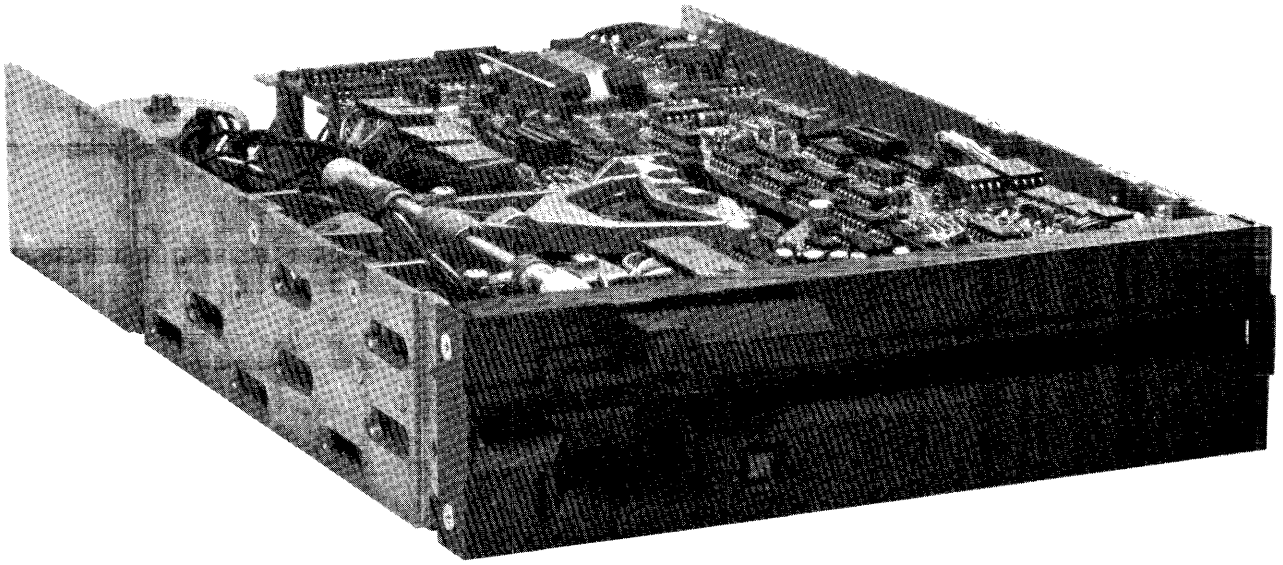
OEM
OPERATING AND SERVICE MANUAL
TM848-1 AND TM848-2 DISK DRIVES
48 TRACKS PER INCH



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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 a 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 ± 5 percent, 0.75 amp typical
+24 V D. C. Power:	+24 volts ± 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
MTTR:	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:	± 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

