls and indicators to manually simulate all controller command functions and provide automatic control over the read/write head, drive motor, track positioning and data simulation.

The controls, indicators, and test points are listed and described in Table 3-4.

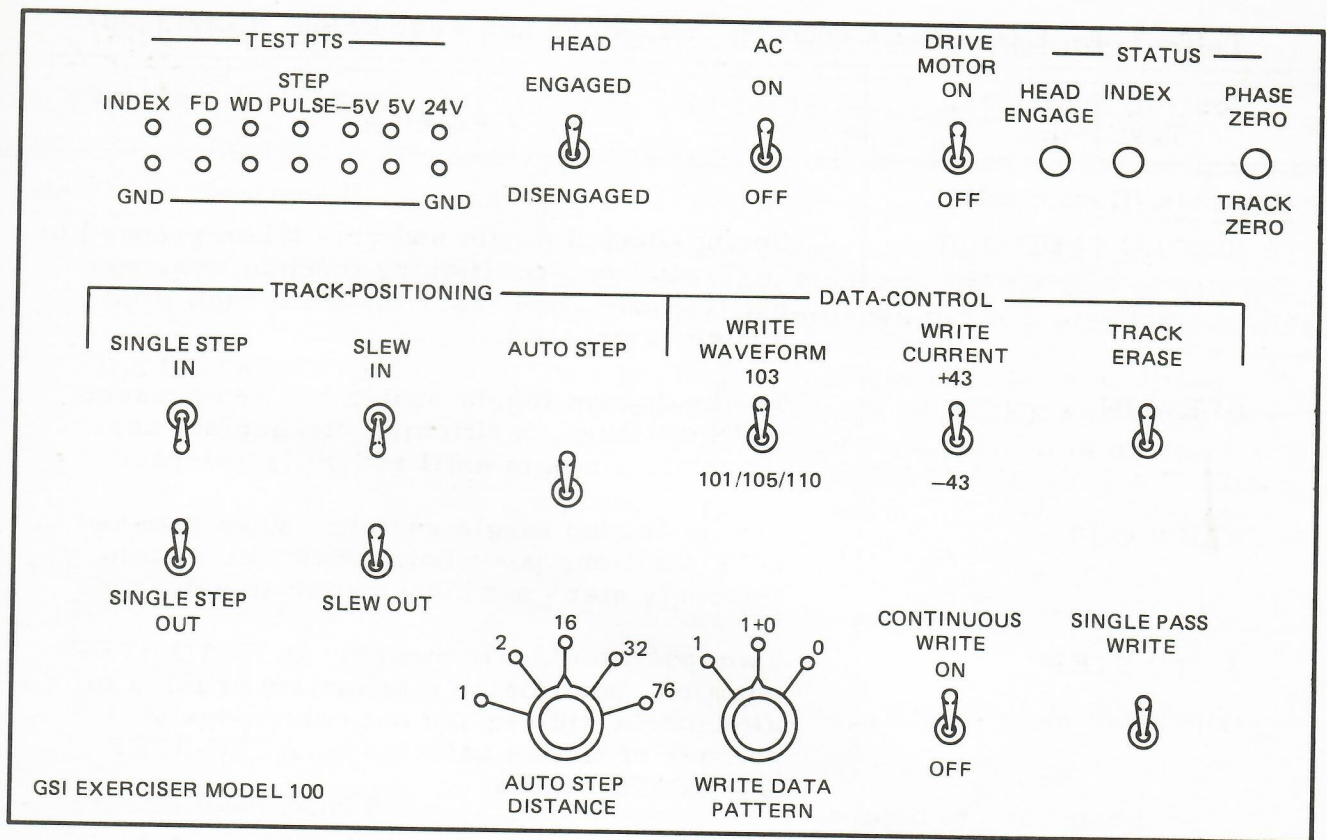


Figure 3-1. GSI Model 100 Disk Drive Exerciser

Table 3-4. Exerciser Controls, Indicators and Test Points

Control, Indicator, Test Point	Function
<u>Controls</u>	
AC ON/OFF	Two-position toggle switch. In ON position, exerciser supplies ac and dc to operate disk drive. In OFF position, ac and dc power is removed.
DRIVE MOTOR ON/OFF	Two-position toggle switch. In ON position, ac drive motor power is applied. In OFF position, drive motor power is removed.
HEAD ENGAGED/DISENGAGED	Two-position toggle switch. In ENGAGED position, head load solenoid is energized to load read/write head. In DISENGAGED position, solenoid is deenergized.
SINGLE STEP IN	Spring-loaded toggle switch. When pressed to IN position, positioning mechanism steps in (forward) one track distance each time switch is pressed.

Table 3-4. Exerciser Controls, Indicators and Test Points (Continued)

Control, Indicator, Test Point	Function
<u>Controls (Continued)</u>	
SINGLE STEP OUT	Spring-loaded toggle switch. When pressed to OUT position, positioning mechanism steps out (reverse) one track distance each time switch is pressed.
SLEW IN	Spring-loaded toggle switch. When pressed to IN position, positioning mechanism continuously steps in until switch is released.
SLEW OUT	Spring-loaded toggle switch. When pressed to OUT position, positioning mechanism continuously steps out until switch is released.
AUTO STEP	Two-position toggle switch. In AUTO STEP position, positioning mechanism enabled to alternately step in and out continuously, number of tracks selected by AUTO STEP DISTANCE switch.
AUTO STEP DISTANCE 1/2/16/32/76	Five-position rotary switch. When in AUTO STEP mode, positioning mechanism alternately steps in and out continuously, number of tracks selected.
WRITE DATA PATTERN 1/1+0/0	Three-position rotary switch. In position 1, data pattern of all ones are written during a write operation. In position 1+0, alternating bytes of ones and zeros are written. In position 0, all zeros are written.
WRITE WAVEFORM 103/101/105/110	Two-position toggle switch. In 103 position, exerciser formats write data for Model 103 Disk Drive. In 101/105/110 position, write data formatted is for Models 101/105 and 110.
WRITE CURRENT +43/-43	Two-position toggle switch. In +43 position, write current is high for writing on tracks 0 through 42. In -43 position, write current is low for writing on tracks 43 through 76.
TRACK ERASE	Two-position toggle switch. In ERASE position, erase current driver is enabled. In down position, erase current driver is disabled.

Table 3-4. Exerciser Controls, Indicators and Test Points (Continued)

Control, Indicator, Test Point	Function
<u>Controls (Continued)</u>	
CONTINUOUS WRITE ON/OFF	Two-position toggle switch. In ON position, write operation starts at INDEX and continues until switch is returned to OFF position.
SINGLE PASS WRITE	Two-position toggle switch. In up position, write operation starts at INDEX and stops at next INDEX. Write data pattern is determined by position of WRITE DATA PATTERN switch.
<u>Indicators</u>	
HEAD ENGAGE	On when head is loaded for read/write operation.
INDEX	On once per disk revolution; when index pulse is detected.
PHASE 0/TRACK 0	On when read/write head is positioned directly over track 00.
<u>Test Points</u>	
INDEX	Monitor for INDEX pulses produced by disk drive.
FD (File Data)	Monitor for recorded information, as read from disk.
WD (Write Data)	Monitor for controller write data, as recorded on disk.
STEP PULSE	Monitor for STEP PULSE used to position read/write head.
-5V	Monitor for -5-volt supply
5V	Monitor for +5-volt supply
24V	Monitor for +24-volt supply

CORRECTIVE MAINTENANCE

Corrective maintenance of the disk drive involves off-line checks to determine the cause of a suspected malfunction. An adjustment or alignment may be required to restore the unit to operational readiness, or a removal and replacement may be required.

The following maintenance procedures are provided to determine and correct any suspected malfunction in the disk drive.

Note

It is recommended that prior to starting operation or maintenance procedure, maintenance personnel read the entire procedure to fully understand the details of the procedure and the tools required.

Input Power

The disk drive uses one ac drive voltage and three dc voltages. The input power is supplied by the controller during normal on-line operations, and from the exerciser during off-line checks and maintenance.

WARNING

Use extreme care when measuring, or connecting ac line power. Electric shock could occur to injure personnel and damage equipment.

Voltage Checks

Initial voltage checks are made with the disk drive connected to the controller to determine if correct input voltages are being supplied.

To check input ac and dc voltages:

- a. Gain access to disk drive ac connector J5.
- b. Using voltohmmeter, verify that ac input voltage measures same as voltages listed in Table 2-1.
- c. Gain access to dc connector J4.
- d. Using voltohmmeter, verify that dc input voltage measures same as voltages listed in Table 2-2.

Voltage Adjustments

Voltage adjustments are not provided in the disk drive. If any dc voltage is out of tolerance, disconnect dc and interface cable and check voltages at controller. If controller dc voltages are correct:

- a. Disconnect disk drive cables.
- b. Remove disk drive and place on clean work surface.
- c. Connect exerciser and recheck all dc voltages, off-line.
- d. Isolate dc voltage problem on printed circuit board, and repair. Replace PCB if necessary. Refer to Printed Circuit Board Replacement procedure.

Spindle Drive System

The spindle drive system consists of the drive motor, drive motor pulley, the spindle drive pulley and the drive belt, as shown in Figure 3-2. The INDEX pulse detector is considered part of the drive system. Refer to Index Pulse Detector Check, if necessary.

Drive Motor and Drive Belt Checks

To check the drive motor and drive belt:

- a. Turn off all ac and dc input power.
- b. Gain access to PCB side of disk drive.
- c. Rotate drive motor manually and inspect drive belt for wear, cracks, or fraying edges. Replace drive belt, if necessary. Refer to Drive Belt Replacement procedure.
- d. Rotate motor manually and inspect for bearing noises or binding. Replace drive motor, if necessary. Refer to Drive Motor Replacement procedure.
- e. Turn on ac line power to disk drive.

