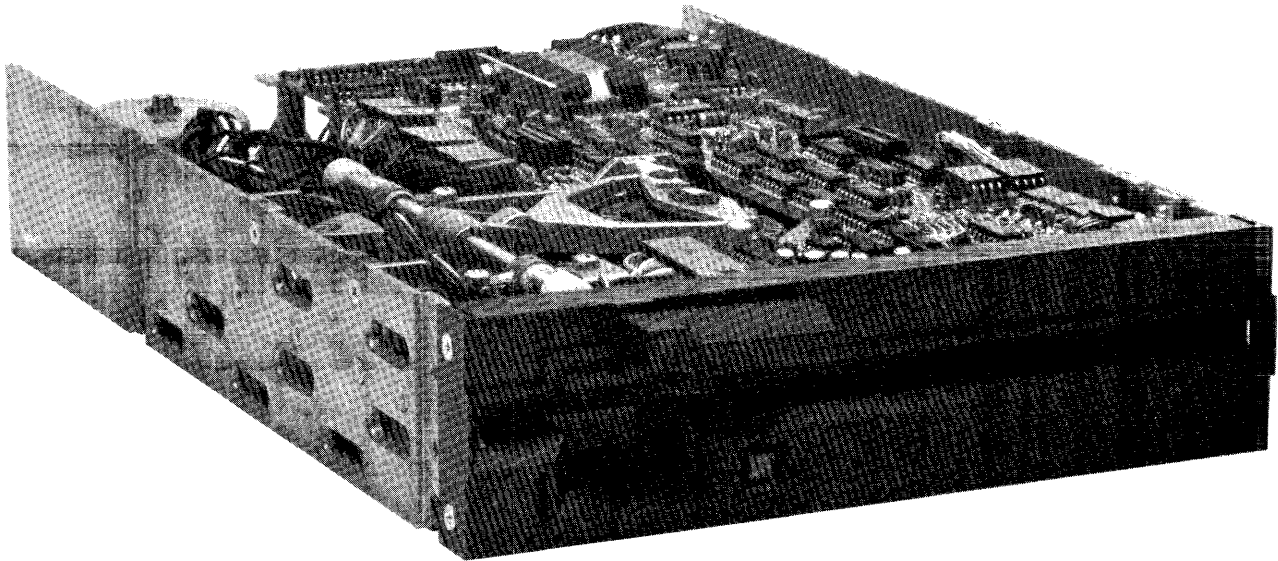


**OEM
OPERATING AND SERVICE MANUAL
TM848-1 AND TM848-2 DISK DRIVES
48 TRACKS PER INCH**



Tandon CORPORATION

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SECTION I

INTRODUCTION TO THE TM848 FAMILY OF DISK DRIVES

1. INTRODUCTION

This section contains a description of the physical and functional specifications for the TM848-1 and -2 disk drives, 48 tracks per inch (TPI), manufactured by Tandon Corporation.

1.1 PURPOSE OF THE DRIVE

The drive is an eight-inch disk memory designed for random access data entry, storage, and retrieval applications. These applications typically are intelligent terminal controllers, microcomputers, word processing systems, data communications systems, error logging, microprogram loading, point-of-sale terminals, and Winchester back ups.

The drive is capable of recording and reading digital data, using FM, and MFM.

1.2 PHYSICAL DESCRIPTION OF THE DRIVE

The drive can be mounted in any vertical or horizontal plane. However, when mounted horizontally, the printed circuit board must be up.

The spindle is belt driven by a brushless D.C. motor with an integral tachometer. The servo control circuit, suitably sized pulleys, and the tachometer control the speed of the spindle. The Read/Write, double-sided head assembly is positioned by means of a stepper motor, split band, and a pulley.

The Read/Write/Erase head assembly is a glass-bonded manganese/zinc ceramic structure. It has a life in excess of 20,000 hours.

For diskette loading, operator access is provide via a slot located on the front of the drive.

The electronic components of the drive are mounted on a circuit board assembly located in the chassis. Power and interface signals are routed through connectors that plug into the back of the drive.

1.3 FUNCTIONAL DESCRIPTION OF THE DRIVE

The drive is fully self-contained. It requires no operator intervention during normal operation. The drive consists of a spindle drive system, a head positioning system, and a read/write/erase system.

The TM848-1 is a single-sided drive. The TM848-2 is a double-sided drive. The only difference between the two drives is the number of heads. The circuit board is identical in both models.

When the diskette lever is opened, access is provided for the insertion of a diskette. The diskette is accurately positioned by plastic guides. The disk position is ensured by the backstop and disk ejector.

Closing the diskette lever activates the cone/clamp system, resulting in centering of the diskette and clamping of the diskette to the drive hub. The drive hub is driven at a constant speed of 360 RPM by a servo-controlled brushless D. C. motor. The head is loaded into contact with the recording medium whenever the diskette lever is latched.

The head is positioned over the desired track by means of a stepper motor/band assembly and its associated electronics. This positioner employs a 3.6 degree rotation to cause a one-track linear movement. When a write-protected diskette is inserted into the drive, the Write Protect sensor disables the write electronics of the drive, and a Write Protect status output signal is available to the interface.

When performing a write operation, a 0.013-inch wide (nominal) data track is recorded. This track is then tunnel erased to 0.012 inch (nominal).

Data recovery electronics include a low-level head amplifier, a differentiator, a zero crossing detector, and digitizing circuits.

No data-clock separation is provided.

In addition, the drive is supplied with the following sensor systems:

1. A track 00 sensor that senses when the Head Carriage Assembly is positioned at Track 00.
2. The two index sensors, each of which consists of a L.E.D. light source and a phototransistor, are positioned so that a signal is generated when an index hole is detected. The drive can determine whether a single- or double-sided diskette is installed. This output signal is present at the interface.
3. The Write Protect sensor disables the drive's write electronics whenever a write-enable tab is removed from the diskette (see Section 1.12).

1.4 DISKETTES

The drive uses a standard eight-inch diskette. Diskettes are available with a single index hole or with index and sector holes. They also are available double- or single-sided.

Single index hole diskettes are used when sector information is pre-recorded on the diskette (soft sectoring). Multiple index hole diskettes provide sector pulses by means of the index sensor and electronics (hard sectoring).

1.5 MECHANICAL AND ELECTRICAL SPECIFICATIONS

The mechanical and electrical specifications of the drive are listed in Table 1-1.

1.6 POWER REQUIREMENTS

The power requirements of the drive are listed in Table 1-2.

1.7 INTERFACE CIRCUIT SPECIFICATIONS

The interface circuits are designed so that a disconnected wire results in a false signal.

Levels:

True = +0.4 V, maximum

False = +2.4 V, minimum

1.8 INCOMING INSPECTION CHECKS AND PROCEDURES

There are two kinds of recommended incoming inspection checks and procedures: static and dynamic ones.

The static incoming inspection checks include the minimum steps that should be taken to ensure that the drive is operational when received.

TABLE 1-1

MECHANICAL AND ELECTRICAL SPECIFICATIONS

MECHANICAL

Height: 2.30 inches	Length: 13.125 inches behind front panel
Width: 8 inches	Weight: 5.5 pounds

ELECTRICAL

+ 5 V D. C. Power:	+5 volts \pm 5 percent, 0.75 amp typical
+24 V D. C. Power:	+24 volts \pm 10 percent
Selected Motor On:	0.75 amp typical
Deselected:	0.20 amp typical
Spindle Motor:	0.40 amp typical
Start Current Surge:	2.5 amps, 400 msec on, 24 volts total

ENVIRONMENTAL

Operating Temperature:	4.4°C to 46°C (40°F to 115°F)
Storage Temperature:	-40°C to 71°C (-40°F to 160°F)
Wet Bulb Temperature:	26°C (78°F) maximum
Noncondensing Operating Humidity:	20-to-80 percent

RELIABILITY

MTBF:	10,000 power-on hours
MTRR:	30 minutes
Error Rates:	
Soft Read:	1 in 10 ⁹ bits
Hard Read:	1 in 10 ¹² bits
Seek Errors:	1 in 10 ⁶ seeks

PERFORMANCE

Head Wear Guarantee:	15,000 media hours
Number of Tracks:	77 for TM848-1; 154 for TM848-2, 77 per surface
Track-To-Track Access Time:	3 milliseconds
Head Settling Time:	15 milliseconds
Average Access Time, including head settling time:	91 milliseconds
Motor Start Time:	700 milliseconds
Disk Rotational Speed:	360 RPM
Instantaneous Speed Variation:	\pm 1.0 percent
Flux Changes Per Inch, Inside Track:	6536 FCI, Side 0, both models; 6818 FCI, Side 1, TM848-2 only
Transfer Rates:	250K BPS single density, 500K BPS double density
Unformatted Recording Capacity:	0.8 MBytes per disk, single density, double-sided drive 1.6 MBytes per disk, double density, double-sided drive
IBM Format Recording Capacity:	0.6 MBytes, single density, double-sided drive 1.2 MBytes, double density, double-sided drive
Recording Method:	FM single density, MFM double density

TABLE 1-2
POWER REQUIREMENTS

1. +5 Volts: 0.70 Amps typical

2. +24 Volts: After motor start interval

Spindle Motor 0.35 Amps typical

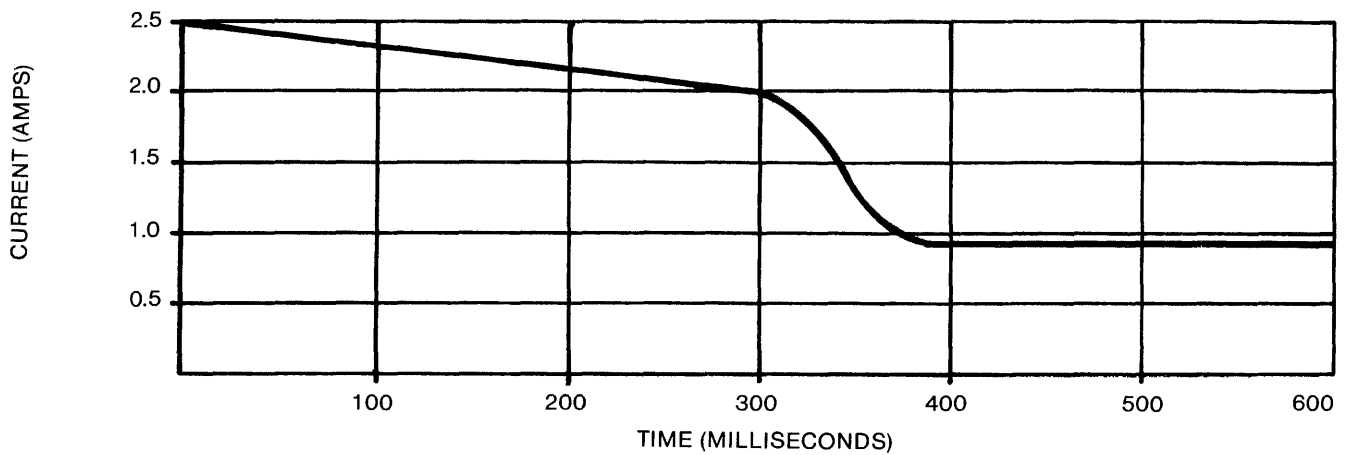
Stepper Motor 0.40 Amps typical

Electronics 0.17 Amps typical

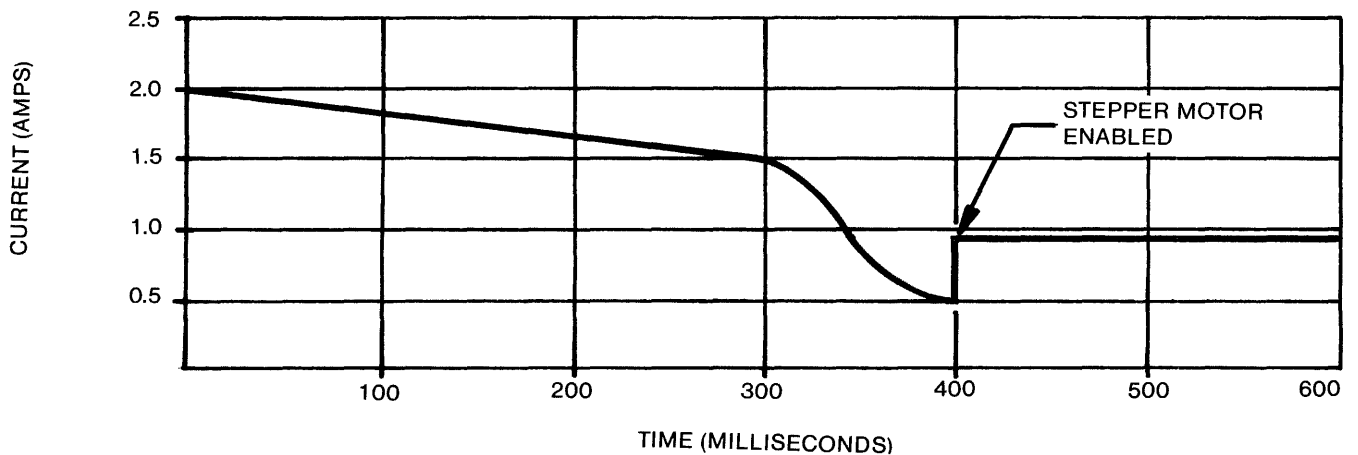
Total 0.92 Amps typical

3. +24 Volts: During motor start interval

a. Configured for stepper motor enabled during motor start.
2.5 Amps typical surge.



b. Configured for stepper motor disabled until motor comes up to speed. 2.1 Amps typical surge.



- A. Inspect the shipping package for obvious damage.
- B. Open the shipping container, and remove the drive.
- C. Inspect the drive's overall appearance. Ensure that there are no scratches on the bezel.
- D. Ensure that all internal connectors are seated properly.
- E. Turn the diskette lever counterclockwise, and remove the shipping diskette.
- F. Insert a blank diskette, close, and then open the diskette lever. The diskette should eject.
- G. Insert a blank diskette, and manually turn the spindle pulley. It should rotate freely.

The dynamic incoming inspection procedures include:

- A. Connect the drive to an exerciser or computer tester capable of seeking, writing, and reading.
- B. Power up the test equipment, and apply power to the drive.
- C. Select the drive, and ensure that the Activity L. E. D. located on the bezel illuminates.
- D. Insert a work diskette and write/verify from Track 00 to Track 76. Ensure that there are no errors.
- E. Insert a diskette written previously on another drive. Read this diskette, and ensure that there are no data errors. If excessive errors occur, check the diskette on the drive on which it was written.
- F. If the drive passes all the checks listed above, it is operational. If not, review Section II.

1.9 INTERFACE CONNECTIONS

Signal connections for the drive are made via a user-supplied 50-pin, flat ribbon connector (3M Scotchflex 3415). This connector mates directly with the circuit board connector at the rear of the drive. The D. C. power connector is a six-pin connector (Amp Mate-N-Lok Part Number 1-480270-0), which mates with the connector at the rear of the drive.

The signal connector harness should be of the flat ribbon or twisted pair type, have a maximum length of ten feet, and have a 22-to-28 gauge conductor compatible with the connector that is to be used.

Power connections should be made with 18-AWG cable, minimum.

1.10 MOUNTING THE DRIVE

The drive has been designed to mount in any plane, i.e.: upright, horizontal, or vertical. The only restriction is that the printed circuit board side of the chassis must be uppermost when the drive is mounted horizontally. Eight holes are provided for mounting: two on each side and four on the bottom of the housing (see Figure 1-1). The two on each side are tapped for 8-32 screws. The four mounting holes on the bottom require 8-32 thread forming screws.

Optional straps are available to permit attaching two drives together for installation in standard width drive openings.

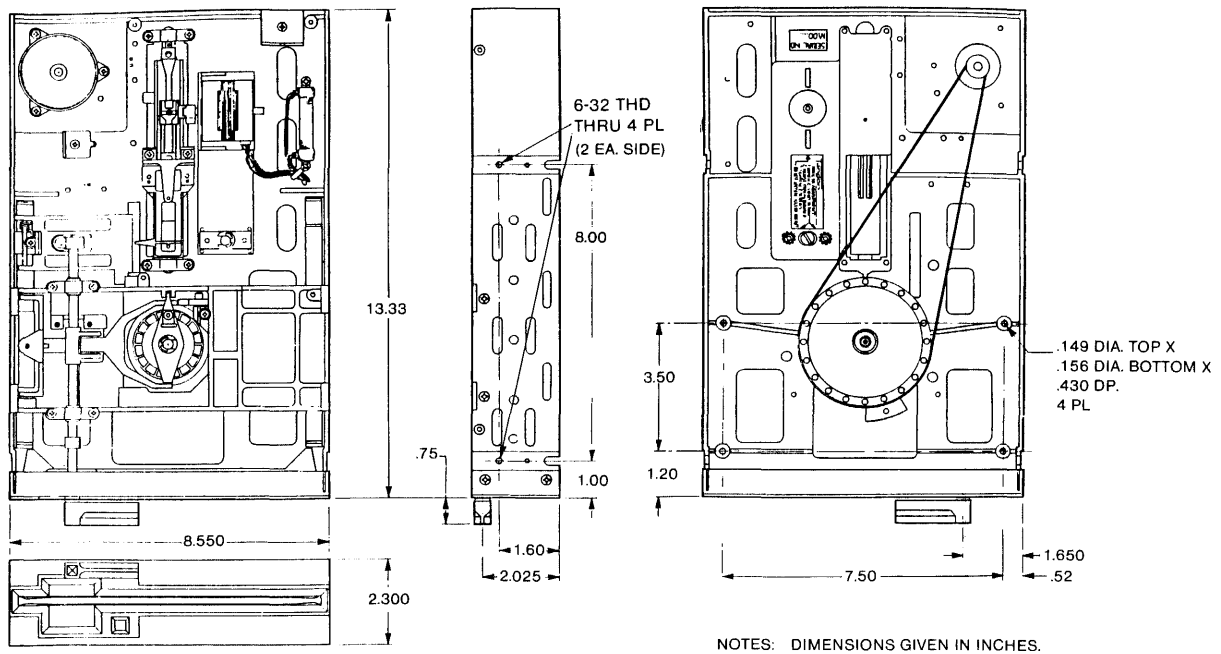


Figure 1-1
TM848 Disk Drive Mounting Configuration

1.10.1 Hardware

The drive is manufactured with certain critical internal alignments that must be maintained. Hence, it is important that the mounting hardware does not introduce significant stress on the drive.

A three-part mounting scheme is recommended. Any mounting scheme in which the drive is part of the structural integrity of the enclosure may cause equipment operating problems and should be avoided. In addition, the mounting scheme should allow for adjustable brackets or incorporate resilient members to accommodate tolerances.

1.10.2 Dust Cover

The design of an enclosure should incorporate a means to prevent contamination from loose items e.g., dust, lint, and paper since the drive does not have a dust cover.

1.10.3 Cooling System Requirements

Heat dissipation from a single drive is normally 30 watts (102) Btu/Hr.) under high line conditions. When the drive is mounted so that the components have access to the free flow of air, normal convection cooling allows operation over the specified temperature range.

When the drive is mounted in a confined environment, air flow must be provided to maintain specified air temperatures in the vicinity of the motors, the circuit board, and the diskette.

1.11 DISKETTE CARE, HANDLING, AND STORAGE

It is important that the diskette be cared for, handled, and stored properly so that the integrity of the recorded data is maintained. A damaged or contaminated diskette can impair or prevent recovery of data, and can result in damage to the read/write heads of the drive.

The following list contains information on how the diskette can be cared for, handled, and stored.

1. Keep the diskette away from magnetic fields.
2. Do not touch the precision surface of the diskette with fingers.
3. Insert the diskette carefully into the drive until the backstop is encountered.
4. Do not bend or fold the diskette.
5. Put the diskette into its jacket when it is not in use.
6. Store the diskette at temperatures between 10°C and 52°C or 50°F and 125°F.

1.12 WRITE PROTECT

The drive is equipped with a Write Protect Sensor Assembly. This sensor operates in conjunction with a diskette that has a slot cut in the protective jacket.

When the slot is uncovered, the diskette is write protected. The slot must be covered to write on the diskette. An option is available on the board for defeating the write protect sensor.

1.13 OPERATION OF THE DRIVE

The drive consists of the mechanical and electrical components necessary to record and to read digital data on a diskette. User-provided D.C. power at +24 volts and +5 volts is required for operation of the drive.

1.14 ORGANIZATION OF THE DRIVE

All electrical subassemblies in the drive are constructed with leads that terminate in multipin connectors, enabling the individual assemblies to be removed.

The heads are connected to the circuit board via cables that terminate in five-pin female connectors and their associated male sockets that are located in close proximity to the read/write data electronics.

Interface signals and power are provided via connectors at the rear of the drive.

1.15 COMPONENTS OF THE DRIVE

The drive consists of six functional groups:

1. Index Pulse Shaper
2. Drive Status Logic
 - A. Write Protect
 - B. Track 00 Sensor
 - C. Double-sided Disk
 - D. Ready
 - E. Disk Change

3. Spindle Drive Control
4. Carriage Position Control
5. Write/Erase Control
6. Read Amplifier and Digitizer

Figure 1-2 is a functional block diagram of the drive. It should be referred to in conjunction with the following sections. The data in the ensuing figures is primarily represented in simplified form.

1.15.1 Index Pulse

An index pulse is provided to the user system via the index pulse interface line. The index circuitry consists of an index L. E. D., an index phototransistor, and a pulse shaping network. As the index hole in the disk passes an index L. E. D. phototransistor combination, light from the L. E. D. strikes the index phototransistor, causing it to conduct. The signal from the index phototransistor is passed on to the pulse shaping network, which produces a pulse for each hole detected. This pulse is presented to the user on the index pulse interface line.

1.15.2 Drive Status Logic

There are five drive status logic lines: Write Protect, Track 00 Sensor, Two-Sided Ready and Disk Change.

A. Write Protect

A write protect signal is provided to the user's system via the write protect interface line. The write protect circuitry consists of a write protect sensor and circuitry that routes the signal that is produced.

When a write protected diskette is inserted in the drive, the sensor is activated and the logic disables the write electronics and supplies the status signal to the interface.

B. Track 00 Sensor

The level on the Track 00 interface line is a function of the position of the head assembly. When the head is positioned at Track 00 and the stepper motor is at the home position, a true (low) level signal is generated at the interface.

C. Two-Sided Disk

This signal is low (true) when the drive is selected and has detected the presence of the Index Two hole in the diskette currently installed.

D. Ready

This signal is true when Drive Select is low (true) if the spindle drive is up to speed and the drive is ready to read and write.

E. Disk Change

This signal is true when Drive Select is low (true) if the diskette lever has been moved to the open position after the previous drive select went false.

1.15.3 Spindle Drive System

The spindle drive system consists of a spindle assembly driven through a drive belt by a brushless D.C. motor/tachometer.

The servo electronics required for speed control are located on the printed circuit board.

The control circuitry contains an interface control line. When the drive motor control interface line is false (high), the drive motor is allowed to come up to speed.

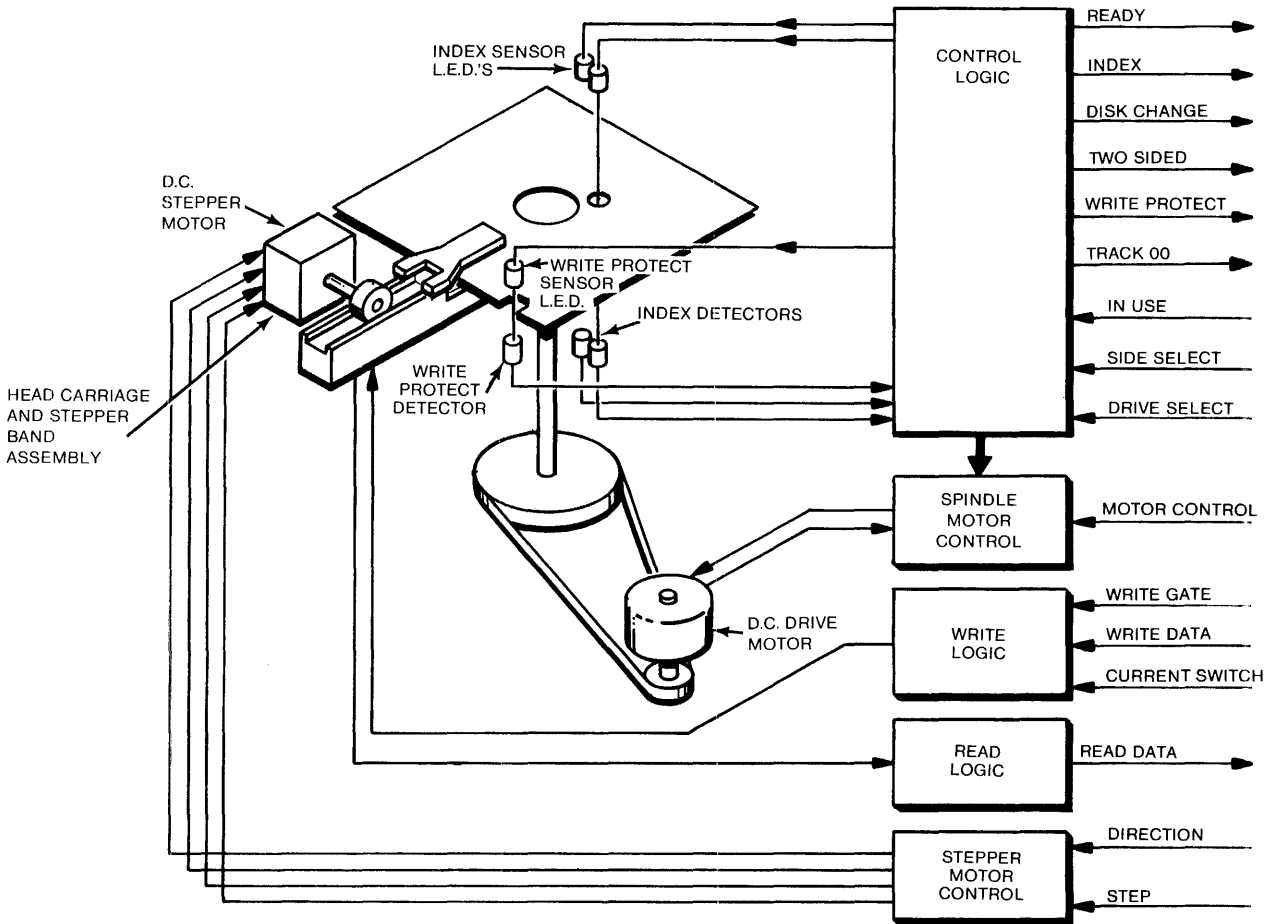


Figure 1-2
TM848 Disk Drive Functional Block Diagram

1.15.4 Positioner Control

The head positioning system uses a bipolar-driven motor drive, which changes one phase for each track advancement of the read/write carriage. In addition to the logic necessary for motor control, a gate is provided that inhibits positioner motion during a write operation.

1.15.5 Data Electronics

Information can be recorded on the diskette by using a double-frequency code. Figure 1-3 illustrates the magnetization profiles in each bit cell for the number sequence shown for FM recording.

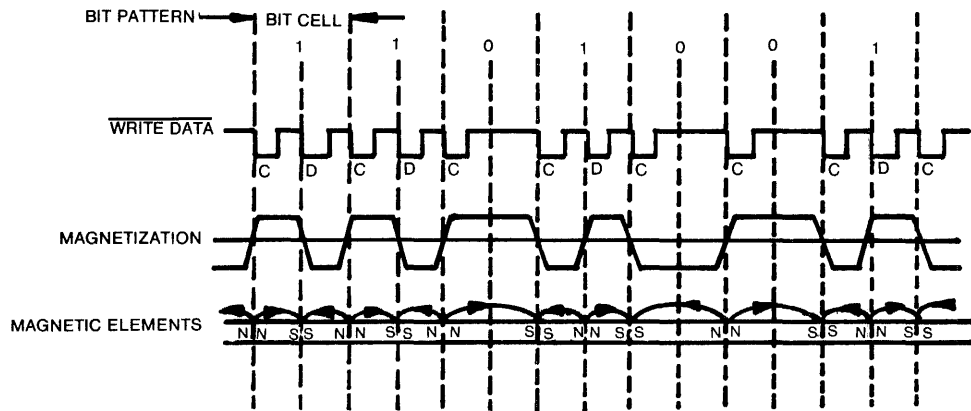


Figure 1-3
FM Recording Magnetization Profiles

The erase gaps provide a guard band on either side of the recorded track.

All signals required to control the data electronics are provided by the user system and are shown in the TM848 drive functional block diagram (see Figure 1-2). These control signals are:

1. Select
2. Write Gate
3. Write Data
4. Side Select
5. Write Current Switch

Composite read data is sent to the user system via the Read Data interface line.

A. Data Recording

The write electronics consist of a switchable write current source, a write waveform generator, an erase current source, the trim erase control logic, and the head selection logic (see Appendix I).

The read/write winding on the head is center-tapped. During a write operation, current from the write current source flows in alternate halves of the winding, under control of the write waveform generator.

The conditions required for recording, i.e. drive ready must be established by the user's system, as follows:

1. Drive speed stabilization occurs 700 milliseconds after the drive motor is started.
2. Subsequent to any read/write operation, the positioner must be allowed to settle. This requires 18 milliseconds maximum after the last step pulse is initiated, i.e., 3 milliseconds for the step motion and 15 milliseconds for settling.
3. The foregoing operations can be overlapped, if required.

Figure 1-4 illustrates the timing diagram for a write operation. At $t = 0$, when the unit is ready, the write gate interface line goes true. This enables the write current source. Write current is switched via the write current switch interface line to a lower value by the user's controller at Track 43.

The Trim Erase control goes true 190 microseconds after the Write Enable interface line since the trim erase gaps are behind the read/write gap. It should be noted that this value is optimized between the requirements at Track 00 and at Track 76, so that the effect of the trim erase gaps on previous information is minimized.

Figure 1-4 shows the information on the write data interface line and the output of the write waveform generator, which toggles on the leading edge of every write data pulse.

A maximum of 4 microseconds between write gate going true and the first write data pulse is only required if faithful reproduction of the first write data transition is significant.