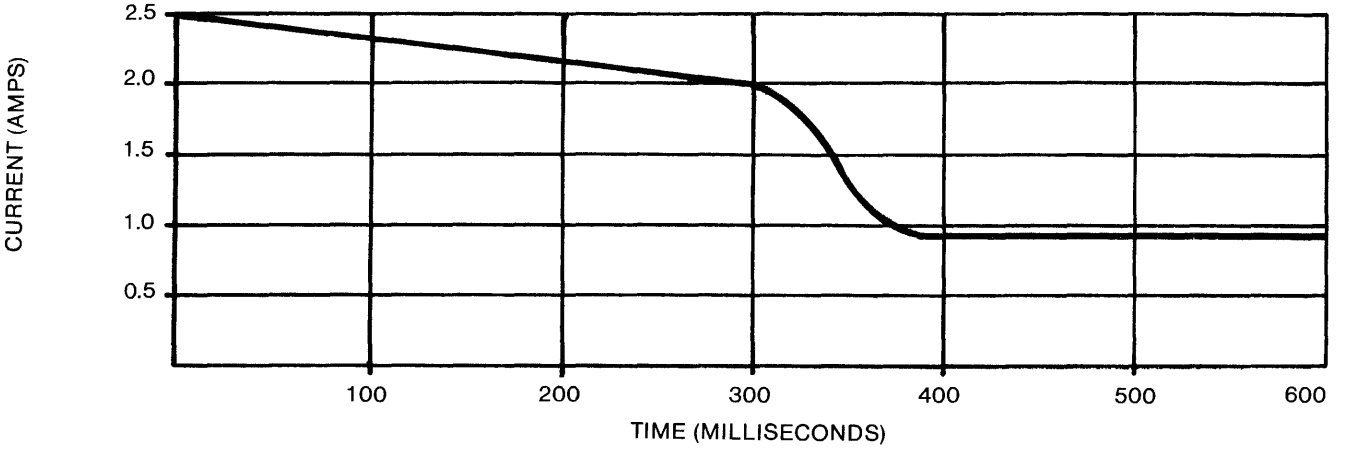
1. +5 Volts: 0.70 Amps typical

2. +24 Volts: After motor start interval

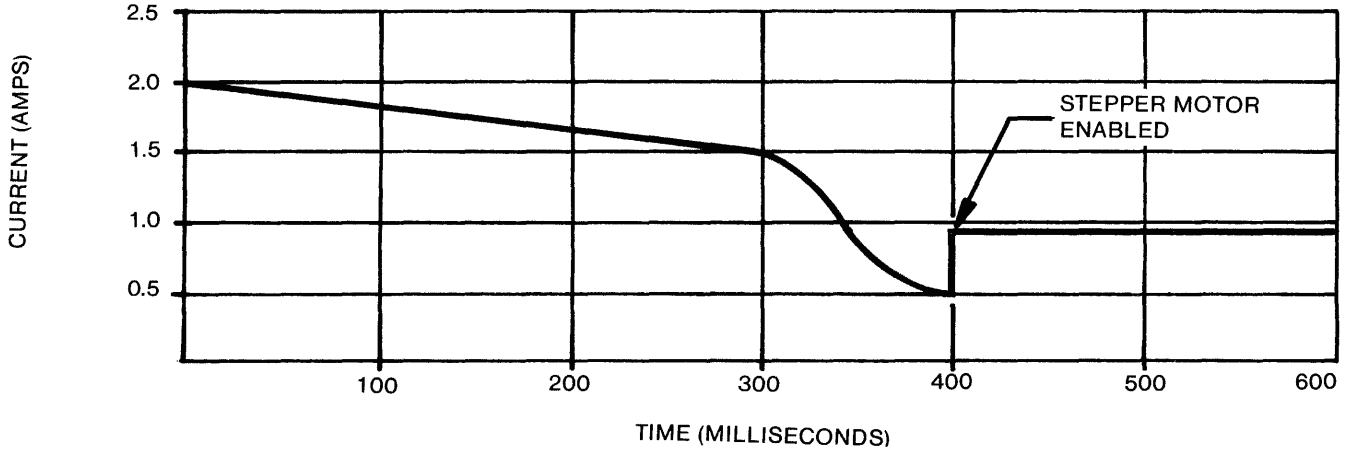
Spindle Motor	0.35 Amps typical
Stepper Motor	0.40 Amps typical
Electronics	0.17 Amps typical
Total	0.92 Amps typical

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.

