Radio Shack®

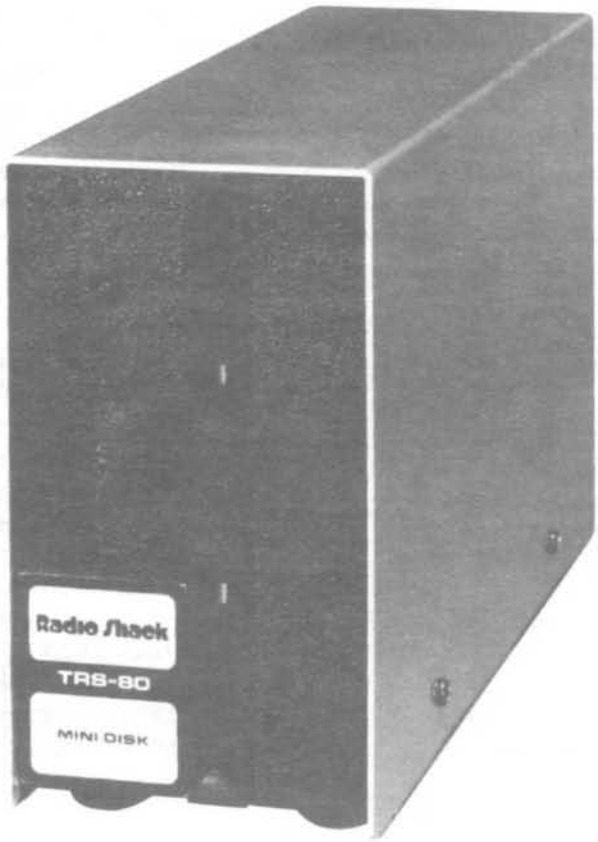
Service Manual

26-1160/1161

TRS-80

MINI DISK

Catalog Number 26-1160/1161



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MINI-DISK SERVICE MANUAL
(ASSY 71013 – 001)

INTRODUCTION

This manual provides a General Description of the Mini-Disk Drive System. It also includes: Theory of Operation; Operation; Maintenance; Schematics; and Parts Lists for Drives that have Logic PC boards with the serial number ASSY171013 – 001.

Service information for Drives that have serial numbers such as MINI25060 – xx can be found in the back of this manual (following the Parts Lists).

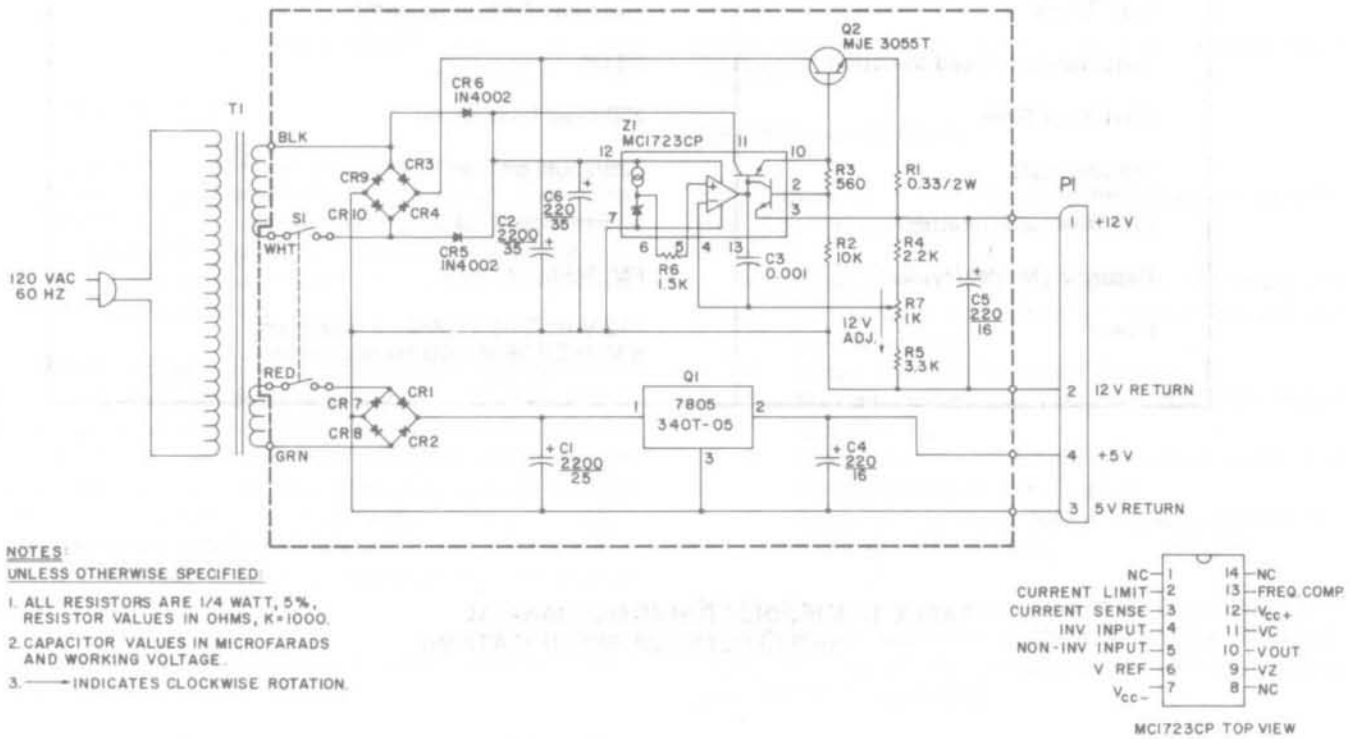
The Power Supply, Case, and external Cables are the same for both units. The Power Supply Specifications are slightly different.

POWER SUPPLY

SPECIFICATIONS

INPUT	120 VAC, 60 Hz
OUTPUT (1)	+12 (±0.6) VDC
CURRENT	900 mA (max), 0.75 A (typ)
MAXIMUM RIPPLE	100 mV p - p
OUTPUT (2)	+5(±0.25) VDC
CURRENT	600 mA (max), 0.50 A (typ)
MAXIMUM RIPPLE	50 mV p-p

NOTE: Refer to Section V – Output (1) current is rated at 1.50 A (max). This value occurs only during Head Loading and lasts approximately 200 ms.



NOTES:
UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE 1/4 WATT, 5%, RESISTOR VALUES IN OHMS, K=1000.
2. CAPACITOR VALUES IN MICROFARADS AND WORKING VOLTAGE.
3. ——→ INDICATES CLOCKWISE ROTATION.

FIGURE 1. MINI-DISK POWER SUPPLY SCHEMATIC.

Media	Industry-compatible 5-1/4 inch (133.4 mm) diskette
Tracks per inch	48
Number of Tracks	35
Read/Write Track Width	9.912 inches (252 mm)
Dimensions	
Height	3.38 inches (85.85 mm)
Width	5.87 inches (149.10 mm)
Depth	8.0 inches (203.2 mm)
Weight	4.5 lbs (2.04 Kg
Temperature (Exclusive of Media)	
Operating	10°C to 43°C (50°F to 110°F)
Non-operating	−40°C to 71°C (−40°F to 160°F)
Relative Humidity (Exclusive of Media)	
Operating	20% to 80%
Non-operating	5% to 95% (non-condensing)
Vibration	6 to 600 Hz 0.5g peak
Seek Time	5 msec track to track
Head Settling Time	15 msec (last track addressed)
Error Rate	1 per 10^9 recoverable 1 per 10^{12} non-recoverable
Head Life	20,000 hours (normal use)
Media Life	3 million passes on a single track
Disk Speed	300 rpm $\pm$1.5% (long term)
Instantaneous Speed Variation	$\pm$3.0%
Start/Stop Time	250 msec (maximum)
Transfer Rate	125/250K bits/sec
Bits/Disk (unformatted)	1.75 million (FM)
Recording Modes (typical)	FM, MFM, MMFM
Power	+12 V dc $\pm$0.6 V, 900 ma maximum 5 V dc $\pm$0.25 V, 600 ma maximum

TABLE 1. MINI-DISK DRIVE MECHANICAL AND ELECTRICAL SPECIFICATIONS.

SECTION I

GENERAL DESCRIPTION

INTRODUCTION

The Disk Drive is a "MINI" Disk Memory designed for random access data entry, storage, and retrieval applications. These applications typically, are intelligent terminal controllers, micro-computers, word processing systems, data communications systems, error logging, micro-program loading and point-of-sale terminals. The Disk Drive is capable of recording and reading digital data using FM, MFM or M^2FM techniques.