At the end of recording, at least one additional pulse on the write data line must be inserted after the last significant write data pulse to avoid excessive peak shift effects.

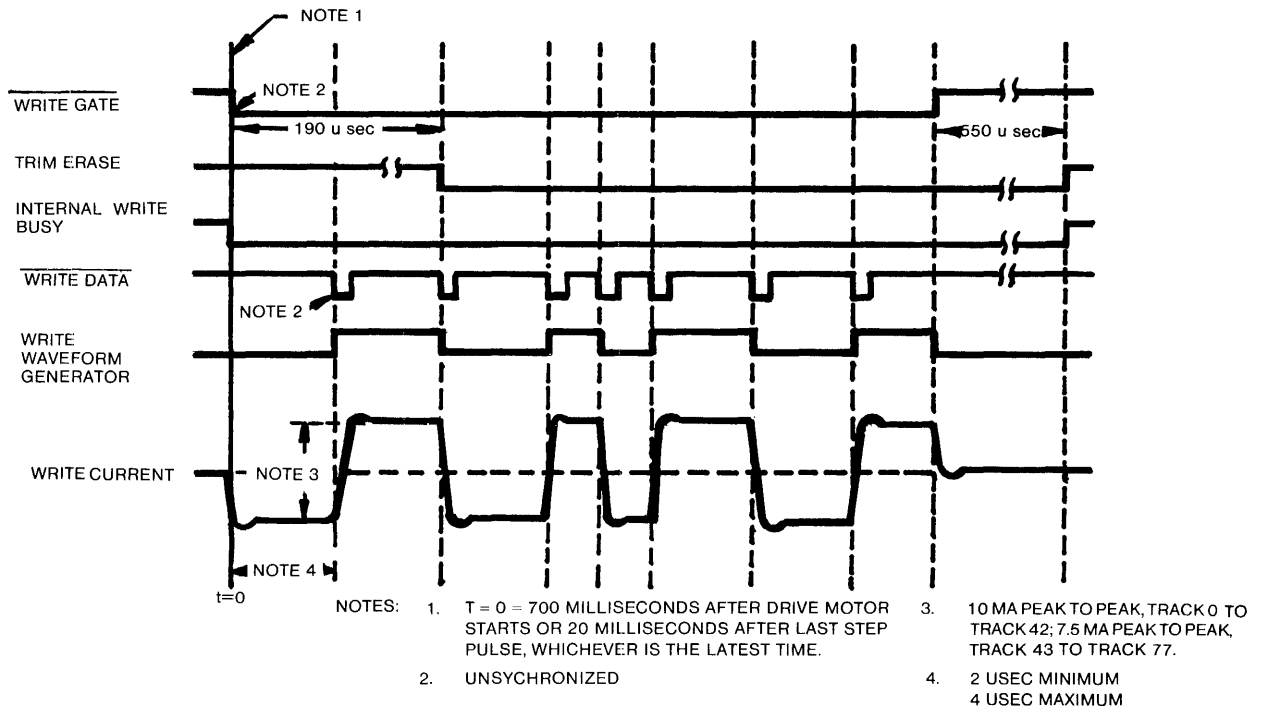


Figure 1-4
Write Operation Timing Diagram

The duration of a write operation is from the true going edge of write gate to the false going edge of erase. This is indicated by the internal write busy waveform shown (see Figure 1-4).

The Read electronics consist of:

1. Read Switch/Side Select
2. Read Preamplifier
3. Filter
4. Differentiator
5. Time Domain Filter and Digitizer

The read switch is used to isolate the read amplifier from the voltage excursion across the head during a write operation. The side select is used to enable one of the read/write/erase heads.

The drive must be in a ready condition before reading can begin. As with the data recording operation, this ready condition must be established by the user system. In addition to the requirements established in this section, a period of 100 microseconds is necessary after a trim erase operation occurs to allow the read amplifier to settle after the transient caused by the read switch returning to the read mode.

The output signal from the read/write head is amplified by a read preamplifier and filtered by a low-pass linear phase filter to remove noise (see Figure 1-5). The linear output from the filter is passed to the differentiator, which generates a wave form whose zero crossovers correspond to the peaks of the Read signal. This signal is then fed to the zero crossing detector and digitizer.

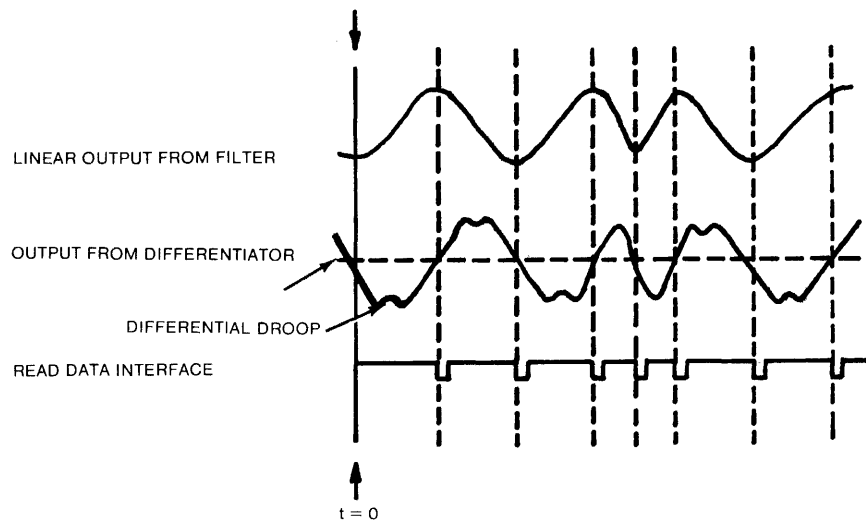


Figure 1-5
Read Timing Diagram

Note

T = 0 is defined as 250 milliseconds after drive motor starts, or 20 milliseconds after a step command, or 100 microseconds after termination of write busy, whichever is the latest time.

The zero crossover detector and digitizer circuitry generate a 200 nanosecond read data pulse, corresponding to each peak of the read signal. The composite read data signal is sent to the user system via the read data interface line.

1.16 INTERFACE ELECTRONICS

All interface signals are TTL compatible. Logic true (low) is +0.4 volt maximum, logic false (high) is +2.4 volts minimum. The maximum interface cable length is ten feet. It is recommended that the interface cable be flat ribbon cable that has a characteristic impedance of 100 ohms.

1.16.1 Interface Connector Pin Assignments, P13

The interface connector pin assignments, P13, are listed in Table 1-3.

1.16.2 Power Connector Pin Assignments

The power connector pin assignments are listed in Table 1-4.

TABLE 1-3
INTERFACE CONNECTOR PIN ASSIGNMENTS

<u>Ground</u>	<u>Pin Number</u>	<u>Signal</u>
1	2	Write Current Switch
3	4	Motor Off Control 1
5	6	Motor Off Control 2
7	8	Motor Off Control 3
9	10	Two Sided (option) (Model TM848-2 only)
11	12	Disk Change (option)
13	14	Side Select (Model TM848-2 only)
15	16	Activity Indicator (option)
17	18	Head Load
19	20	Index
21	22	Ready
23	24	Motor Off Control 4
25	26	Drive Select 1 (Side Select Option, TM848-2 only)
27	28	Drive Select 2 (Side Select Option, TM848-2 only)
29	30	Drive Select 3 (Side Select Option, TM848-2 only)
31	32	Drive Select 4 (Side Select Option, TM848-2 only)
33	34	Direction Select (Side Select Option, TM848-2 only)
35	36	Step
37	38	Write Data
39	40	Write Gate
41	42	Track 00
43	44	Write Protect
45	46	Read Data
47	48	Alternate I/O
49	50	Alternate I/O

TABLE 1-4

POWER CONNECTOR PIN ASSIGNMENTS

<u>Pin</u>	<u>Supply Voltage</u>
1	24V D. C.
6	Return
3	Return
2	Return
5	5V D. C.

1.17 TERMINATED LINES

1.17.1 Input Line Terminations From Removable Resistor Pack

The drive has the capability of terminating the following input lines:

1. Write Current Switch
2. Write Data
3. Write Gate
4. Side Select (TM848-2 only)
5. Direction
6. Step
7. Head Load

These input lines are individually terminated through a 150 ohm resistor pack that is installed in the dip socket located at integrated circuit location RP1. In a single-drive system, this resistor pack should be installed to provide the proper terminations. In a multiple-drive system, only the last drive on the interface is to be terminated. All other drives on the interface must have the resistor pack removed (see Figure 1-6).

1.17.2 Drive Select

The Select lines provide a means of selecting and deselecting a drive. These four lines -- DS1 through DS4--allow independent selection of up to four drives attached to the controller.

When the signal logic level is true (low), the drive electronics are activated and the drive is conditioned to respond to Step or to Read/Write commands. When the signal logic level is false (high), the input control lines and the output status lines are disabled.

The drive select address is determined by a movable shorting plug installed on the circuit board. Select lines one through four provide a means of daisy chaining a maximum of four drives to a controller. Only one line can be true (low) at a time. An undefined operation might result if two or more units are assigned the same address or if two or more select lines are in the true (low) state simultaneously (see Figure 1-7). A select line must remain stable in the true (low) state until the execution of a Step or Read/Write command is completed.

1.17.3 Program Shunt

The program shunt is AMP Part Number 435704-8. The program shunt positions are programmed by cutting the particular shunt. The program shunt is installed in a dip socket. At the user's option, the program shunt may be removed and replaced by a dip switch. Pins 8 and 9 of the program shunt are not used. See Table 1-5 for a listing of the program shunts.

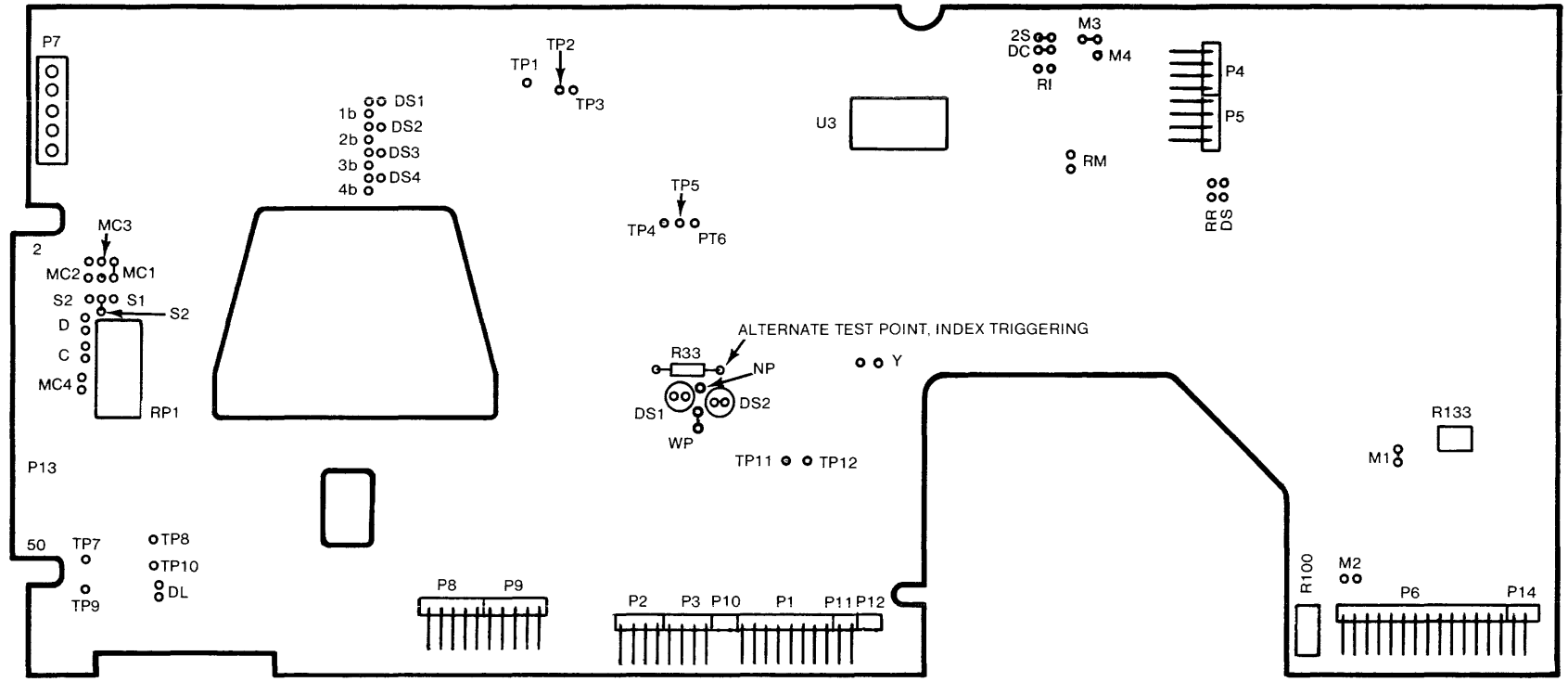


Figure 1-6
Circuit Board Assembly

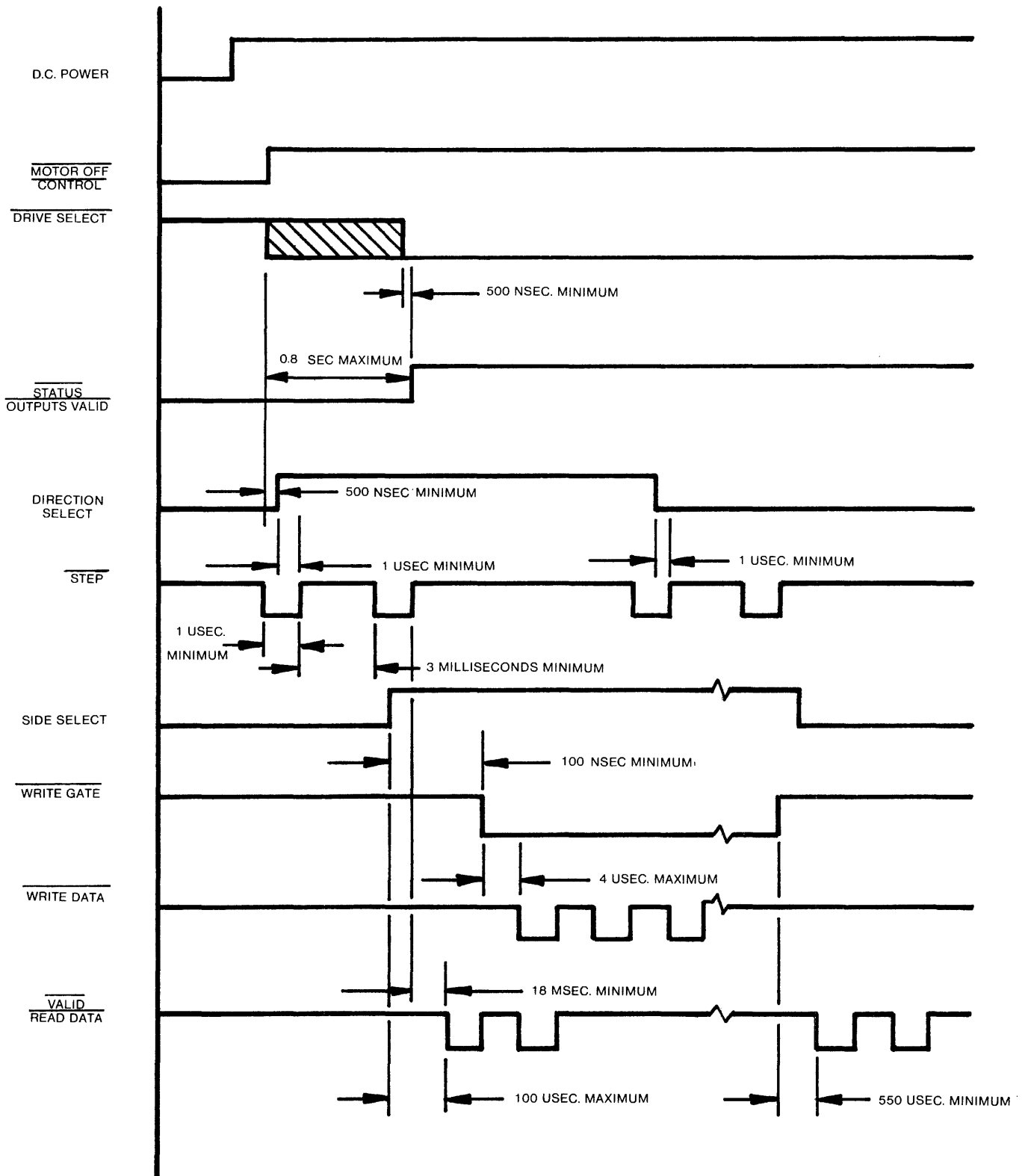


Figure 1-7
General Control and Data Timing Requirements

1.18 DS AND HL POWER SAVE OPTIONS

The drive is set up with the HL option in. This stepper power from head load line option supplies power to the stepper motor when the head load line goes low (true), which results in lower stand-by current consumption. As shipped from the factory, HL is installed but will remove power from the stepper motor when the drive is deselected. There should be a 20 millisecond wait after a Drive Select command is given in order to allow the step motor electronics to settle.

The stepper power from drive select, DS option, allows the user to remove D. C. power from the stepper motor using drive select, which results in lower stand-by current consumption. This option is implemented by installing DS, and cutting HL.

1.19 USER SELECTABLE OPTIONS

The description of user selectable options should be used in conjunction with the following list of options that are available for model numbers TM848-1 and TM848-2 (see Table 1-5).

TABLE 1-5

OPTIONS

<u>OPTION</u>	<u>TRACE DESIGNATOR</u>	<u>Shunt/Pin Locations</u>	<u>AS SHIPPED</u>	
			<u>Installed</u>	<u>Not Installed</u>
Drive Select	DS1-DS4		DS1	
Side Select Options using Drive Select	1B-4B			X
In Use, Drive Select	Z	U3, 1-16	X	
In Use, Head Load	Y			X
Ready Alternate Output Pad	R	U3, 7-10	X	
Radial Ready	RR		X	
Ready, Modified	RM			X
Radial Index	RI		X	
Index, Alternate Output Pad	I	U3, 6-11	X	
In Use, Alternate Output Pad	D			X
Diskette Lever Lock Latch Option	DL			X
Disk Change	DC		X	
Two-Sided Diskette Installed	2S		X	
Stepper Power from Drive Select	DS			X
Stepper Power from Head Load Line	HL	U3, 2-15	X	
Head Load Alternate Output Pad	C			X
Radial Head Load Signal	A	U3, 3-14	X	
Radial Head Load Signal	B	U3, 4-13	X	
Radial Head Load Signal	X	U3, 5-12	X	
Inhibit Write When Write Protected	WP		X	
Allow Write When Write Protected	NP			X
Head Side Select Options	S1-S3		S2	
Spindle Motor Control Options	M1-M4		M1, M3	M2, M4
Motor Control Select	MC1-MC4		MC1	

1.19.1 Drive Select DS1-DS4

This option allows the user to daisy chain up to four drives, and to enable one drive at a time.

Drive select is implemented by shorting one of the four connections, using a shorting plug. The drive comes equipped from the factory with DS1 installed. All outputs are gated with drive select, as set-up at the factory.

1.19.2 Side Select Options Using Drive Select 1B-4B

This option allows the user to select the head to be used with drive select.

Side Select options are implemented by removing the shorting plug from the DS1-DS4 option pads, installing Pins 1B-4B, and connecting the shorting plug to the desired 1B-4B pins. S2 should be etched out, and S3 installed (see Section 1.18).

1.19.3 In Use From Drive Select (Z)

This option allows the user to enable the activity L. E. D. when the drive is selected.

In Use From Drive Select is factory installed.

1.19.4 In Use From Head Load (Y)

This option allows the user to use the head load line to enable the Activity L. E. D.

In Use From Head Load is implemented by punching out Option Z between Pins 1 and 16 of U3. A jumper must be installed at location Y.

1.19.5 Ready Alternate Output Pad (R)

This low going signal is derived by gating the internal ready and drive select to give the controller a true (low) ready status of the drive.

The Ready Alternate Output Pad is factory installed.

1.19.6 Radial Ready (RR)

This option allows the user to monitor the ready status of all drives without selecting them. This option cannot be used concurrently with individual motor control lines for each drive. (see Figure 1-8).

Radial Ready is implemented by punching out Option R between Pins 7 and 10 of U3, by etching RR, then by running a wire from U4, Pin 3 to the desired alternate output lines 4, 6, 8, and 24.

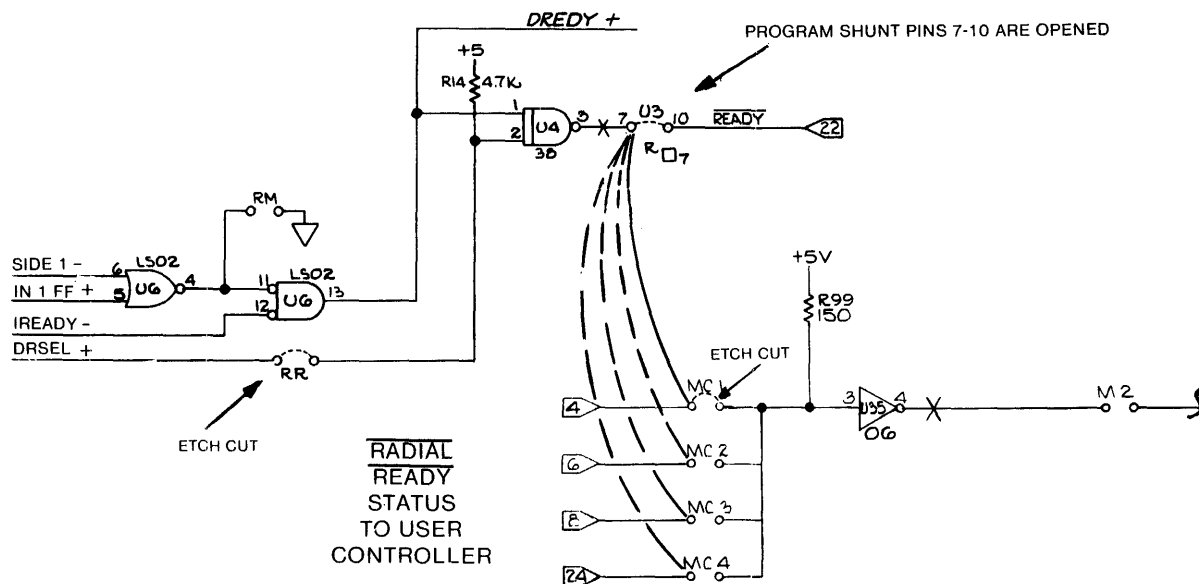


Figure 1-8
Radial Ready Installation

Note

MC1 through MC4 cannot be used as radial motor control when using this option.

1.19.7 Ready, Modified (RM)

This option allows the drive to write on the upper surface of a single-sided diskette. It prevents the drive from making Ready become false when the upper surface of a single-sided diskette is selected. To implement this option, connect a jumper at the RM pads.

1.19.8 Radial Index (RI)

This option uses the alternate I/O lines for radial index lines. This option allows the user to monitor the index of each drive independent of drive select. This option cannot be used concurrently with radial ready, or with independent motor control.

Radial Index is implemented by removing the shunt bridge at U3, Pins 6 and 11, by etch cutting radial index, and by running a wire from U4, Pin 6, to the appropriate alternate I/O lines. If use of MC1 is desired, interface line 20 may be used as one index line. In this case, the shunt pack, U3, 6-11, remains intact on one drive, (see Figure 1-9).

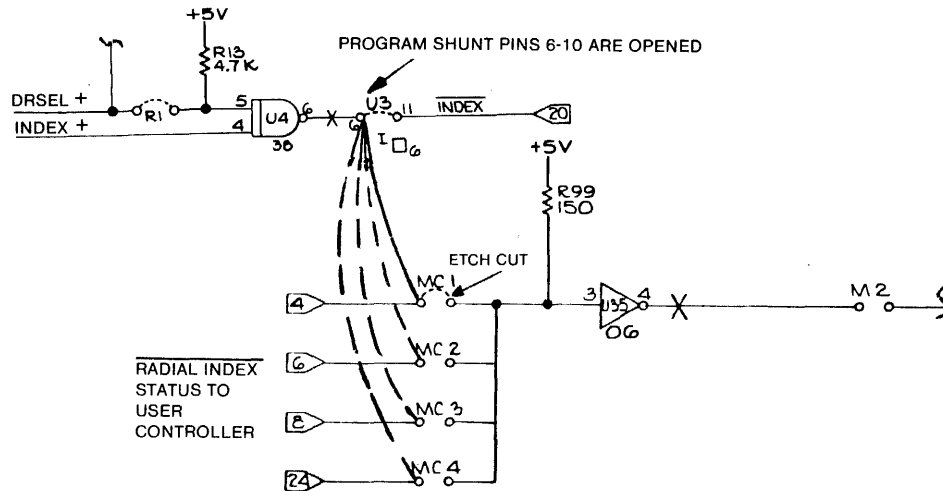


Figure 1-9
Radial Index Installation

1.19.9 Index Alternate Output Pad (I)

The internal index pulse is gated with drive select to give a low true signal at Pad I. This option should be left connected for the controller to receive the index pulse. See Radial Index for other uses of this line.

The Index Alternate Output Pad option is factory installed.

1.19.10 In Use Alternate Output Pad (D)

This line may be used to latch a lever lock solenoid, which is an optional feature. A low (true) command is sent by the controller to Pin 16 of interface connector P13. Then this signal is used with drive select to latch the locking solenoid by pulsing drive select with IN USE low. The solenoid is unlatched when drive select is pulsed and IN USE is high.

To implement this option, locate option pads D and DL. Install jumpers at these locations.

1.19.11 Diskette Lever Lock Latch Option (DL)

This option is used in conjunction with in use, alternate output pad.

To implement this option, locate option pads D and DL. Install jumpers at these locations (see Section 1.18).

1.19.12 Disk Change (DC)

This output is used to indicate to the controller that a disk change has been made. The internal signal is gated with drive select. When the lever is opened, the disk change line goes low (true), and stays low until the trailing edge of the next drive select.

1.19.13 Two-Sided Diskette Installed (2S)

When a two-sided diskette is installed, internal circuitry gates this signal with drive select, and sends a low (true) signal to the controller, which means that a double-sided diskette is installed (index hole two is present).

The Two-Sided Diskette Installed option is factory installed.

1.19.14 Stepper Power From Drive Select (DS)

This option allows the user to remove D. C. power from the stepper motor using drive select, which results in lower stand-by current consumption.

The Stepper Power From Drive Select option is implemented by installing DS, and cutting HL.

1.19.15 Stepper Power From Head Load Line (HL)

This option supplies power to the stepper motor when the head load line goes low (true). This results in lower stand-by current consumption.

This option is factory installed. DS must be removed for proper operation.

1.19.16 Head Load Alternate Output Pad Option C

This option allows the user to load and unload the head load solenoid (optional) and, along with the HL and Y options, enables the stepper motor and lights the Activity L. E. D., respectively. Head load is accomplished by connecting both option pads C located near interface connector P13.

1.19.17 Radial Head Load Signal, Options A, B, and X

By selection of the appropriate combination of the A, B, or X jumper, the user can use either Drive Select or Head Load to activate the Activity L. E. D. and Lever Lock Solenoid option (see Figure 1-10).

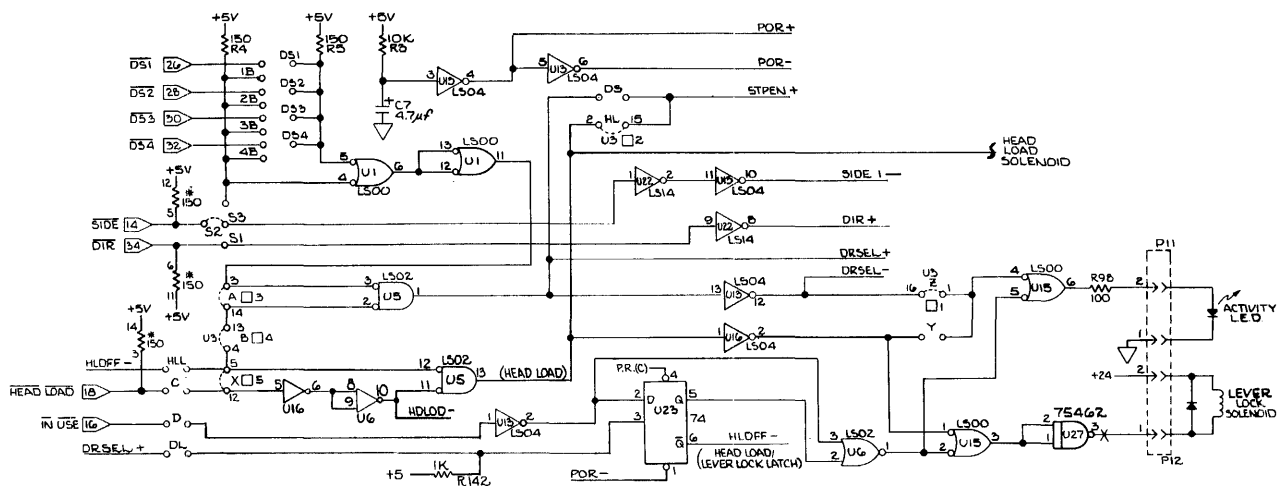


Figure 1-10
Radial Head Load Signal

1.19.18 Inhibit Write When Write Protected (WP)

This option is used to lock out the write gate when a write protected diskette is installed. Inhibit Write When Write Protected is factory installed.

1.19.19 Allow Write When Write Protected (NP)

This option allows the controller to write on any diskette, whether or not is is write protected.

Note

This option does not stop the write protect signal from being sent on the interface line. This option is implemented by cutting WP, and by installing NP.

1.19.20 Head Side Select Options S1--S3

This option allows heads to be selected by side select, drive select, or the direction control signal. The drive comes with side select, S2, installed.

To use the drive select line to enable the heads, cut S2 and install S3 along with the proper 1B-4B jumper that is used with S3 (see 1B-4B). For head selection using Direction Select, cut S2, and install S1.

1.19.21 Spindle Motor Control Options M1--M4

M1 is used to enable the motor off delay timer. When this jumper is installed, the drive motor is enabled and disabled by either the drive select (M3) or head load (M4) commands. A 20-second turn off delay of the spindle motor is activated on the trailing edge of the controlling signal.