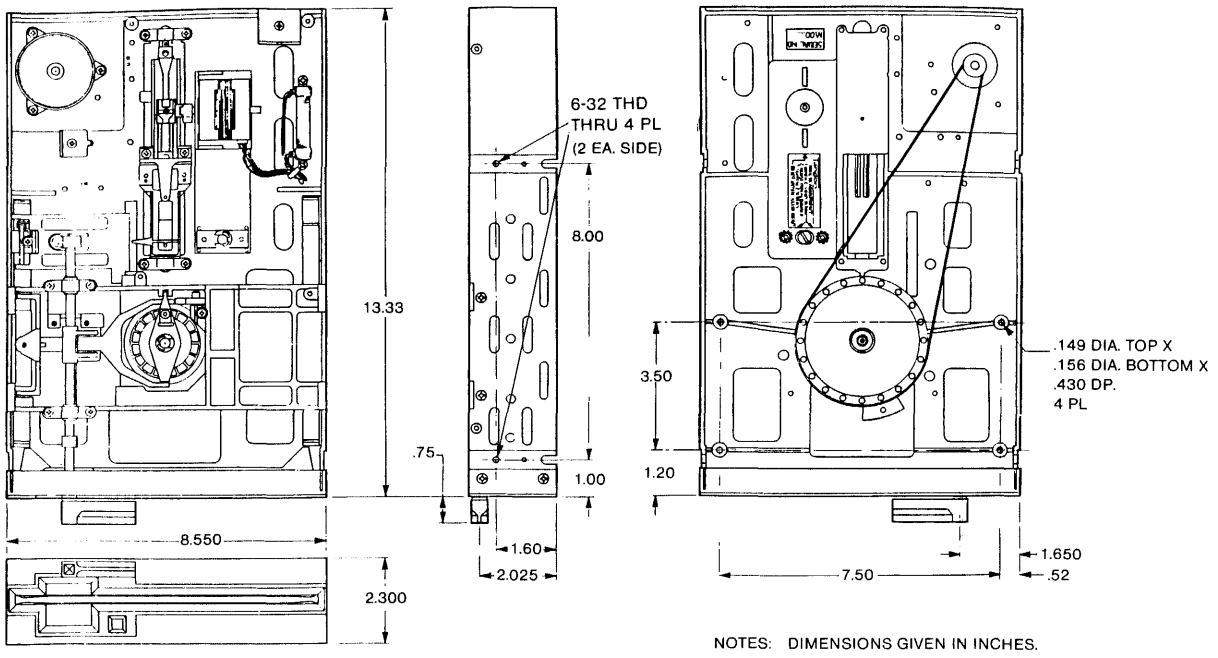


Figure 1-1
TM848 Disk Drive Mounting Configuration

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 tolerences.

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.