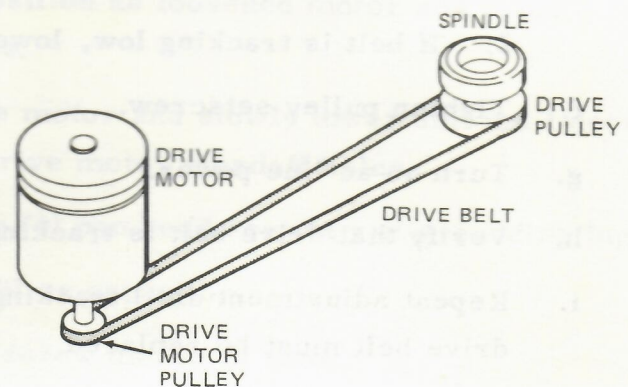


Figure 3-2. Spindle Drive System

- f. Verify that new drive motor and/or new drive belt operates normally, and that drive belt tracks smoothly and evenly in center of both pulleys. If tracking is irregular, refer to Drive Belt Adjustment procedure.

Drive Belt Adjustment

To properly adjust the drive belt:

- a. Turn on ac line power to disk drive.
- b. Observe drive belt rotation in relationship to spindle pulley. Determine if drive belt is tracking low or high.
- c. Turn off ac line power to disk drive.
- d. Loosen drive motor pulley setscrew from rear of unit.
- e. Adjust position of drive motor pulley:
 1. If belt is tracking high, raise pulley.
 2. If belt is tracking low, lower pulley.
- f. Tighten pulley setscrew.
- g. Turn on ac line power.
- h. Verify that drive belt is tracking properly.
- i. Repeat adjustment until tracking is correct, or until it is determined that drive belt must be replaced.

Drive Belt Replacement

To replace the drive belt:

- a. Turn off ac line power to disk drive.
- b. Remove PCB. Refer to Printed Circuit Board Replacement procedure.
- c. Remove drive belt from spindle pulley and discard.
- d. Clean both pulleys with alcohol.
- e. Install replacement drive belt and rotate spindle pulley to correctly position drive belt.
- f. Install PCB and connectors P1 and P2.

Drive Motor Replacement

To replace drive motor:

- a. Disconnect all cables, remove disk drive from mounting, and place on clean work surface.
- b. Remove PCB. Refer to Printed Circuit Board Replacement procedure.
- c. Remove drive belt.
- d. Loosen setscrew and remove drive motor pulley.
- e. Identify and remove quick-disconnect wires from ac line filter capacitor.
- f. Remove four (4) pan-head screws and grounding lug. Drive motor is now loosened from disk drive.
- g. Lift disk drive straight up and away from loosened drive motor. Remove four (4) standoffs from loosened motor screw holes.
- h. Place new drive motor in same position as loosened motor and place four (4) standoffs over screw holes.
- i. Position disk drive over new drive motor and slowly lower unit until deck assembly holes are aligned with drive motor standoff holes.
- j. Fasten new drive motor using four (4) pan head screws and grounding lug.
- k. Connect ac input wires to ac line filter capacitor.
- l. Install drive motor pulley with setscrew on flat of shaft.
- m. Install drive belt and verify correct tracking. Refer to Drive Belt Adjustment procedure.
- n. Install PCB and connectors P1 and P2.

Positioning System

The positioning system consists of a stepper motor and head carriage assembly, and a track 00 detector (microswitch).

Stepper Motor Check and Alignment

To check the stepper motor:

- a. Turn off all ac and dc input power.
- b. Disconnect controller cables, remove disk drive from mounting, and place on clean work surface.
- c. Remove disk drive latching handle by loosening two (2) hex socket-head screws.
- d. Carefully, remove push-on bezel from bezel mounting plate.
- e. Remove four (4) pan-head screws fastening bezel mounting plate to deck assembly.
- f. Raise carrier slowly, and carefully unlatch ejector pins.
- g. Lift pressure pad (head load) arm out from behind pressure pad lifter, lower arm to read/write head, and open carrier assembly fully. Do not allow carrier to fall forward.
- h. Connect exerciser cables and set exerciser AC switch to ON, applying ac and dc power to disk drive.
- i. Using exerciser, step head carriage out to track 00 (TRACK 0 indicator comes on).
- j. Install Track 00 Alignment Tool as shown in Figure 3-3.
- k. While viewing read/write head through microscope (see Figure 3-3), verify that read/write and tunnel erase heads are aligned, exactly as shown.
- l. If alignment is required - loosen three (3) hex socket-head screws fastening stepper motor to deck assembly.
- m. While viewing read/write head through microscope, rotate stepper motor until correct alignment is attained.
- n. Tighten stepper motor mounting screws and recheck alignment. Repeat alignment, if necessary.
- o. Perform Head Carriage Stop Check procedure.

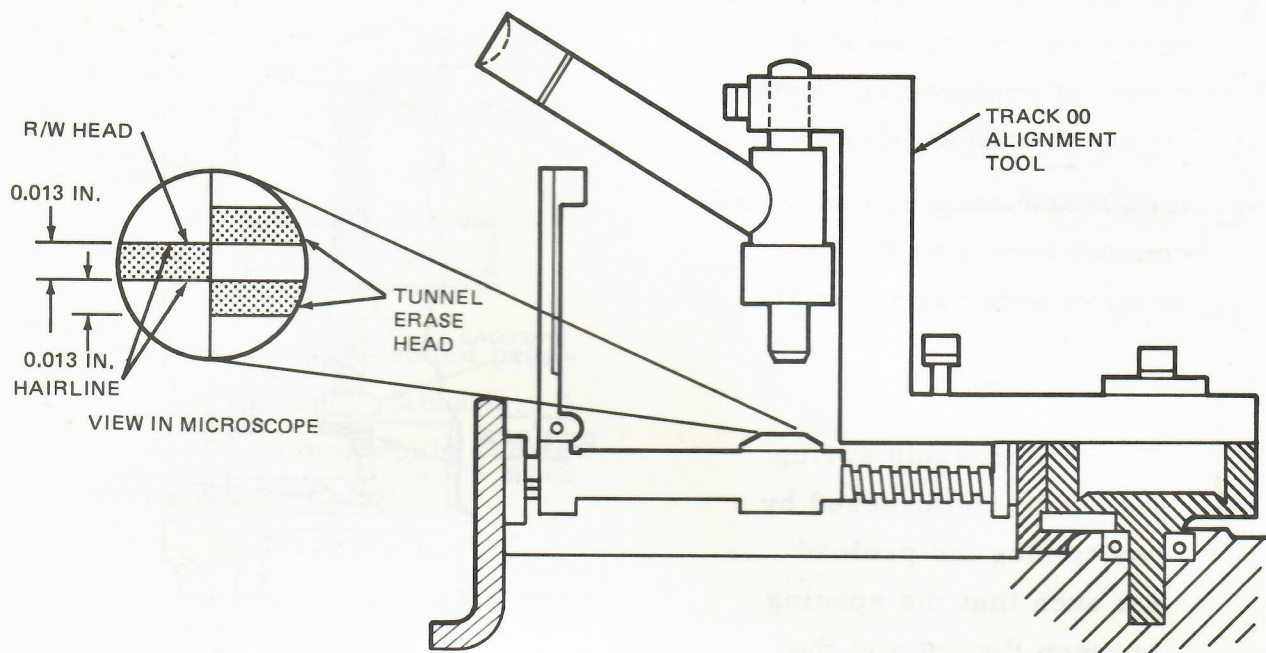


Figure 3-3. Track 00 Alignment Tool, Installed

Stepper Motor Replacement

To replace the stepper motor:

- a. Turn off all ac and dc power to disk drive.
- b. Disconnect controller cables, remove disk from mounting, and place on clean work surface.
- c. Remove PCB and drive belt.
- d. Remove stepper motor pins 3, 4, C, and D, from plug P2.
- e. Using wire cutters, cut all plastic tie-wraps holding stepper motor wires in wiring harness, loosen cable clamp, and pull stepper motor wires to rear of disk drive.
- f. Loosen inner and outer stop setscrews (see Figure 3-4).
- g. Rotate stepper motor lead screw manually until head carriage assembly is moved out against inner stop.
- h. Loosen three (3) hex socket-head stepper motor screws and pull lead screw out of bearing in deck assembly.
- i. Remove motor slowly, while manually rotating lead screw to remove shim washer, inner stop, and head carriage assembly.

- j. Remove outer stop from lead screw and install on lead screw of replacement motor. Do not tighten setscrew.
- k. Install new stepper motor and connect wiring to P2, in reverse order of removal.

Note

The compression spring should be compressed by positioning the preload nut such that the spacing between the nut and the bottom of the carriage is as shown in Figure 3-4.

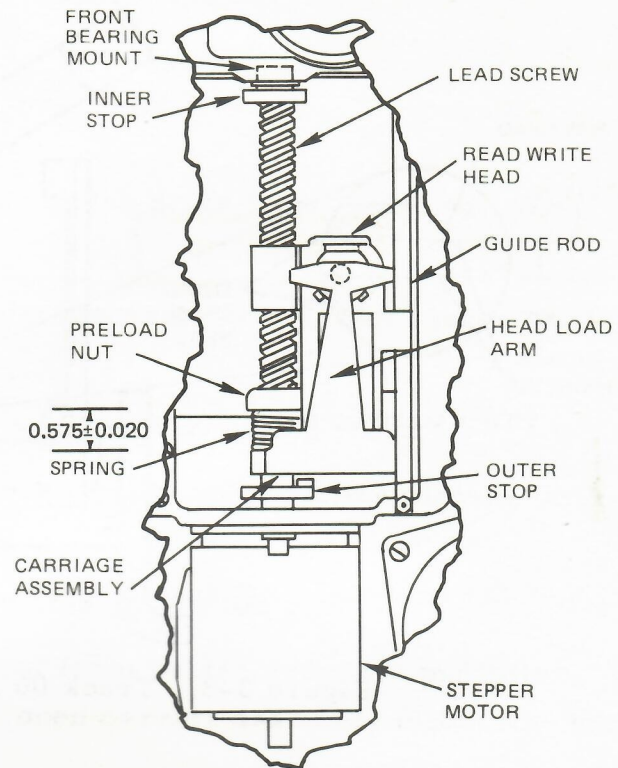


Figure 3-4. Stepper Motor Replacement

- l. Perform Stepper Motor Check and Alignment procedure.
- m. Perform Head Carriage Stop Check and Alignment procedure.