M2 is used for radial motor control independent of the motor control functions installed with M1, M3, and M4.

M2 should be in if the user wishes to enable the drive motor continuously or to use the radial motor on line MC1-MC4.

M3 is used to control the drive motor using drive select. When the drive select line goes low (true), the drive motor comes up to speed in less than 500 milliseconds and becomes ready in less than 700 milliseconds. After the drive select line goes false (high), the motor will run for 20 seconds. To implement this option, install a jumper at location M3. For correct operation of M3, remove M4.

M4 is used to start the drive motor using the head load interface lines. When the head load line goes low (true), the drive motor comes up to speed in less than 500 milliseconds and becomes ready in less than 700 milliseconds. After the head load line goes high (false), the motor will run for 20 seconds. To implement this option, remove M3 for correct operation of option M4.

1.19.22 Motor Control Select Options MC1--MC4

This option is used if the drive motor is to be enabled independent of drive select or head select. When these lines are low (true), the motor is off. The drive comes without this option installed. This option does not operate the time out delay circuit.

To implement this option that controls the drive motor using an MCx line, install the appropriate MC1-MC4 jumper. When using this option, M2 must be installed. If the motor turn off delay is desired, the delay can be triggered by Drive Select or Head Load commands, when used in conjunction with M3 or M4.

SECTION II

MAINTENANCE CHECKS AND ADJUSTMENTS

2. INTRODUCTION

This section is for the use of the OEM Repair Department. It contains checks and adjustments that are used during the normal life of the drive.

Before applying power to the drive or doing any checks or adjustments, visually inspect the drive to ensure that it has no missing or broken parts.

The following equipment is required for checks and adjustments:

1. A dual-channel, wideband oscilloscope: Tektronix 465 or equivalent
2. An exerciser or software routine capable of stepping the drive to any track, selecting the upper or lower head, and writing a 1F, all zeros if FM, or a 2F, all ones if FM, pattern on the disk.
3. A Phillips screwdriver
4. A set of Allen wrenches
5. A flat blade screwdriver
6. A blank diskette
7. An alignment diskette: Dysan P/N 360/2A or equivalent
8. Integrated circuit dip clips, 14 and 16 pin

2.1 SPINDLE DRIVE MOTOR CHECKS AND ADJUSTMENTS

The long-term drive motor speed adjustment ensures that the motor's speed is within the range of tolerance specified. The motor speed specification is 360 RPM \pm 1.25 percent.

2.1.1. Long-Term Drive Motor Speed Checks and Adjustments

A. Preliminary checks required:

Verify power: +24V D. C. \pm 10 percent
 +5V D. C. \pm 5 percent

B. Apply power to the drive.

C. Activate the drive motor on the interface line.

D. Insert a work diskette.

E. Set up the oscilloscope, as follows:

Voltage: 2 volts per division

Time Per Division: 20 milliseconds

Trigger: Negative, Channel A, R33

Note

For the TM848-1 single-sided drive, trigger off of R33. For the TM848-2 double-sided drive, trigger off of Test Point 12, with the exception of azimuth, which must be triggered off of R33 (see Figure 2-1).

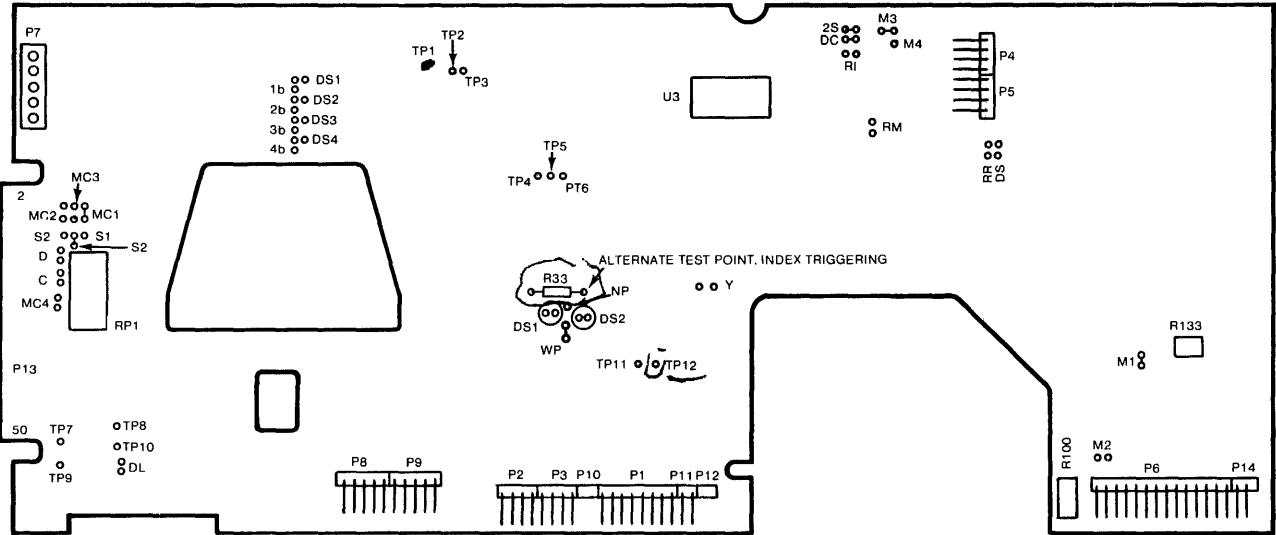


Figure 2-1
Circuit Board Assembly

F. Adjust R133 until a reading of 166.667 milliseconds is achieved from leading edge to leading edge of the index pulses.

G. If the drive motor's speed cannot be adjusted, see Section IV, Troubleshooting Guide.

2.2 CATS EYE ALIGNMENT CHECK AND ADJUSTMENT

The Cats Eye (C. E.) alignment procedure locates the read/write head at the proper radial distance from the hub center line, ensuring that the track location is accurate (see Figure 2-2). This adjustment is necessary only after servicing or if diskette interchange problems are suspected.

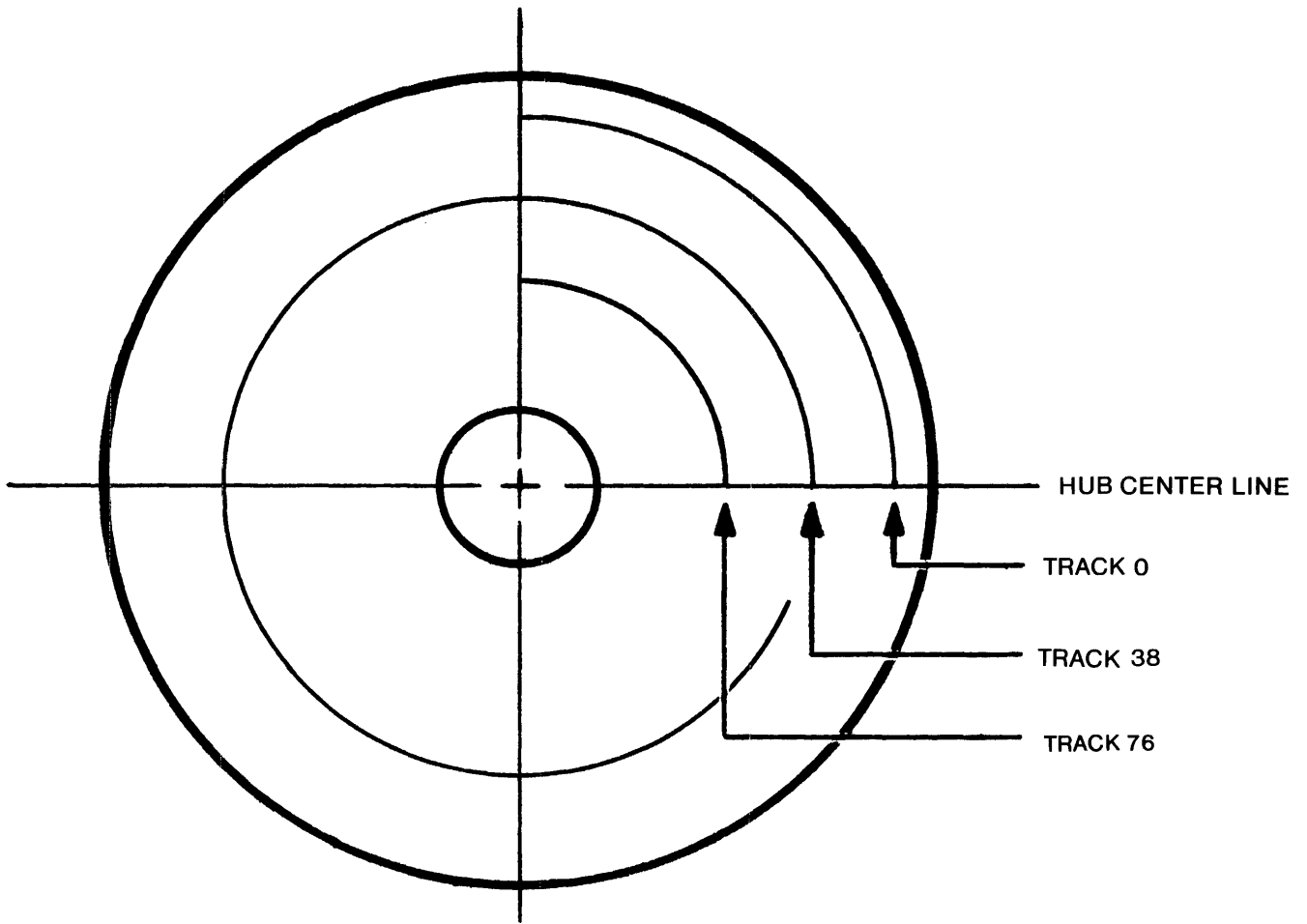


Figure 2-2
Hub Center Line and Track Locations

2.2.1 Cats Eye Alignment Check

A. Set up an oscilloscope, as follows:

Channel A; Test Point 2 alternate is Test Point 4 on R30

Channel B: Test Point 3 alternate is Test Point 5 on R29

Ground Test Point 1

Read Differentially: A plus B, B inverted

Time Base: 20 milliseconds per division

External Trigger: Test Point 11, negative trigger, for single-sided drives. Test Point 12, negative trigger, for double-sided drives. R33 (end closest to DS2), negative trigger, is an alternate test point for both single- and double-sided drives.

B. Apply power to the drive.

Note

The Track 38 radius is $2.8207 \pm .0020$. Other track locations are computed based upon 48TPI.

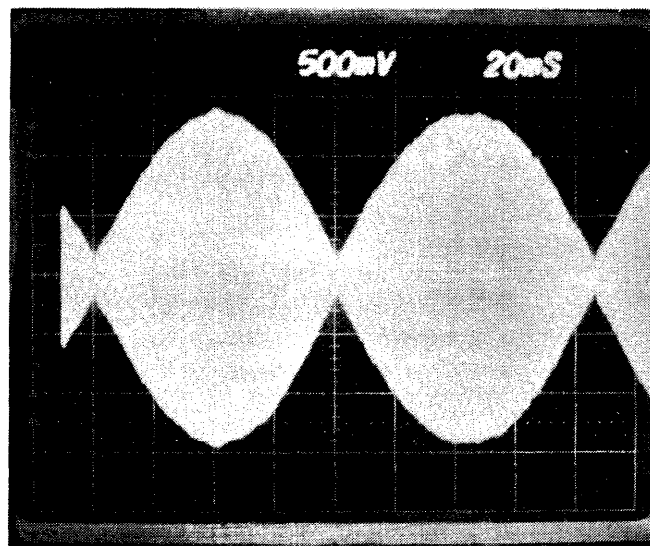
C. Select the drive at the interface.

D. Insert the alignment diskette into the drive.

E. Select Head 00, the lower head.

F. Seek to and observe Track 38 for Cats Eye alignment of the lower head.

G. Adjust the oscilloscope to observe a Cats Eye pattern (see Figure 2-3).



Equal amplitude.
Lobes shown at 100
percent on Track 38.

Time Scale: 20 ms

Figure 2-3
Cats Eye Pattern

- H. Verify that the smaller of the two Cats Eye lobes is not less than 75 percent in amplitude of the other one. The calculation is: $\frac{\text{amp of smaller lobe}}{\text{amp of larger lobe}} \times 100$
- I. Step the drive to Track 00, then, step it back to Track 38.
- J. Reverify the Cats Eye pattern.
- K. Step the drive to Track 76; then, step it back to Track 38.
- L. Reverify the Cats Eye pattern.
- M. On double-headed drives, select the upper head (Head 01) and repeat Steps F through L.
- N. If any of the checks listed above does not meet the conditions stated in Step H, the head carriage must be adjusted.

2.3 HEAD CARRIAGE ADJUSTMENT

- A. Turn the two position retaining screws that straddle the nylon adjustment cam located beneath the drive until the cam can be moved (see Figure 2-4).

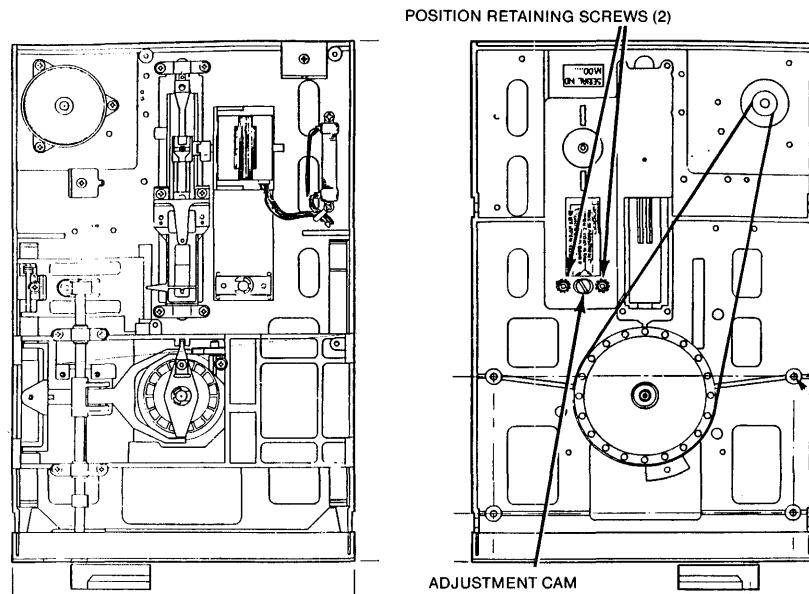


Figure 2-4

Head Module Retaining and Cam Screws

- B. Observe the Cats Eye pattern from the head that is farthest out of alignment.
- C. Using a flat blade screwdriver, turn the adjustment cam until one Cats Eye lobe is within 75 percent of the amplitude of the other lobe.

Note

Check the upper and lower heads on double-sided drives (see Section 2.2.1, “F” through “L” on upper head).

- D. Tighten the two positioner retaining screws (see Figure 2-4).

E. Reverify the Cats Eye alignment (see Section 2.2.1).

2.4 INDEX SENSOR CHECKS AND ADJUSTMENTS

The index adjustment changes the time period from the index pulse to the start of the data. The adjustment should be checked after the drive has been aligned (see Section 2.1.1) or when diskette interchange errors are suspected.

2.4.1 Index-to-Data Burst Check

- A. Apply power to the drive.
- B. Select the drive.
- C. Check the spindle speed of the drive (see Section 2.1).
- D. Set up an oscilloscope as follows:

Trigger:	Single-sided drives trigger on right lead of R33 (closest to DS2), negative edge; double-sided drives trigger on Test Point 12, negative edge.
----------	--

Read Differentially:	A plus B, B inverted
----------------------	----------------------

Channel A:	Test Point 2
------------	--------------

Channel B:	Test Point 3
------------	--------------

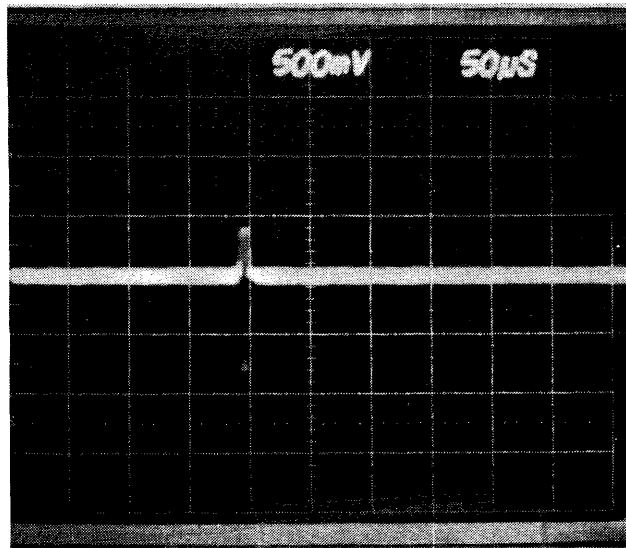
Time Base:	50 microseconds per division
------------	------------------------------

- E. Insert an alignment diskette.
- F. Seek to Track 1.
- G. Select Head 00, the lower head.
- H. Ensure that the index-to-data burst occurs at 200 microseconds \pm 100 microseconds from the leading edge of the index pulse (see Figure 2-5).
- I. For double-sided drives, select Head 01 and repeat the steps above.

Note

Head 01 should meet the same specification.

- J. If either Head 00 or Head 01 does not meet the specifications, adjust the index sensor (see Section 2.4.2.).



Time Scale:
50 usec per
division

Figure 2-5
Index-to-Data Burst

- K. When both index measurements on a double-sided drive or the one index measurement on a single-sided drive meet the specifications, see Section H, check the index-to-data burst on Track 76.
- L. On a double-sided drive, check Heads 01 and 00, the upper and lower heads.

Note

If any index measurement does not meet the specification, the index sensor must be adjusted (see Section 2.4.2).

2.4.2 Index Sensor Adjustment

- A. Loosen the index sensor's retaining screw located on the underside of the chassis (see Figure 2-6).

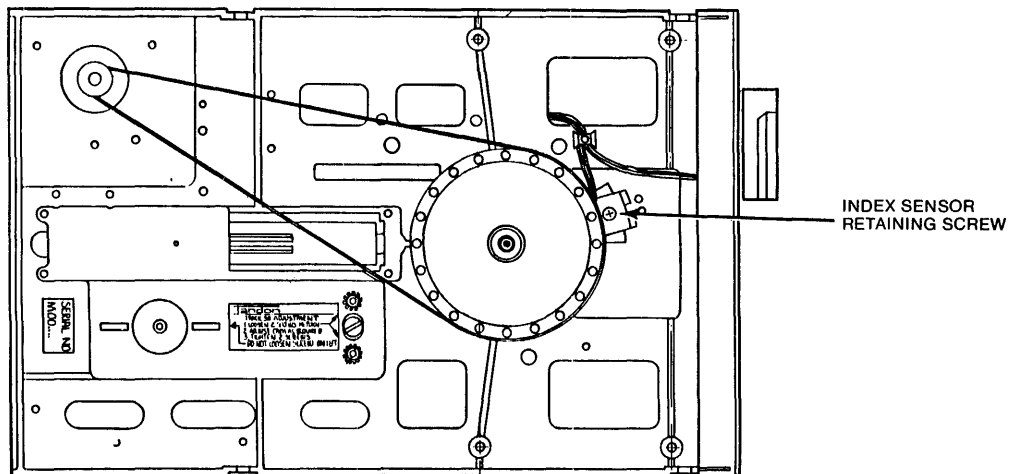


Figure 2-6
Index Sensor's Retaining Screw and Adjustment

- B. Adjust the index sensor with a flat blade screwdriver until the index-to-data burst occurs 200 microseconds \pm 100 microseconds from the leading edge of the index pulse.
- C. Tighten the index sensor's retaining screw.
- D. Reverify the index-to-data bursts (see Section 2.3.1).

2.4.3 Index Pulse Width Check

The index pulse width is nonadjustable. If the index pulse width is not within specifications, replace the Index Sensor Assembly.

- A. Set up an oscilloscope as follows:

Channel A:	To appropriate index test point, see Section 2, Item Number 1.
Ground:	Test Point 1
Time Base:	.5 millisecond per division
Voltage:	2 volts per division
Trigger:	Negative leading edge of Channel A, appropriate test point.

- B. Ensure that the negative going pulse width is between 1.0 and 2.3 milliseconds (see Figure 2-7).

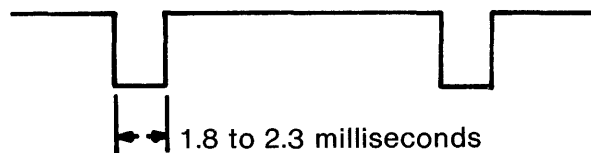


Figure 2-7
Negative Going Pulse Width

2.5 TRACK 00 SENSOR CHECK AND ADJUSTMENT

The Track 00 sensor provides a signal that identifies Track 00 to the logic electronics. A Track 00 signal is sent to the controller on Pin 20 of the interface.

- A. Apply power to the drive.
- B. Load an alignment diskette into the drive.
- C. Step the carriage to the radial alignment track, Track 38 (see Section 2.2).

- D. Confirm the position by observing the Cats Eye pattern.
- E. Attach Channel A to Test Point 10.
- F. Restore the carriage to Track 00, and ensure that the Track 00 L. E. D. on the exerciser turns on.
- G. Seek to Track 1, and ensure that the signal at Test Point 10 is high.
- H. Seek to Track 2, and ensure that this line is low or in transition.
- I. Seek to Track 3, and ensure that this line is low.
- J. If the signal is incorrect, restore to Track 00 with the oscilloscope attached as above.
- K. Seek out to Track 2, and loosen the two retaining screws that hold the Track 00 sensor (see Figure 2-8).

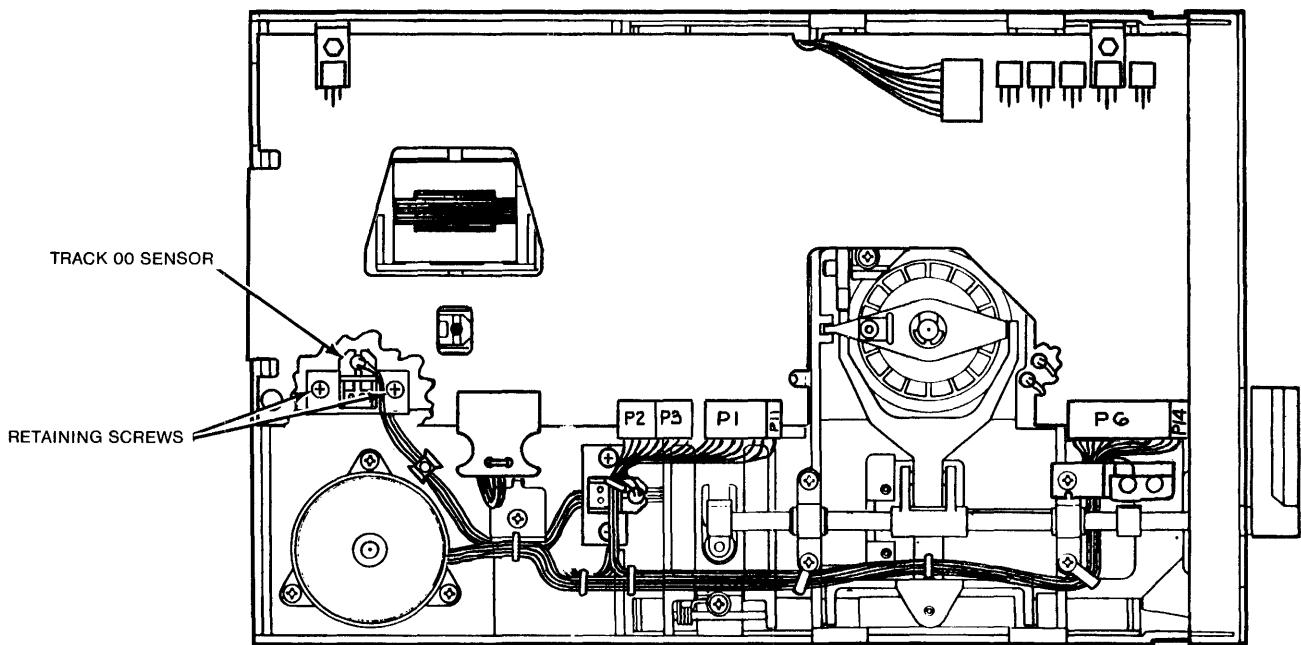


Figure 2-8
Track 00 Sensor

- L. Push the sensor toward the back of the drive, and slowly push it forward until the signal on the oscilloscope just goes low (true).
- M. Tighten the retaining screws, and repeat Steps E through I.
- N. Verify the adjustment.

2.6 AMPLITUDE CHECK

The amplitude test checks the necessary read, channel amplifier/differential output voltage.

- A. Restore to Track 00
- B. Insert a work diskette and write a 2F, all ones, pattern on the lower head.

C. Connect an oscilloscope to Test Points 4 and 5, using Test Point 1 as a ground.

D. Set up an oscilloscope as follows:

Channel A:	Test Point 4, 1 volt per division
Channel B:	Test Point 5, 1 volt per division
Both Channels:	A. C. coupled, Channels A and B added, Channel B inverted
Time Base:	50 milliseconds per division, synchronize internally on Channel A or B
Trigger:	Automatic

E. The minimum amplitude displayed on the scope should be no less than three (3) volts peak-to-peak at any point.

F. Reverify the measurement with another work diskette.

G. Check the upper and lower head, if applicable.

H. If the amplitude is less than the specification, inspect the heads to ensure they are not contaminated.

I. Clean the heads with a cleaning diskette if they are contaminated.

J. Replace the circuit board if cleaning does not improve the amplitude.

K. If replacing the circuit board does not correct the amplitude, replace the Head Carriage Assembly.

2.7 AZIMUTH CHECK

Azimuth is the angle of the heads with respect to the track at the point of the read/write gap. Azimuth is measured in minutes (one minute = 1/60 degree).

A. Set up an oscilloscope as follows:

Channel A:	Test Point 2, 100 mV per division
Channel B:	Test Point 3, 100 mV per division
Ground:	Test Point 1
Both Channels:	A. C. coupled, Channels A and B added, Channel B inverted
Time Base:	1 millisecond or as required to display the pulse groups
Trigger:	Leading edge of appropriate test point (see Section 2, Item Number 1)

B. Insert an alignment diskette.

C. Step the drive to Track 76.

D. Observe the following pattern. Figure 2-9 depicts an optimum head alignment of zero minutes of azimuth error. This means that the Head Carriage Assembly is perpendicular to the track being read, Track 76. Bursts 1 and 4 are of equal amplitude; Bursts 2 and 3 are of equal amplitude.

Note

Measure the azimuth burst. Ensure that Burst 1 is less than or equal to Burst 2, and that Burst 4 is less than or equal to Burst 3.

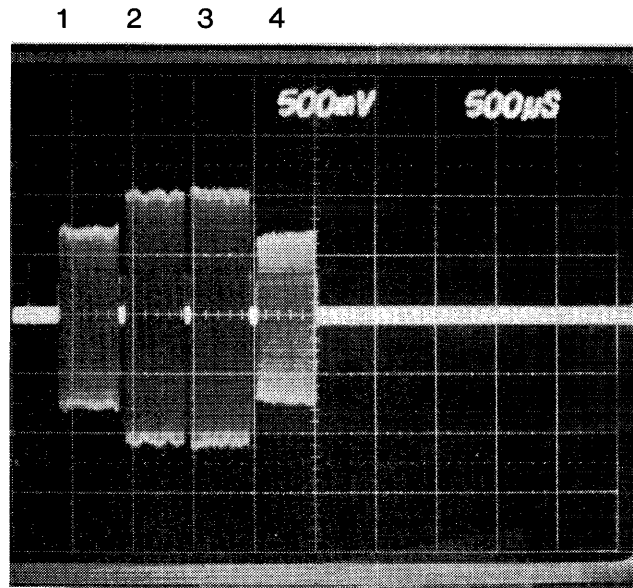


Figure 2-9

Optimum Head Azimuth Alignment

- E. Figure 2-10 depicts an azimuth of exactly minus 9, 12, or 18 minutes, depending upon the manufacturer of the diskette used. This is the lower limit of allowable azimuth error. Bursts 1 and 2 are of equal amplitude. If this signal is observed, the Cats Eye alignment should be checked prior to any corrective action.

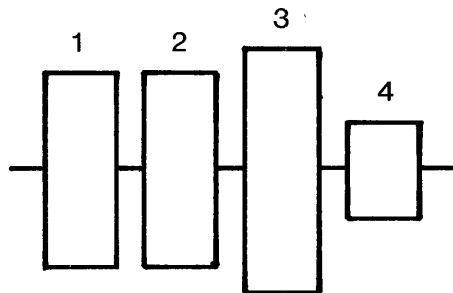


Figure 2-10
Head Azimuth of Acceptable Lower Limits

- F. Figure 2-11 depicts an alignment of exactly plus 9, 12, or 18 minutes, depending upon the manufacturer of the diskette used. Bursts 3 and 4 are of equal amplitude. This is the upper limit of allowable azimuth error. If this signal is observed, the Cats Eye alignment should be checked prior to any corrective action.
- G. After the lower head has been checked, switch to read on the upper head and observe the azimuth pattern. Both the upper and lower heads should be within the specification.

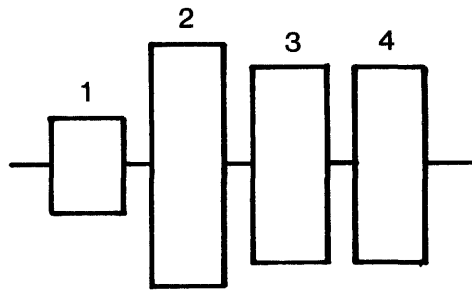


Figure 2-11
Head Azimuth Alignment of Acceptable Upper Limits

Note

The head's azimuth is not adjustable. It is suggested that the drive be sent to an authorized repair center or a new Head assembly be installed. In the latter case, all previous adjustments should be made again.

2.8 LOAD ARM ADJUSTMENT

This adjustment is made to ensure proper loading of the head when the diskette is engaged (see Figure 2-12).