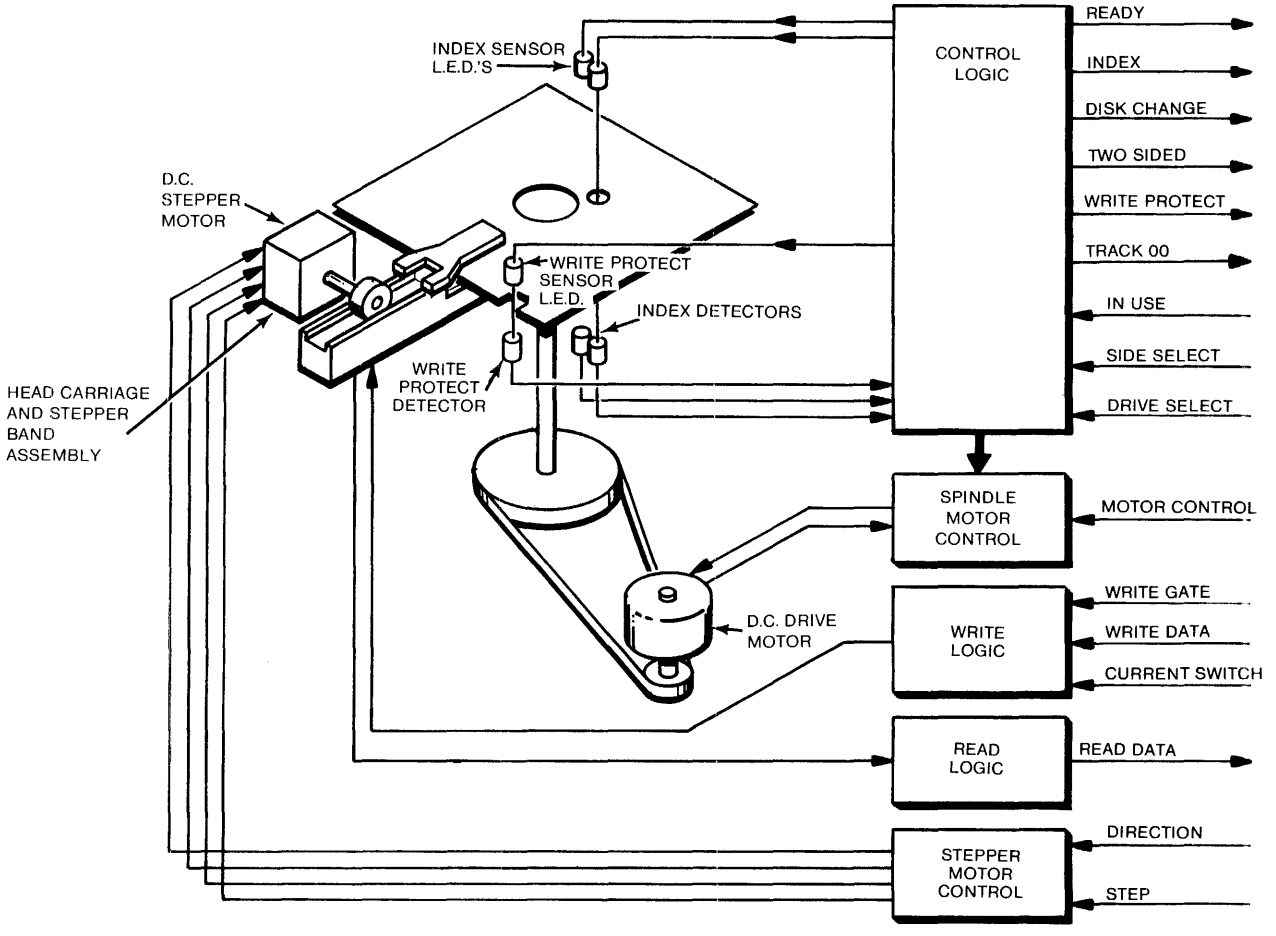


Figure 1-2
TM848 Disk Drive Functional Block Diagram

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.

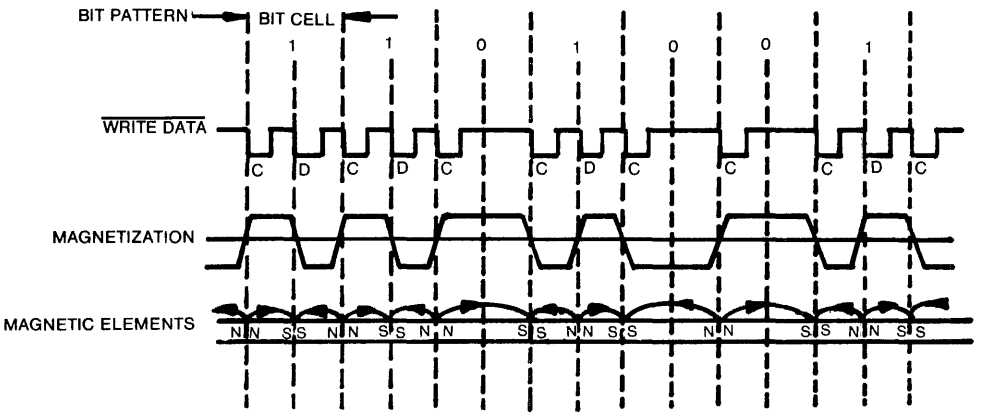


Figure 1-3
FM Recording Magnetization Profiles

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.

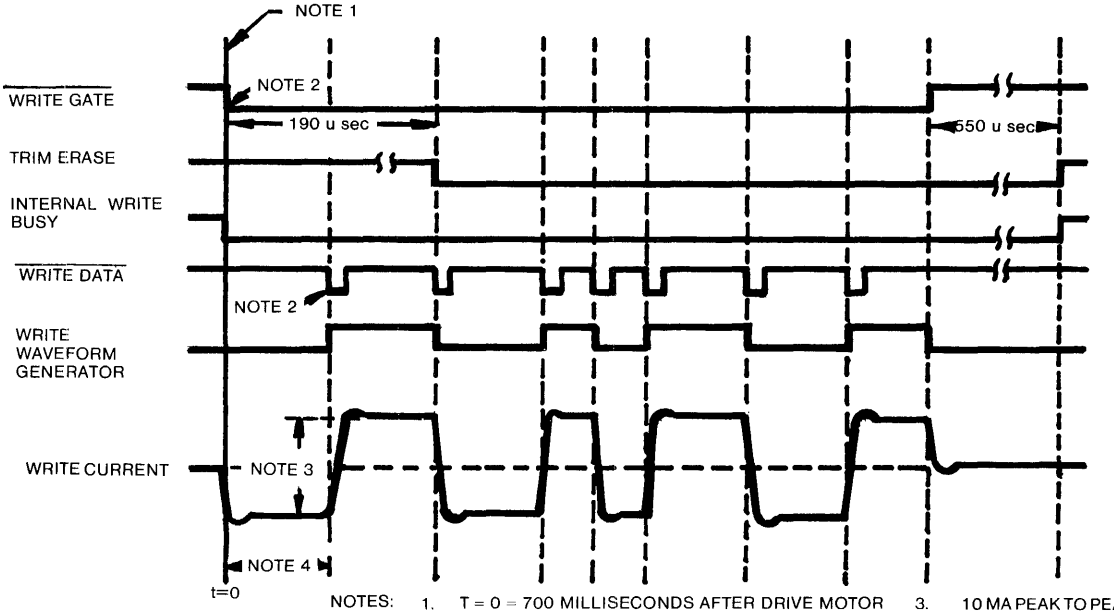
Figure 1-4 illustrates the timing diagram for a write operation. At t = 0, when the unit is ready, the write gate interface line goes true. This enables the write current source. Write current is switched via the write current switch interface line to a lower value by the user's controller at Track 43.