Head Carriage Stop Check and Alignment

To check the head carriage outer and inner stops:

- a. Perform Stepper Motor Check and Alignment.
- b. Set exercise AC switch to OFF, removing ac and dc power from disk drive.
- c. Rotate stepper motor lead screw manually, until head carriage is stopped by outer stop (see Figure 3-5).
- d. Observe, through microscope, that tunnel erase head is aligned between crosshairs, as shown.
- e. Loosen outer stop setscrew and, while viewing erase head, align as shown.

- f. Tighten setscrew and recheck alignment.
- g. Remove Track Zero Alignment Tool.



Lower spring-loaded pressure pad arm manually. A sudden return could damage read/write head.

- h. Set exerciser AC switch to ON.
- i. Step in to track 77.
- j. Loosen inner stop setscrew, rotate stop until firm against head carriage, and tighten setscrew.
- k. Step to track 00 and observe that exerciser TRACK 0 indicator is on when head carriage is at outer stop.
- l. Step to track 77 to verify head carriage is at inner stop.
- m. Set exerciser AC switch to OFF, removing ac and dc power from disk drive.
- n. Lower carrier assembly by:
 1. Raising pressure pad (head load) arm and placing one side behind pressure pad lifter.
 2. Carefully reposition ejector pins with ejector assembly.
- o. Install bezel mounting plate, bezel and handle, in reverse order of removal.

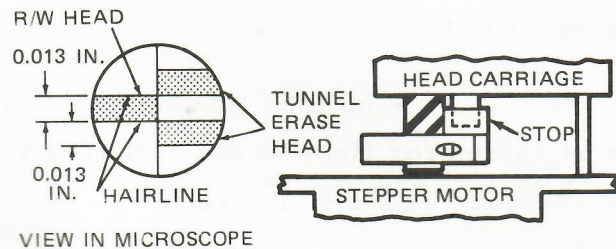


Figure 3-5. Head Carriage Outer Stop Position

Read/Write System

The read/write system comprises the read/write head and associated logic on the PCB. The read/write head is mounted on the carriage assembly and is not replaceable as a single component. If the head is found to be defective, the complete head

carriage assembly must be replaced. Refer to Stepper Motor Replacement and perform all steps that apply.

The read/write head load mechanism ensures that the pressure pad (head load) arm is raised for flexible disk insertion and ejection, and lowered to apply proper disk pressure against the head.

Head Load Check and Adjustment

To check the head load operation:

- a. Turn off all ac and dc power to disk drive.
- b. Disconnect controller cables.
- c. Remove disk drive from mounting and place on clean work surface.
- d. Connect exerciser and set AC switch to ON.
- e. Step to track 00 and observe that TRACK 0 indicator comes on.
- f. While observing side view of head load solenoid and pressure pad arm, set exerciser HEAD switch to ENGAGED (loading head).
- g. Verify that a gap exists between head load solenoid tang and pressure pad (load) arm (see Figure 3-6).

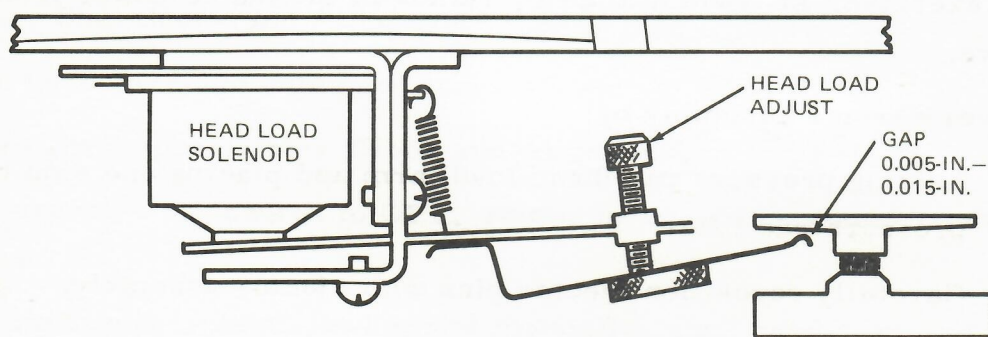


Figure 3-6. Head Load Adjust, Head Engaged

- h. If gap is not correct, adjust head load adjust hex socket-head screw until gap is correct.
- i. With head loaded, step in to track 76, verifying that head load solenoid tang and pressure pad arm do not touch over complete distance.
- j. Disconnect exerciser and install disk drive.

Electronics

The electronics of the disk drive consist of the PCB, the INDEX pulse detector and logic, and the write protect detector and logic. The PCB contains IC circuits and discrete components necessary to logically perform all read/write and control functions. The INDEX pulse detector and write-protect detector are separate and independent LED/photo transistor assemblies.

The detectors and the read/write logic can be easily checked to ensure proper operation.

Index Pulse Detector Check

To check the INDEX pulse detector and associated logic:

- a. Turn off all ac and dc power to disk drive.
- b. Disconnect controller cables.
- c. Connect exerciser with AC switch set to OFF
- d. Insert scratch disk cartridge with index hole only.
- e. Set exerciser AC switch to ON.
- f. Set DRIVE MOTOR switch to ON.
- g. Set oscilloscope as follows, to monitor INDEX pulse period, as shown in Figure 3-7.

SYNC: INT POS
HORIZ: 20 MS/cm
VERT: 2V/cm
CHAN 1: INDEX (exerciser TP)
OBSERVE: Pulse period of
 167 ± 6 MS

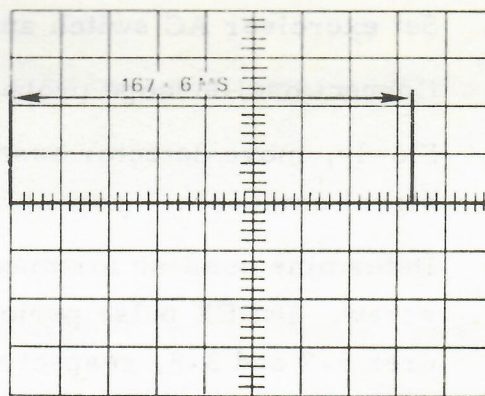


Figure 3-7. Index Pulse Period

- h. Observe that INDEX indicator comes on when INDEX pulse is detected; once per disk revolution.

- i. Set oscilloscope as follows, to monitor INDEX pulse duration, as shown in Figure 3-8.

SYNC: INT POS
HORIZ: 2 MS/cm,
0.1 MS/cm
VERT: 2V/cm
CHAN 1: INDEX (exercise
TP)
OBSERVE: Pulse duration of:
1.7 MS
(INDEX disk)
0.4 MS
(Sectored disk)

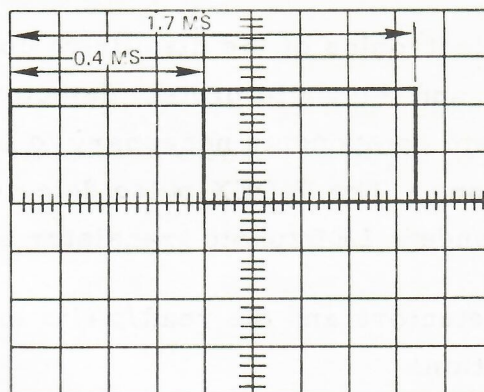


Figure 3-8. Index Pulse Duration

- j. Perform Index Pulse Detector Alignment procedure if INDEX pulse does not occur as shown in Figures 3-6 and 3-7.

Index Pulse Detector Alignment

To align the INDEX pulse detector for soft-sector (index only) applications:

- Perform Index Pulse Detector Check
- Loosen index detector mounting screw, adjacent to spindle pulley.
- Set exerciser AC switch and DRIVE MOTOR switch both to ON.
- Connect oscilloscope probe to monitor INDEX pulse at TP12 of PCB.
- Slowly, move detector assembly left then right, to both sides of maximum signal amplitude. Repeat as required.
- Determine position for maximum signal amplitude and tighten mounting screw. INDEX pulse period and duration should be as shown in Figures 3-7 and 3-8, respectively.

Index and Read Data Synchronization

To align the INDEX pulse detector for hard-sector (index and sector pulse) applications:

- Perform Index Pulse Detector Check using hard-sectored alignment flexible disk.

- b. Loosen index detector mounting screw, adjacent to spindle pulley.
- c. Set exerciser AC switch and DRIVE MOTOR switch both to ON.
- d. Set HEAD switch to ENGAGED. Observe that exerciser HEAD ENGAGE indicator and disk drive indicator both come on.
- e. Press and release spring-loaded SINGLE STEP IN switch to stop read/write head to track 00. At track 00, exerciser TRACK 0 indicator comes on. Exerciser INDEX indicator comes on at each index and sector pulse.
- f. Set oscilloscope as follows, to monitor leading edge of INDEX pulse and RAW DATA, as shown in Figure 3-9.