PHYSICAL DESCRIPTION

The electronic components are mounted on two PC boards: the Logic board - located above the chassis and the Servo board - mounted at the rear of the Unit. Power and Interface signals are connected directly to the Logic board (Figure 2).

The spindle is belt driven by a DC motor with an integral tachometer. The servo control circuit, pulleys and the tachometer control the speed of the spindle. The read/write/erase head assembly is positioned by means of a stepper motor, split band and a pulley.

FUNCTIONAL DESCRIPTION

The Disk Drive is fully self-contained. It consists of a spindle drive system, a head positioning system, and read/write/erase system.

When the front latch is opened, access is provided for the insertion of a 5.25 inch (133.4 mm) standard diskette. The diskette is positioned in place by plastic guides, the front latch and a back stop.

Closing the front latch activates the cone/clamp system which centers and clamps the diskette to the drive hub. The drive hub is driven at a constant speed of 300 rpm by a servo controlled DC motor. In operation, the magnetic head is loaded into contact with the recording medium whenever the front latch is closed.

A 4-phase stepper motor/band assembly and its associated electronics position the magnetic head over the desired track. This positioner employs a one-step rotation to cause a 1-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 an appropriate signal is applied to the interface. (When performing a write operation, a 0.013-inch (0.33 mm) [nominal] data track is recorded.)

When performing a write operation, a 0.013-inch (0.33 mm) [nominal] data track is recorded.

Data recovery electronics include a low-level read amplifier, differentiator, zero-crossing detector and digitizing circuits. No data decoding facilities are provided in the basic Drive.

The Drive is also supplied with the following sensor systems:

1. A track ØØ switch which senses when the Head/Carriage assembly is positioned at Track ØØ.
2. The index sensor (an LED light source and a photo-transistor) is positioned so that when an index hole is detected, a digital signal is guaranteed. The index sensor used is a high resolution device which can distinguish holes placed close together, i.e., index-sector holes in a hard sectored diskette.
3. The write-protect sensor disables the Disk Drive electronics whenever a write-protect tab is applied to the diskette.

INTERFACE CONNECTIONS

Signal connections for the Disk Drive are made via a user-supplied 34-pin flat ribbon connector (3M Part Number 3463-001 or equivalent). This connector mates directly with the PC board connector (J1) at the rear of the Drive. The DC power connector is a four-pin connector (J2) which is keyed to mate with the connector on the Logic PC board at the top rear of the Drive.

The signal connector harness should be of the flat ribbon or twisted pair type with the following characteristics:

1. Maximum length of 10 feet (3 M).
2. 22 - 24 gauge conductor compatible with the connector to be used.

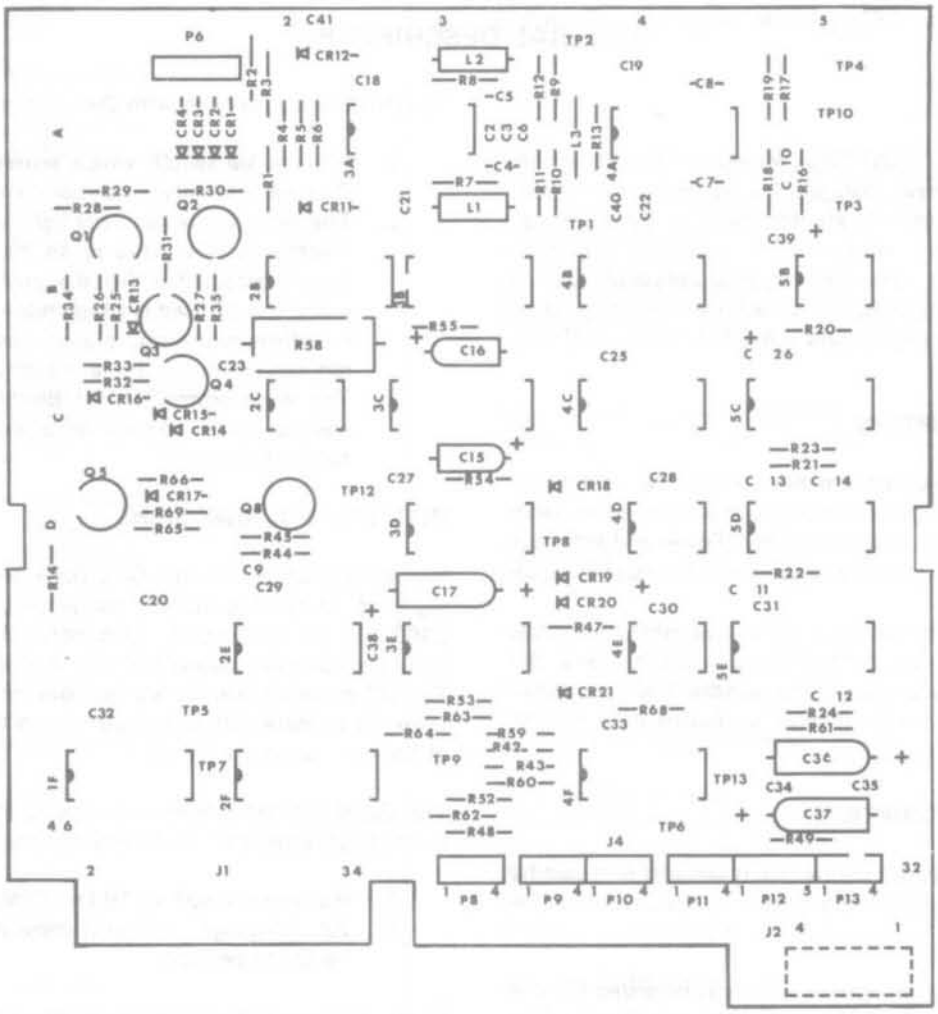
Power connections should be made with 18 AWG cable minimum).

PHYSICAL CHECKOUT

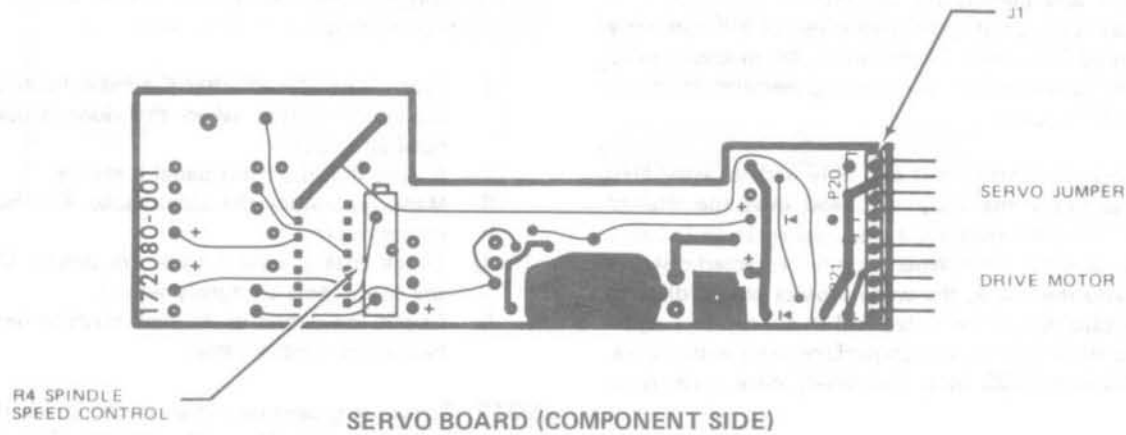
Before applying power to the unit, the following inspection should be performed:

1. Front latch. Check that the front latch opens and closes. Note that when the door is opened, the head arm raises.
2. Ensure that the front panel is secure.
3. Manually rotate the drive hub. The hub should rotate freely.
4. Check that the PC boards are secure. Check that the connectors are firmly seated.
5. Check for debris or foreign material between the heads and remove same.

NOTE: To ensure proper operation of the Drive, the chassis should be connected to earth ground. The 3/16-inch (4.76 mm) male QC lug, located at the rear of the chassis, is provided for this connection.



LOGIC BOARD (COMPONENT SIDE)



SERVO BOARD (COMPONENT SIDE)

FIGURE 2. PC BOARD COMPONENT LOCATIONS.