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 signifcant.

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.



NOTES:
1. T = 0 = 700 MILLISECONDS AFTER DRIVE MOTOR STARTS OR 20 MILLISECONDS AFTER LAST STEP PULSE, WHICHEVER IS THE LATEST TIME.
2. UNSYCHRONIZED
3. 10 MA PEAK TO PEAK, TRACK 0 TO TRACK 42; 7.5 MA PEAK TO PEAK, TRACK 43 TO TRACK 77.
4. 2 USEC MINIMUM
   4 USEC MAXIMUM

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. Differentiatior
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.

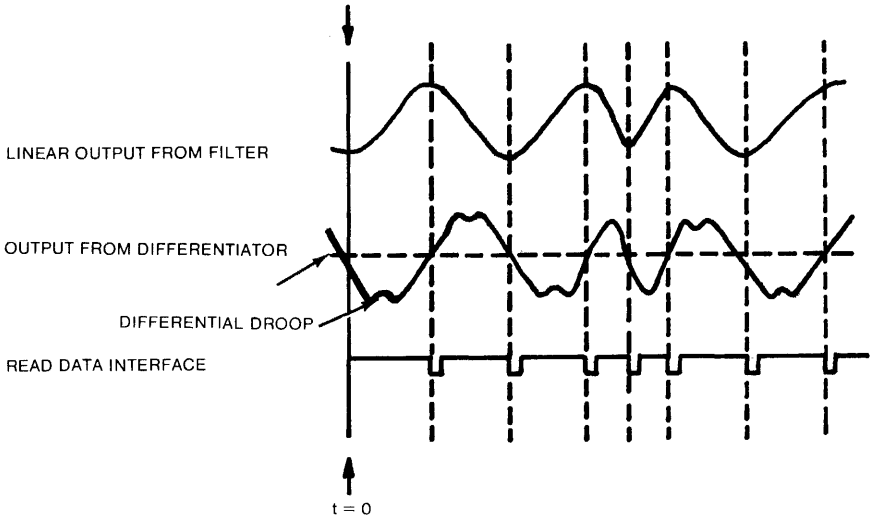


Figure 1-5
Read Timing Diagram

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 impedence 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

Ground	Pin Number	Signal
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

Pin	Supply Voltage
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 if 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.