SYNC: INT (INDEX TP)
 HORIZ: 0.1 MS/cm
 VERT: 2V/cm
 CHAN 1: INDEX (exerciser TP)
 CHAN 2: RAW DATA (disk drive TP11)

OBSERVE: Synchronized Data

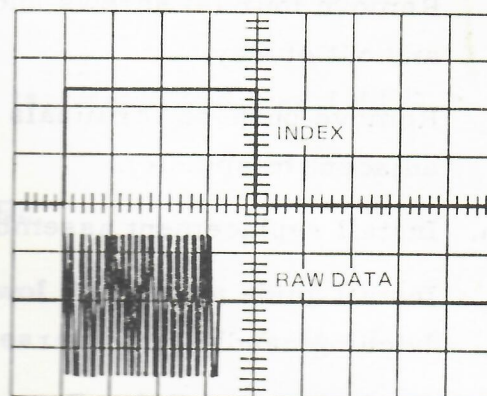


Figure 3-9. Synchronized Data

Index Pulse Detector Replacement

The index pulse detector comprises an LED and a phototransistor assembly. To replace the LED:

- a. Disconnect cables from disk drive.
- b. Remove disk drive from mounting and place on clean work surface.
- c. Remove latching handle by loosening two (2) hex socket-head screws.
- d. Carefully, remove push-on bezel from bezel mounting plate. Remove mounting plate.
- e. Raise carrier slowly and unlatch ejector pins.
- f. Lift pressure pad (head load) arm out from behind pressure pad lifter, lower arm to rest on read/write head, and open carrier fully. Do not allow carrier to fall forward.

- g. Locate LED recessed in well of guide assembly, and carefully unsolder blue and white connecting wires. Remove LED.
- h. Install replacement LED, observing diode polarity, and carefully resolder connecting wires as removed.

To replace the phototransistor assembly:

- i. Perform steps a through f.
- j. Remove index detector mounting screw and washer.
- k. Remove four (4) screws and cable clamp, and raise guide assembly up and out of way.
- l. Remove push-on terminals from phototransistor assembly (Red wire adjacent to spindle).
- m. Install replacement assembly in reverse order of removal.
- n. Install guide assembly, lower carrier assembly, and install bezel and latching handle, in reverse order.
- o. Perform Index Pulse Detector Check and Alignment procedures.

Write-Protect Detector Check

To check the write-protect detector and associated logic:

- a. Insert non write-protect flexible disk in disk drive (write-protect hole covered).
- b. Turn on ac and dc input power.
- c. With voltohmmeter, measure logical 0 voltage level (+2.4 to +5.5-volt) at WRT PROTECT/ interface connector J3 pin 44.
- d. Remove non write-protect disk and insert write-protect disk (hole open).
- e. With voltohmmeter, measure logical 1 voltage level (0.0 to +0.4-volt) at J3 pin 44; verifying write-protect circuit functions properly.

Write-Protect Detector Replacement

The write-protect detector comprises an LED and a phototransistor assembly.

To replace the LED:

- a. Disconnect cables from disk drive.
- b. Remove disk drive from mounting and place on clean work surface.
- c. Disconnect plugs P1 and P2 and remove PCB.
- d. Locate LED wires (orange and white), loosen holder ring and gently, but firmly, pull LED from snap-in holder recessed in deck assembly.
- e. Pull protective sleeves back to expose soldered terminals, unsolder wires from defective LED and solder same wire on replacement LED, one at a time.
- f. Push protective sleeves over soldered terminals and insert LED in snap-in holder in deck assembly.
- g. Install PCB and connect plugs P1 and P2.

To replace phototransistor assembly:

- h. Perform steps a and b.
- i. Remove latching handle by loosening two (2) hex socket-head screws.
- j. Carefully, remove push-on bezel from bezel mounting plate. Remove mounting plate.
- k. Raise carrier slowly and unlatch ejector pins.
- l. Lift pressure pad (head load) arm out from behind pressure pad lifter, lower arm to rest on read/write head, and open carrier fully. Do not allow carrier to fall forward.
- m. Locate photo-transistor assembly and remove push-on terminals (green wire on inside).
- n. Remove single pan-head screw and lift assembly straight up from deck assembly guide pin hole.
- o. Install replacement photo-transistor assembly in guide pin hole and tighten up against side alignment block.
- p. Lower carrier assembly, and install mounting plate, bezel, and latching handle, in reverse order of removal.
- q. Perform Write-Protect Detector Check.

Printed Circuit Board (PCB) Replacement

The PCB contains the logic circuitry for the disk drive, is easily accessible and can be removed and replaced quite readily.

To replace the PCB:

- a. Turn off all ac and dc power to disk drive.
- b. Disconnect controller cables from connector J3 (Signal), J4 (DC), and J5 (AC).
- c. Remove disk drive from mounting and place on clean work surface.
- d. Disconnect plug P1 (upper right-hand corner) and plug P2 (upper left-hand corner).
- e. Remove four (4) pan-head screws from corners of PCB up and away from deck assembly. Do not remove flat washers on standoffs.
- f. Install replacement PCB in reverse order.
- g. Install disk drive.

SECTION 4

ILLUSTRATED PARTS BREAKDOWN

GENERAL

This section provides an illustrated parts breakdown of all assemblies and parts in the GSI-110 Flexible Disk Drive. The entire unit is sequentially listed in one continuous indentured breakdown, with all attaching hardware.

Figures 4-1 through 4-6 illustrate all assemblies and their parts. Parts identified by item number correspond to item numbers in the parts list. Figure 4-7 illustrates the PCB assembly and all parts are identified by reference designator.

PURPOSE

The purpose of this section is to provide a complete listing of all items of the disk drive, in assembly breakdown order, to aid maintenance personnel. The illustrations and parts list are related for use in identification, requisitioning, storing, and issuing of replacement parts.

INDENTURED PARTS LIST

The parts list provides an indentured listing of all parts of the disk drive, in an assembly breakdown order, with attaching parts. For all assemblies, except the PCB, the list is divided into five columns of information:

- | | | |
|----------|---------------|---------------|
| ● Item | ● Description | ● Part Number |
| ● Indent | | ● Quantity |

Item Number	The number assigned to a line item part. All numbers are sequential, starting from the number 1. Major assemblies and parts are called out on illustrations, except for the PCB.
-------------	--

Indent	A number assigned for the assembly order of breakdown and subordinate piece parts. All indentured numbers show relationship to next higher assembly. The PCB parts list does not have Indent numbers.
--------	---

Description	This column is prepared to graphically indicate the indenture and fully describe the item. This description should be included when ordering. The PCB description column is not indentured.
Part Number	The manufacturers part number of the item. This number must be included when ordering.
Quantity	The quantity used per assembly.
Ref Desig	The reference designator column is used in the PCB parts list only. This column lists the reference designator of all identical parts having the same part number and description. The parts are listed in alpha-numeric order. All option parts are listed by option.

ORDERING PARTS

Parts will be supplied by General Systems International, Inc., upon receipt of an order specifying the part number and description as listed in this section.

ACCESSORIES

The following accessories are available for use with the GSI-110 Flexible Disk Drive:

215100	Model 100 Disk Drive Exerciser
205004	Track 0 Alignment Tool
205033	Track 36 Alignment Tool

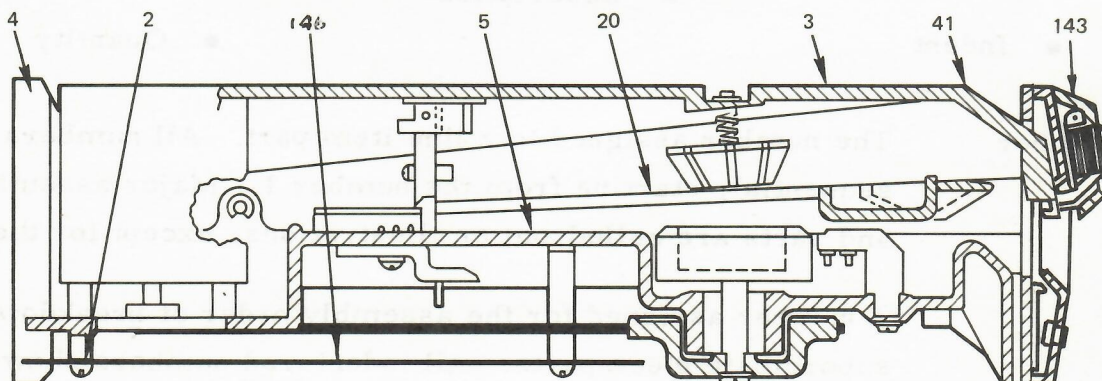


Figure 4-1. GSI-110 Flexible Disk Drive, Cutaway Side View

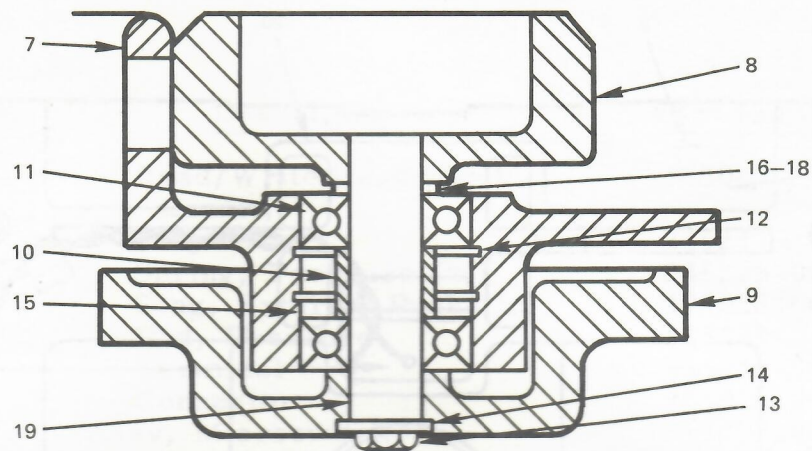


Figure 4-2. Deck/Spindle Assy, 215134

Item	Indent	Description	Part Number	Quantity		
				0	0	0
1	1	Assy, Final (Figure 4-1)	205037-XXX	0	0	0
2	2	Screw, Binder Hd (6-32 x 3/16)	345000-303	4	4	4
3	2	Label, GSI, Identification	245357	1	1	1
4	2	Assy, Deck	205040-XXX			
5	3	Assy, Chassis	215141-XXX			
6	4	Assy, Deck/Spindle (Figure 4-2)	215134-001	1	-	-
6	4	Assy, Deck/Spindle	215134-002	-	1	-
7	5	Deck, Machined	245328-001	1	-	-
7	5	Deck, Machined	245328-002	-	1	-
8	5	Spindle, Machined	245330	1	1	-
9	5	Pulley, Spindle	245327-XXX	1	1	
10	5	Spacer, Bearing	245304-006	1	1	
11	5	Bearing, Radial	445000-001	2	2	
12	5	Retainer, Ring	375022-015	2	2	
13	5	Screw, Hex Head	345004-503	1	1	
14	5	Washer, Flat	375003-500	1	1	
15	5	Washer, Wave Spring	375018-014	3	3	
16	5	Shim, Spacer	245246-001		AR	
17	5	Shim, Spacer	245246-002		AR	
18	5	Shim, Spacer	245246-003		AR	
19	5	Shaft, Spindle	245331-	1	1	
20	4	Assy, Diskette Guide	215113-001	1	1	
21	5	Microswitch	485001	1	1	
22	5	Plate, Nut	245247	1	1	
23	5	Diode, Light Emitting	335004	1	1	
24	5	Guide, Diskette	245014	1	1	
25	5	Screw, Soc. Hd. Cap.	345001-109	2	2	
26	5	Washer, Flat	375003-100	2	2	
27	4	Assy, Carriage	215138-001	1	1	
28	5	Carriage	245226-002	1	1	
29	5	Arm, Pressure Pad	245032-	1	1	