MOUNTING THE DISK DRIVE

The Drive can be mounted in any plane, i.e. upright, horizontal or vertical. However, when it is mounted horizontally, the Logic PC board side of the chassis must be the uppermost side. Tapped holes are provided in various locations for the attachment of user-supplied hardware.

RESISTOR TERMINATION, DIP SHUNT AND JUMPER (See Figure 3).

1. The Resistor Termination in the IC socket is used in Drive number zero only. It must be removed for Drives one, two and three.
2. The DIP Shunt package is used in all Drives and must be punched and seated as illustrated.

NOTE: Some Logic PC boards will not have a DIP Shunt in the Drive Select circuit. These boards have been redesigned and the Drive Select circuit is etched into the board.

3. The Jumper Wire between pin 32 of J1 and the DS4 connection (see Figure 5) is used on all Drives.

NOTE: Some Logic PC boards will not have the Jumper Wire. The connection will be etched into the board.

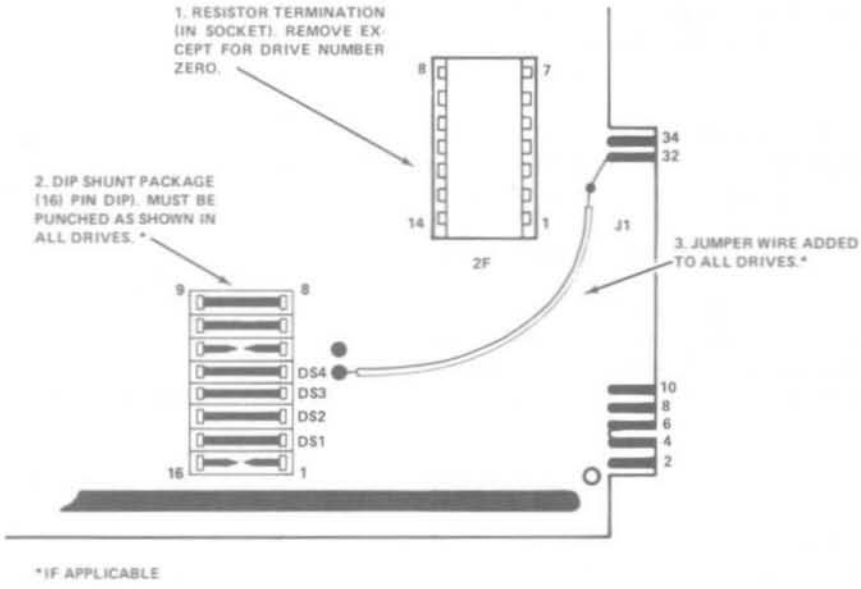


FIGURE 3. RESISTOR TERMINATION, DIP SHUNT AND JUMPER.

FLAT RIBBON CABLE ASSEMBLY (see Figure 4).

Pins must be removed from Drive connectors on the Cable Assembly as follows and as illustrated:

1. Connector for Drive number zero – pins 12, 14 and 32.
2. Connector for Drive number one – pins 10, 14 and 32.
3. Connector for Drive number two – pins 10, 12 and 32.
4. Connector for Drive number three – pins 10, 12 and 14.

Do not remove any pins from the connector to the Expansion Interface.

DRIVE NUMBER ZERO	DRIVE NUMBER ONE	DRIVE NUMBER TWO	DRIVE NUMBER THREE
12	10	10	10
14	14	12	12
32	32	32	14

FIGURE 4. CABLE ASSEMBLY – CONNECTOR PIN REMOVAL CHART.

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SECTION II

THEORY OF OPERATION

INTRODUCTION

The Disk Drive consists of the mechanical and electrical components necessary to record and read digital data on a diskette. DC power at ±12 V and +5 V (provided by the user) is required for operation.

ORGANIZATION OF THE DISK DRIVE

All electrical subassemblies in the Disk Drive are constructed with leads which terminate in 4 or 5 pin connectors, enabling the individual assemblies to be removed.

The magnetic head is connected to the PC board via a cable terminating in a 5-pin female connector and its associated male socket which is located in close proximity to the read/write data electronics.

Interface signals and power are provided via connectors at the rear of the Drive. A detailed description of these signals is presented in Section III of this manual.

FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

Figure 5 is a functional block diagram of the Disk Drive and should be referred to in conjunction with the following discussion:

The Disk Drive consists of the following functional groups:

* Index Pulse Shaper
* Write Protect Sensor
* Track ØØ Sensor
* Spindle Drive Control
* Carriage Position Control
* Write/Erase Control
* Read Amplifier and Digitizer

INDEX

An index pulse is provided to the user system via the INDEX PULSE interface line. The index circuitry consists of an Index LED, Index Phototransistor and a Pulse Shaping Network. As the index hole in the disk passes the Index LED/Phototransistor combination, light from the LED strikes the Index Phototransistor causing it to conduct. The signal from the Index Phototransistor is passed 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.

WRITE PROTECT

A Write Protect signal is provided to the user system via the WRITE PROTECT interface line. The write protect circuitry consists of a Write Protect Sensor and circuitry to route the signal 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.

TRACK ØØ SWITCH

The level on the TRACK ØØ interface line is a function of the position of the magnetic head assembly. When the head is positioned at Track ØØ and the stepper motor is at the home position, a true level is generated and sent to the user.

SPINDLE DRIVE

The Spindle Drive system consists of a spindle assembly driven by a DC motor-tachometer combination through a drive belt.

Associated with the spindle drive motor are the servo electronics required for control.

The control circuitry also includes a current limiter and an interface control line. When the DRIVE MOTOR ENABLE interface line is true, the drive motor is allowed to come up to speed. When the current through the drive motor exceeds 1.3 A, the current limit circuitry disables the motor drive.

POSITIONER CONTROL

The Head Positioning system utilizes a four-phase stepper motor drive which changes one phase for each track advancement of the Read/Write carriage. In addition to the logic necessary for motion control, a gate is provided as an element for inhibiting positioner motion during a write operation.

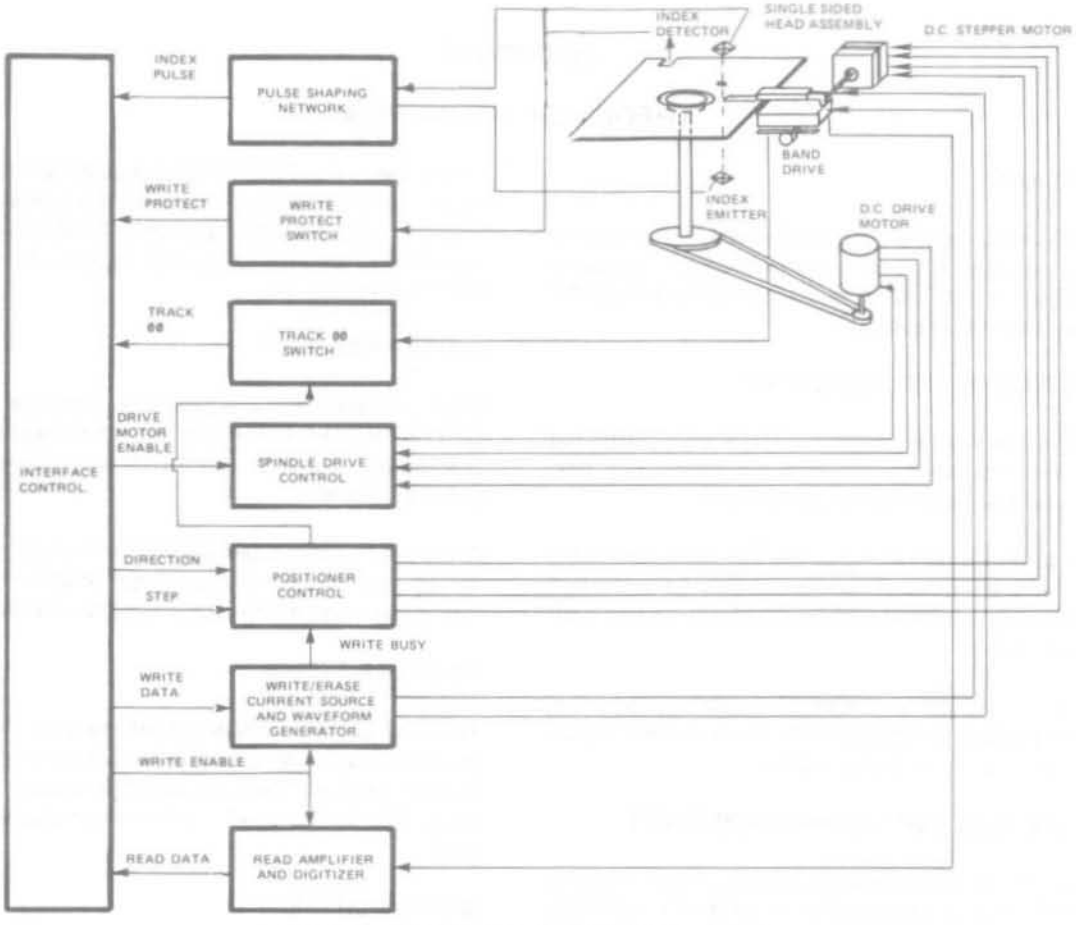


FIGURE 5. FUNCTIONAL BLOCK DIAGRAM

DATA ELECTRONICS

Information can be recorded on the diskette using a double-frequency code. Figure 6 illustrates the magnetization profiles in each bit cell for the number sequence shown.