- A. Insert a work diskette into the drive.
- B. Turn the diskette lever to load the disk, and seek to Track 00. There should be a space of .015 inch minimum between the head load arm and the load plate.
- C. Seek to Track 76, and ensure that a space of .015 inch minimum remains between the head load arm and the load arm.
- D. Adjust the screw located behind the head load cam until the foam just touches the platen.
- E. Insert a work diskette and ensure that there is adequate space between the upper head and the diskette.
- F. The upper head should not hit the diskette when inserting and ejecting it.

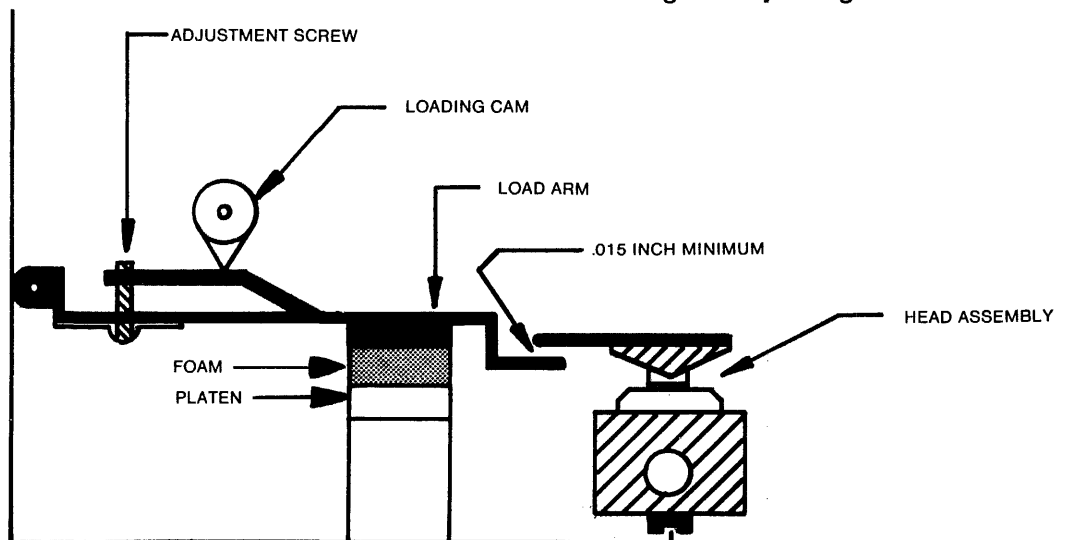


Figure 2-12
Load Arm Adjustment, Front View

SECTION III

PRINTED CIRCUIT BOARD OPERATION

3. INTRODUCTION

This section contains the interface description and the circuit board theory of operations for the TM848 family of disk drives. In addition, Sections 3.1 and 3.2 contain schematic diagrams of the circuit boards installed in the drive.

3.1 PHYSICAL DESCRIPTION OF THE CIRCUIT BOARD

The printed circuit board is approximately 12.50-inches long by 5.25-inches wide. Figure 3-1 contains an illustration of the placement of test points and connectors.

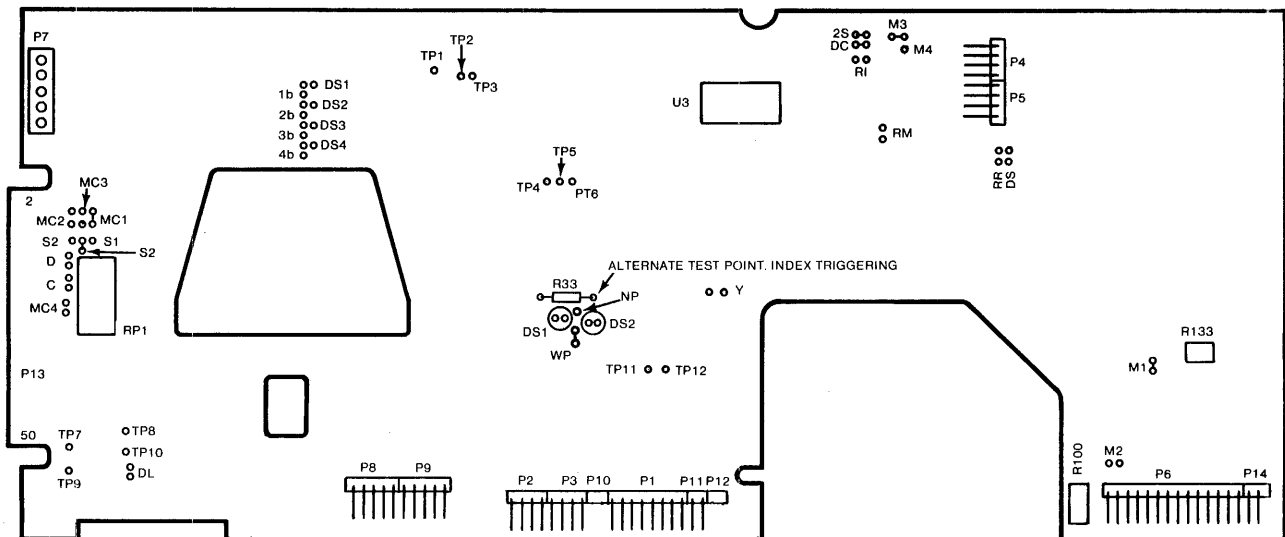


Figure 3-1
Printed Circuit Board

3.2 INTERFACE ELECTRONICS SPECIFICATIONS

All interface signals are TTL compatible. Logic true (low) is +0.4 volt minimum. Figure 3-2 illustrates the interface configuration. The maximum interface cable length is ten feet.

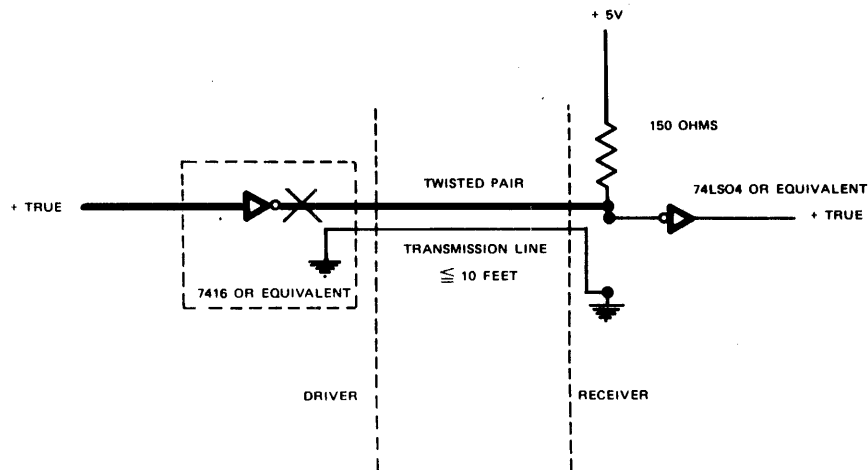


Figure 3-2
Interface Configuration

It is recommended that the interface cable be flat ribbon cable, with a characteristic impedance of 100 ohms.

Interface connector pin assignments are given in Table 3-1.

3.3 INPUT CONTROL LINES

A. DS1-DS4, Select Lines

Functional Description

The select lines (see Figure 3-3) provide a means of selecting and deselecting a drive. These four lines, DS1 through DS4, select one of the four drives attached to the controller. When the signal logic level is true (low), the drive electronics are activated, and the drive is conditioned to respond to Step or Read/Write commands. When the logic level is false (high), the input control lines and output status lines are disabled.

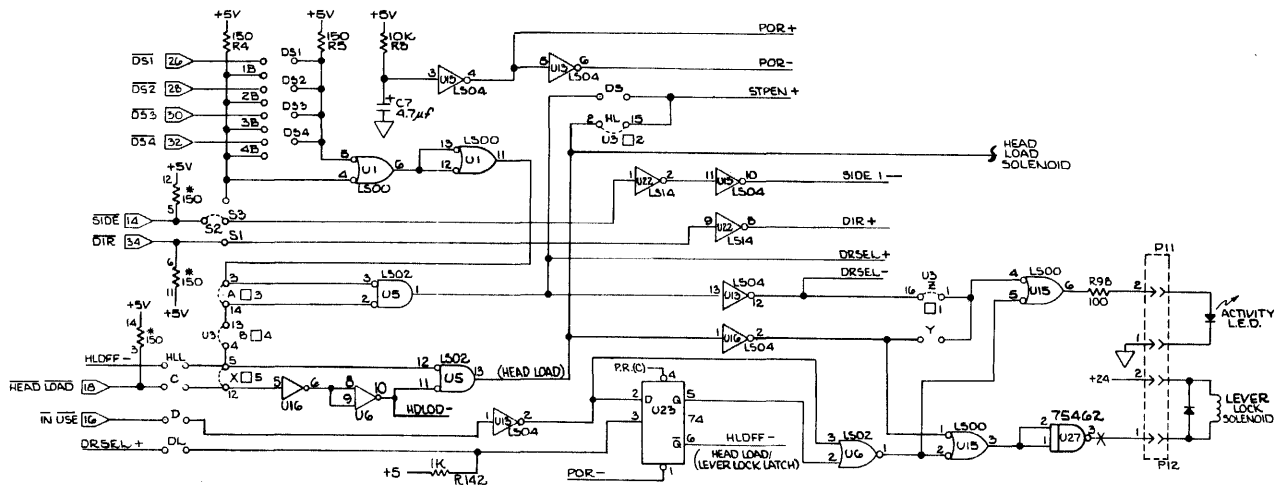


Figure 3-3
Select Lines Schematic Diagram

A select line must remain stable in the true (low) state until after a Step or Read/Write command has been executed.

The drive select address (1-4) is determined by shorting plugs on the circuit board. Select lines 1 through 4 provide a means of daisy chaining a maximum of four drives to a controller. Only one line can be true (low) at a time. An undefined operation might result if two or more units are assigned the same address or if two or more select lines are in the true (low) state simultaneously.

Circuit Description

An 150-ohm resistor holds the output of the appropriate Select latch line high (false) until the line is driven low (true). Then, the Select signal is gated through U1 and U5 to derive the signal DRSEL+. DRSEL+ is used to gate all I/O Port, ensuring that only one drive's data is present on the interface at a time. Writing and stepping are also gated by the signal DRSEL+. This signal is inverted by U13, then buffered by U15 to drive the Activity L. E. D., which is located on the front panel. Option Z is factory installed. It should be installed for the Activity L. E. D. to operate with Drive Select.

B. MOTOR ON, Drive Motor Enable

TABLE 3-1 .

DRIVE INTERFACE LINES AND PIN CONNECTORS

<u>Ground</u>	<u>Pin Number</u>	<u>Signal</u>
1	2	Write Current Switch
3	4	Motor Off Control 1
5	6	Motor Off Control 2
7	8	Motor Off Control 3
9	10	Two Sided (Strappable) (Model TM848-2 only)
11	12	Disk Change (Strappable)
13	14	Side Select (Model TM848-2 only)
15	16	Activity Indicator (Strappable)
17	18	Head Load Line
19	20	Index
21	22	Ready
23	24	Motor Off Control 4
25	26	Drive Select 1 (Side Select Option, TM848-2 only)
27	28	Drive Select 2 (Side Select Option, TM848-2 only)
29	30	Drive Select 3 (Side Select Option, TM848-2 only)
31	32	Drive Select 4 (Side Select Option, TM848-2 only)
33	34	Direction Select (Side Select Option, TM848-2 only)
35	36	Step
37	38	Write Data
39	40	Write Gate
41	42	Track 00
43	44	Write Protect
45	46	Read Data
47	48	Alternate I/O
49	50	Alternate I/O

Functional Description

The TM848 has a D. C. brushless motor that can be enabled in three ways:

1. By using the four radial Motor Control lines, MC1 through MC4.
2. By the Head Load line using shorting plug M4. Using this line enables all drives' Motor On lines.
3. By Drive Select, using shorting plug M3.

The Motor Control lines, MC1 through MC4, are true (low) signals that turn the motor off. Shorting plug M2 must be installed for these control lines to operate.

When a Motor Control line is false (high), the drive motor accelerates to its operational speed in less than 500 milliseconds. This keeps the spindle rotating at a constant speed of 360 RPM. When the Motor Control line is true (low) the motor coasts to a stop.

When using Head Load to enable the drive motor, M4 must be installed. All of the motors are enabled when the Head Load line goes true (low). M1 should be installed if a motor turn off delay is desired. See Section 1.19.21 for an additional description of this circuit.

When a Drive Select line is to be used for Motor Enable, M3 must be installed. This enables the drive motor when the Select line goes low.

Circuit Description

When the motor is enabled by any of the above, U35, Pin 6, floats high, allowing the speed control U41 to start the drive motor. Two Hall Effect transducers in the motor, supply the necessary feedback signals for proper speed regulation. When U35-6 goes high, the output of U41, Pin 6, turns on Q21, which in turn applies a varying voltage to Q20 that regulates the amount of current through Q20, and the motor driver transistors Q1 through Q4. Transistors Q1 through Q4 are turned on by the gated pulses derived from the conditioned outputs of the Hall Effect transducers. The conditioned output of U38, Pin2, is subsequently conditioned by Gate U36, which acts as an edge trigger and pulse doubler. This signal is fed back to U41, Pins 2 and 3, which results in closed loop speed control. The drive motor's rotational speed is approximately 2520 RPM, when adjusted, to give a spindle speed of 360 RPM.

C. DIR STEP, Direction and Step Lines

Functional Description

When the drive is selected, a true (low) pulse with a time duration between 200 nanoseconds and 2 milliseconds on the Step line initiates the track access motion. The direction of motion is determined by the logic state of the Direction line when a Step pulse is issued. The motion is toward the center of the drive if the Direction line is in the true (low) state when a Step pulse is issued. The direction of motion is away from the center of the drive if the Direction line is in the false (high) state when a Step pulse is issued. To ensure proper positioning, the Direction line should be stable for a minimum of 100 microseconds before the trailing edge of the corresponding Step pulse. The Direction line should also remain stable until 100 microseconds after the trailing edge of the Step pulse. The access motion is initiated on the trailing edge of the Step pulse.

When the carriage is positioned at Track 00 and the stepper motor is at Phase 0, the signal at Pin 42 of P13 goes true (low), indicating that Track 00 has been reached.

When stepping in or out, Test Point 8 is a high going pulse for each step pulse issued.

Circuit Description

The Direction line comes in on Pin 34 of the interface connector. A high signal directs the step logic to step toward Track 00. A low signal directs the step logic to step toward a higher numbered track.

The direction line sets the proper phase to the exclusive OR gates of U9.

TABLE 3-2
STEPPER LOGIC TRUTH TABLE

<u>Step Out Toward Track 00</u>					<u>Step In Toward The Upper Tracks</u>					
<u>Pin No.</u>	<u>Phase</u>				<u>Pin No.</u>	<u>Phase</u>				
	0	3	2	1		0	1	2	3	0
U21-9	0	1	1	0	0	0	0	1	1	0
U21-8	1	0	0	1	1	1	1	0	0	1
U21-5	0	0	1	1	0	0	1	1	0	0
U21-6	1	1	0	0	1	1	0	0	1	1

The step pulses come in at Pin 36 of the interface connector. They are buffered by U22 and gated at U14 by the unit select, and the Not Write signal. The step pulses then go to the C inputs of the two flip flops at U21. The direction of the step, hence the selection of the flip flop to be toggled, is done by the two exclusive OR gates of U9. These gates are controlled by the step direction line and by the state of the two flip flop outputs.

The POR- (Power On Reset) signal resets the two flip flops to Phase 0 after a Power On.

The output of the two flip flops drives the stepper motor through the drivers of U39, U40, and U12. The diodes, CR2-9, are for voltage spike elimination. The current through the stepper motor coils is reversed sequentially, one at a time.

D. WRT GATE

Functional Description

When the Write Gate signal is true (low), the write electronics are prepared for writing data (read electronics disabled). This signal turns on the write current in the read/write head. Data is written under control of the Write Data input line. It is necessary for the Write Gate interface line to go low before the first Write Data pulse. However, the separation between the leading edge of Write Gate and the first significant Write Data pulse should not be less than two microseconds and not greater than four microseconds. The same restrictions exist for the relationship between the last Write Data pulse and the termination of the Write Gate signal. When the Write Gate line goes false (high), the trim erase will stay on for 550 microseconds (see Trim Erase, page 3-7).

When a write-protected diskette is installed in the drive, the write electronics are disabled, irrespective of the state of the Write Gate line. Check the list of options (see Section 1.19) for exceptions and further discussion of write protect options. Stepping is also disabled by a true (low) Write Gate.

Tandon Corporation recommends that the controller wait one millisecond after the WRT GATE goes high (false) before any step pulses are sent to the drive.

Circuit Description

A low (true) WRT GATE signal is applied to Pin 40 of the interface connector P13. This signal is

inverted and gated with Write Protect and Drive Select to enable U23, U30, and Q13. Transistors Q13 and Q12 are write current switches. Q13 and Q12 are on in parallel when the low Write Current interface is high (false). This results in a write current of 10 milliamps. When the low Write Current line goes low (true), transistor Q12 turns off, and the current decreases to 7 milliamps. R52 and R51 determine the amount of write current supplied to the head. The network CR18, CR19, CR20, R80 and R81 is a power-loss write disable. If a sudden voltage loss occurs, transistor Q14 turns off, disabling the write current.

E. WRT DATA

Functional Description

When the drive is selected, the write data line provides the bit-serial Write Data pulses that control the switching of the write current in the heads. The write electronics must be conditioned for writing by the Write Gate line.

For each high-to-low transition on the WRT DATA line, a flux change is produced at the head write gap. This causes a flux change to be stored on the diskette (see Figure 3-4).

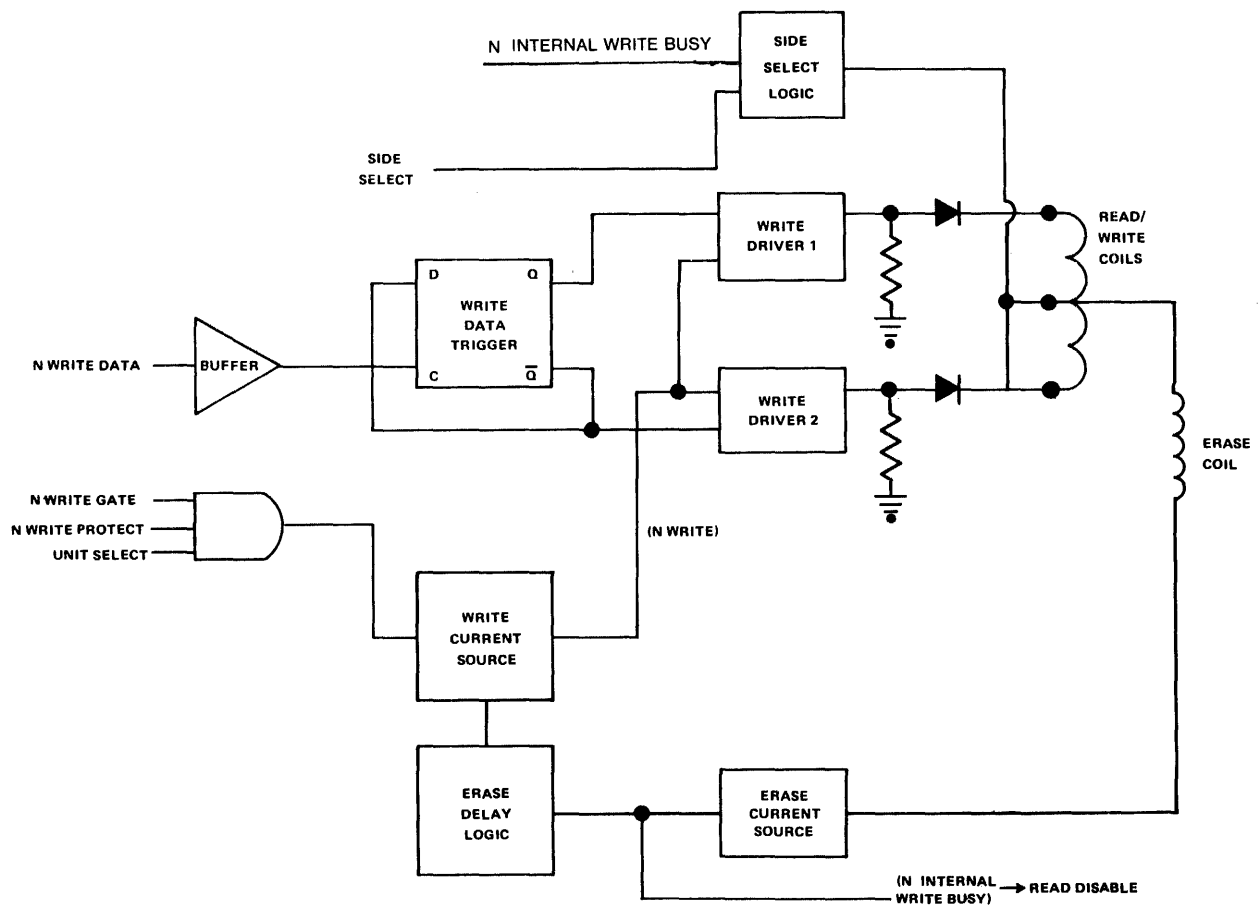


Figure 3-4
Write Data Circuit Block Diagram

When a double-frequency type encoding technique is used (in which data and clock form the combined Write Data signal), it is recommended that the repetition of the high-to-low transitions, when writing all zeros, be equal to the nominal data rate ± 0.1 percent. The repetition rate of the high-to-low transitions, when writing all ones, should be equal to twice the nominal data rate ± 0.1 percent. The data transfer rate for a 1F pattern is 250,000 Bits Per Second (BPS). The data transfer rate for a 2F pattern is 500,000 BPS.

Circuit Description

Data is sent to the drive via interface Pin 38. This signal is inverted by U22, and is used to clock the D flip flop U23. The outputs of U23 are inverted subsequently, and used to drive Q15 and Q17, which direct the write current to the correct winding.

F. TRIM ERASE

Functional Description

The TM848 uses a tunnel erase scheme to achieve trim erase, which is used to erase a guard band around the data tracks, allowing minor track offsets and minor misalignment without data errors occurring. The erase poles are staggered .036 inch behind the read/write poles. At a media rotational speed of 360 RPM, the tunnel erase method requires that the trim erase be delayed for 190 microseconds after the start of writing and that it be continued for 550 microseconds after the end of writing the data. The two one shots in U30 provide these delay time intervals.

When the write gate goes low, U30, Pin 9, (A input), is triggered and a high to low to high transition of 190 us is generated. The write gate is also applied to U30 Pin 1 (A input). When the write data is applied to the $\overline{\text{WRT DATA}}$ line, U23 conditions the data which in turn generates the signal WRT TRAN+ (write transition+). This signal is then applied to U30 Pin 2, (B input) which is a positive triggered input. This clock will retrigger this one shot continuously until the last transition of the WRT TRAN+ and WRT GATE- occurs. At this time, the one shot stays on for an additional 550 us. These outputs (U30, Pins 12 and 13) are gated by U31 which is the trim erase gate. This output goes low whenever both inputs are high, causing the trim erase to be enabled (see Figure 3-5).

G. SIDE SELECT

Functional Description

$\overline{\text{SIDE SELECT}}$ can be generated three ways. See the option listing, Section 1.19, for this information. As shipped from the factory, the side is selected using the $\overline{\text{SIDE SELECT}}$ interface line.

When the Side Select signal is low, Side 1 (the upper head) of the drive is selected for read/write operations. When this signal is high, Side 0 of the drive is selected (see Figure 3-6). The Side Select signal must be stable during an entire read or write operation. This signal is best implemented in synchronization with the Drive Select line signal.

Circuit Description

As shipped from the factory, the Side Select signal is received on Pin 14 of edge connector P13. This signal is received by U22, inverted, then inverted again by U13. The output of U13, Pin 10, generates the signal called Side 1-.

The Side 1- signal is applied to U13, Pin 9, and U24, Pin 13. The output of U13, Pin 8, is applied to U24, Pin 1. This output at Pin 2 of U24 is the opposite of U24, Pin 12. The resistor divider network sets up the biasing voltages to turn on and turn off the head select transistor, Q18 or Q19. The head biasing voltages seen across the collector resistors will be 5.2V D. C. when selecting a head for a read operation, 12V D.C. during a write operation, and 0V D. C. when the head is not selected. The emitter voltages on Q18 and Q19 will always be the opposite of each other, causing CT0 or CT1 (center tap 0, center tap 1) to be selected.

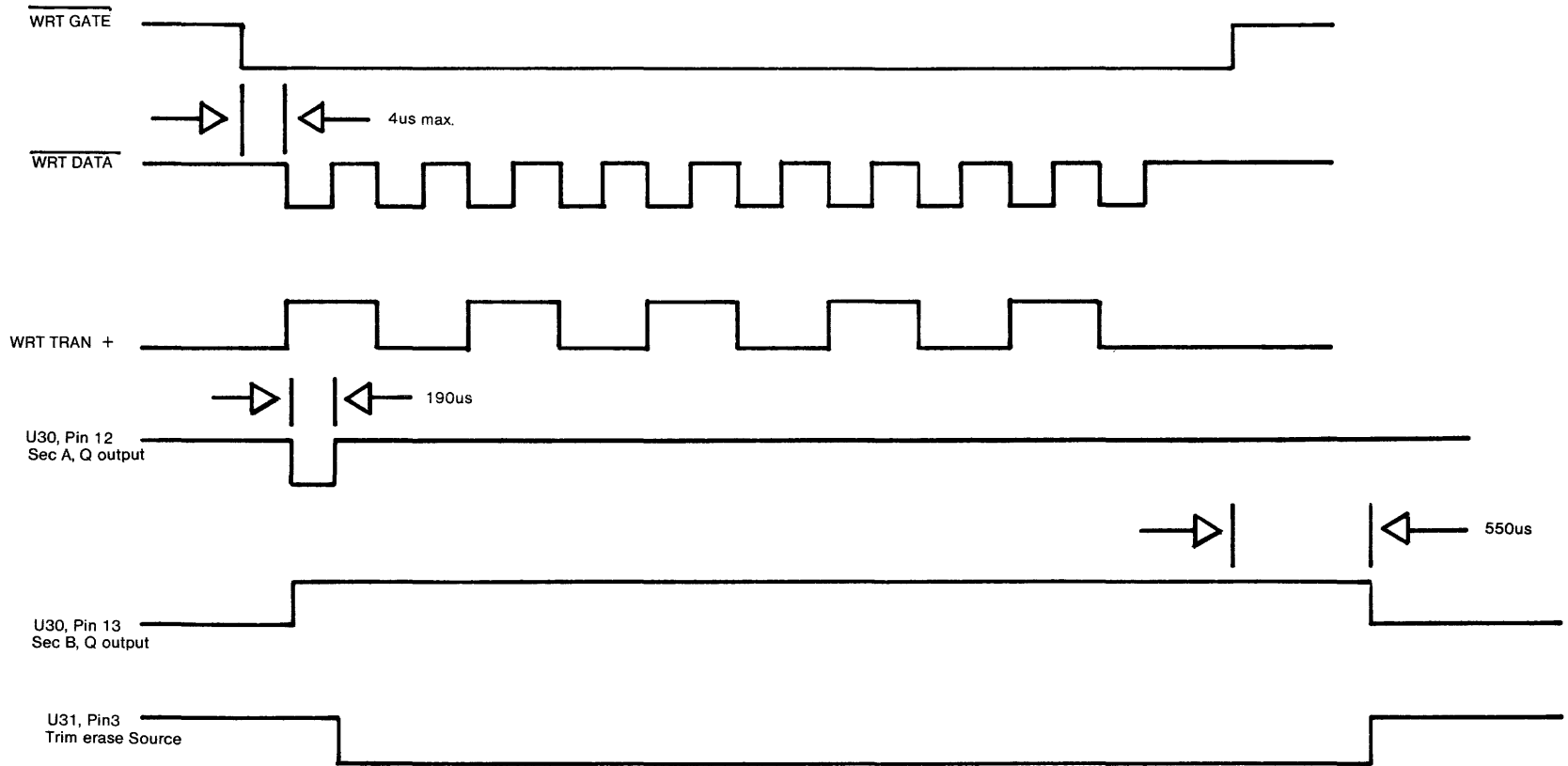


Figure 3-5
Trim Erase Diagram

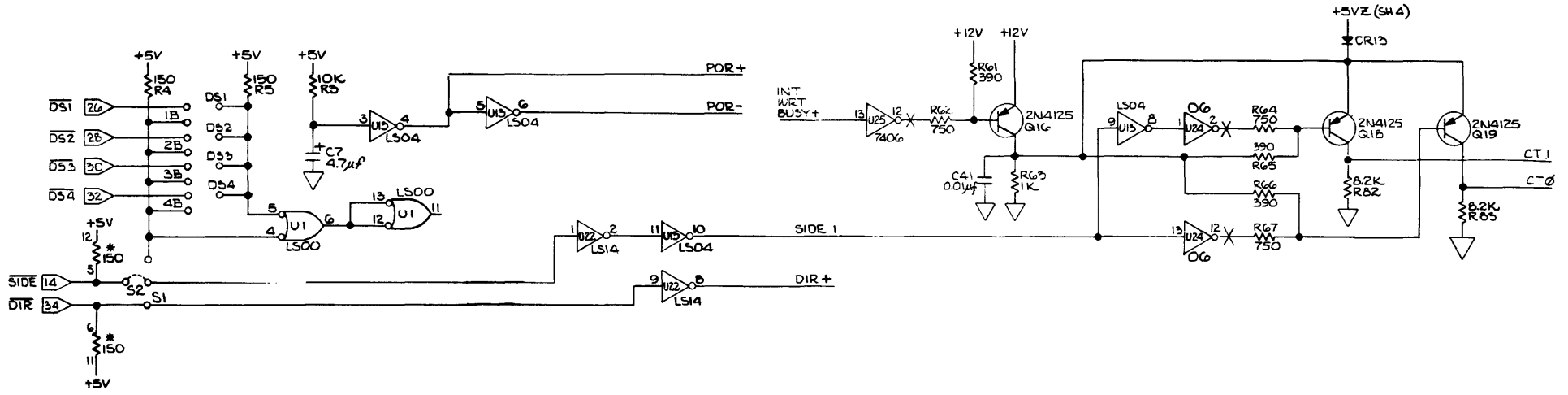


Figure 3-6 Side Select Schematic Diagram

3.4 OUTPUT CONTROL LINES

A. INDEX/SECTOR

Functional Description

The Index signal is provided once each revolution (166.667 milliseconds nominal) to indicate the beginning of a track to the controller. The Index line remains in a low (true) state for the duration of the index pulse. The duration of the Index pulse is nominally 2.0 milliseconds. Two index sensors are supplied for use with single- or double-sided media.