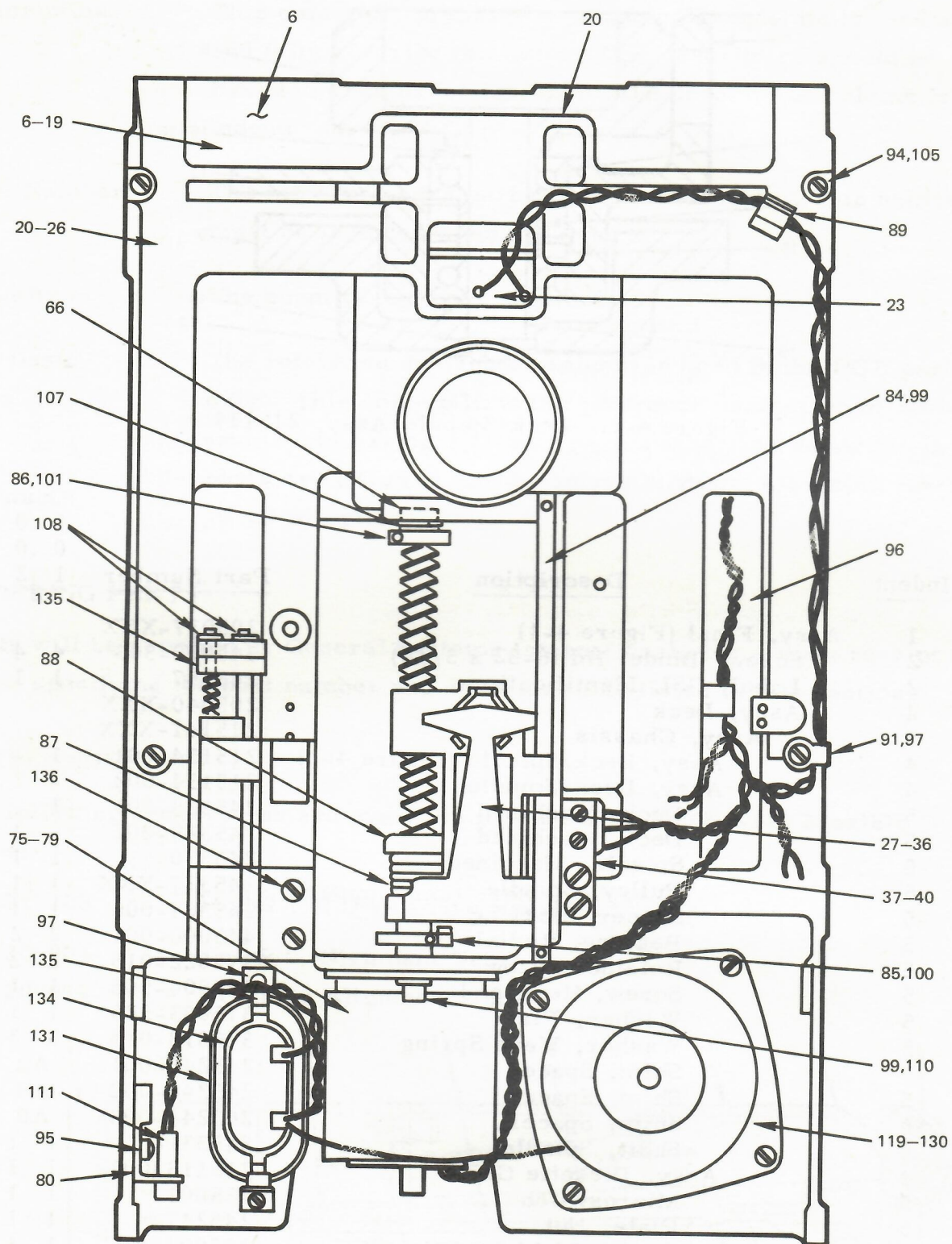


Figure 4-3. Chassis Assy, 215141, Top View
(Carrier Assy Removed for Clarity)

Item	Indent	Description	Part Number	Quantity		
				0	0	0
				0	0	0
				1	2	3
30	5	Read/Write Head (Double-Density	105047-	1	1	
31	5	Pin, Pivot	245217	1	1	
32	5	Spring, Pressure Pad	245218-001	1	1	
33	5	Ring, External Push-On	375028-003	2	2	
34	5	Pad, Pressure	245033-	1	1	
35	5	Terminal	355046-001	4	4	
36	5	Connector	325018-001	1	1	
37	4	Assy, Microswitch	215095-001	1	1	
38	5	Microswitch	485001-	1	1	
39	5	Bracket, Switch Mtg.	245081-	1	1	
40	5	Screw, Binder Hd.	345000-106	2	2	
41	4	Assy, Carrier (Figure 4-6)	215124-001	1	-	
41	4	Assy, Carrier	215124-002	-	1	
42	5	Carrier, Molded	245191-001	1	-	
42	5	Carrier, Molded	245191-002	-	1	
43	5	Clamp, Cable	355027-006	1	1	
44	5	Label, Warning	245035-	1	1	
45A	5	Spring, Compression	245021-002	1	1	
45B	5	Spring, Compression	245021-003	1	1	
46	5	Shaft, Cone	245233-	1	1	
47	5	Follower, Cone	245020-	1	1	
48	5	Cone, Thrust	245018-	1	1	
49	5	Assy, Trip, Ejector	215112-	1	1	
50	6	Arm, Stop	245192-	1	1	
51	6	Block, Pivot	245180-	1	1	
52	6	Trip, Ejector	245153-	1	1	
53	6	Pin, Pivot	245158-002	1	1	
54	6	Spring, Compression	245021-007	1	1	
55	6	Washer, Beryllium Copper	375023-021	1	1	
56	5	Assy, Head Engage	215108-	1	1	
57	6	Lifter, Pressure Pad	245194-	1	1	
58	6	Relay, 24 VDC	465000-	1	1	
59	6	Bracket, Relay Mtg.	245181-	1	1	
60	6	Spring, Extension	375025-030	1	1	
61	6	Foam, Pressure Pad	245056	1	1	
62	6	Connector, Crimp Type (Female)	325000-003	1	1	
63	6	Terminal, Crimp Type	355002-003	1	1	
64	6	Key, Connector	355001	1	1	
65	5	Ring, "E" Retaining	375001-004	3	3	
66	5	Bearing, Flanged Ball	445001-001	1	1	
67	5	Washer, Shim	245011-001	1	1	
68	5	Washer, Nylon	245022-002	1	1	
69	5	Screw, Binder Hd (6-32 x 1/4)	345000-304	2	2	
70	5	Screw, Binder Hd (4-40 x 5/8)	345000-210	2	2	
71	5	Nut, Locking (4-40)	370001-004	2	2	
72	4	Assy, Photo Transistor (Index)	215005-001	1	1	
73	5	Holder, Transistor	245026-	1	1	