The erase gaps provide an erased guard band on either side of the recorded track. This accommodates the tolerances in track positioning.

All signals required to control the data electronics are provided by the user system and are shown in the Block Diagram (Figure 5). These control signals are:

- ★ SELECT
- ★ WRITE ENABLE
- ★ WRITE DATA

The READ DATA composite signal is sent to the user system via the interface.

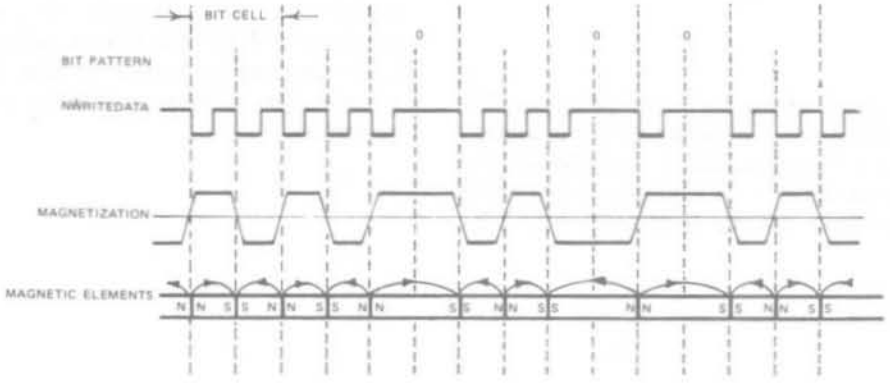


FIGURE 6. F M RECORDING

DATA RECORDING

Referring to Figure 5, it can be seen that the Write Electronics consists of a Write/Erase Current Source and Write Waveform Generator, Erase Current Source and Trim Erase Control Logic.

The read/write winding on the magnetic 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.

Before recording can begin, certain conditions must be satisfied. The conditions required for recording (i.e., unit ready) must be established by the user system as follows:

(1) Drive speed stabilization. This condition will exist 250 mSec after starting the drive motor.

(2) Subsequent to any step operation, the positioner must be allowed to settle. This requires 20 mSec total after the last step pulse is initiated, i.e., 5 mSec for the step motion and 15 mSec for settling.

NOTE: All of the foregoing operations can be overlapped, if required.

Figure 7 shows the relevant timing diagram for a write operation. At t = Ø when the unit is ready, the WRITE ENABLE interface line goes true, this enables the Write Current Source.

Since the trim erase gaps are behind the read/write gap, the TRIM ERASE control goes true 390 μSec after the WRITE ENABLE interface line. It should be noted that this value is optimized between the requirements at Track ØØ and Track 34 so that the effect of the trim erase gaps on previous information is minimized.

Figure 7 also 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.

Note that a minimum of 4 μSec and a maximum of 8 μSec between WRITE ENABLE 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.

The TRIM ERASE signal must remain true for 800 μSec after the termination of WRITE ENABLE to ensure that all recorded data are trim erased. This value is again optimized between the requirements at Tracks ØØ and 34.

The duration of a write operation is from the true-going edge of WRITE ENABLE to the false-going edge of TRIM ERASE. This is indicated by the internal WRITE BUSY waveform shown.

DATA REPRODUCTION

The Read Electronics consists of the following:

- ★ Read Switch
- ★ Read Amplifier
- ★ Filter
- ★ Differentiator
- ★ Comparator and Digitizer

The Read Switch is used to isolate the Read Amplifier from electrical signals across the magnetic head during a write operation.

Before reading can begin, the Drive must be in a ready condition. As with the data recording operation, this ready condition must be established by the user system. In addition to the requirements established in the paragraph, DATA RECORDING, a 100 μSec delay must exist from the trailing edge of the TRIM ERASE signal to allow the Read Amplifier to settle after the transient caused by the Read Switch returning to the Read mode.

Referring to Figure 8, the output signal from the read/write head is amplified by a read amplifier and filtered to remove noise by a linear phase Filter. The linear output from the Filter is passed to the Differentiator which generates a waveform whose zero crossovers correspond to the peaks of of the read signal. This signal is then fed to the Comparator and Digitizer circuit.

The Comparator and Digitizer circuitry generates a 1 μSec READ DATA pulse corresponding to each peak of the read signal. This Composite Read Data signal is then sent to the user system via the READ DATA interface line.

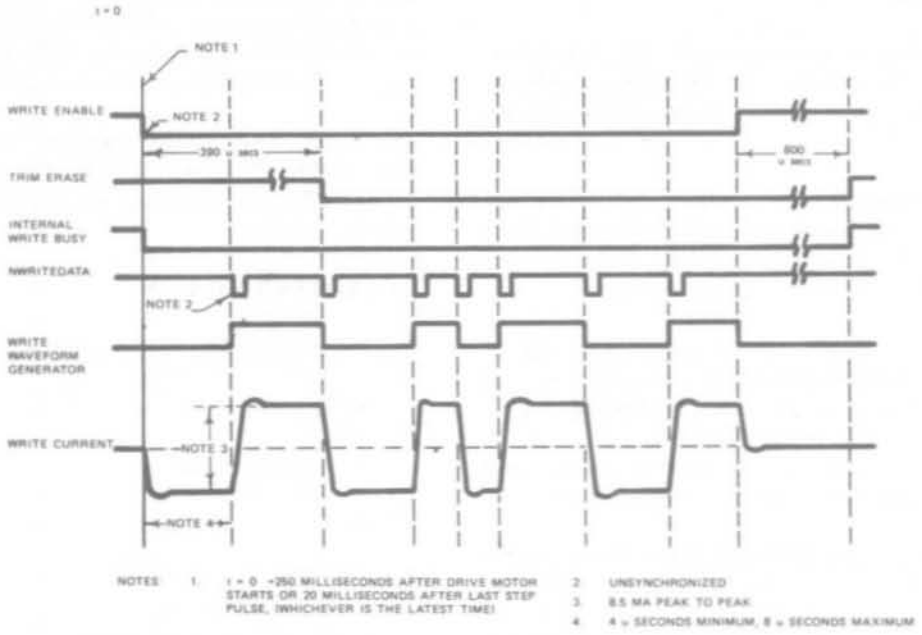
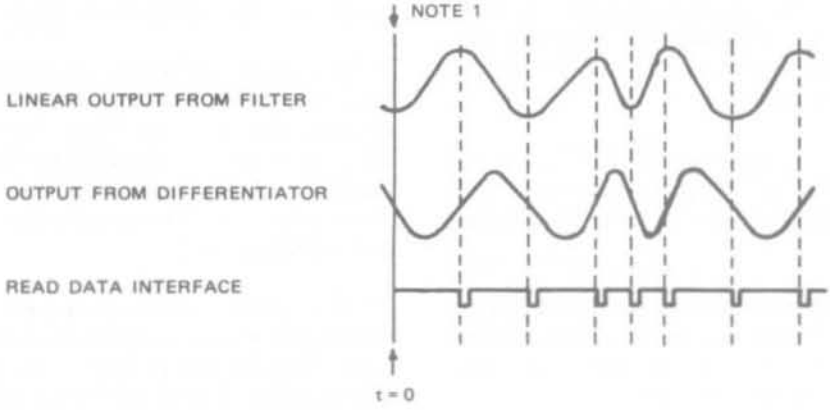


FIGURE 7. WRITE TIMING DIAGRAM.