The leading edge of an Index pulse is always used for timing to ensure diskette interchangeability between drives.

With a standard, soft-sectored diskette installed, the signal at R33 (see Figures 3-7 and 3-8) is a high going pulse, nominally 2.0 milliseconds in duration, every 166.667 milliseconds.

Circuit Description

Light from the Index L. E. D. is used to drive the index sensor, which is applied to the inverting input of U32. This signal is conditioned by U32, then inverted by U33. It is used to drive U26. Then the Respective index pulses are gated by U20, then with drive select by U4 to generate the signal index. U26 and the associated support integrated circuits U16 and U20 are configured to allow only the Index 1 signal to be present on the interface when a two-hole diskette envelope is used.

When a double-sided diskette is installed, the signal IN1FF+ is generated and gated by U4 to enable the output TWO SIDED.

B. Ready

Functional Description

Ready is used by the controller to ascertain the status of the drive. This signal is generated when the drive motor is on, the diskette installed, and the drive is selected. The signal takes less than 700 milliseconds to go true (low) from a motor start by Drive Select or Head Load (see Section 1.19.21).

Circuit Description

The index pulse is gated by U5, which in turn, triggers U17, a 220 millisecond retriggerable one shot. When the index-to-index time becomes less than 220 milliseconds, the one shot becomes continuously enabled and generates the signal SPIN—.

This signal is gated with POR+, Power On Reset, to enable the two-revolution counters U18. The output of U18, Pin 8, enables U6, whose output is gated with Drive Select to generate the signal ready. Whenever the drive motor is disabled, MTRON+ goes low, causing this sequence to be repeated when the motor is restarted.

C. Disk Change

Functional Description

The signal $\overline{\text{DISK CHANGE}}$ is used to indicate the host controller that a disk change operation has been made.

Circuit Description

The disk change flip-flop, U10, is reset by OPEN- whenever the lever is in the open position. When this occurs, U10-6 is high, and a true disk change status is sent to the interface on Pin 12 from U4-11. Flip-flop U10 is set on the trailing edge of drive select causing U10-6 to go low and setting the disk change status to the false state.

In actual use, this signal can be used by the host controller to determine that the diskette lever has been opened since the end of the previous drive select operation.

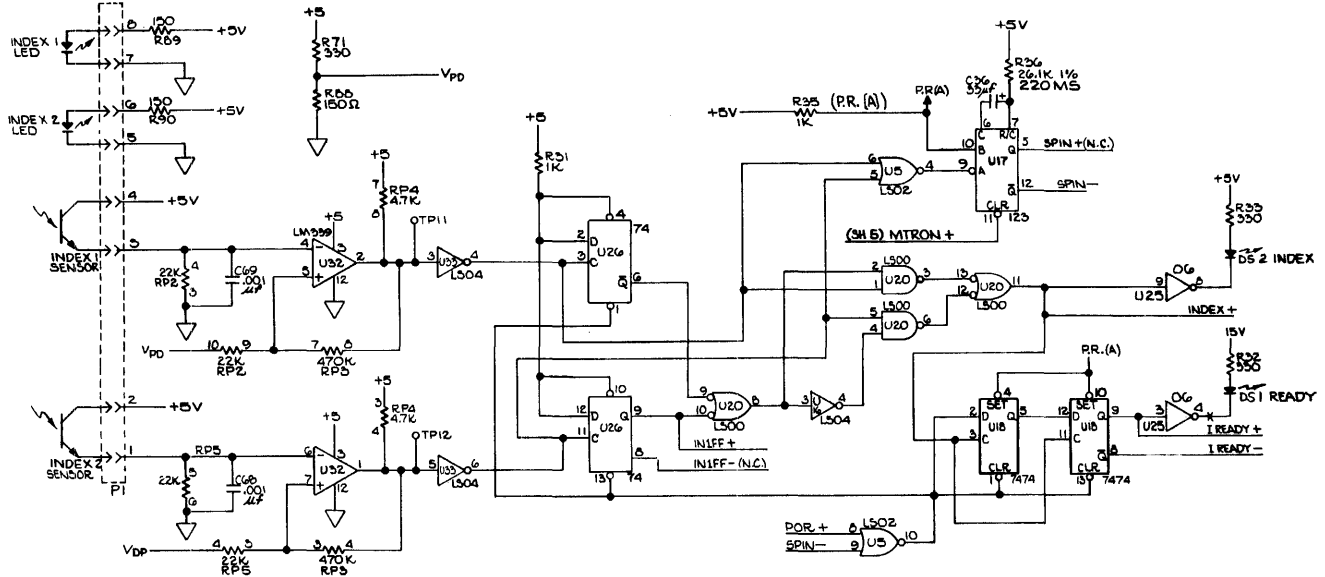


Figure 3-7
Index Schematic Diagram

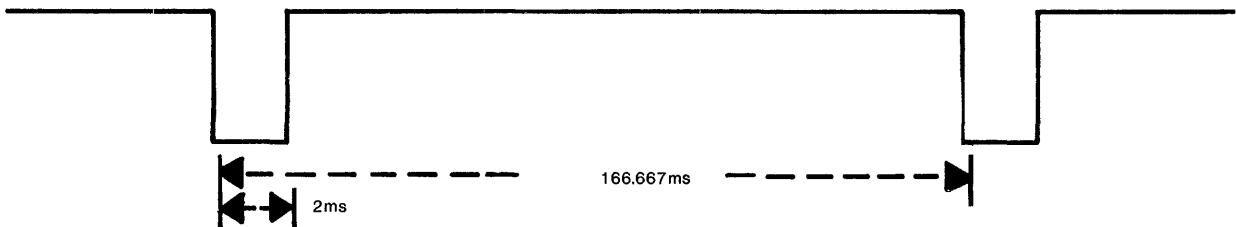


Figure 3-8
Waveform at Test Point 11 or 12
Alternate Test Point, R33
Soft Sector Diskette Installed

D. TRK 00

Functional Description

When the drive is selected, the Track 00 interface signal indicates to the controller that the read/write head is positioned at Track 00. The Track 00 signal remains true (low) until the head is moved away from Track 00. The Track 00 sensor is activated internally between Tracks 2 and 3.

Interface Pin 42 (see Figure 3-9) is true (low) when the carriage is positioned at Track 00 and the step motor is at Phase 0.

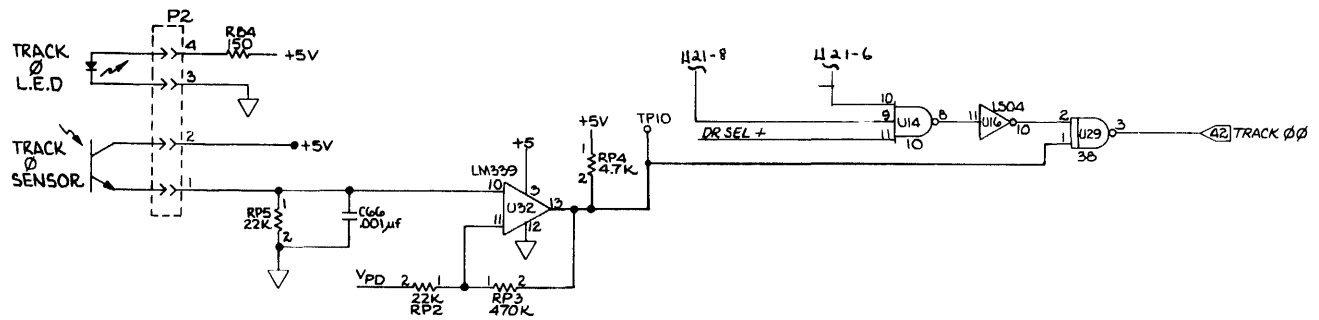


Figure 3-9
Track 00 Schematic Diagram

Circuit Description

When the read/write carriage is restored to Track 00, a tab on the carriage blocks light from the Track 00 L. E. D., turning off the Track 00 sensor transistor. This enables the inverting input of U32, a quad comparator causing U32, Pin 13, to go high.

This signal is gated with Phase 0 of the step circuit and with drive select to generate the signal $\overline{\text{TRK 00}}$. The signal at Test Point 10 should go high between Tracks 2 and 3, as the carriage is being moved toward $\overline{\text{TRK 00}}$.

E. WRITE PROTECT

Functional Description

When the drive is selected and the diskette is write protected, the $\overline{\text{WRITE PROTECT}}$ line's true (low). The write electronics are internally disabled when the diskette is write protected (see Option Listing for exceptions).

When the signal on the $\overline{\text{WRITE PROTECT}}$ line is false (high), the write electronics are enabled and the write operation can be performed. It is recommended that the controller not issue a Write command when the Write Protect signal is true (low).

It is recommended that the Write Data line be inactive whenever Write Gate is false (high).

Circuit Description

When a write protected diskette is installed, light from the Write Protect L. E. D. is detected by the Write Protected sensor transistor. The output of the sensor is high and is conditioned by U32. The output at Pin 14 is low generating the signal WR PROT-. This signal is used internally with the read/write circuitry. The signal WR PROT- is inverted by U33, and gated with DR SEL+ to generate the Write Protect signal.

F. READ DATA

Functional Description

The Read Data interface line transmits the read data to the controller when the drive is selected. It provides a pulse for each flux transition recorded on the media. The Read Data output line goes true (low) for a duration of 200 nanoseconds for each flux change recorded.

The leading edge of the low going, read data output pulse represents the true positions of the flux transitions on the diskette surface.

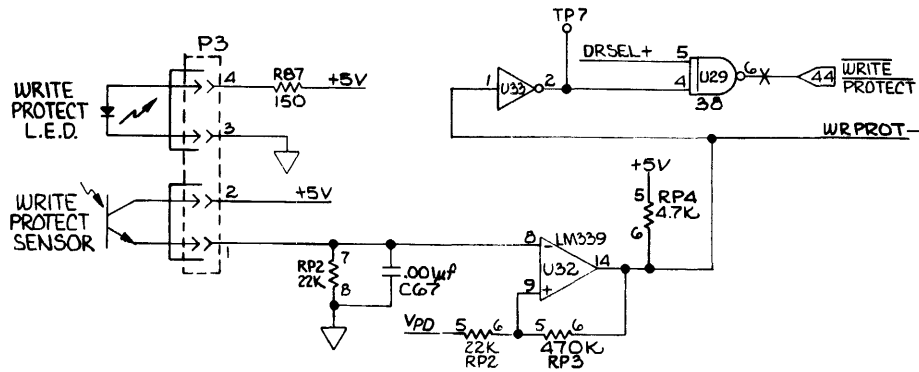


Figure 3-10
Write Protect Schematic Diagram

Test Points 2 and 3 (see Figure 3-11) are provided to observe the differential output of the first stage of Read signal preamplification. Test Points 4 and 5 are provided to observe the differential output of the second stage amplifier and differentiated Read signal. Test Point 9 is the output of the single shot used in the Read section, nominally 200 nanoseconds for each flux transition detected. Test Point 1 is signal ground.

Circuit Description

The read signal comes from the selected head on the drive. It is gated to the preamplifier U7 by the -Write signal to U25, which forward biases diodes CR14 and CR15. Then, the Read signal passes through a linear bandpass filter. The Read signal is then input to U2, the differentiator.

The output of U2 goes through the D. C. blocking capacitors to the crossover detector, U8, which digitizes the signal. This converts the signal into standard TTL level. Integrated circuits U9, U11, and U10 comprise a comparator circuit. Any pulses that occur outside of the normal duty cycle of U11 are eliminated. U9 is an edge detector. U11 acts as a one shot, with a timeout of approximately 860 nanoseconds. U10 is the actual comparator.

The Read signal is presented to U9. Then it goes to U11, where the pulses are shaped to 200 nanoseconds. This output is gated at U29 with the Unit Select signal to produce a digital output at Pin 46 of the interface connector (see Figure 3-12).

Note

U11, the final one shot, is disabled when the drive is writing data onto the diskette.

G. Two Sided

Functional Description

This output enables the controller to determine if a diskette is installed, which utilizes the Index 2 index hole. This may be used to indicate to the host controller that a two-sided diskette is in the drive.

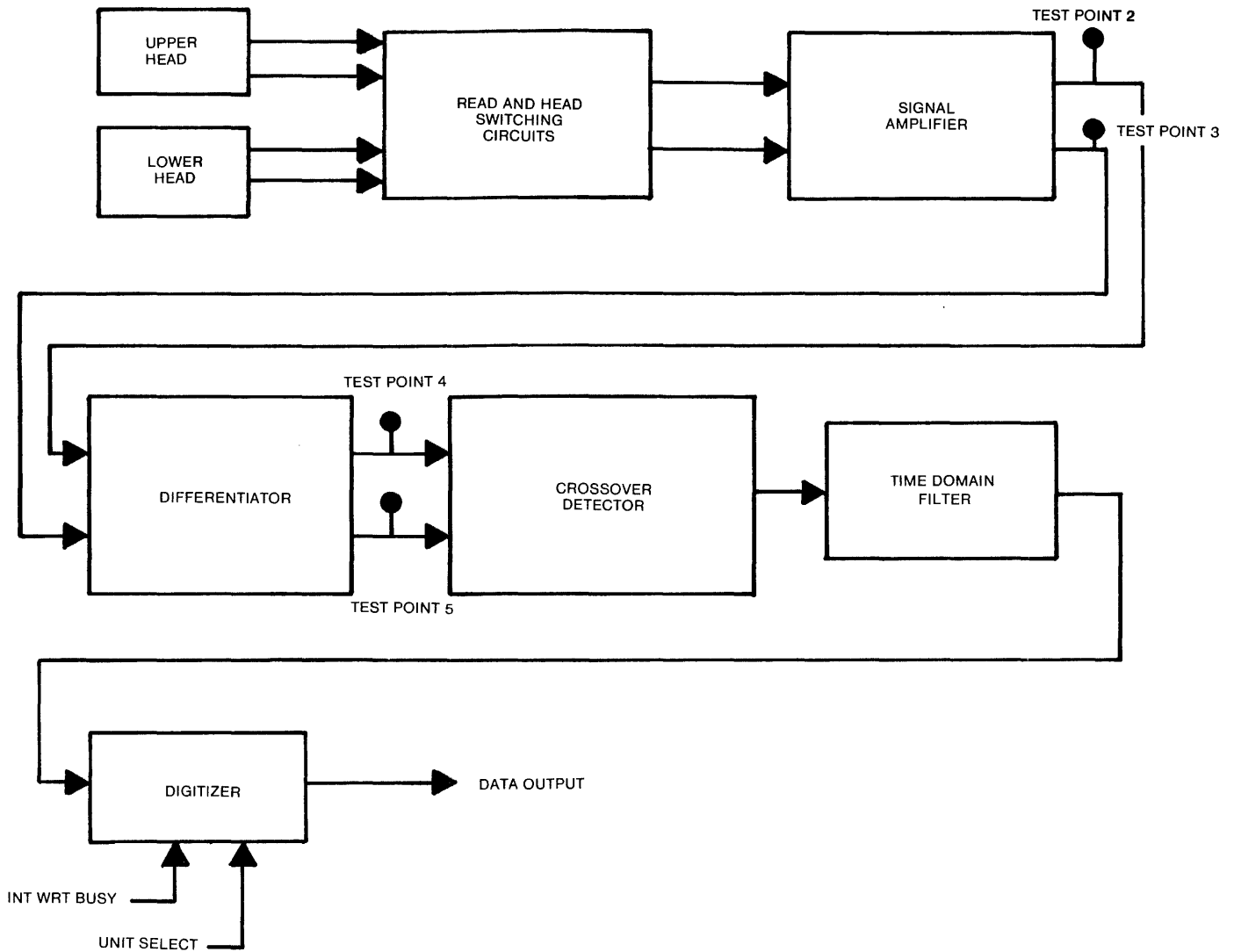


Figure 3-11
Read Circuit Block Diagram

Circuit Description

When a two-sided diskette is installed, the signal IN1FF+ is generated and gated by U4 to enable the low-going output Two Sided. The IN1FF signal also goes to the ready circuitry at U6-5 to disable Ready in the event that the upper head (Head 1) is selected when a single-sided (Head 0) diskette is installed (see Option RM for further discussion).

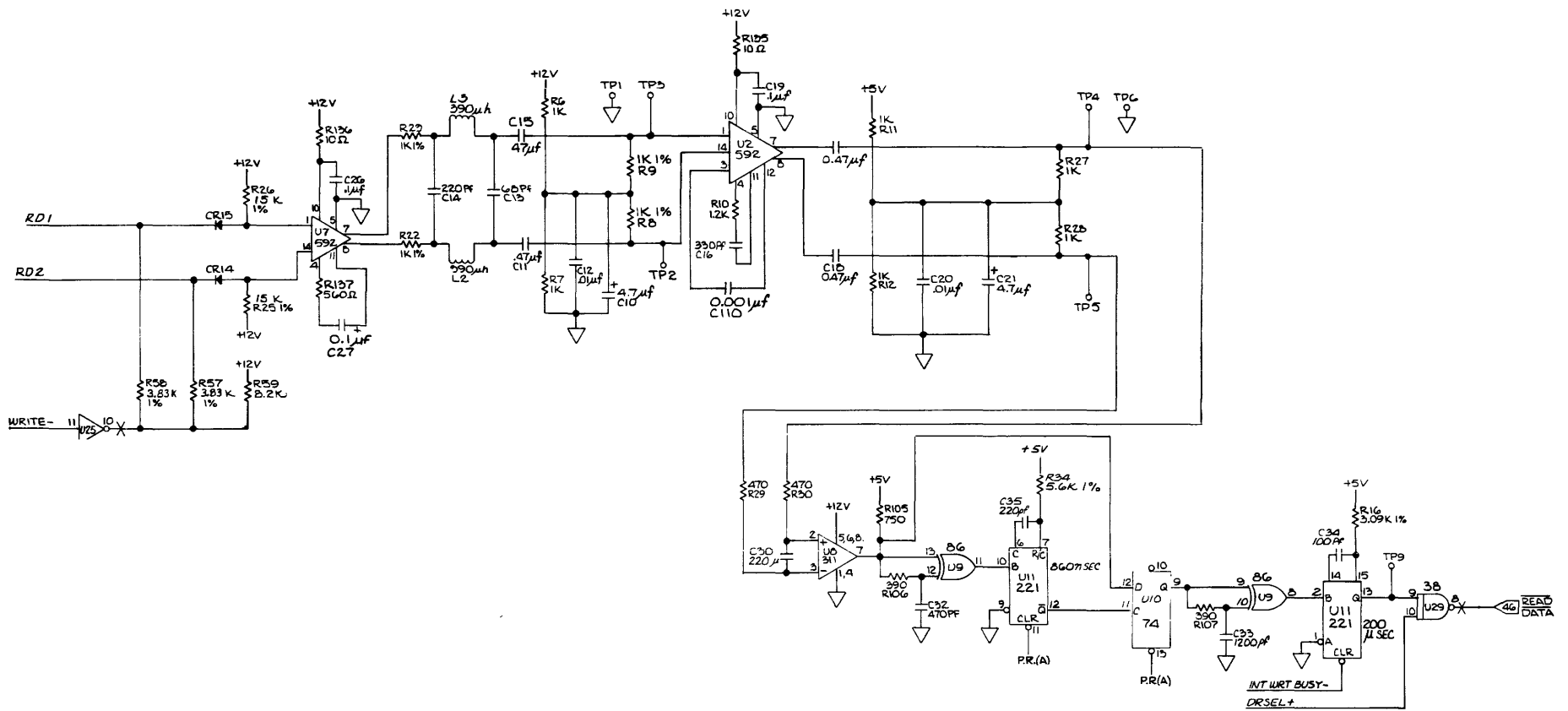


Figure 3-12
Read Data Schematic Diagram

SECTION IV

TROUBLESHOOTING GUIDE

4. INTRODUCTION

This section is presented in the form of a table. Each section contains four major parts:

1. The section number.
2. A statement of the presenting condition.
3. A list of the possible causes of the condition.
4. The recommended action to be taken.

<u>SECTION</u>	<u>CONDITION</u>	<u>POSSIBLE CAUSE</u>	<u>RECOMMENDED ACTION</u>
4.1	NOT READY AND/OR NO INDEX	Diskette not inserted.	Insert diskette.
		Diskette not clamped.	Turn knob lock lever clockwise so that it is perpendicular to the diskette insertion slot.
		Unit not selected.	Verify unit select and jumper configuration.
		Drive motor not turning	Verify interface drive motor on. Check Connector P6. Verify drive belt installed Replace circuit board. Replace Drive Motor Assembly.
		Index sensor not connected.	Check P1.
		Index sensor defective.	Replace index sensor.
4.2	WILL NOT SEEK OR RESTORE	Interface not enabled.	Verify interface direction, step, and select signals.
		Step motor disconnected.	Check Connectors P4 and P5.
		Defective step logic.	Replace circuit board.
		Defective stepper motor.	Replace Stepper Motor Assembly.
		Wrong option selected.	Check options DS and HL for the particular application.

<u>SECTION</u>	<u>CONDITION</u>	<u>POSSIBLE CAUSE</u>	<u>RECOMMENDED ACTION</u>
4.3	WILL NOT WRITE	Interface not enabled.	Verify write enable, select, and write data interface lines.
		Heads or write protect switch not connected.	Check Connectors P3, P8, and P9.
		Write protect switch misadjusted.	Check write protect switch operation.
		Defective write logic.	Replace circuit board.
		Defective heads.	Replace Head Carriage Assembly.
		Misadjusted platen load arm.	Adjust platen load arm.
4.4	WILL NOT READ	Interface incorrect.	Verify select is true and write enable is false.
		Alignment off.	Verify C. E. lobes, index burst, and Track 00 sensor adjustment.
		Defective read electronics.	Replace circuit board.
		Defective heads.	Replace Head Carriage Assembly.
		Platen load arm misadjusted.	Adjust platen load arm.
4.5	ACTIVITY L.E.D. INOPERATIVE	Interface not enabled.	Verify interface select and jumper configuration.

<u>SECTION</u>	<u>CONDITION</u>	<u>POSSIBLE CAUSE</u>	<u>RECOMMENDED ACTION</u>
4.5	ACTIVITY L. E. D. INOPERATIVE	Activity L.E.D. not connected.	Check P11
		Activity L.E.D. defective.	Replace Activity L. E. D. Assembly.
		Activity L.E.D. driver defective.	Replace circuit board.
4.6	NO TRACK 00 SENSOR INDICATION	Defective seek.	See Section 4.2
		Track 00 sensor not connected. Defective logic.	Check P2. Replace circuit board.
		Defective Track 00 sensor.	Replace Track00 Sensor Assembly.
4.7	DRIVE MOTOR WILL NOT START WHEN DOOR LATCHED.	Defective microswitch.	Replace switch.
		Microswitch not connected.	Check P14.
		Misadjusted switch bracket.	Realign.

SECTION V

REPLACEMENT PROCEDURES

5 INTRODUCTION

This section contains the replacement procedures for the TM848 family of disk drives' parts and assemblies:

1. Drive Belt
2. Drive Motor
3. Circuit Board
4. Cone Assembly
5. Diskette Lever
6. Bridge Assembly
7. Front Panel
8. Activity L. E. D.
9. Load Arm Assembly
10. Track 00 Sensor Assembly
11. Write Protect Sensor Assembly
12. Door Switch Assembly
13. Index Sensor Assembly
14. Diskette Ejector Assembly
15. Load Resistor Assembly
16. Stepper Band
17. Stepper Motor Assembly
18. Head Carriage Assembly

5.1 DRIVE BELT

5.1.1 Removal

- A. Turn the drive over so that the spindle is facing upward (see Figure 5-1).

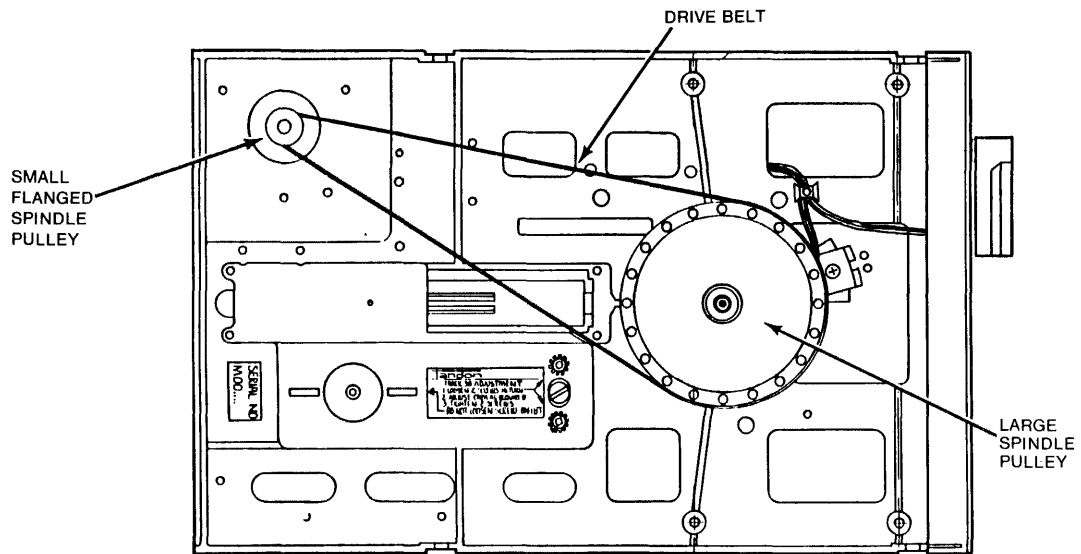


Figure 5-1
Drive Belt and Spindle

- B. Grasp the drive belt, and remove it from the pulleys.

5.1.2 Installation

- A. With the shiny side inward, loop the new drive belt onto the small, flanged spindle pulley.
- B. While turning the spindle, put the drive belt on the large spindle pulley.

5.1.3 Checks

- A. After turning the drive motor on, check that the drive belt does not slip or fall off the large pulley.
- B. Check the spindle speed (see Section II).

5.2 DRIVE MOTOR

5.2.1 Removal

- A. Remove the drive belt (see Section 5.1).
- B. After turning the drive over, cut the tie wraps that hold the drive motor's wires (see Figure 5-2).
- C. Unplug P6 from the circuit board.
- D. Remove the three mounting screws that attached the drive motor to the chassis.
- E. Lift out the drive motor.

5.2.2 Installation

- A. Set the drive motor on the chassis, aligning the three mounting holes.
- B. Reinstall and tighten the three mounting screws.

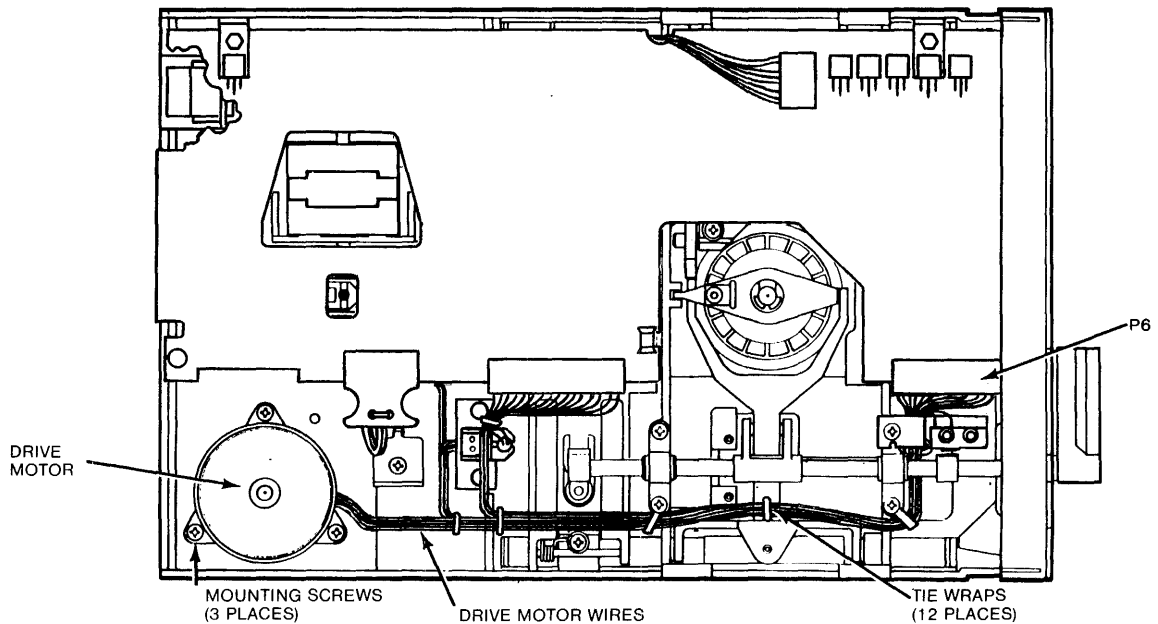


Figure 5-2
Drive Motor and Related Parts

- C. Carefully rebundle the wires, including the drive motor wire, and cable harness them (see Figure 5-2).
- D. Plug P6 into the circuit board.
- E. Turn the drive over, and reinstall the drive belt (see Section 5.1.2).

5.2.3 Checks

- A. Check to ensure that the drive motor works.
- B. Check the spindle speed (see Section II).

5.3 CIRCUIT BOARD

5.3.1 Removal

- A. Remove all the connectors from the circuit board.
- B. Remove the two side mounting screws that connect the two regulator heat sinks to the drive's chassis (see Figure 5-3).
- C. Remove the screw and the retaining clip that attach the circuit board to the drive's chassis.
- D. Lift the circuit board away from the drive.
- E. Remove the power connector by pushing down on its top. Lift its wires out, using the slot provided (see Figure 5-3).

5.3.2 Installation

- A. Install the power connector by rethreading the power wires and pushing in the power connector from the back of the drive.