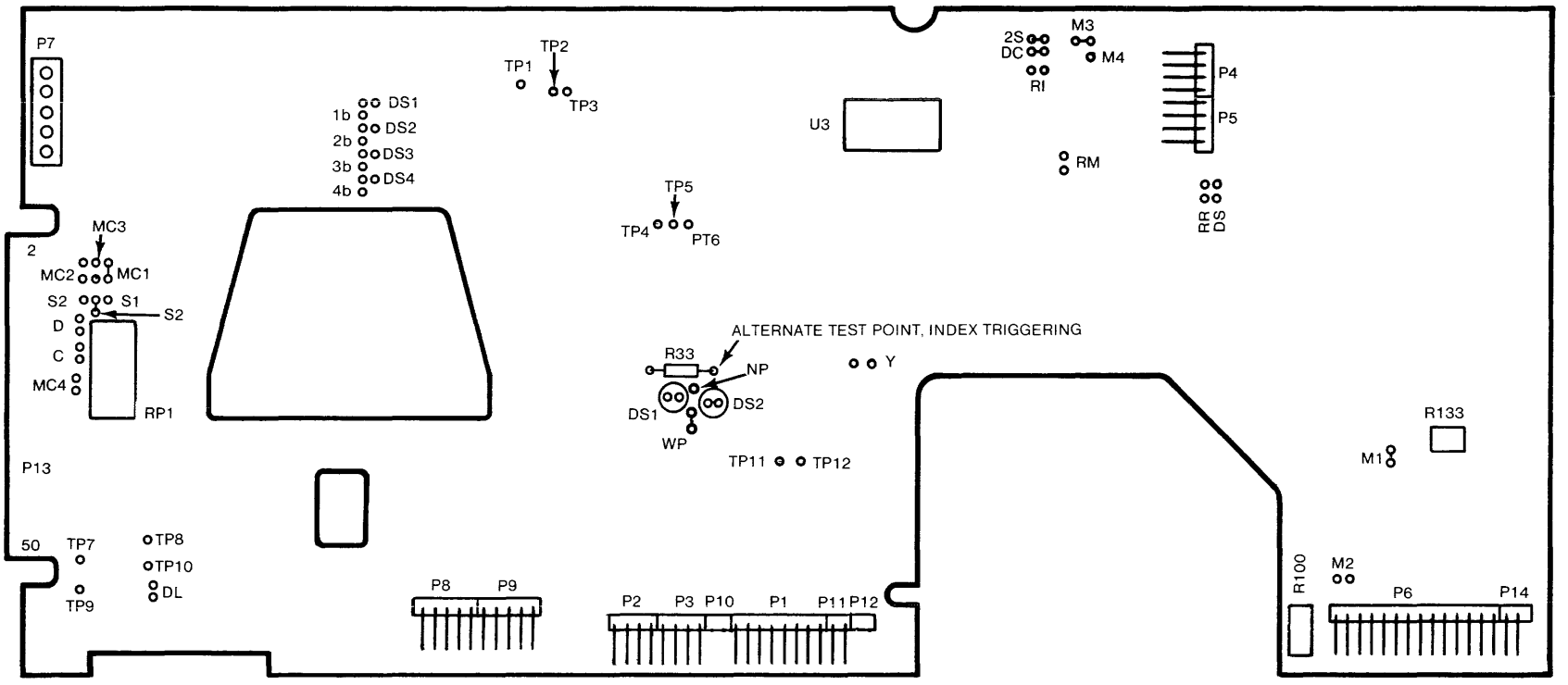


Figure 1-6
Circuit Board Assembly

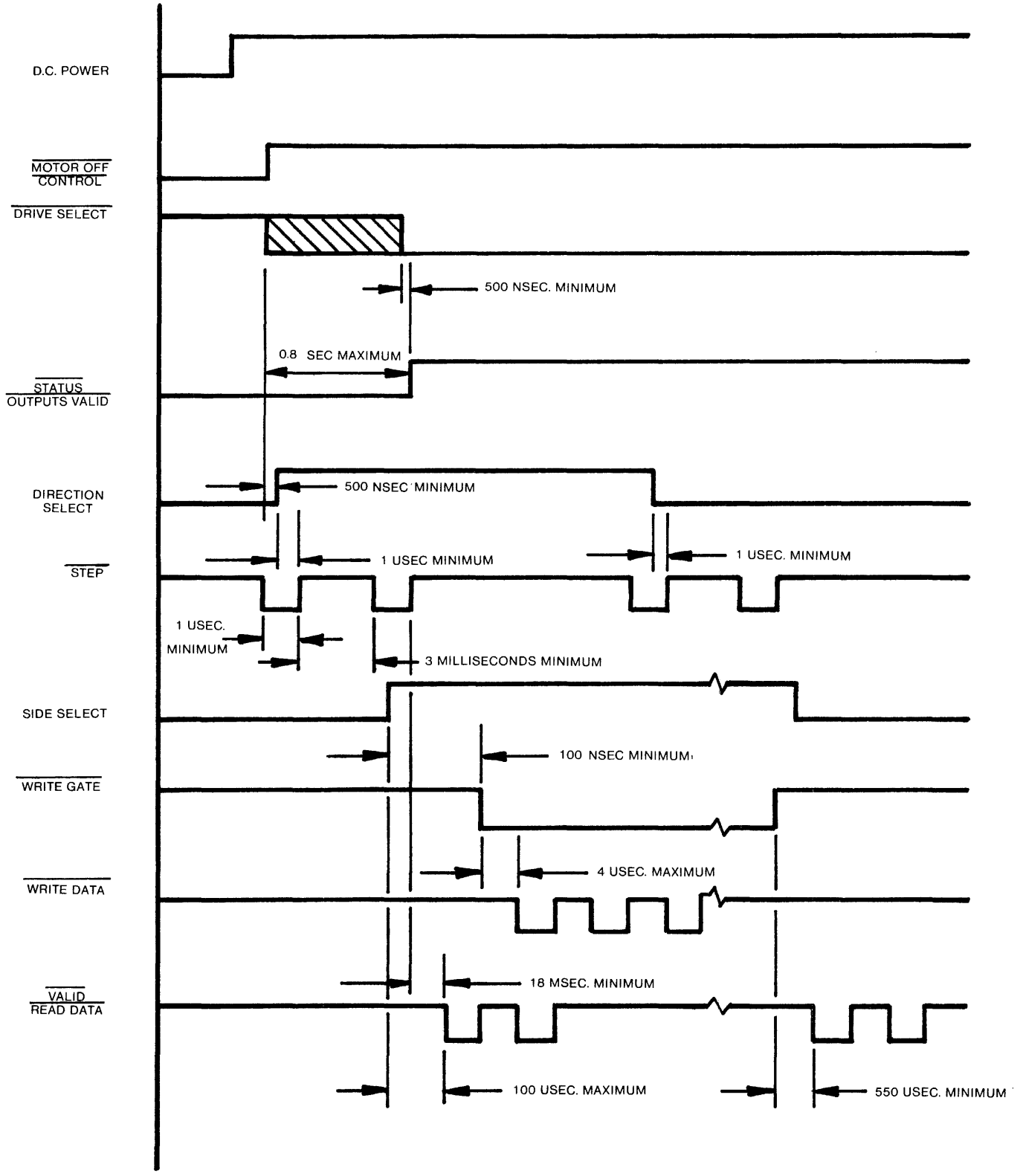


Figure 1-7
General Control and Data Timing Requirements

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

OPTION	TRACE DESIGNATOR	Shunt/Pin Locations	AS SHIPPED Installed	AS SHIPPED Not Installed
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 at 