NOTES: t = 0 =250 MILLISECONDS AFTER DRIVE MOTOR STARTS, OR 20 MILLISECONDS AFTER STEP COMMAND, OR 100 u SECONDS AFTER TERMINATION OF WRITE BUSY, (WHICHEVER IS THE LATEST TIME)

FIGURE 8. READ TIMING DIAGRAM.

SECTION III

OPERATION

INTRODUCTION

This section contains the interface description and the electrical adjustments necessary for the Disk Drive.

INTERFACE ELECTRONICS SPECIFICATIONS

All interface signals are TTL compatible. Logic true (low) is +0.4 V (maximum). Logic false (high) is +2.4 V (minimum). Figure 9 illustrates the interface configuration.

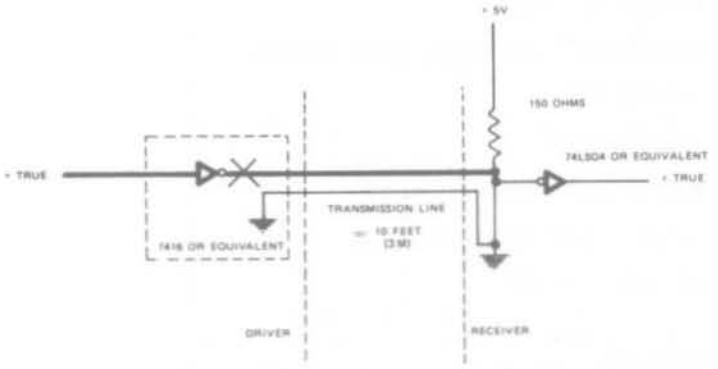


FIGURE 9. INTERFACE CONFIGURATION.

It is recommended that the interface cable be a flat ribbon cable, with a characteristic impedance of 100 ohms. (or equivalent twisted pairs). Maximum interface cable length is 10 feet (3 M).

Interface connector pin assignments and power connector pin assignments are given in Table 2 and Table 3.

INPUT CONTROL LINES (see Table 2)

SELECT LINES (NDS1 - NDS4)

The SELECT lines provide a means of selecting and deselecting a Disk Drive. These four lines (NDS1 - NDS3 are standard; NDS4 is optional) select one of the four Disk Drives attached to the controller. When the signal logic level is true (low), the Disk 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.

A SELECT line must remain stable in the true (low) state until the execution of a step or read/write command is completed.

The Disk Drive address is determined by SELECT lines 1 through 4 (or a DIP Shunt in the 1E position) on the PC board. These lines provide a means of daisy-chaining a maximum of four Disk 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,

DRIVE MOTOR ENABLE (NMOTORON)

When this signal line logic level goes true (low), the drive motor accelerates to its nominal speed of 300 rpm and stabilizes in less than 250 mSec. When the logic level goes false (high), the Disk Drive decelerates to a stop.

DIRECTION and STEP Lines (2 Lines) (DIR) (NSTEP)

When the Disk Drive is selected, a true (low) pulse with a time duration greater than 200 nSec on the STEP line initiates the 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 towards the center of the disk 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 disk 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 0.1 μSec (minimum) before the trailing edge of the corresponding STEP pulse and remain stable until 0.1 μSec after the trailing edge of the STEP pulse. The access motion is initiated on the trailing edge of the STEP pulse.

WRITE DATA (NWRITEDATA)

When the Disk Drive is selected, this interface line provides the bit-serial WRITE DATA pulses that control the switching of the write current in the head. The write electronics must be conditioned for writing by the WRITE ENABLE line (refer to the WRITE ENABLE paragraph below).

For each high-to-low transition on the WRITE DATA line, a flux change is produced at the head write gap. This causes a flux change to be stored on the disk.

When the double-frequency type encoding technique is used (in which data and clock form the combined Write Data signal), it is recommended that; when writing all zeroes, the repetition rate of the high-to-low transitions be equal to the nominal data rate, $\pm$0.1%. The repetition rate of the high-to-low transitions, when writing all ones, should be equal to twice the nominal data rate, $\pm$0.1%.

WRITE ENABLE (NWRITE GATE)

When this signal is true (low), the write electronics are prepared for writing data (read electronics disabled). This signal turns on write current in the read/write head. Data is written under control of the WRITE DATA input line. It is generally recommended that changes of state on the WRITE ENABLE line occur before the first WRITE DATA pulse. However, the separation between the leading edge of WRITE ENABLE and the first significant WRITE DATA pulse should not be less than 4 μSec and not greater than 8 μSec. The same restrictions exist for the relationship between the least significant WRITE DATA pulse and the

Controller-to-Disk Drive		
Ground	Signal	Description (Mnemonic)
1	2	Connector clamp
3	4	(Spare)
5	6	(Spare)
9	10	SELECT 1 (NDS1)
11	12	SELECT 2 (NDS2)
13	14	SELECT 3 (NDS3)
15	16	DRIVE-MOTOR ENABLE (NMOTORON)
17	18	DIRECTION
19	20	STEP (NSTEP)
21	22	WRITE DATA (NWRITEDATA)
23	24	WRITE GATE (NWRITEGATE)
31	32	SELECT 4 (NDS4)

Disk Drive-to-Controller		
Ground	Signal	Description (Mnemonic)
7	8	INDEX (NINDEX/SECTOR)
25	26	TRACK ØØ (NTRKØØ)
27	28	WRITE PROTECT (NWRITEPROTECT)
29	30	READ DATA (NREADDATA)
33	34	Connector Clamp

TABLE 2. INTERFACE CONNECTOR PIN ASSIGNMENTS, J1/P1

Pin	Supply Voltage
1	+12 V DC
2	Return (+12 V DC)
3	Return (+5 V DC)
4	+5 V DC

TABLE 3. POWER CONNECTOR PIN ASSIGNMENT

termination of the WRITE ENABLE signal. When the WRITE ENABLE line is false (high), all write electronics are disabled.

When a write protected diskette is installed in a Disk Drive, the write electronics are disabled irrespective of the state of the WRITE ENABLE line.

OUTPUT STATUS (see Table 2)

INDEX (NINDEX/SECTOR)

The INDEX signal is provided once each revolution (200 mSec, nominal) to indicate to the controller the beginning of a track. The INDEX line remains in the true (low) state for the duration of the INDEX pulse. The duration of an INDEX pulse is nominally 4.0 mSec.

The leading edge of an INDEX pulse must always be used to ensure diskette interchangeability between Disk Drives.

TRACK Ø0 (NTRKØ0)

When the Disk Drive is selected, the TRACK Ø0 interface signal indicates to the controller that the read/write head is positioned at Track Ø0. The Track Ø0 remains true (low) until the head is moved away from Track Ø0.

WRITE PROTECT (NWRITEPROTECT)

When the Disk Drive is selected, this signal line logic level goes true (low) when the diskette is write protected. The write electronics are internally disabled when the diskette is write protected.

NOTE: It is recommended that the write data line be inactive whenever Write Enable is false (i.e., read state).

When the level on this 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).

READ DATA (NREADDATA)

This interface line transmits the readback data to the controller when the Drive is selected. It provides a pulse for each flux transition recorded on the medium. The READ DATA output line goes true (low) for a duration of 1 μSec for each flux change recorded.

The leading edge of the READ DATA output pulse represents the true positions for the flux transitions on the diskette surface.

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SECTION IV

MAINTENANCE

PHYSICAL DESCRIPTION OF THE PC BOARDS

The Logic PC board is approximately 6 inches (152 mm) long by 5.5 inches (139 mm) wide. Figure 10 illustrates the placement of test points and connectors.

CIRCUIT BOARD TEST POINTS

The following test point description assumes that the Logic and Servo P.C. boards are installed in the Drive and that the Drive is in an operational mode with a diskette installed:

Logic Ground (TP6)
Digital Logic ground is referenced at TP6.

Differentiated Read Signal (TP3, TP4)
These test points are provided to observe the differential output of the second stage amplifier and differentiated read signal.

Read Data Single Shot (TP5)
The output of the single shot used in the read section is nominally 1.0 μsec for each flux transition detected.

Index Pulse (TP7)
With a standard soft sectored diskette installed, the signal is a high going pulse, nominally 4.0 msec in duration every 200 msec.