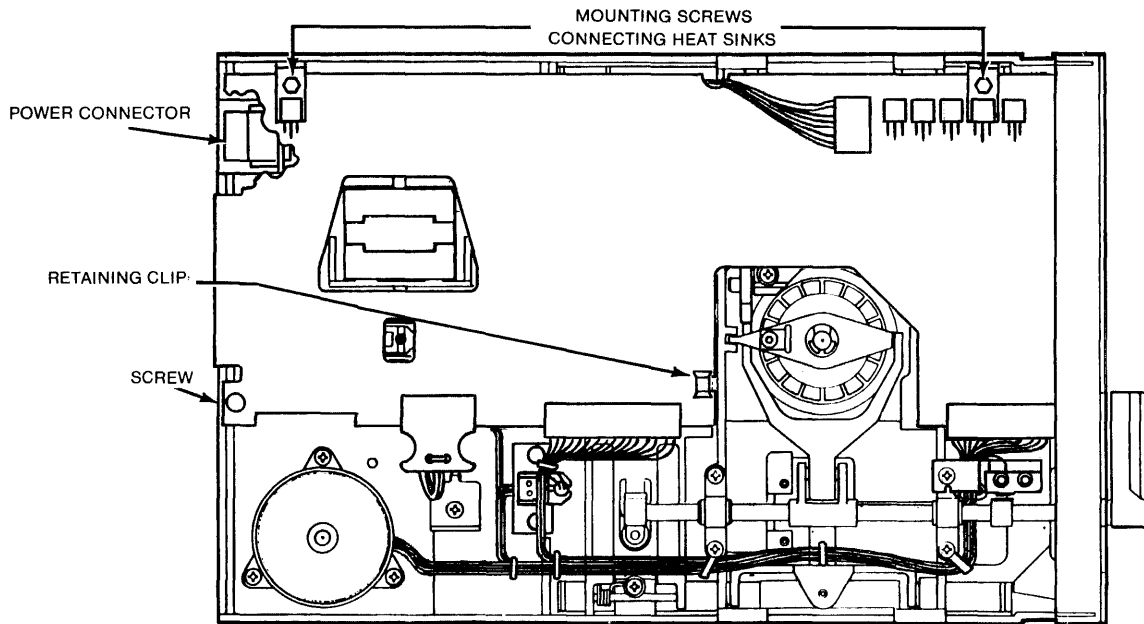


Figure 5-3
Circuit Board Mounting Screws

- B. Remount the circuit board using the two screws to the two heat sinks and the screw and nylon clip that attach the circuit board to the drive's chassis.
- C. Plug in all connectors, ensuring that each one is seated correctly in its proper location.

5.3.3 Checks

- A. Verify the select and options configuration.
- B. Applying power, check the operation of the drive.

5.4 CONE ASSEMBLY

5.4.1 Removal

- A. Remove the screw that attaches the cone bracket to the cone alignment arm (see Figure 5-4).
- B. Unlatch the diskette lever.
- C. Swing the Cone Assembly up 90 degrees so that it points toward the side of the drive.
- D. Carefully remove the E-Ring, flat washer, and washer that holds on the cone shaft.
- E. Gently lift out the Cone Assembly.

5.4.2 Installation

- A. Gently insert the Cone Assembly.
- B. Carefully insert the E-Ring, flat washer, and wave washer that holds on the cone shaft (see Figure 5-5).
- C. Swing the Cone Assembly down 90 degrees so that it points toward the bottom of the unit.

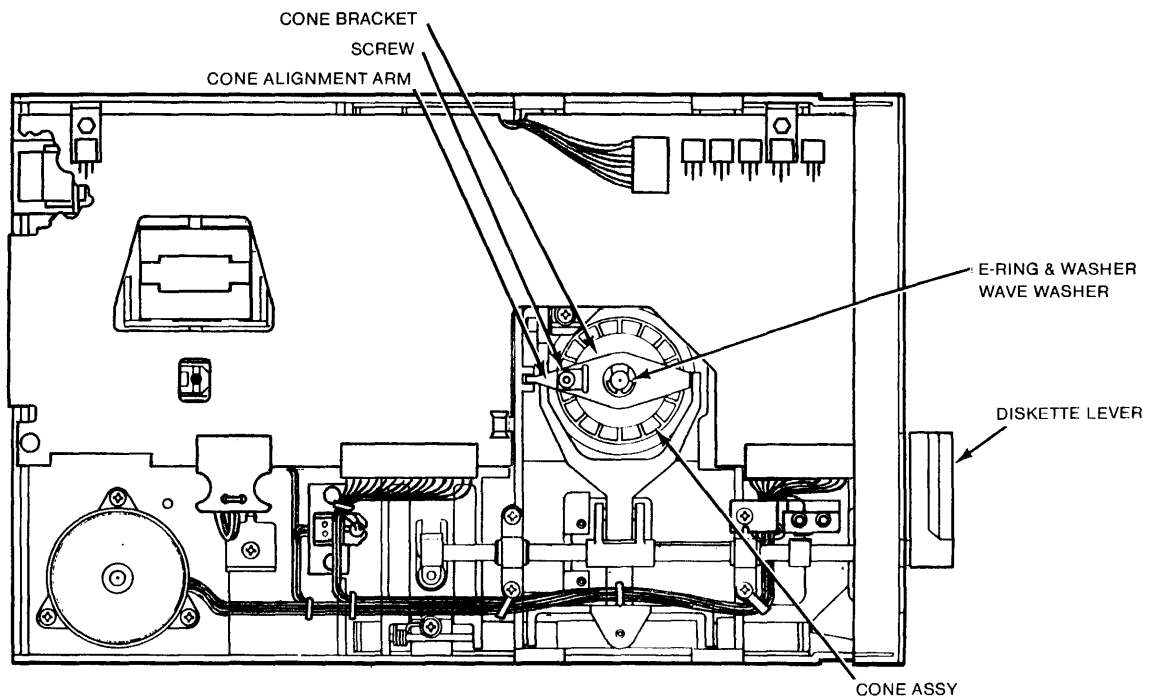


Figure 5-4
Cone Assembly Key Parts

- D. Latch the diskette lever.
- E. Insert the screw that attaches the cone bracket to the cone alignment arm(see Figure 5-5).

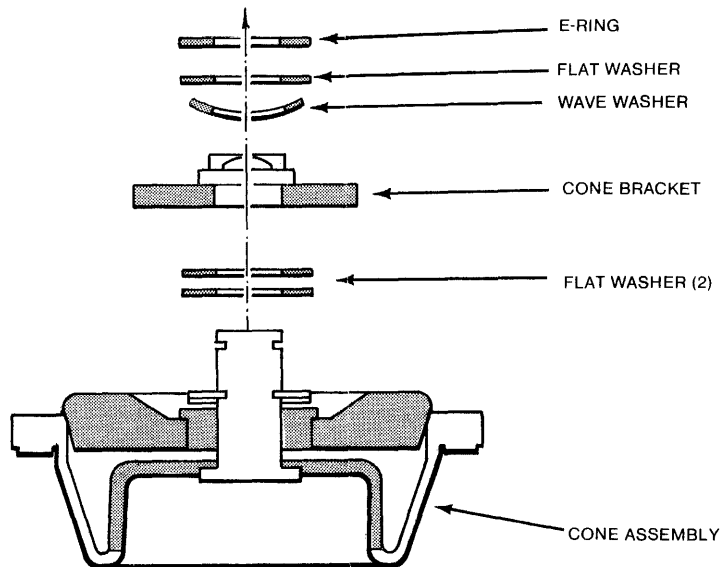


Figure 5-5
Cone Assembly Parts

5.4.3 Checks

- A. Ensure that the Cone Assembly turns freely.
- B. If not, reverify that the Cone Assembly has been installed correctly.
- C. Insert a diskette.
- D. Ensure that the diskette is clamped properly by the cone.

5.5 DISKETTE LEVER

5.5.1 Removal

- A. Pry off the cover that hides the diskette lever's retaining screw (see Figure 5-6).

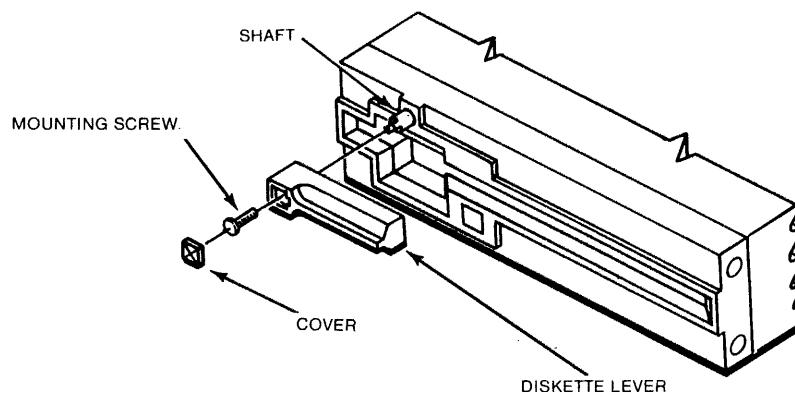


Figure 5-6
Diskette Lever Key Parts

- B. Remove the diskette lever's retaining screw.
- C. Carefully remove the diskette lever.

5.5.2 Installation

- A. Put the diskette lever on the shaft.
- B. Put a drop of Loctite Number 234 on the threads of the diskette lever's screw.
- C. Install and tighten the diskette lever's screw.
- D. Put the cover back on the diskette lever.

5.5.3 Checks

- A. Ensure that the diskette lever is perpendicular to the drive when the diskette is clamped. See Figure 5-7 for the adjustment.
- B. Ensure that the diskette lever is parallel to the drive when the diskette is unclamped. See Figure 5-7 for the adjustment.

5.6 BRIDGE ASSEMBLY

5.6.1 Removal

- A. Remove the circuit board (see Section 5.3.1).
- B. Remove the diskette lever (see Section 5.5.1).
- C. Remove the four bridge mounting screws that attach the Bridge Assembly to the chassis (see) Figur 5-8).

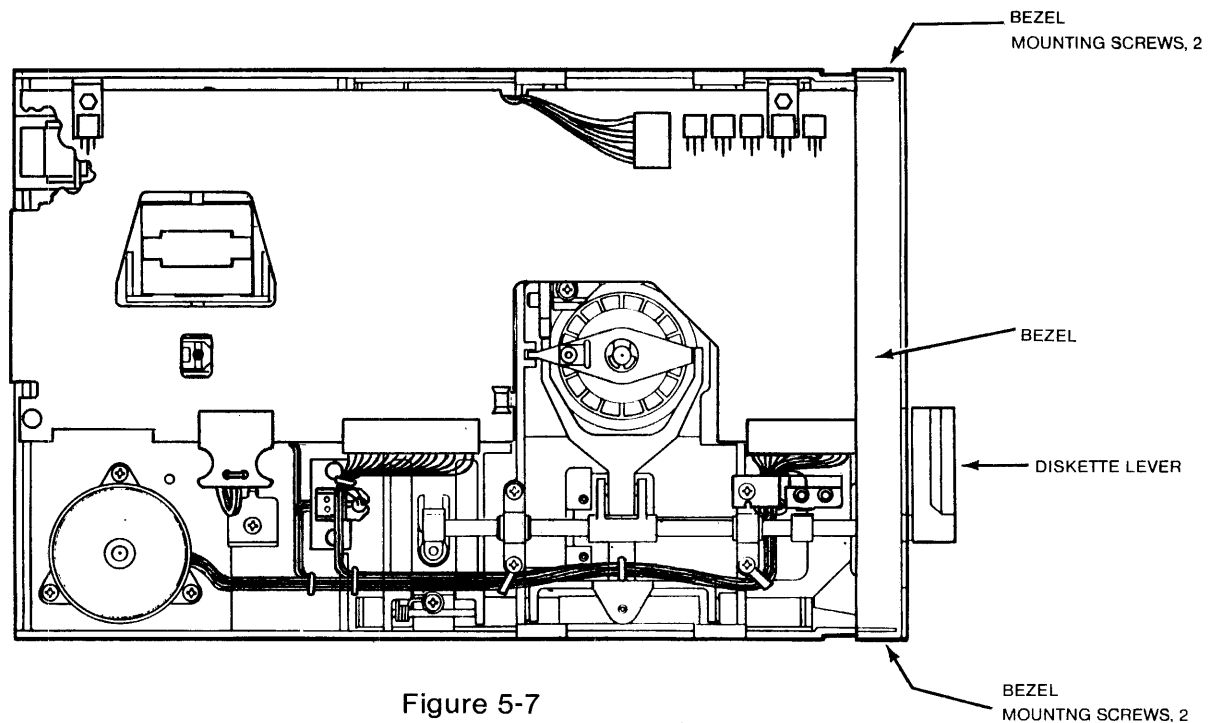


Figure 5-7
Diskette Lever Adjustment

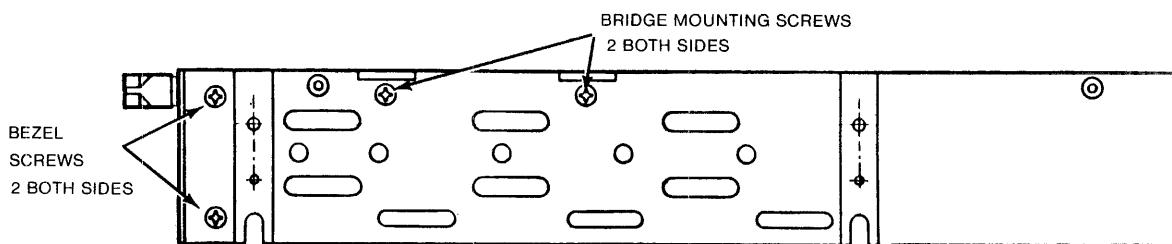


Figure 5-8
Bridge Assembly Key Parts

- D. Carefully pull out the two index L. E. D.'s in the Bridge Assembly.
- E. Carefully lift out the Bridge Assembly toward the back of the drive. The shaft must clear the bezel.

5.6.2 Installation

- A. Insert the shaft into the bezel and lay the Bridge Assembly in place.
- B. Install and tighten the four bridge mounting screws that attach the Bridge Assembly to the chassis.
- C. Install the two index L. E. D.'s into the Bridge Assembly.
- D. Install the diskette lever (see Section 5.5.2).
- E. Install the circuit board (see Section 5.3.2).

5.6.3 Checks

- A. Ensure that the diskette lever clamps the cone and loads the head (see Figure 5-9).

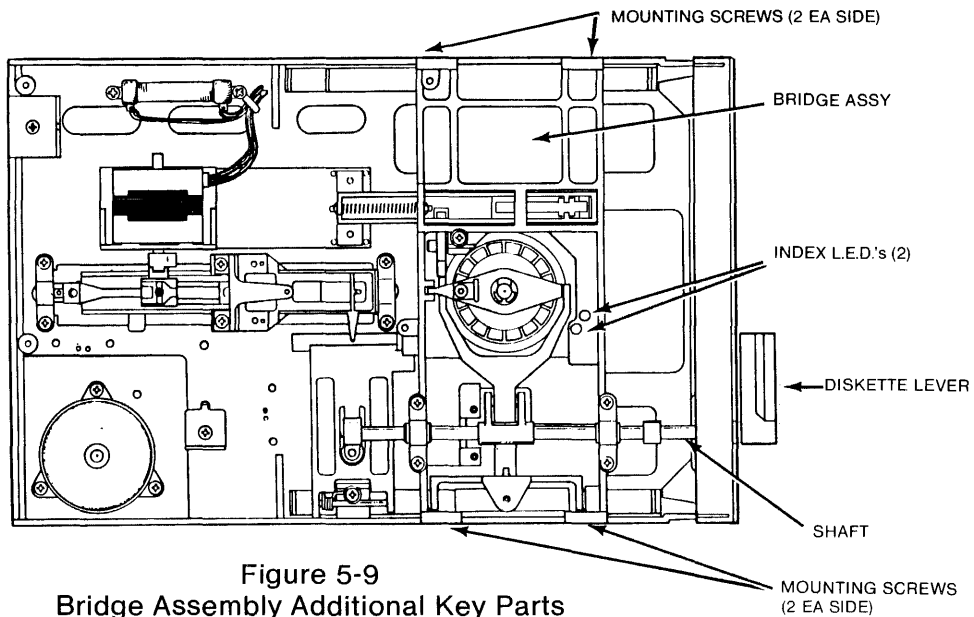


Figure 5-9
Bridge Assembly Additional Key Parts

5.7 BEZEL

5.7.1 Removal

- A. Remove the diskette lever (see Section 5.5).
- B. Remove the four bezel mounting screws, two on each side, that attach the bezel to the chassis (see Figure 5-10).

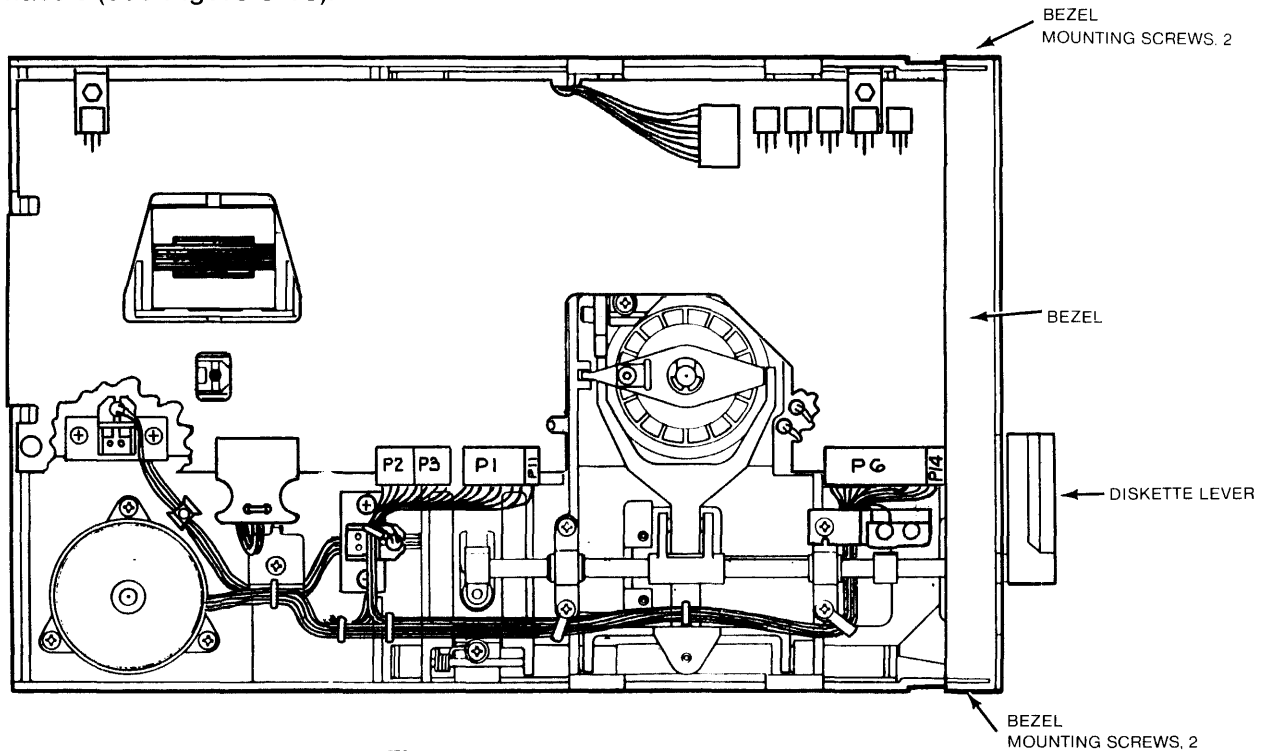


Figure 5-10
Bezel and Related Parts

- C. Lift off the bezel, being careful that the Activity L. E. D. comes out of its mounting with no binding.

5.7.2 Installation

- A. Put the bezel on the drive, ensuring that the Activity L. E. D. goes into its holder.
- B. Install the four bezel mounting screws that attach the bezel to the chassis.

5.7.3 Checks

- A. Ensure that the Activity L. E. D. goes on when required.
- B. Ensure that the diskette lever clamps the cone and loads the head.

5.8 ACTIVITY L. E. D.

5.8.1 Removal

- A. Remove the bezel (see Section 5.7.1).
- B. Remove the brackets that hold the bundle of wires going to P11 from the chassis (see Figure 5-11).

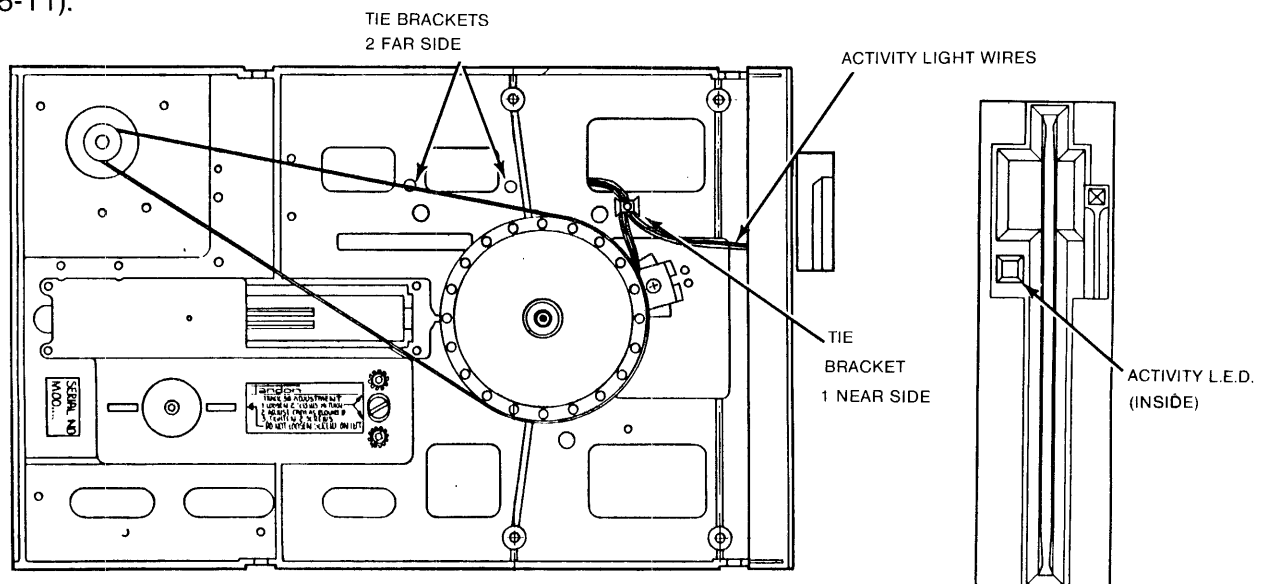


Figure 5-11
Activity L. E. D. Key Parts

- C. Remove the Activity L. E. D. and its wires after unplugging P11.

5.8.2 Installation

- A. Install the Activity L. E. D. into the bezel.
- B. Install the bezel.
- C. Attach the Activity L. E. D. wires to the chassis with brackets (see Figure 5-11).
- D. Plug P11 into the circuit board.

5.8.3 Checks

- A. Ensure that the Activity L. E. D. does not interfere with the drive mechanisms.
- B. Ensure that the Activity L. E. D. goes on when required.

5.9 LOAD ARM ASSEMBLY

5.9.1 Removal

- A. Remove the circuit board (see Section 5.3.1).
- B. Remove the mounting screw and washer that are used to attach the Load Arm Assembly to the chassis (see Figure 5-12).

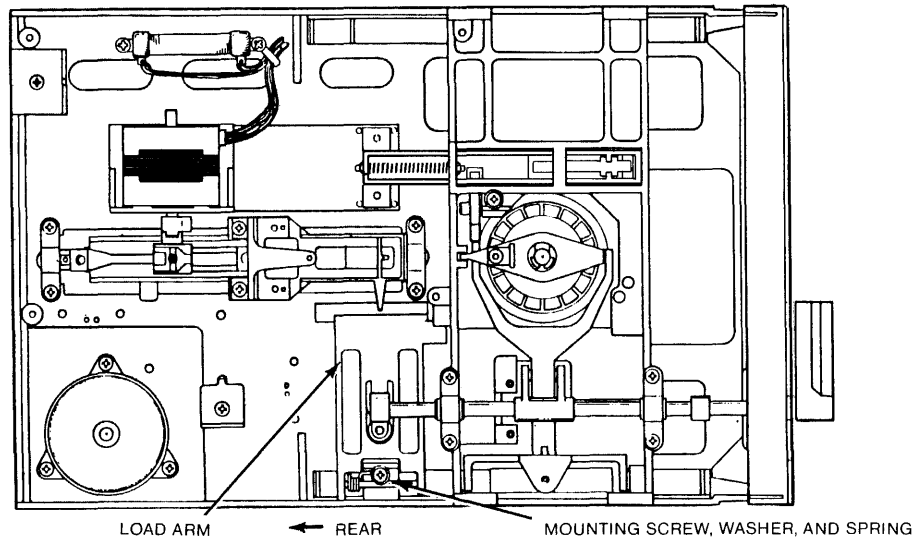


Figure 5-12
Load Arm Assembly Key Parts

- C. Carefully slide out the Load Arm Assembly toward the rear of the chassis.

5.9.2 Installation

- A. Slide the Load Arm Assembly into position from the rear of the chassis, ensuring that the load spring is sitting under the front of the mounting screw.
- B. Install and tighten the mounting screw that attaches the Load Arm Assembly to the chassis, ensuring that the washer is under the screw and that the head lift arm is over the Load Arm Assembly.
- C. Install the circuit board (see Section 5.3.2).

5.9.3 Checks

- A. Insert a diskette in the drive.
- B. Ensure that the head is loaded when the diskette lever is activated and that adequate clearance is attained for diskette insertion and ejection (see Section II).

5.10 TRACK 00 SENSOR ASSEMBLY

5.10.1 Removal

- A. Remove P2 from the circuit board.
- B. Cut the tie wraps that hold the cable harness, and remove the P2 wires (see Figure 5-13).

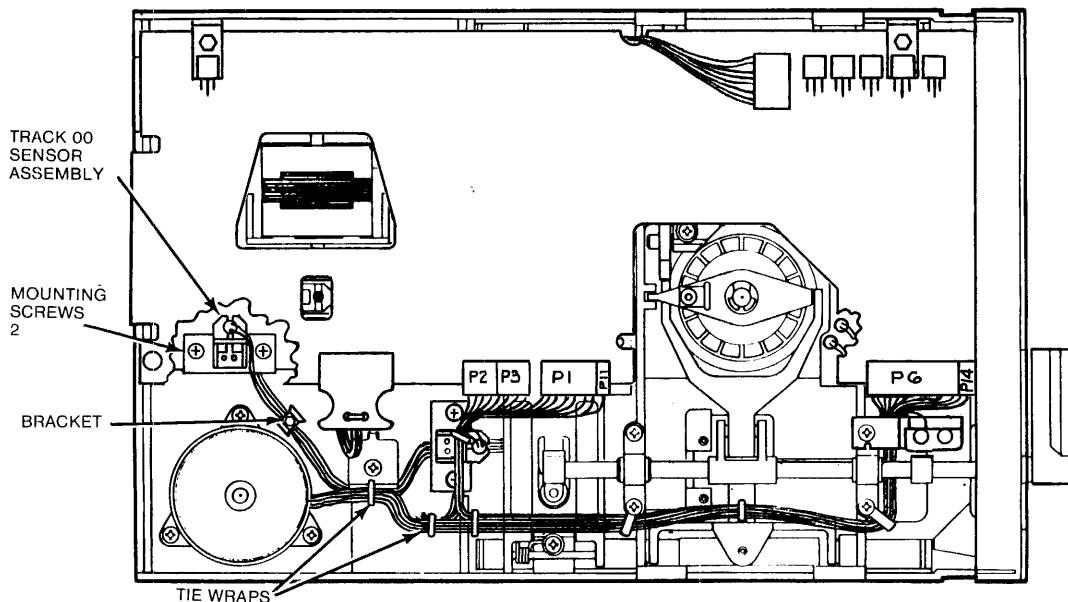


Figure 5-13
Track 00 Sensor Assembly Key Parts

- C. Remove the P2 wires from the bracket attached to the chassis.
- D. Remove the two mounting screws that hold down the Track 00 Sensor Assembly.
- E. Lift off the Track 00 Sensor Assembly.

5.10.2 Installation

- A. Using the two original mounting screws, install the Track 00 Sensor Assembly.
- B. Loop the P2 wires from the Track 00 Sensor Assembly through the bracket attached to the chassis.
- C. Using tie wraps, cable harness the P2 wires and the other wires together.
- D. Plug P2 into the circuit board.

5.10.3 Checks

- A. Adjust the Track 00 sensor (see Section II).

5.11 WRITE PROTECT SENSOR ASSEMBLY

5.11.1 Removal

- A. Remove P3 from the circuit board.
- B. Remove the two mounting screws that attach the Write Protect Sensor Assembly to the chassis (see Figure 5-14).
- C. Cut the tie wraps that hold the wires to the cable harness, and lift out the Write Protect Sensor Assembly.

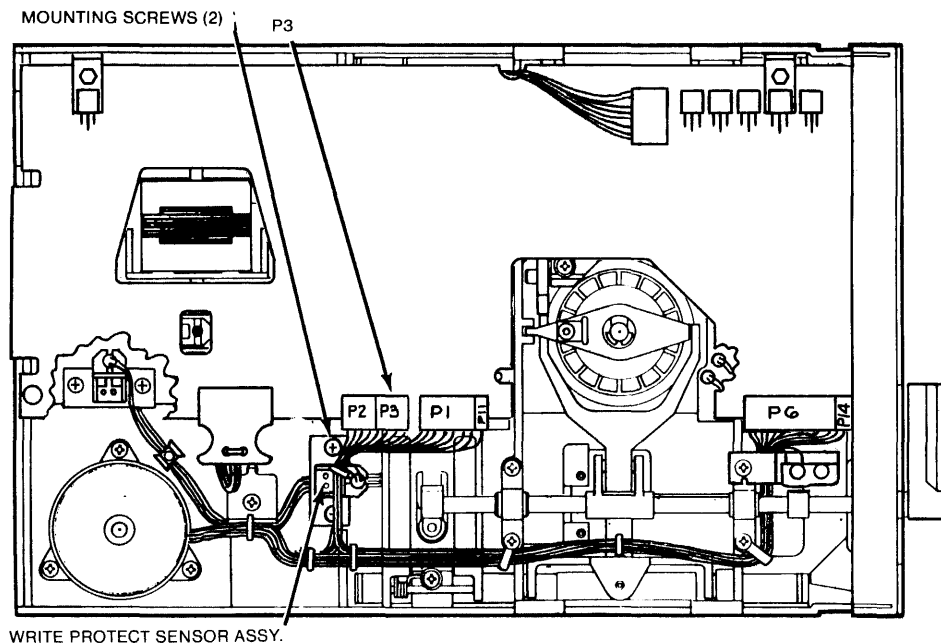


Figure 5-14
Write Protect Sensor Assembly Key Parts

5.11.2 Installation

- A. Using the two original mounting screws, attach the Write Protect Sensor Assembly to the chassis.
- B. Plug P3 into the circuit board.
- C. Tie wrap the Write Protect wires to the cable harness.