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 etch cut, 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 etch cutting RR, then by running a wire from U4, Pin 3 to the desired alternate output lines 4, 6, 8, and 24.

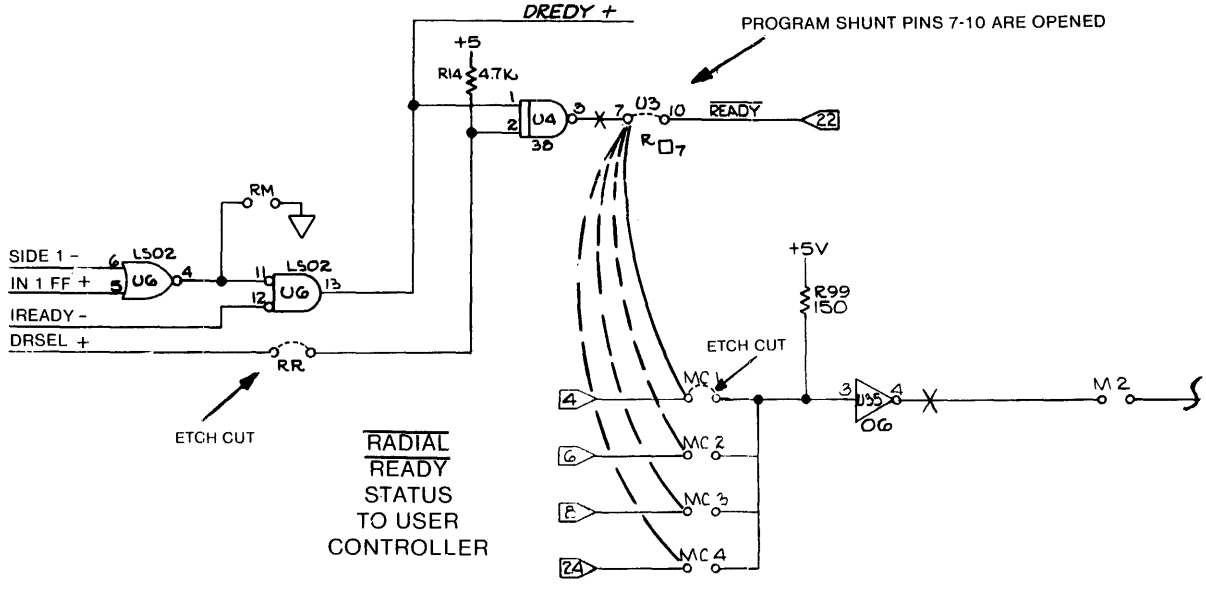


Figure 1-8

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 diskete 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).