Amplified Read Signal (TP1, TP2)
These test points are provided to observe the differential output of the first stage of read signal amplification.

Motor On (TP13)
This signal is low true for the "motor on" condition.

Track Ø0 (TP8)
This signal is low true when the carriage is positioned at track Ø0 and the step motor phase is correct.

Analog Ground (TP10)
The analog ground reference point is provided for measuring read/write waveforms.

Step Pulse (TP12)
When stepping in or out, the signal is a high going pulse for each step of the carriage.

Write Protect Switch (TP9)
When a write protected diskette is installed in the Drive, the signal is high.

OPTION SELECT

Input Line Terminations

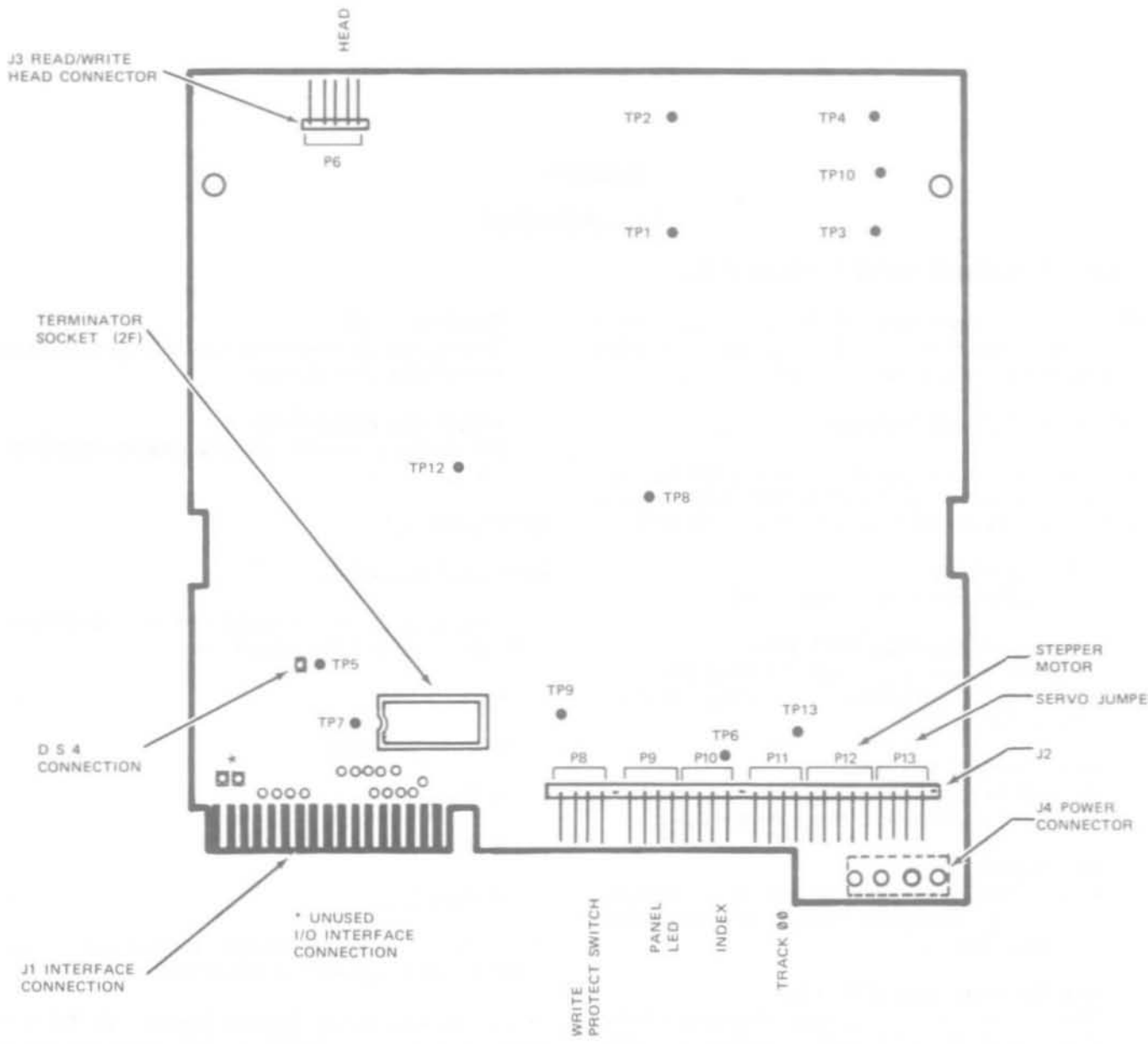
The Disk Drive has been provided with the capability of terminating the input lines listed below:

* Motor On
* Direction Select
* Step
* Write Data
* Write Gate

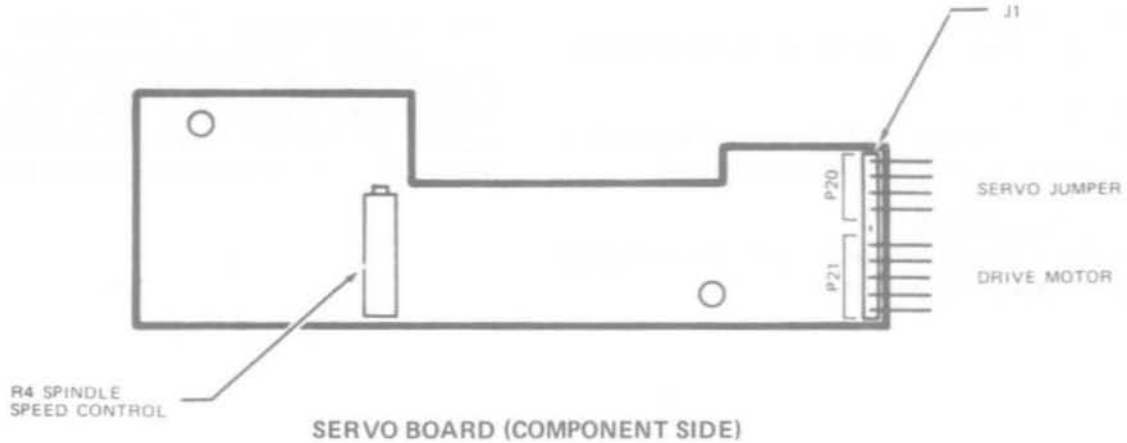
These lines are terminated through a 150 ohm resistor pack installed in a DIP socket located at IC location 2F.

In a single drive system (Catalog Number 26-1160) this resistor pack should be kept in place to provide the proper terminations.

In a multiple drive system (Catalog Numbers 26-1160 and one to three 26-1161's) only the last drive on the interface is to be terminated. All other drives on the interface must have the resistor pack removed. Catalog Number 26-1160 is shipped with the termination resistor installed. Catalog Number 26-1161 is shipped without a resistor pack.



LOGIC BOARD (COMPONENT SIDE)



SERVO BOARD (COMPONENT SIDE)

FIGURE 10. CIRCUIT BOARD TEST POINTS
AND CONNECTOR LOCATIONS.

PREVENTIVE MAINTENANCE

To ensure that the Disk Drive operates at its design potential, the only scheduled preventive maintenance required is periodic cleaning of the magnetic recording head.

Mechanical and electrical adjustment details are provided for further service as a result of disassembly or repair.

CLEANING THE HEAD

To clean the magnetic head, use a lint-free cloth or cotton swab moistened with 91% Isopropyl alcohol. Wipe the head carefully to remove all accumulated oxide and dirt. Dry the head using a lint-free cloth.

CAUTION: Rough or abrasive cloth should not be used to clean the magnetic recording head. Use of cleaning solvents other than 91% Isopropyl alcohol may damage the head.

Extreme care must be exercised to prevent the heads from being damaged (i.e., scratching, banging together, etc.).

ADJUSTMENT

CE ALIGNMENT

The CE alignment procedure locates the magnetic read/write head at the proper radial distance from the hub centerline, thus assuring accurate track location. This adjustment is necessary only after service, or for suspected diskette interchange problems.

DISK DRIVE PREPARATION

1. Apply the necessary power and control to turn on the Disk Drive.

2. Insert a CE Alignment Diskette (Dysan Part Number 224-2A or equivalent) into the drive and close the front latch.

3. Attach oscilloscope probes to test points TP1 and TP2. Place the ground clip of the signal probes to TP10. Adjust the oscilloscope to read differentially (A + B with B inverted). Sync the oscilloscope on the leading edge of the Index pulse at TP7 with the sync probe ground clip at TP6.