5.11.3 Checks

- A. Verify operation of the Write Protect Sensor Assembly.

5.12 DOOR SWITCH ASSEMBLY

5.12.1 Removal

- A. Remove P14 from the circuit board.
- B. Remove the mounting screw from the door switch bracket (see Figure 5-15).
- C. Cut the tie wraps leading to P14.
- D. Lift out the Door Switch Assembly.

5.12.2 Installation

- A. Mount the Door Switch Assembly to the bridge, using the original mounting screw.
- B. Plug P14 into the circuit board.

5.12.3 Checks

- A. Ensure that the door switch operates properly.

5.13 INDEX SENSOR ASSEMBLY

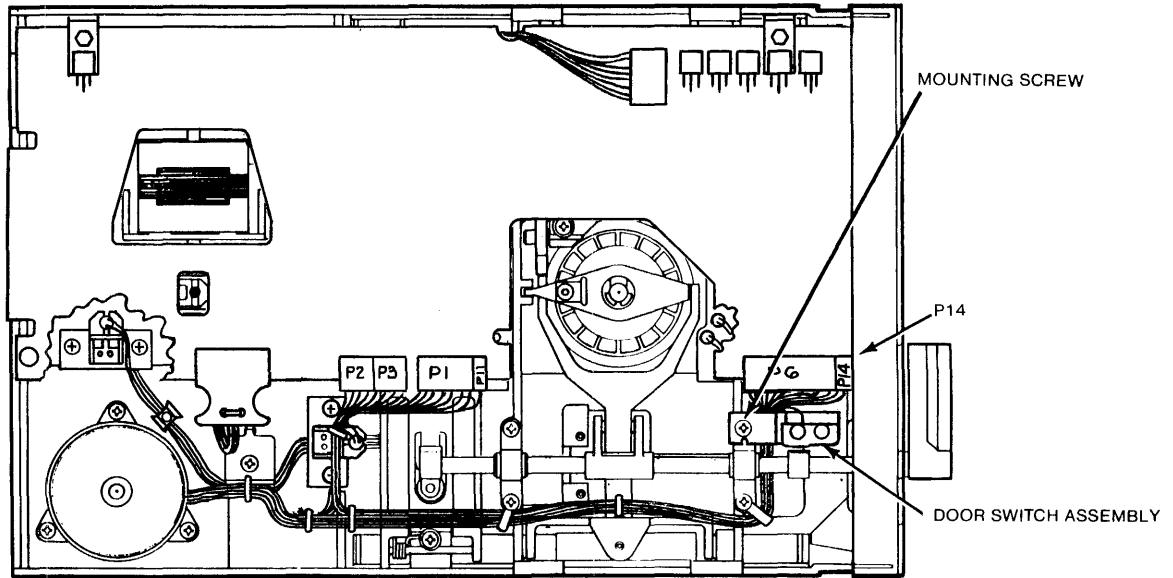


Figure 5-15
Door Switch Assembly Key Parts

5.13.1 Removal

- A. Remove the circuit board (see Section 5.3.1).
- B. Gently remove the two index L. E. D. 's from the Bridge Assembly (see Figure 5-16).

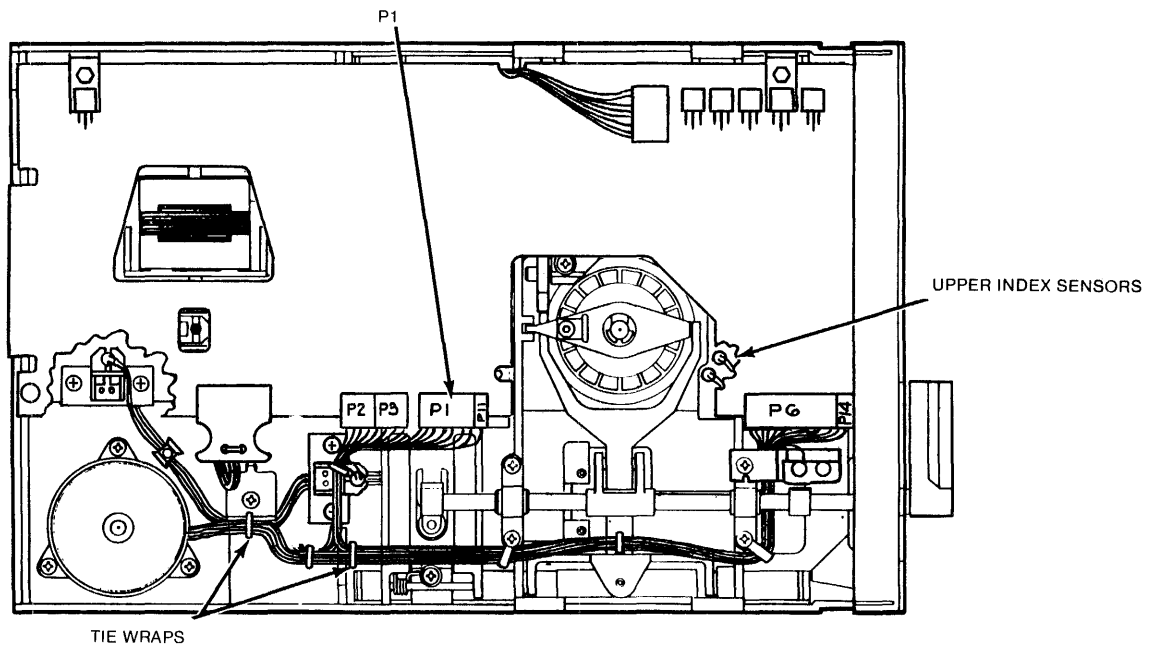


Figure 5-16
Index Sensor Assembly Key Parts, Top View

- C. Turn the drive over and remove the mounting screw from the Index Sensor Assembly (see Figure 5-17).
- D. Remove the two brackets that attach the Index Sensor Assembly's wires to the chassis (see Figure 5-16).

E. Cut the tie wraps along the cable harness (see Figure 5-16).

F. Lift out the Index Sensor Assembly (P1).

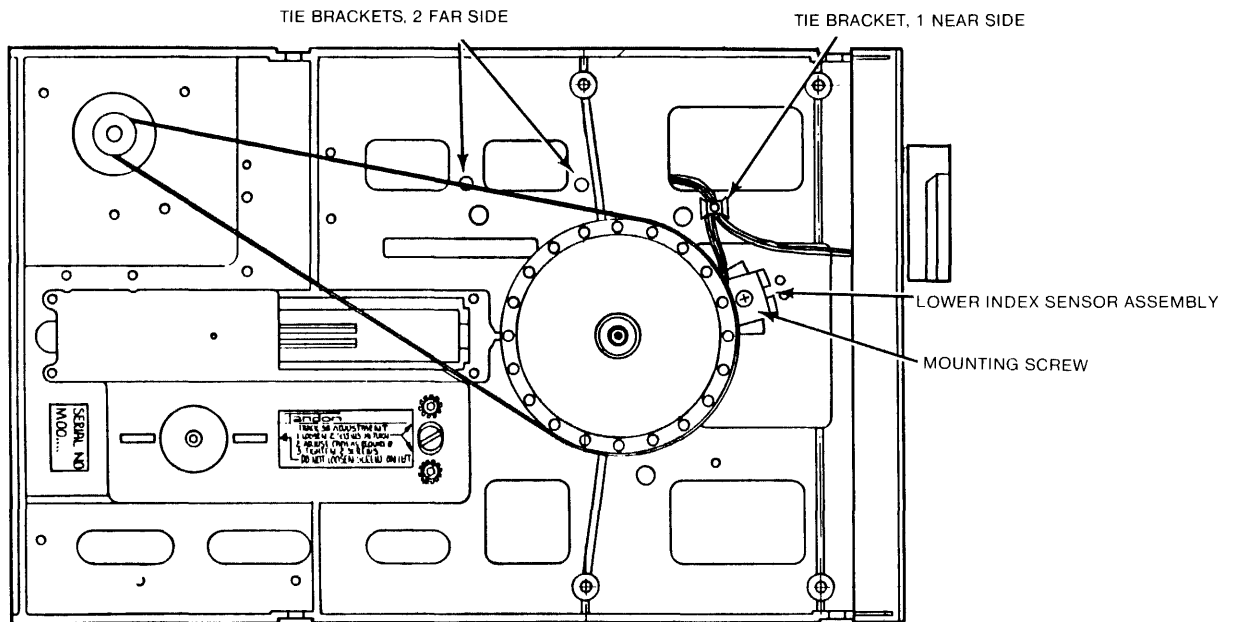


Figure 5-17
Index Sensor Assembly Key Parts, Bottom View

5.13.2 Installation

- A. Put the Index Sensor Assembly into the drive.
- B. Loop the wires to the cable harness and chassis.
- C. Insert the two L. E. D. index sensors into their sockets.
- D. Using the original mounting screw, attach the index L. E. D. to the drive's chassis.
- E. Cable harness the bundle of wires, including the Index Sensor Assembly's wires.
- F. Reinstall the circuit board (see Section 5.3.2).

5.13.3 Checks

- A. Check the index-to-data adjustment (see Section II).

5.14 DISKETTE EJECTOR ASSEMBLY

5.14.1 Removal

- A. Remove the circuit board (see Section 5.3.1).
- B. Remove the door lock lever (see Figure 5-6).
- C. Locate and remove the four screws, two on each side, that hold the Bridge Assembly (see Figure 5-7).

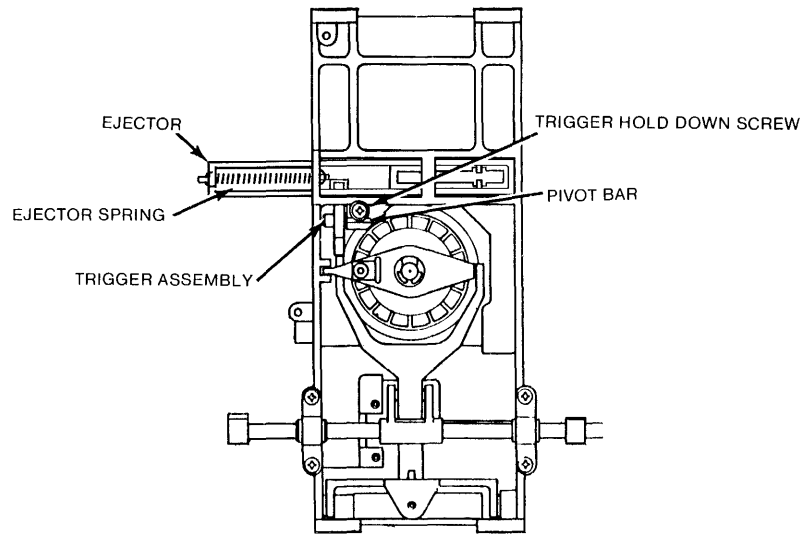


Figure 5-18
Diskette Ejector Assembly Key Parts

- D. Lift up the Bridge Assembly approximately two inches, taking care not to pull the L. E. D.'s from their sockets.
- E. Release the spring attached to the rear of the ejector.
- F. Remove the ejector.

5.14.2 Installation

- A. Insert the ejector.
- B. Engage the spring attached to the rear of the ejector.
- C. Insert the Bridge Assembly approximately two inches, taking care to put the L. E. D.'s in their respective sockets.
- D. Reinstall the original four screws that hold the Bridge Assembly.
- E. Push on the lever. Reinstall the retaining screw. Insert the small plug in the door lever.
- F. Reinstall the circuit board (see Section 5.3.1).

5.14.3 Checks

- A. Insert a work diskette into the drive.
- B. Ensure that the diskette stays in prior to being closed.
- C. Close and open the diskette lever.
- D. The diskette should eject.
- E. If not, see Section 5.4.

5.15 LOAD RESISTOR ASSEMBLY

5.15.1 Removal

- A. Remove P5 from the circuit board.
- B. Remove the circuit board (see Section 5.3.1).
- C. Remove the two mounting screws that attach the Load Resistor Assembly to the chassis.
- D. Unsolder the wires to the load resistors (see Figure 5-19).
- E. Mark or identify these wires so that they can be put back in the same location.

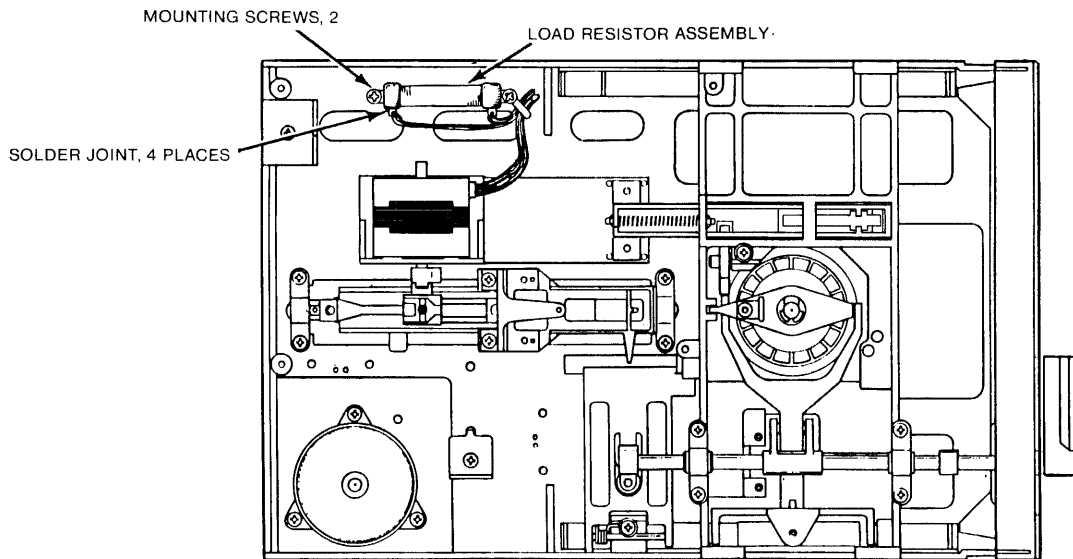


Figure 5-19
Load Resistor Assembly and Key Parts

5.15.2 Installation

- A. Solder the wires back in the same place at which they were originally.
- B. Mount the Load Resistor Assembly onto the chassis using the two original mounting screws.
- C. Install the circuit board (see Section 5.3.2).
- D. Plug P5 into the circuit board.

5.15.3 Checks

- A. Enable the drive through the interface logic.
- B. Step the drive to Track 00.
- C. Step the drive to Track 76.
- D. Do the C. E. alignment verification procedure (see Section II).

5.16 STEPPER BAND

5.16.1 Removal

It is suggested that the drive be returned to an authorized Tandon repair center when removing the stepper band.

- A. Remove the circuit board (see Section 5.3.1).
- B. Lift off the stepper band from the spring tensioner (see Figure 5-20).

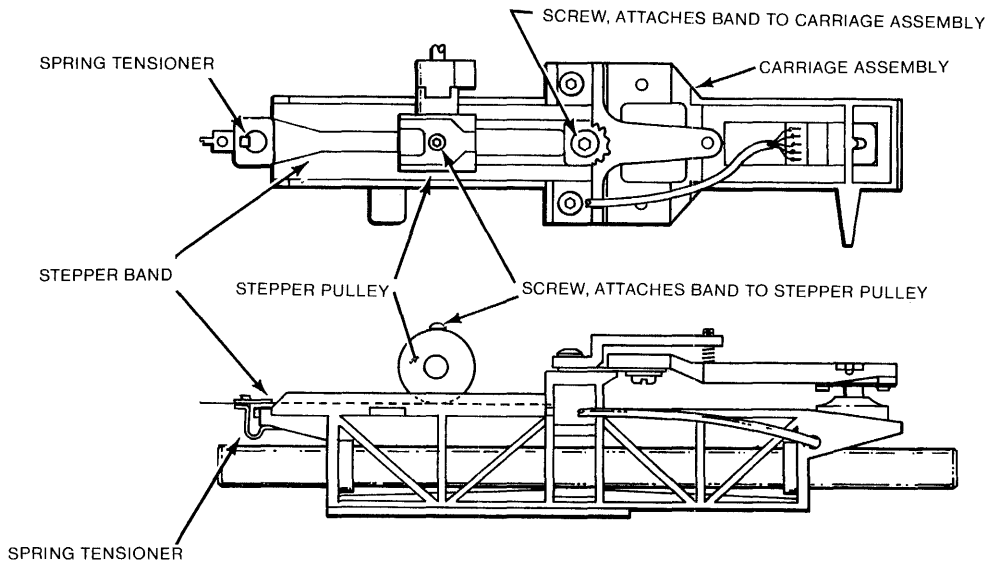


Figure 5-20
Stepper Band Key Parts

- C. Remove the screw that attaches the front of the stepper band to the Head Carriage Assembly.
- D. Remove the mounting screw that attaches the stepper band to the stepper pulley.
- E. Lift out the stepper band.

5.16.2 Installation

- A. Screw the front of the stepper band into the Head Carriage Assembly (see Figure 5-21).
- B. Loop the stepper band around the stepper pulley.
- C. Attach the rear of the band to the spring tensioner.
- D. Attach the stepper band to the stepper pulley loosely with the mounting screw.
- E. Move the Head Carriage Assembly back and fourth at least five times.
- F. Visually inspect the stepper band to ensure that it is centered on the stepper pulley.
- G. Tighten the mounting screw that attaches the stepper pulley to the stepper band.
- H. Install the circuit board (see Section 5.3.2).

5.16.3 Checks

- A. Check the C. E. alignment (see Section II).

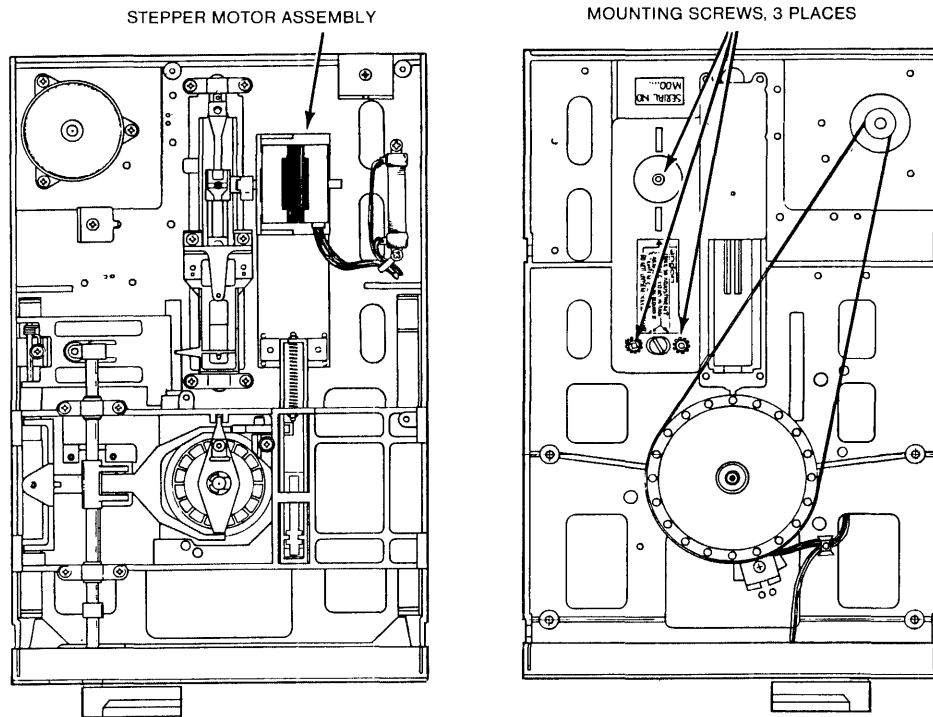


Figure 5-21
Stepper Band Additional Key Parts

5.17 STEPPER MOTOR ASSEMBLY

5.17.1 Removal

It is suggested that the drive be returned to an authorized Tandon repair center when removing the Stepper Motor Assembly.

- A. Remove the circuit board (see Section 5.3.1).
- B. Remove the stepper band (see Section 5.16.1).
- C. Remove the three mounting screws that attach the Stepper Motor Assembly to the chassis (see Figure 5-22).
- D. Remove plug connectors P4 and P5 from the circuit board.
- E. Cut the tie wraps that connect the stepper motor wires to the load resistors.
- F. Lift out the Stepper Motor Assembly.

Note

Be careful not to damage the stepper band.

5.17.2 Installation

- A. Place the Stepper Motor Assembly into the drive's chassis.
- B. Using the original three mounting screws, attach the Stepper Motor Assembly to the chassis.

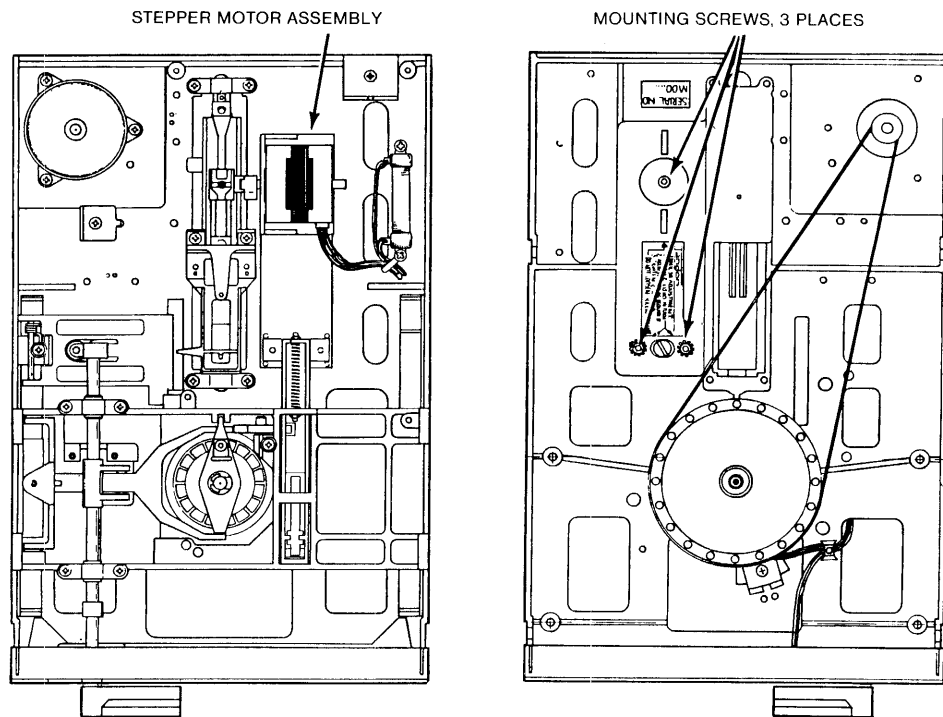


Figure 5-22
Stepper Motor Assembly Key Parts

- C. Replace the stepper band (see Section 5.16.2).
- D. Replace the circuit board (see Section 5.3.2).

5.17.3 Checks

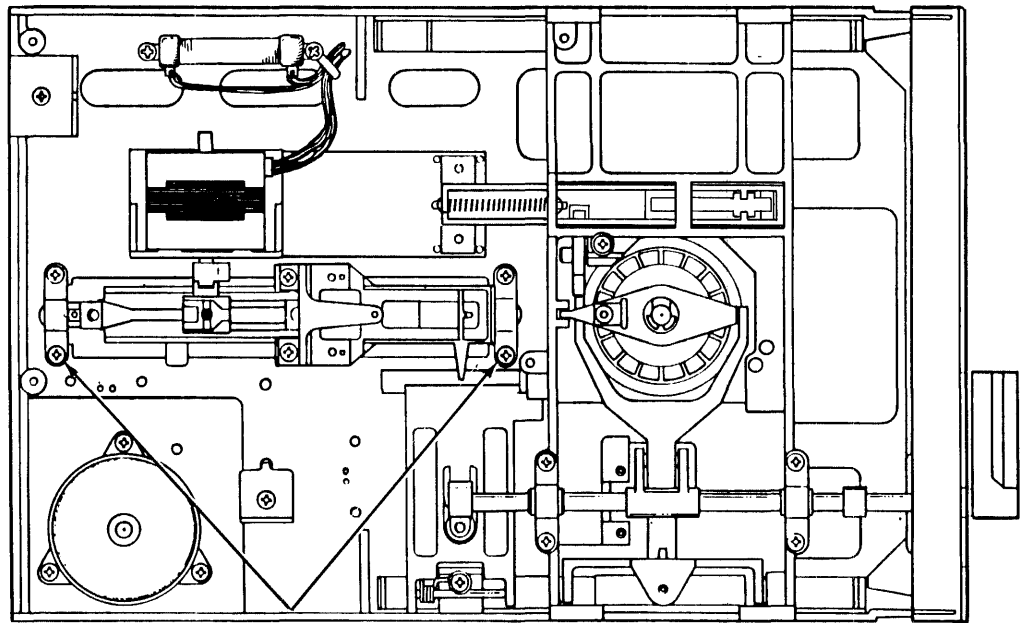
- A. Align the C. E. lobes on the drive (see Section II).

5.18 HEAD CARRIAGE ASSEMBLY

5.18.1 Removal

It is suggested that the drive be returned to an authorized Tandon repair center when removing the Head Carriage Assembly.

- A. Remove the Stepper Motor Assembly (see Section 5.17.1).
- B. Remove plug connectors P8 and P9 from the circuit board.
- C. Cut the tie wraps that hold the head cables to the chassis.
- D. Remove the clip that holds the head cables to the head cable flexure bracket.
- E. Remove the four mounting screws that attach the carriage shaft to the chassis (see Figure 5-23).



MOUNTING SCREWS 4 PLACES

Figure 5-23
Head Carriage Removal

F. Lift out the Head Carriage Assembly.

5.18.2 Installation

- A. Install the carriage shaft in the carriage.
- B. Using the four original mounting screws, attach the carriage shaft to the chassis.
- C. Install the Stepper Motor Assembly (see Section 5.17.2).

Note

Take care not to damage the Arm Spring Assembly.

- D. Plug connectors P8 and P9 into the circuit board.
- E. Cable harness the Head Carriage Assembly's wires to the main wire bundle.

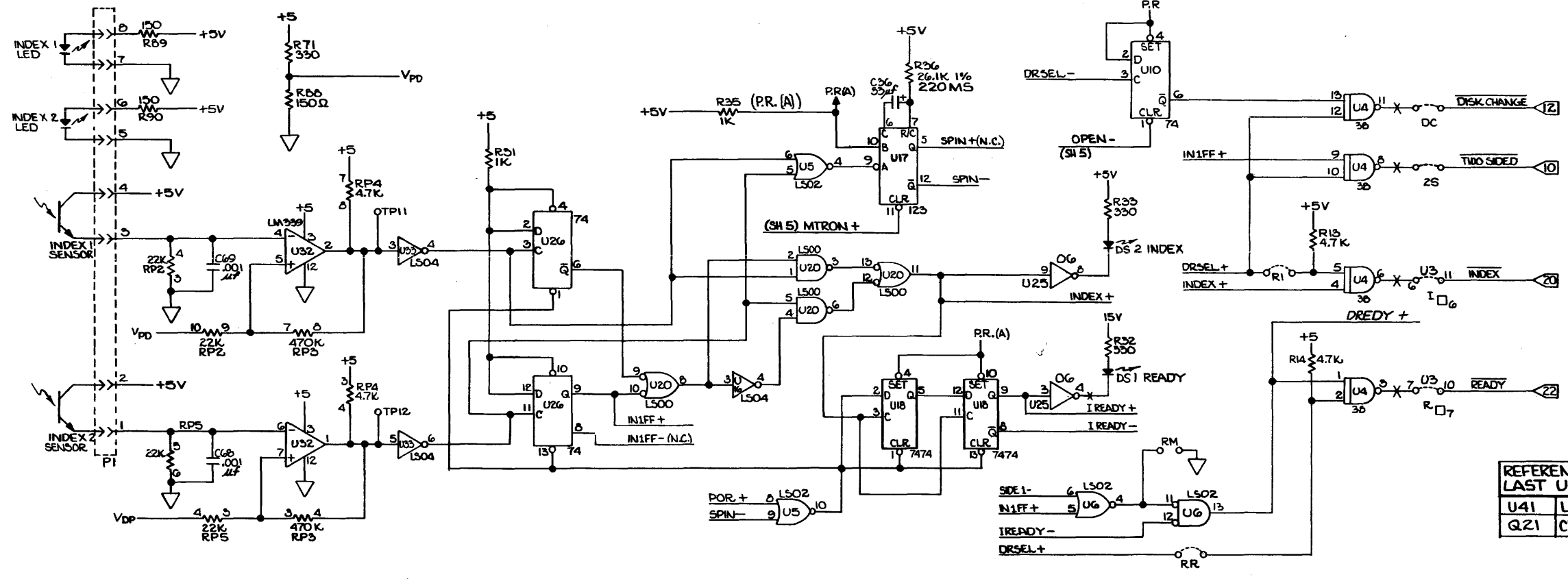
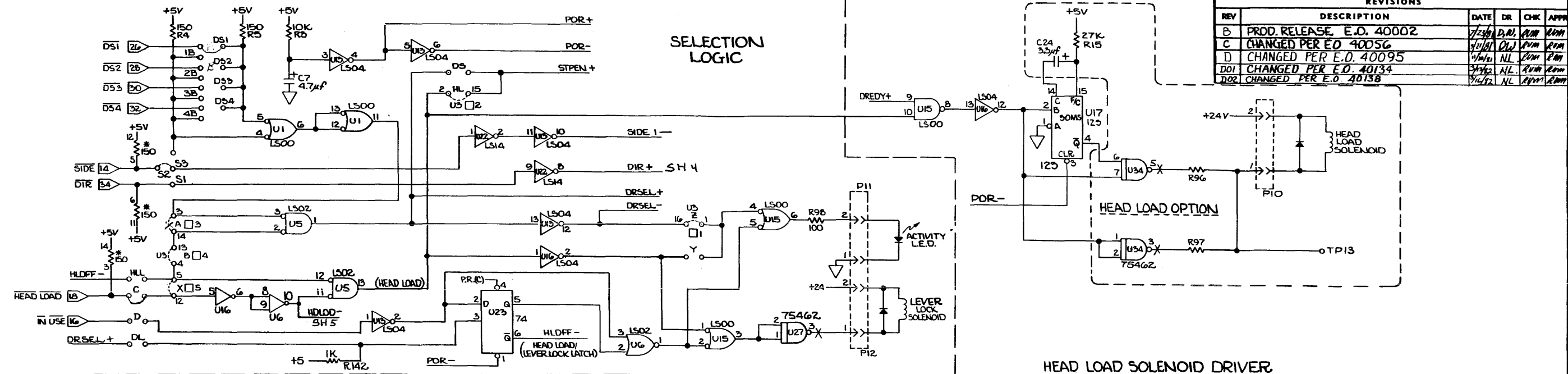
5.18.3 Checks

- A. Check the azimuth (see Section II).
- B. Check the Cats Eye alignment (see Section II).
- C. Check the index alignment (see Section II).