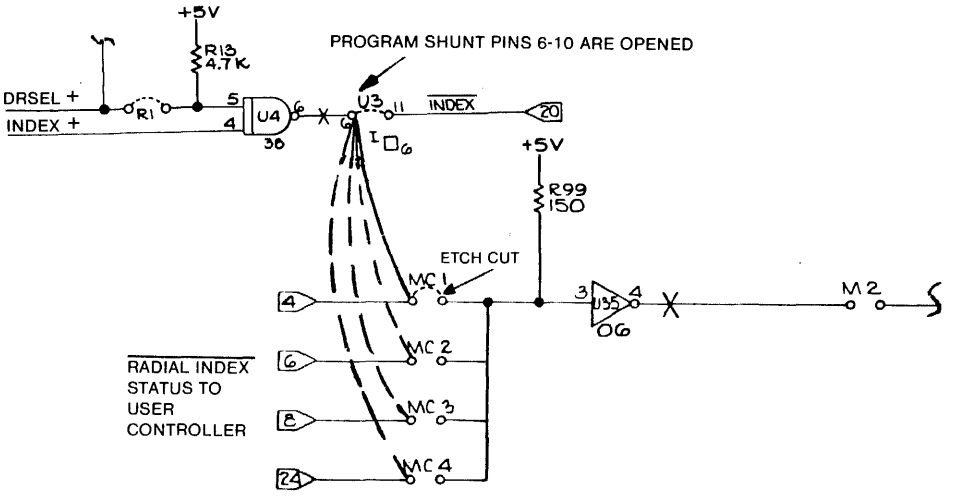


Figure 1-9
Radial Index Installation

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 $\overline{\text{IN USE}}$ low. The solenoid is unlatched when drive select is pulsed and $\overline{\text{IN USE}}$ 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).

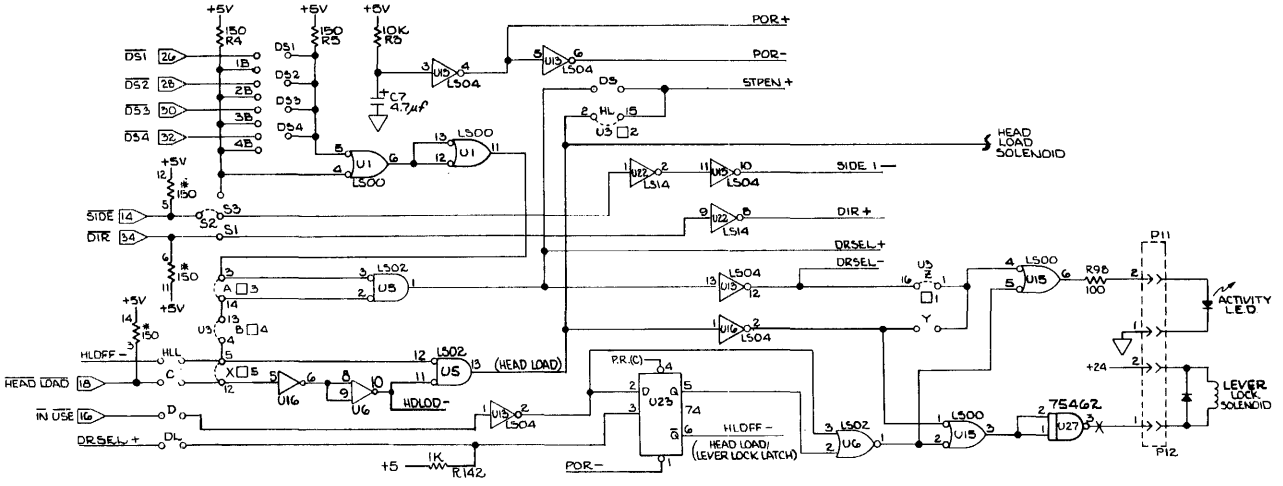


Figure 1-10
Radial Head Load Signal

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 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 then 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.