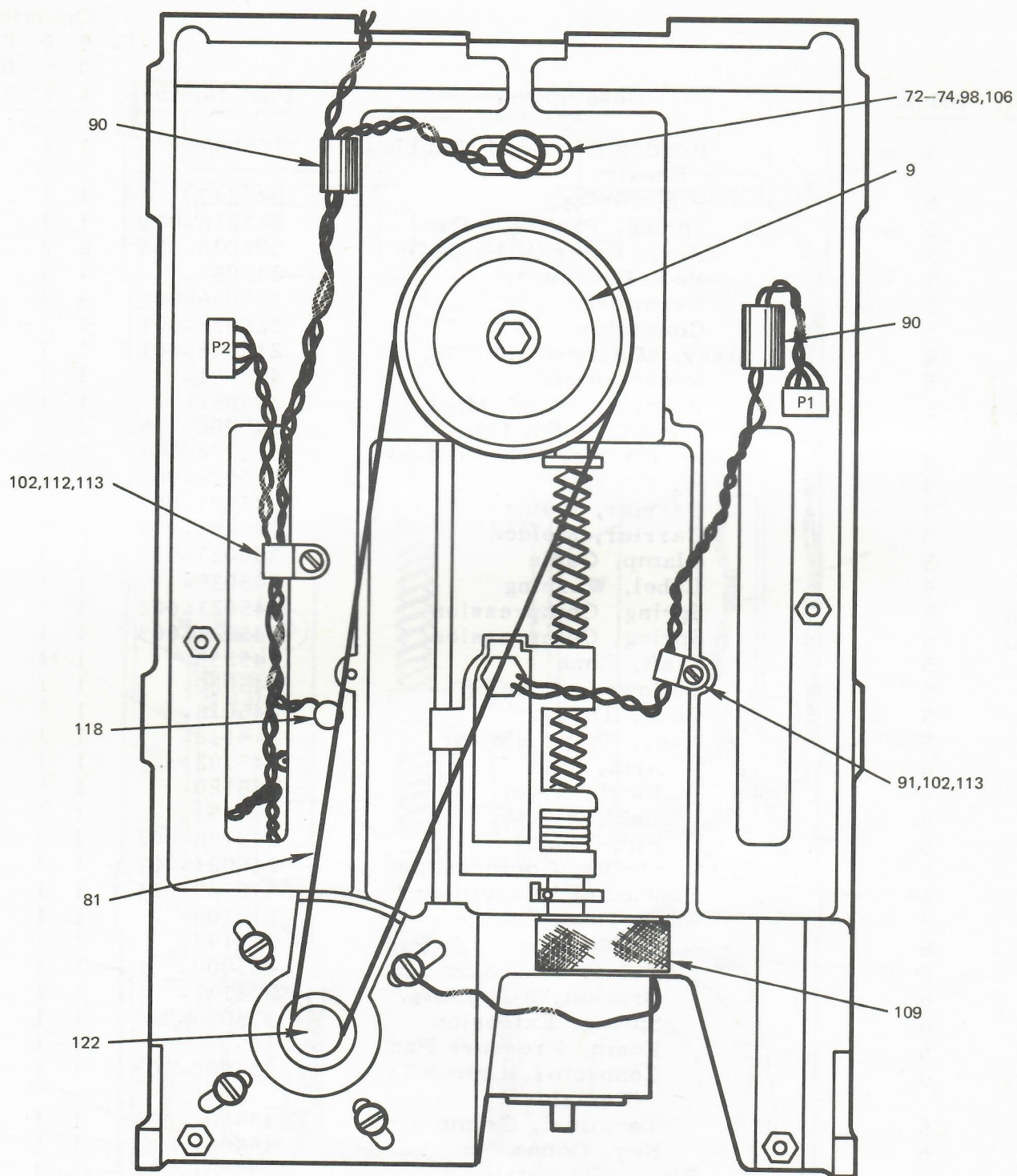


Figure 4-4. Chassis Assy, 215141, Bottom View
(PCB Assy Removed for Clarity)

Item	Indent	Description	Part Number	Quantity		
				0	0	0
				0	0	0
				1	2	3
74	5	Transistor, Photo	505000-	1	1	
75	4	Assy, Stepper Motor	215111-001	1	1	
76	5	Motor, Stepper	405004-	1	1	
77	5	Connector, Female	325000-008	1	1	
78	5	Terminal, Crimp	355002-003	4	4	
79	5	Key, Connector	355001	1	1	
80	4	Bracket, Connector	245333-001	1	1	
81	4	Belt, Spindle Drive	545000-001	1	1	
82	4	Shaft, Carrier Mtg	245061-001	2	2	
83	4	Bearing, Flanged	445001-001	1	1	
84	4	Rod, Guide	245012-001	1	1	
85	4	Stop, Outer	245009-001	1	1	
86	4	Stop, Inner	245008-001	1	1	
87	4	Spring, Compression	245021-005	1	1	
88	4	Nut, Preload	245010-002	1	1	
89	4	Clamp, Cable, Adhesive	355027-006	1	1	
90	4	Clamp, Cable, Adhesive	355027-012	2	2	
91	4	Clamp, Cable, Nylon	355004-001	2	2	
92	4	Standoff, 3/8 Hex, M-F	375043-222	2	2	
93	4	Standoff, 3/8 Hex, M-F	375043-204	2	2	
94	4	Screw, Fillister Hd (4-40 x 7/8)	345028-214	2	2	
95	4	Screw, Binder Hd (4-40 x 3/16)	345000-203	2	2	
96	4	Assy, Harness	210113-001	1	1	
97	4	Screw, Binder Hd (4-40 x 1/2)	345000-208	4	4	
98	4	Screw, Binder Hd (8-32 x 1/2)	345000-408	1	1	
99	4	Screw, Hex Soc. Hd. (4-40 x 1/2)	345001-208	5	5	
100	4	Screw, Hex Soc, Hd. (4-40 x 5/8)	345001-210	1	1	
101	4	Screw, Hex Soc. Hd. (2-56 x 1/4)	345001-104	1	1	
102	4	Screw, Binder Hd (6-32 x 1/4)	345000-304	2	2	
103	4	Washer, Internal Tooth (#4)	375024-201	2	2	
104	4	Washer, Flat, Light (#6)	375040-300	4	4	
105	4	Washer, S/Lock (#4)	375002-200	2	2	
106	4	Washer, Flat (#10)	375003-500	1	1	
107	4	Washer, Shim	245011-001	3	3	
108	4	Ring, "E" Retaining	375001-004	4	4	
109	4	Cushion, Rubber, Adhesive (1/8 x 1 1/2)	425004-001	1	1	
110	4	Cleat, Motor Mtg	375032-005	3	3	
111	4	Connector, J5	325014-001	1	1	
112	4	Clamp, Cable, Nylon	355004-004	1	1	
113	4	Washer, Flat (#6)	375003-300	2	2	
114	3	Pkg, Write Protect Option	295001-001			
115	4	Transistor, Photo	505000	1		
116	4	Holder, Transistor	245326-001	1		
117	4	Screw, Binder Hd (6-32 x 3/8)	345000-306	1		
118	4	Diode, Light Emitting	335012	1		
119	3	Pkg, A. C. Option	215142-001	1	-	-
119	3	Pkg, A. C. Option	215142-002	-	1	-

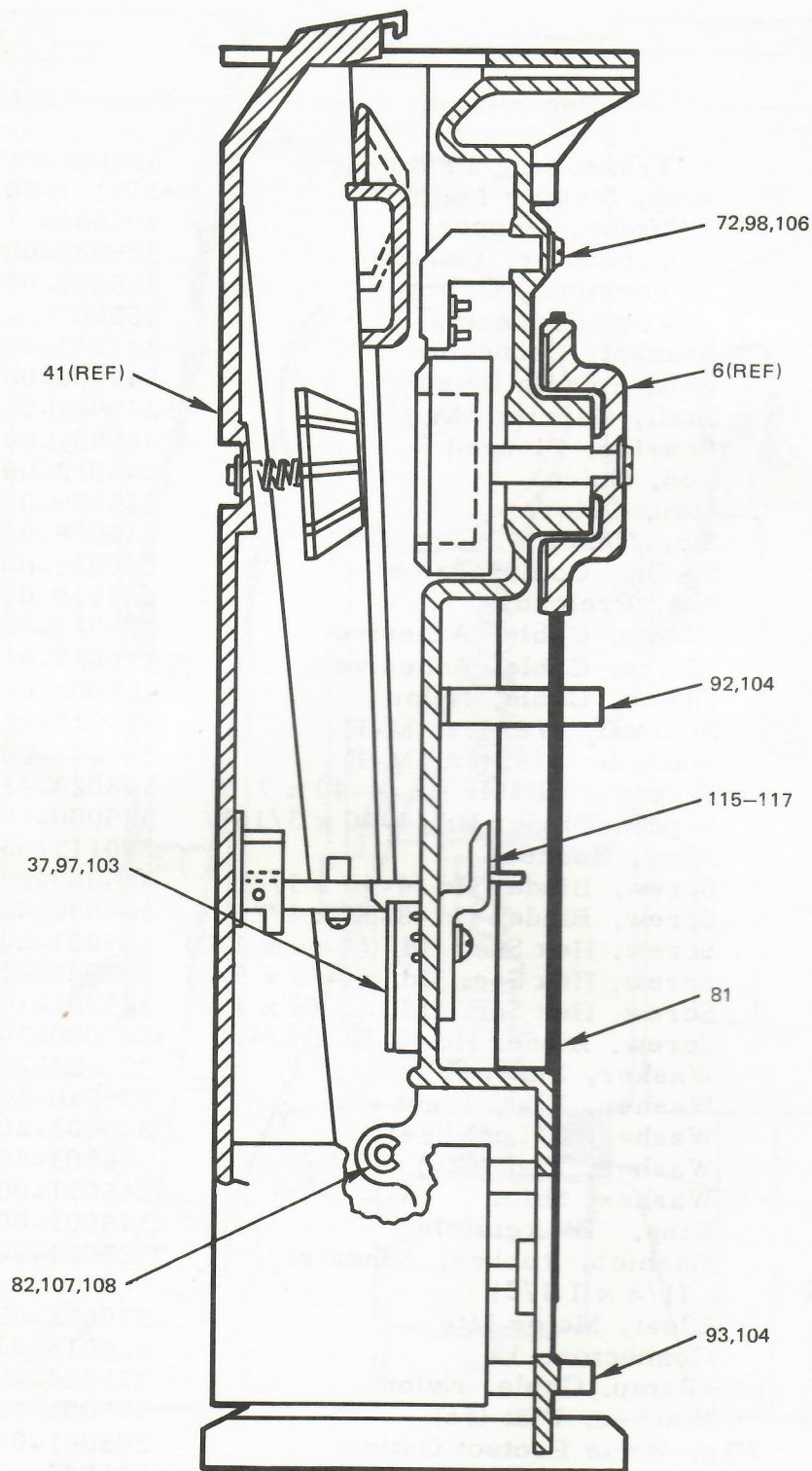


Figure 4-5. Chassis Assy, 215141, Side View
(Cutaway View for Clarity)