APPENDIX I

PRINTED CIRCUIT BOARD SCHEMATICS AND ASSEMBLY DRAWINGS

REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APP
B	PROD. RELEASE E.O. 40002	7/23/81	DLW	RLM	RLM
C	CHANGED PER E.O. 40056	10/1/81	DLW	RLM	RLM
D	CHANGED PER E.O. 40095	11/16/81	NL	RLM	RLM
DO1	CHANGED PER E.O. 40134	3/16/82	NL	RLM	RLM
DO2	CHANGED PER E.O. 40138	3/16/82	NL	RLM	RLM



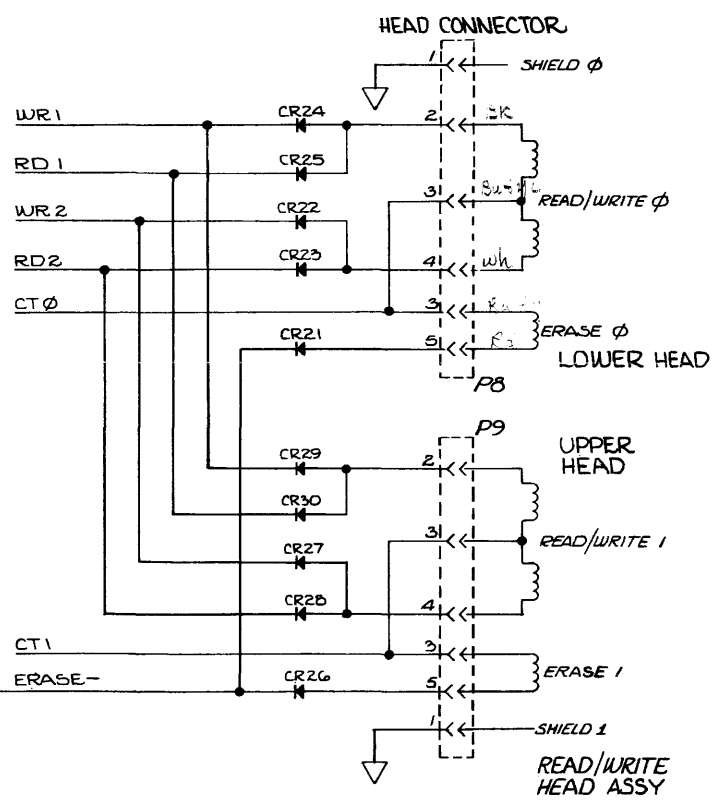
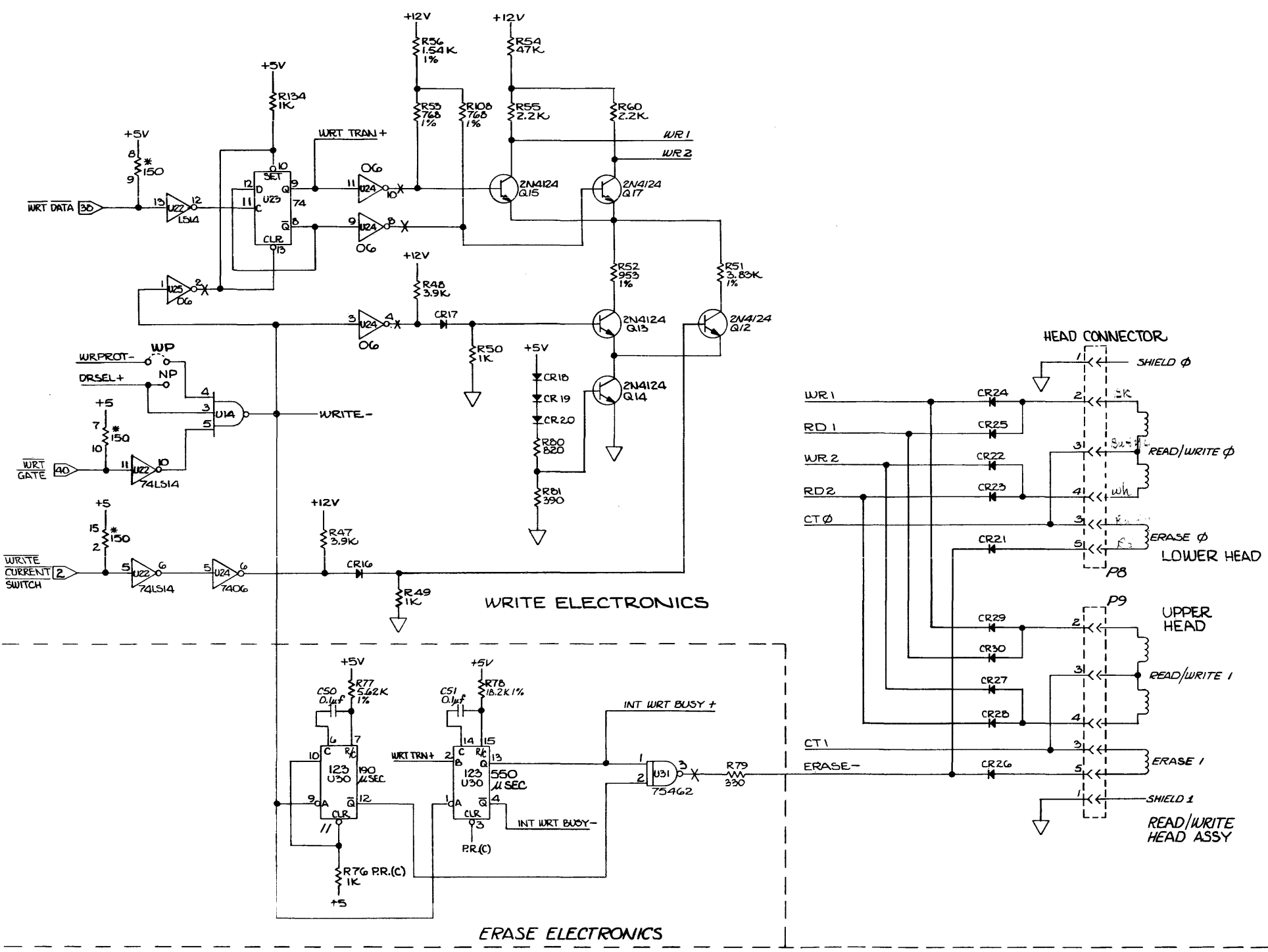
REFERENCE DESIGNATIONS LAST USED			
U41	L5	C112	
Q21	CR31	RI43	

APPLICABLE P.C. BOARD REV. LEVEL	210060-000 REV. D-E
APPLICABLE ASSY REV. LEVEL	210094-000 REV. G-J

- 8. ALL CAPACITORS ARE IN MICROFARADS 50V.
- 7. ALL INDUCTORS ARE MICROHENRY'S ± 10%.
- 6. ALL RESISTORS ARE IN OHMS 1/4W, ± 5%.
- 5. - - - STRAP OPTION.
- 4. □ - STRAP OPTION LOCATED IN SHUNT U3.
- 3. * - RESISTOR LOCATED IN RESISTOR PACK RP1.
- 2. □ - ON P13 UNLESS OTHERWISE SPECIFIED.
- 1. - - - STRAP PRE ETCH ON CIRCUIT BOARD.

SIGNATURES		DATE	
DR. DANIEL WILKINS		6/2/81	
DES	RLM		
ENGR	RLM		
PROJ. ENGR. DLW/RLM		7/23/81	TITLE
			MODEL 848 DISKETTE DRIVE ELECTRONICS.
MATERIAL		FINISH:	SIZE
			CODE
NEXT ASSY		FIRST USE	DWG. NO.
			210092-000
APPLICATION		SCALE	REV
		DO NOT SCALE DWG	DO2
			SHEET 1 OF 5

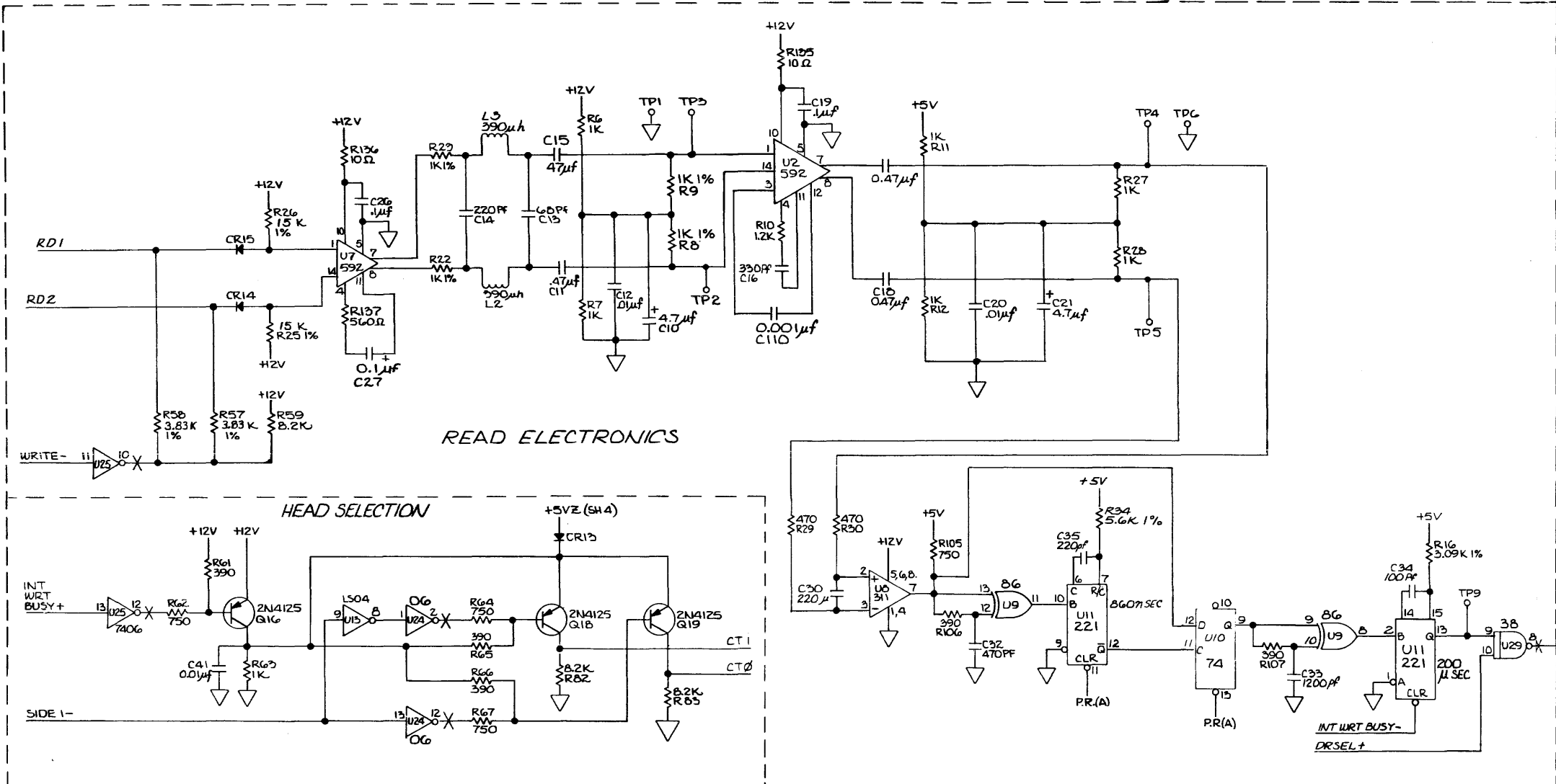
REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APP
E	SEE SH 1				



1. *-RESISTOR LOCATED IN RESISTOR PACK RPI

<small>THE INFORMATION CONTAINED HEREON IS THE PROPERTY OF TANDON MAGNETICS. NO PORTION OF THE DATA SHALL BE RELEASED, DISCLOSED, USED OR DUPLICATED FOR USE IN PROCUREMENT OR MANUFACTURE WITHOUT SPECIFIC WRITTEN PERMISSION FROM TANDON MAGNETICS.</small> <small>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES</small> <small>TOLERANCES:</small> DIM: ± .010 ANGULAR: ± 1/2° X: ± .005 Y: ± .005 <small>BREAK ALL SHARP CORNERS APPROX. .010</small>		SIGNATURES DR: WILTSHIRE ENGR: RUM PROJ. ENGR: RUM DATE: 7/27/81	Tandon CORPORATION TITLE MODEL 848 DISKETTE DRIVE ELECTRONICS
NEXT ASSY FIRST USE APPLICATION	FINISH: MATL:	SIZE: NONE CODE IDENT NO.: DWG NO.: 210092-000 REV: 1002 DO NOT SCALE DWG SHEET 2 OF 5	

REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APP
E	SEE SH 1				

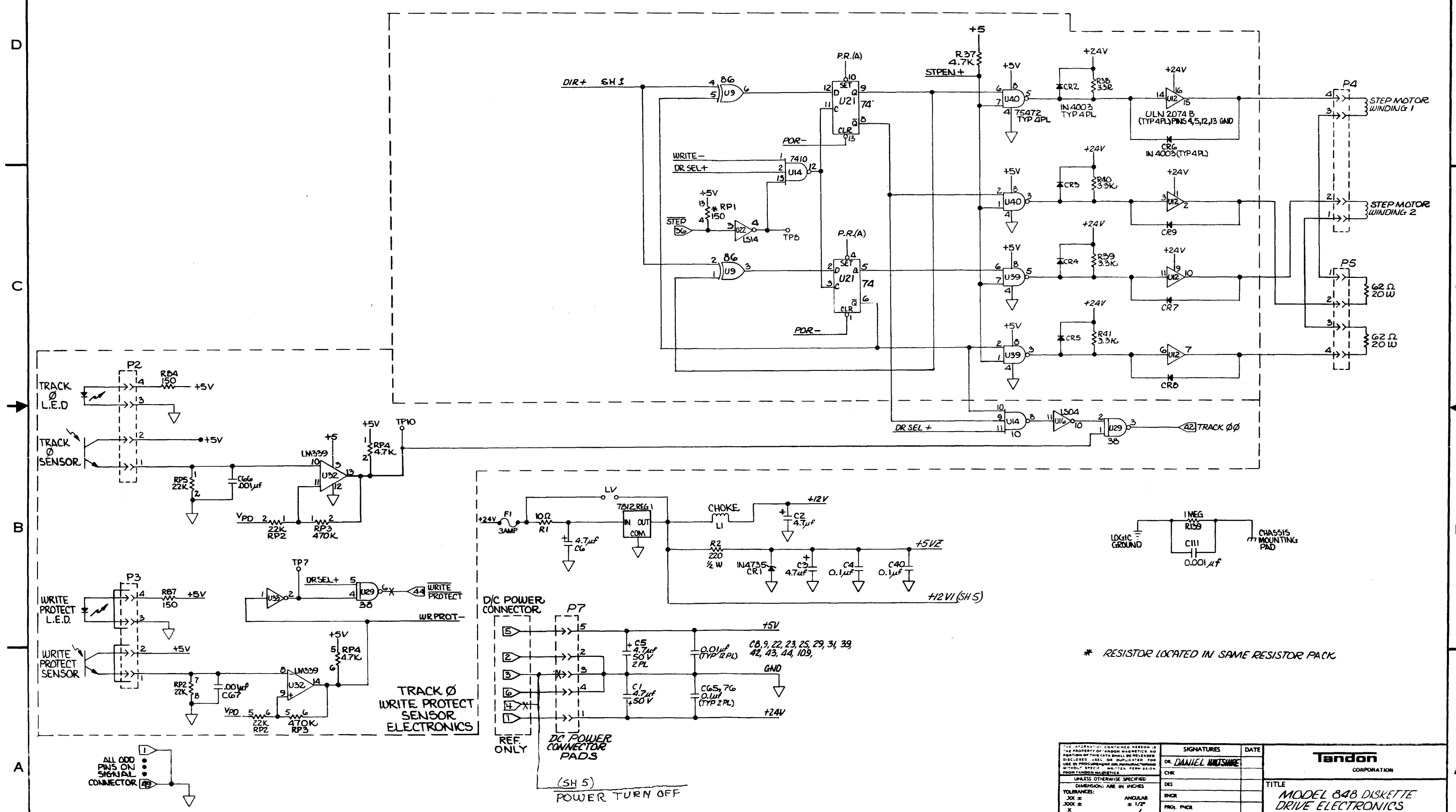


READ ELECTRONICS

HEAD SELECTION

<small>THE INFORMATION CONTAINED HEREON IS THE PROPERTY OF TANDON MAGNETICS AND NO PORTION OF THIS DATA SHALL BE RELEASED, DISCLOSED, USED OR DUPLICATED FOR USE IN PERFORMANCE OF WORKS CONTRACTING WITHOUT SPECIFIC WRITTEN PERMISSION FROM TANDON MAGNETICS.</small> <small>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES</small> <small>TOLERANCES:</small> <small>XXX ±</small> <small>XX ±</small> <small>X ±</small> <small>∅ ±</small> <small>BREAK ALL SHARP CORNERS APPROX. .010</small>		SIGNATURES DATE	Tandon CORPORATION
CHK: <i>MULTSHIRE, D</i> DES: <i>RUM</i> ENGR: <i>RUM</i> PROJ. ENGR: <i>RUMMAN</i>	TITLE MODEL 848 DISKETTE DRIVE ELECTRONICS	DATE 7/8/81	MATL:
NEXT ASSY FIRST USE APPLICATION	FINISH:	SIZE: <i>D</i> CODE IDENT NO.: DWG NO.: 210092-000 SCALE:	REV: D02 DO NOT SCALE DWG SHEET 3 OF 5

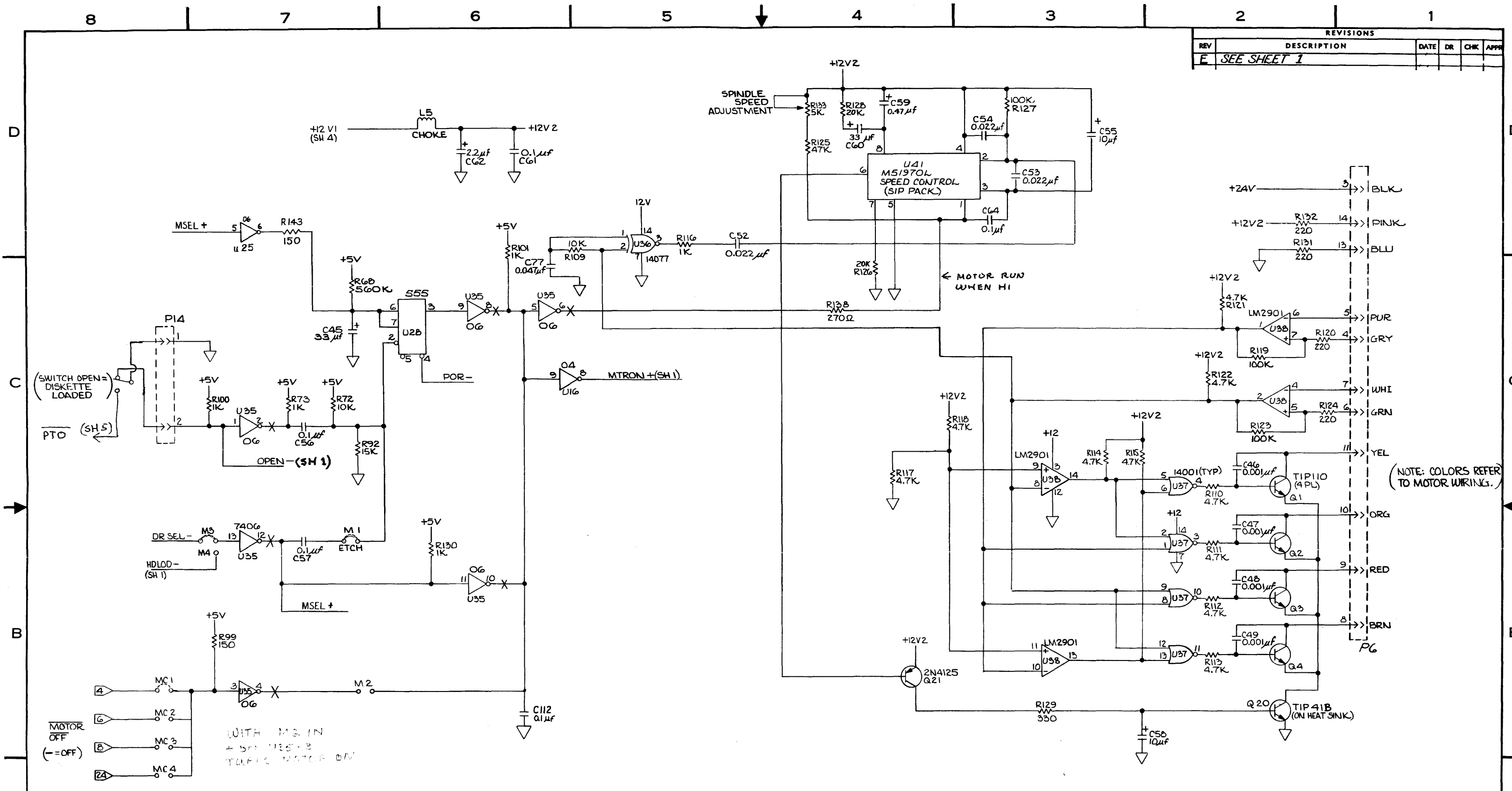
REVISIONS				
REV	DESCRIPTION	DATE	DR	CHK
E	SEE SHEET 1			



* RESISTOR LOCATED IN SAME RESISTOR PACK

<small>THE INFORMATION CONTAINED HEREON IS THE PROPERTY OF TANDON ELECTRONICS. NO PORTION OF THIS DATA SHALL BE RELEASED, DISCLOSED, USED, OR REPRODUCED FOR USE IN PROCUREMENT OR MANUFACTURING WITHOUT EXPRESS WRITTEN PERMISSION FROM TANDON ELECTRONICS.</small>		Tandon CORPORATION	
DIMENSIONS ARE IN INCHES TOLERANCES: DEC = ANGULAR JDDX ± 1/2" X ± BREAK ALL SHARP CORNERS APPROX. 0.10		TITLE MODEL 848 DISKETTE DRIVE ELECTRONICS	
NEXT ASSY: _____ FIRST USE: _____ APPLICATION: _____		FINISH: _____ MATL: _____	
SCALE: _____		SIZE: _____ CODE IDENT NO: 210092-000 DWG NO: D02 SHEET 4 OF 5	

REVISIONS				
REV	DESCRIPTION	DATE	DR	CHK
E	SEE SHEET 1			

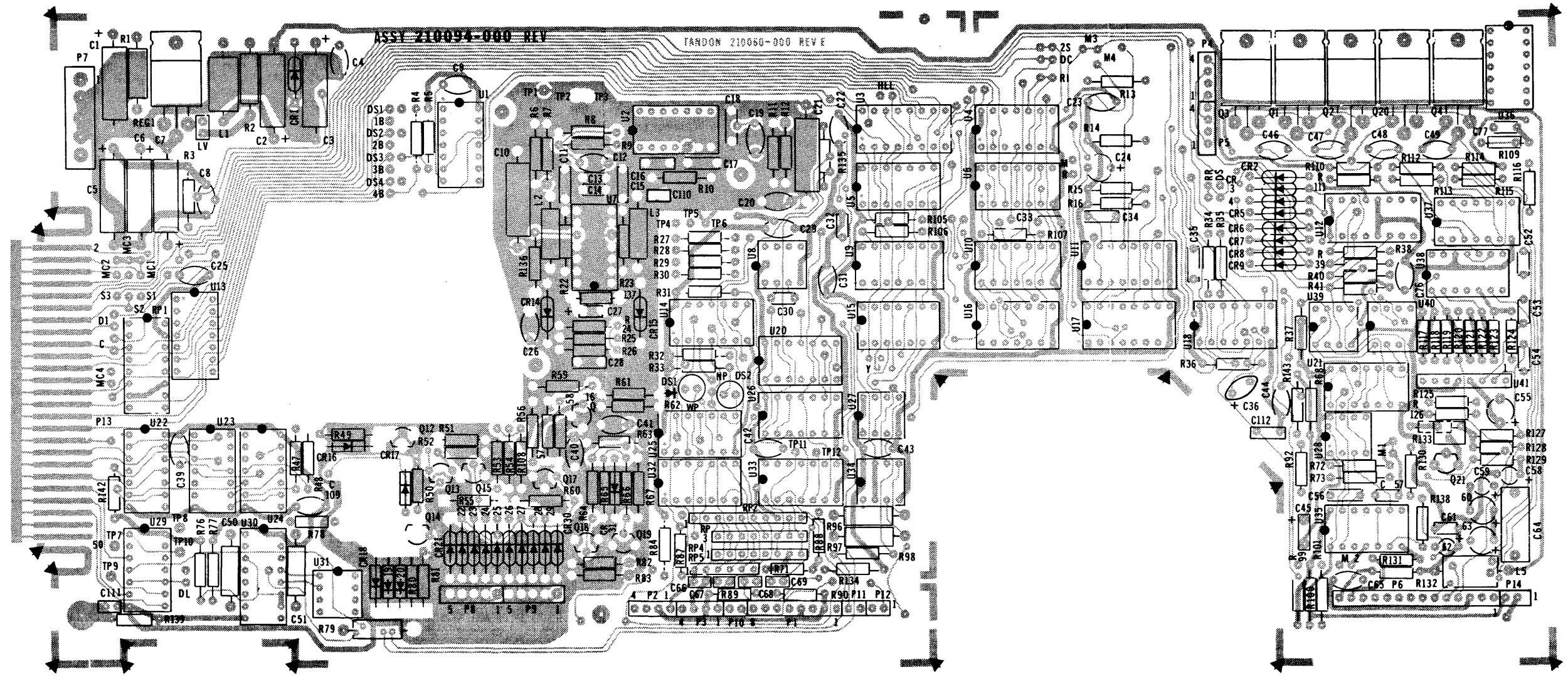


BRUSHLESS DC SPINDLE MOTOR CONTROL

<small>THE INFORMATION CONTAINED HEREON IS THE PROPERTY OF TANDON MAGNETICS AND PORTION OF THIS DATA SHALL BE RELEASED UNLESS OTHERWISE SPECIFIED IN WRITING WITHOUT SPECIFIC WRITTEN PERMISSION FROM TANDON MAGNETICS.</small>		SIGNATURES <i>[Signature]</i> DATE 7-23-81		Tandon CORPORATION	
<small>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES</small>		DES: <i>[Signature]</i> ENGR: <i>[Signature]</i> PROJ. ENGR: <i>[Signature]</i>		TITLE MODEL 848 DISKETTE DRIVE ELECTRONICS	
TOLERANCES: DIM: ± 0.005 ANGULAR: ± 1/2° X: ± X: ± BREAK ALL SHARP CORNERS APPROX. 0.10		FINISH: MATL:		SIZE: D CODE IDENT NO: 210092-000 DWG NO: 1002 SCALE: 1 DO NOT SCALE DIMS	
NEXT ASSY:		FIRST USE:		APPLICATION:	

WITH M3 IN +5V DISK-2 TURNS MOTOR ON

(NOTE: COLORS REFER TO MOTOR WIRING.)



APPENDIX II
RECOMMENDED SPARE PARTS LIST

PARTS AND SUBASSEMBLIES

<u>Part</u>	<u>Part Number</u>
Drive Belt	210062-000
Drive Motor	210061-000
Circuit Board	210094-000
Cone Assembly	210085-000
Diskette Lever	210084-000
Bridge Assembly	210086-000
Bezel	210011-000
Activity L. E. D. (Front Panel)	210081-000
Load Arm Assembly	210089-000
Track 00 Sensor Assembly	210080-000
Write Protect Sensor Assembly	210079-000
Door Open Switch Assembly	210083-000
Index Sensor Assembly	210075-000
Diskette Ejector Assembly	210124-000
Head Carriage Assembly:	
Single-Sided Recording	210065-001
Double-Sided Recording	210065-002
Stepper Motor (Mounting) Assembly	210090-000
Stepper Band	210112-000
Load (Power) Resistors	210076-000
Diskette Lever Lock	210082-000
Ejector Spring	210036-000
Load Arm Spring	210122-000

Note

All components are standard commercial parts purchased to original equipment manufacturer's specifications.

OEM OPERATING AND SERVICE MANUAL, TM848-1 AND TM848-2 THINLINE™ DISK DRIVES, 48 TPI, TANDON P/N 179031-001

ALIGNMENT DISKETTE

Recommended: Dysan 800680, Model Number 360/2A

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