RADIAL TRACK ALIGNMENT

1. Loosen (do not remove) the two module retaining screws on the bottom of the chassis and the one at the top rear of the module.

2. Follow the instructions that came with the CE Diskette.

3. Manually rotate the cam at the rear of the module until the cat's-eye pattern, shown in Figure 11, is observed. Carefully rotate the cam until the cat's-eye pattern has equal amplitudes.

4. Secure the module by tightening the three retaining screws that were previously loosened.

5. After securing the module screw, verify Step 4. Repeat as required.

INDEX SENSOR ALIGNMENT

1. Position the Index sensor to the center of travel; lightly tighten the retaining screw.

2. Perform the CE alignment as required to locate the cat's-eye pattern (refer to RADIAL TRACK ALIGNMENT above).

3. Perform fifteen step out commands to position the carriage to Track Ø1.

4. Set the oscilloscope horizontal time base to 50 μSec per division.

5. Referring to Figure 12, adjust the photo transistor mounting block until the first transition of the 2 mSec burst recorded at Track Ø1 occurs 200 ±50 μSec after the leading edge of the index pulse. Adjustment may be made with the use of a flat-bladed screwdriver placed between the photo transistor mounting block and the Cone Lever as required.

6. Secure the retaining screws on the photo transistor mounting blocks and verify the burst location. Readjust as necessary.

TRACK ØØ SWITCH

1. Apply the necessary power and control to turn on the Drive.

2. Insert the CE Alignment Diskette into the Drive and close the front latch.

3. Position the carriage to the radial alignment track. Confirm the position by observing the cat's-eye pattern.

4. If adjustment is required, remove the CE Diskette. Loosen the retaining screw on the base of the Track 00 bracket, retighten slightly to provide some friction on the bracket and rotate the Track 00 Adjustment Screw (at the rear of the chassis) counterclockwise as far as it will go without forcing it.

5. Position the carriage to Track 01 by performing repetitive step out pulses.

6. Rotate the Track 00 Adjustment Screw clockwise — very slowly — until the switch "clicks". Then rotate the screw clockwise (same direction) exactly one half turn.

7. Tighten the retaining screw previously loosened.

WRITE PROTECT SWITCHES

1. Insert a non-write protected diskette partially (halfway) into the Drive.

2. Ensure that the switch is actuated.

3. Insert the diskette fully against the diskette backstop and close the front latch. Ensure that the switch is deactivated.

4. Adjust the switch by loosening the retaining screw, removing the switch assembly and setting the switch higher or lower as required.

DRIVE MOTOR SPEED

1. Apply the necessary power and control to turn on the Drive.

2. Insert the Diskette.

3. Ensure that the Drive Motor Enable line is active.

4. Adjust the Speed Control potentiometer (on the Servo board) until the timing disk is stationary in fluorescent lighting.

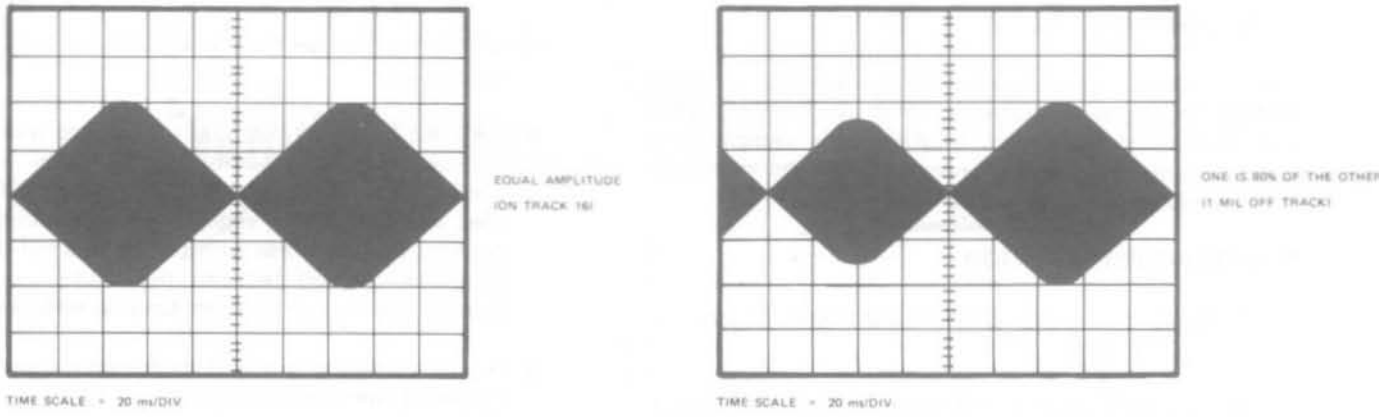


FIGURE 11. CAT'S-EYE PATTERN.

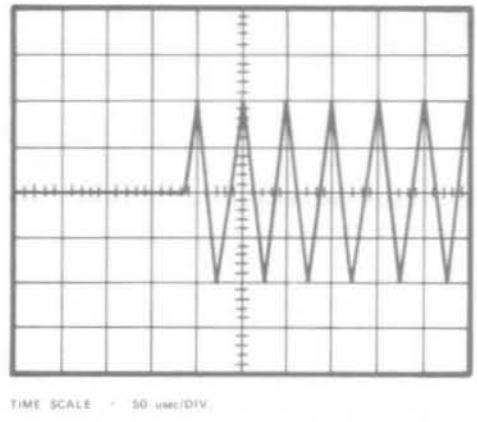


FIGURE 12. INDEX TO DATA

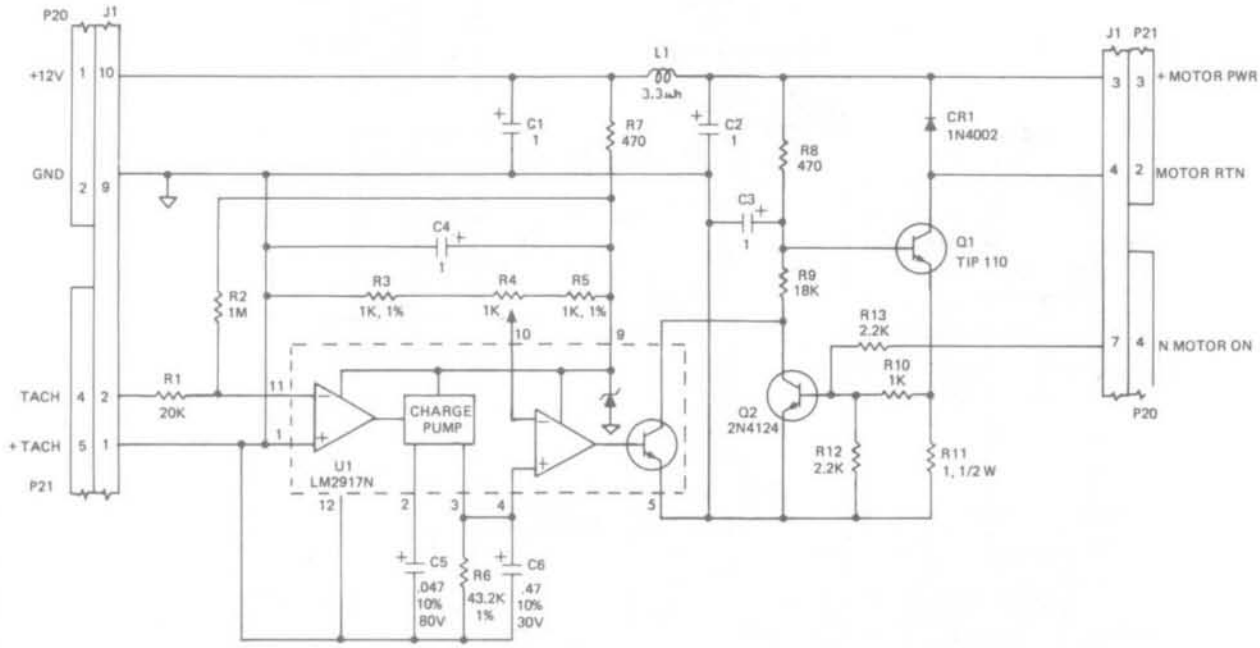


FIGURE 13. SERVO (MOTOR CONTROL) BOARD SCHEMATIC.