Item	Indent	Description	Part Number	Quantity		
				0	0	0
				0	0	0
				1	2	3
119	3	Pkg, A. C. Option	215142-003	-	-	1
120	4	Assy, Spindle Motor (115 V, 60 Hz)	215135-001	1	-	-
120	4	Assy, Spindle Motor (230 V, 50 Hz)	215135-002	-	1	-
120	4	Assy, Spindle Motor (115 V, 50 Hz)	215135-003	-	-	1
121	5	Motor, Spindle (115 V, 60 Hz)	405011	1	-	-
121	5	Motor, Spindle (230 V, 50 Hz)	405012	-	1	-
121	5	Motor, Spindle (115 V, 50 Hz)	405011	-	-	1
122	5	Pulley, Motor (115 V, 60 Hz)	245334-001	1	-	-
122	5	Pulley, Motor (230 V, 50 Hz)	245334-002	-	1	-
122	5	Pulley, Motor (115 V, 50 Hz)	245334-002	-	-	1
123	5	Screw, Hex Soc Set (10-32 x 5/16)	345010-505	1	1	1
124	5	Terminal, Crimp	355040-001	3	3	3
125	5	Terminal, Ring, Tongue	355013-010	1	1	1
126	5	Terminal, Quick Disconnect	325042	2	2	2
127	5	Standoff	375034-002	4	4	4
128	5	Screw, Binder Hd (8-32 x 1.0)	345000-416	4	4	4
129	5	Washer, Flat (#8)	375003-400	3	3	3
130	5	Washer, Star (#8)	375024-104	1	1	1
131	4	Capacitor, AC, Oil-Filled (115 V, 5 UF)	305017-004	1	-	1
131	4	Capacitor, AC, Oil-Filled (230 V, 2 UF)	305017-001	-	1	-
132	4	Terminal, Quick-Disconnect	355014-001	1	1	1
133	4	Terminal, Quick-Disconnect	325042	2	2	2
134	4	Boot, Terminal, Protective	355028	1	1	1
135	4	Bracket, Capacitor Mtg	355025-002	2	-	2
135	4	Bracket, Capacitor Mtg	355025-004	-	2	-
136	4	Screw, Binder Hd (6-32 x 1/2)	345000-308	2	2	2
137	3	Assy, Ejector	245094-001	1	-	-
137	3	Assy, Ejector	245094-002	-	1	1
138	4	Screw, Binder Hd (4-40 x 3/8)	345000-206	2	2	2
139	4	Screw, Binder Hd (8-32 x 3/8)	345000-406	-	2	-
140	4	Screw, Flat Hd Soc (8-32 x 3/8)	345003-406	-	2	-
141	4	Spring, Carrier	375045-001	-	1	-
142	4	Guide, Spring	245341-001	-	4	-
143	2	Assy, Bezel, Decorative	215140-XXX	1	1	1
144	3	Diode, Light Emitting	335009	1	1	1
145	3	Assy, Handle	215110	1	1	1
146	2	Assy, Printed Circuit Board	265029-XXX	1	1	1

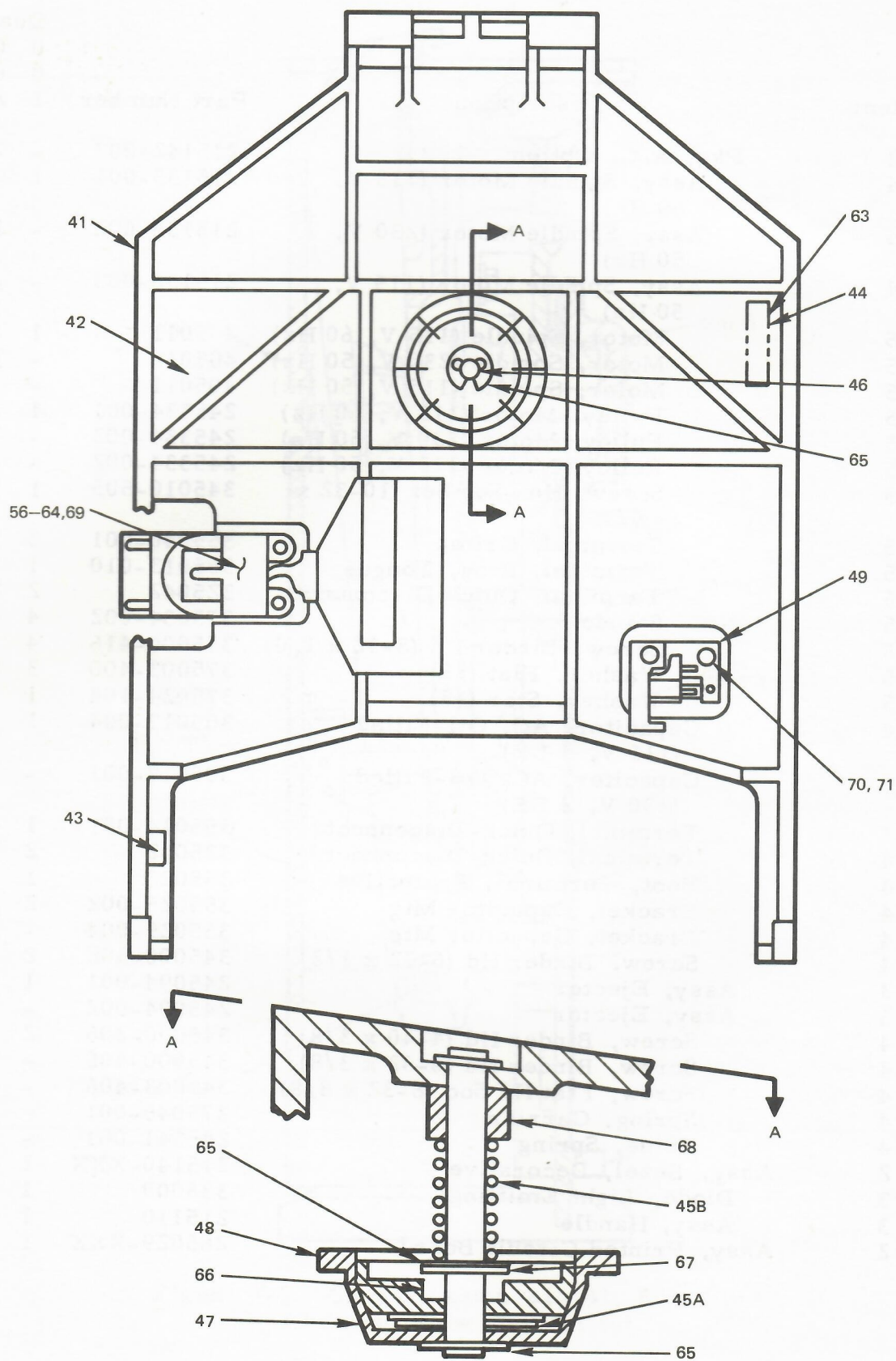


Figure 4-6. Carrier Assy, 215124, Bottom View

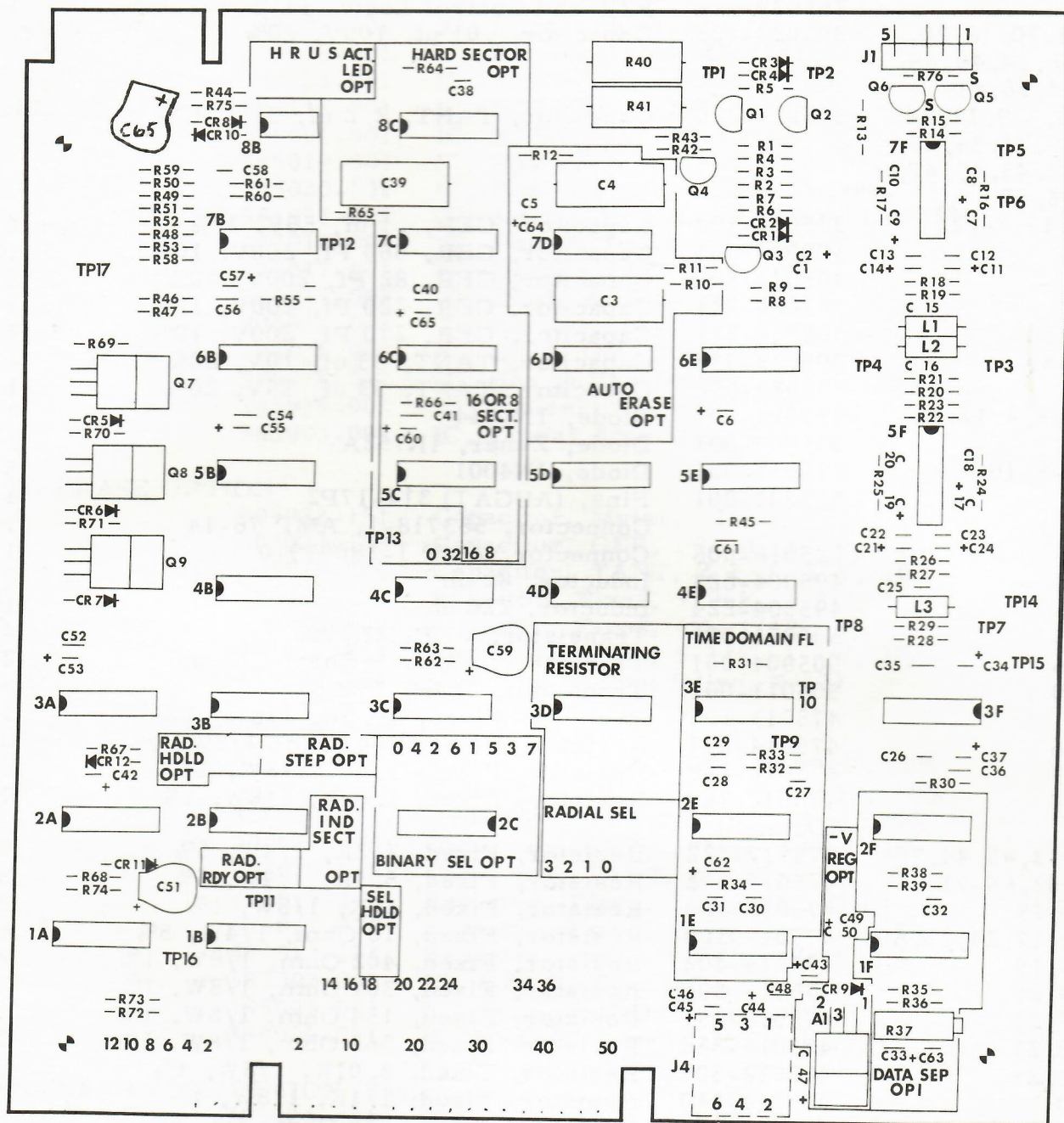


Figure 4-7. Printed Circuit Board Assy, 265029

Ref Desig	Part Number	Description	Quantity
	265029-xxx	R/W and Control Logic, PCB	1
C1, 8, 10, 18, 20, 35, 36, 44, 46, 48, 52, 54, 56, 61	305028-103	Capacitor, .01 uf, 100V, 20%	14
C2, 6, 7, 9, 11, 14 17, 19, 21, 24, 34, 37, 42, 43, 45, 47, 53, 55, 57	305029-225	Capacitor, TANT, 2.2 uf, 35V, 10%	19
C12, 13, 22, 23	305024-104	Capacitor, CER, .1 uf, 50V, 10%	4
C15	305024-561	Capacitor, CER, 560 Pf, 200V, 10%	1
C16	305024-820	Capacitor, CER, 82 Pf, 200V, 10%	1
C25	305024-221	Capacitor, CER, 220 Pf, 200V, 10%	1
C26, 58	305024-271	Capacitor, CER, 270 Pf, 200V, 10%	2
C51, 59	305033-336	Capacitor, TANT, 33 uf, 10V, 20%	2
C66	305029-336	Capacitor, TANT, 33 uf, 35V, 20%	1
CR1, 3, 4, 11, 12	335010-001	Diode, 1N4444	5
CR2	335000-001	Diode, Zener, 1N752A	1
CR5-8, 10	335011-001	Diode, 1N4001	5
J1	365001-001	Pins, (AUGAT) 314-17P2	4
J2		Connector, 583718-1, AMP 76-14	1
J4	325016-006	Connector, AMP 1-380999-0	1
L1, 2	495004-823	Inductor, 82 uh	2
L3	495004-224	Inductor, 220 uh	1
Q1-4	505001-001	Transistor, PNP, 2N3906	4
Q5, 6	505004-001	Transistor, FET, P Chan, 2N5460	2
Q7-9	505011-001	Transistor, PNP, TIP 32	3
R1	475013-105	Resistor, Fixed, 10.5K, 1/8W, 1%	1
R2, 6	475014-274	Resistor, Fixed, 274 Ohm, 1/8W, 1%	2
R3, 7	475012-140	Resistor, Fixed, 1.4K, 1/8W, 1%	2
R4	475012-169	Resistor, Fixed, 1.69K, 1/8W, 1%	1
R5	(Deleted)		
R8, 13, 43, 44, 75	475017-222	Resistor, Fixed, 2.2K, 1/4W, 5%	5
R9, 42, 69-71	475017-512	Resistor, Fixed, 5.1K, 1/4W, 5%	5
R14, 15	475013-100	Resistor, Fixed, 10K, 1/8W, 1%	2
R16, 17, 24, 25, 55	475017-100	Resistor, Fixed, 10 Ohm, 1/4W, 5%	5
R18, 19	475016-402	Resistor, Fixed, 402 Ohm, 1/8W, 1%	2
R20, 21	475016-301	Resistor, Fixed, 301 Ohm, 1/8W, 1%	2
R22, 23	475016-154	Resistor, Fixed, 154 Ohm, 1/8W, 1%	2
R26, 27	475016-365	Resistor, Fixed, 365 Ohm, 1/8W, 1%	2
R28, 29	475012-301	Resistor, Fixed, 3.01K, 1/8W, 1%	2
R30	475012-110	Resistor, Fixed, 1.1K, 1/8W, 1%	1
R40	475004-561	Resistor, Fixed, 560 Ohm, 2W, 5%	1
R41	475004-621	Resistor, Fixed, 620 Ohm, 2W, 5%	1
R45, 52, 58, 72-74	475017-102	Resistor, Fixed, 1K, 1/4W, 5%	6
R46, 47	475017-101	Resistor, Fixed, 100 Ohm, 1/4W, 5%	2
R48, 53, 59, 67, 68	475017-973	Resistor, Fixed, 47K, 1/4W, 5%	5
R49, 50, 60	475013-226	Resistor, Fixed, 22.6K, 1/8W, 1%	3
R51	475017-104	Resistor, Fixed, 100K, 1/4W, 5%	1
R61	475012-442	Resistor, Fixed, 4.42K, 1/8W, 1%	1
R62	475017-103	Resistor, Fixed, 10K, 1/4W, 5%	1
R63	475017-153	Resistor, Fixed, 15K, 1/2W, 5%	1
R76	475012-487	Resistor, Fixed, 4.87K, 1.8W, 1%	1

Ref Desig	Part Number	Description	Quantity
1A, 3A, 5E	385006-001	IC, Edge-Triggered F/F, 7474	3
2A	385008-001	IC, Retriggerable MV, 74123	1
1B, 2B	385023-001	IC, NAND Gate, Buffer, 7438	2
3B, 5D, 4E	385113-001	IC, NOR Gate, 7402	3
4B	385001-001	IC, NAND Gate, 7400	1
5B	385019-001	IC, Pos AND Gate, 7411	1
6B	385020-001	IC, Hex Inverter, Buffer/Driver, 7406	1
7B	385032-001	IC, Linear Amp, Quad Comp, LM 339	1
8B	385014-001	IC, Pos OR Driver, 75453	1
3C	835017-001	IC, Quad, Ex OR Gate, 7486	1
4C	385015-001	IC, Quad, AND Gates, 7408	1
3D	475018-001	Terminator, 14-Sect 898-5	1
4D	385016-001	IC, Quad, OR Gates, 7432	1
6E	385018-001	IC, Hex Buffer/Driver, 7407	1
3F	385026-001	IC, Bidirect OS, 8T20	1
5F, 7F	385003-001	IC, Linear Amp/Diff, 733	2
AUTO ERASE OPTION			
C3, 4	305032-151	Capacitor, Mylar, .15 uf, 100V, 5%	2
C5	305028-103	Capacitor, CER, .01 uf, 100V, 20%	1
C64	305029-225	Capacitor, TANT, 2.2 uf, 35V, 10%	1
R10	475012-196	Resistor, Fixed, 1.96K, 1/8W, 1%	1
R11	475017-102	Resistor, Fixed, 1K, 1/4W, 5%	1
R12	475012-511	Resistor, Fixed, 5.11K, 1/8W, 1%	1
6D, 7D	385002-001	IC, J or N, Dual Inline, 74121	2
TIME DOMAIN FILTER OPTION			
C27	305024-102	Capacitor, CER, .001 uf, 100V, 10%	1
C28, 29	305024-222	Capacitor, CER, 2200 Pf, 100V, 10%	2
C30	305024-151	Capacitor, CER, 150 Pf, 100V, 10%	1
C31	305028-103	Capacitor, CER, .01 uf, 100V, 20%	1
C62	305029-225	Capacitor, TANT, 2.2 uf, 35V, 10%	1
R31	475017-102	Resistor, Fixed, 1K, 1/4W, 5%	1
R32, 33	475017-470	Resistor, Fixed, 47 Ohm, 1/4W, 5%	2
R34	475012-187	Resistor, Fixed, 1.87K, 1/8W, 1%	1
1E	385002-001	IC, J or D, Dual Inline, 74121	1
2E	385001-001	IC, Quad, NAND Gates, 7400	1
3E	385006-001	IC, Dual D, Edge-Trig. F/F 7474	1
DATA SEPARATOR OPTION (FM)			
C32	305024-221	Capacitor, CER, 220 Pf, 100V, 10%	1
C33	305028-103	Capacitor, CER, .01 uf, 100V, 20%	1
C63	305029-225	Capacitor, TANT, 2.2 uf, 35V, 10%	1
R35, 38, 39	475017-102	Resistor, Fixed, 1K, 1.4W, 5%	3
R36	475013-100	Resistor, Fixed, 10K, 1/8W, 1%	1
R37	475010-253	Resistor, Variable, 25K	1
1F	385002-001	IC, J or N, Dual Inline, 74121	1
2F	385023-001	IC, Quad, NAND Buffer, 7438	1

Ref Desig	Part Number	Description	Quantity
HARD SECTOR OPTION			
C38	305024-104	Capacitor, CER, .1 uf, 100V, 10%	1
C39	305032-151	Capacitor, Mylar, 15 uf, 100V, 5%	1
C40, 41	305028-103	Capacitor, CER, .01 uf, 100V, 20%	2
C60, 65	305029-225	Capacitor, TANT, 2.2 uf, 35V, 10%	2
R64	475012-590	Resistor, Fixed, 5.9K, 1.8W, 1%	1
R65	475013-348	Resistor, Fixed, 34.8K, 1/8W, 1%	1
R66	475017-102	Resistor, Fixed, 1K, 1/4W, 5%	1
5C	385006-001	IC, Dual D, Edge-Trig F/F, 7474	1
6C	385001-001	IC, Quad, NAND Gates, 7400	1
7C, 8C	385002-001	IC, J or N, Dual Inline, 74121	2
-5V REGULATOR OPTION			
A1	385114-001	Voltage Reg., MC7905C	1
C49	305028-103	Capacitor, CER, .01 uf, 100V, 20%	1
C50	305029-225	Capacitor, TANT, 2.2 uf, 35V, 10%	1
CR9	335011-001	Diode, 1N4001	1
BINARY SELECT OPTION			
2C	385073-001	IC, Decoder, 4-10 Line, 7442	1

Note

Refer to Table 1-2 in Volume 1, for all options.

SECTION 5

DIAGRAMS

GENERAL

This section contains the logic diagram of the GSI-110 Flexible Disk Drive to aid maintenance personnel.

<u>Diagram Number</u>	<u>Title</u>
125038-001	Read, Write and Control Logic