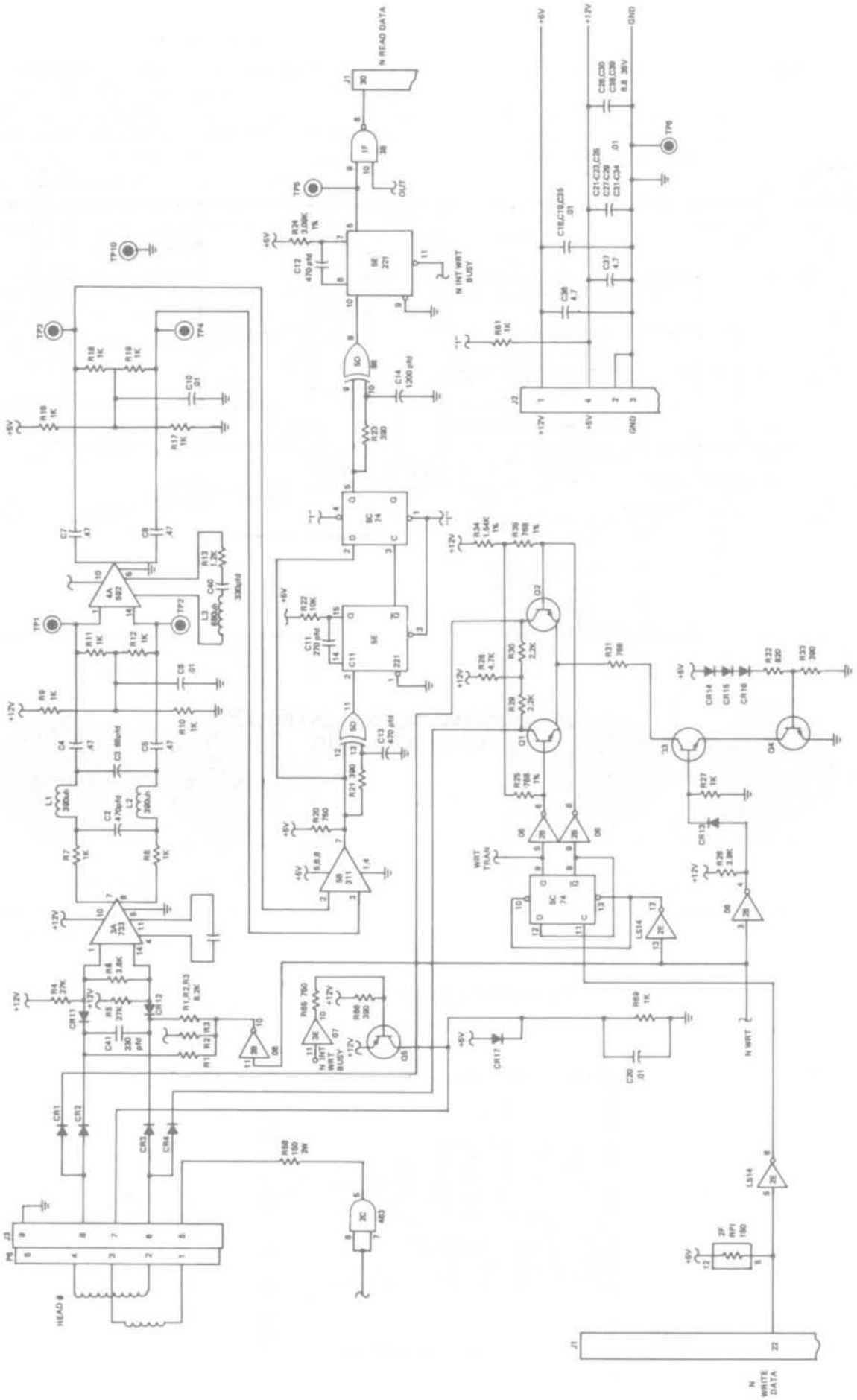


FIGURE 14. MINI-DISK DRIVE SCHEMATIC (Sheet 1).

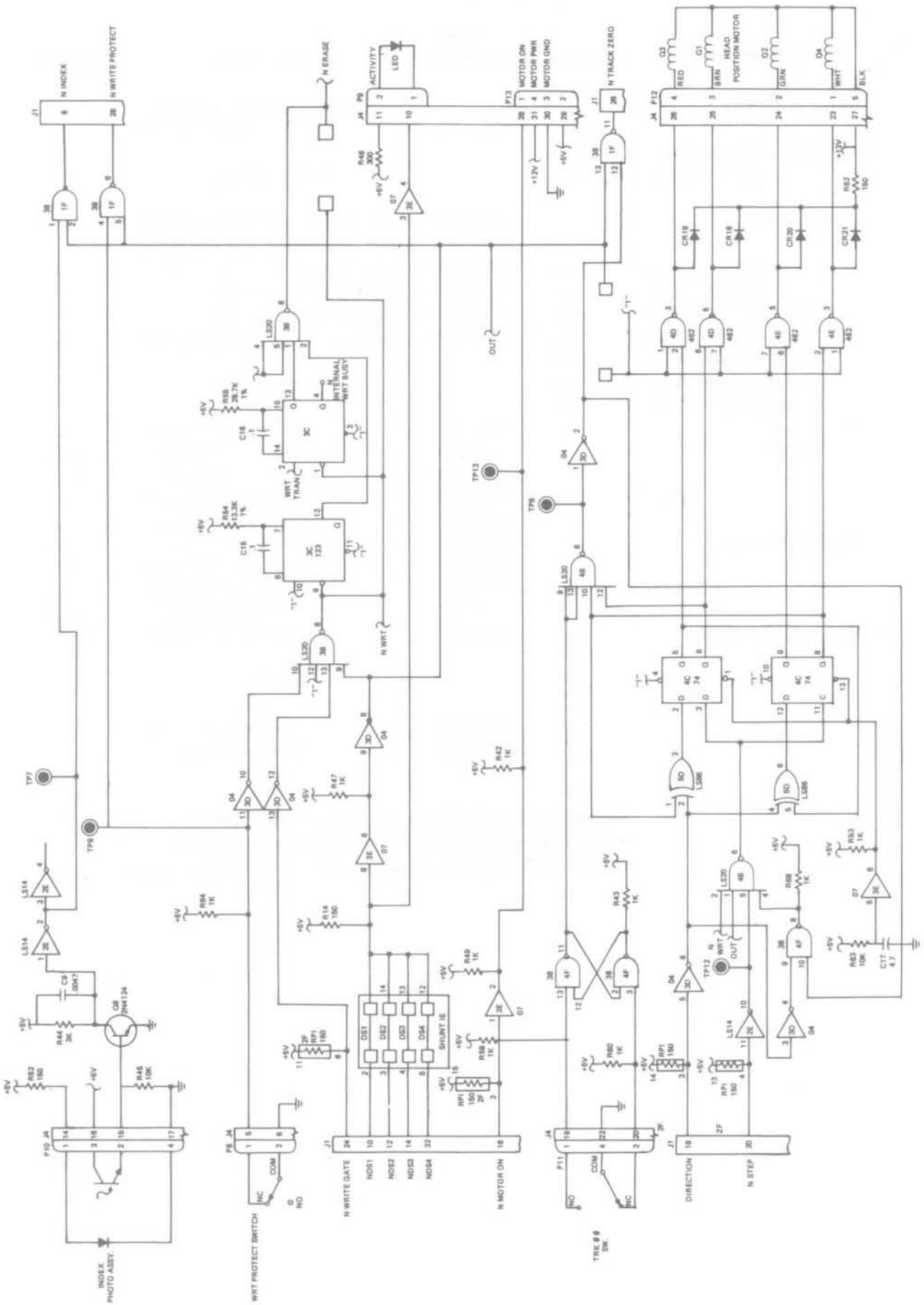


FIGURE 14. MINI-DISK DRIVE SCHEMATIC (Sheet 2).

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MINI-DISK POWER SUPPLY
PARTS LIST

SYMBOL	DESCRIPTION	PART NUMBER
	PRINTED CIRCUIT BOARD, POWER SUPPLY	8790008
	CAPACITORS	
C1	2,200 μF, 25V, Electrolytic, Radial	8328222
C2	2,200 μF, 35V, Electrolytic, Radial	8328223
C3	0.001 μF, 100V, Polyester, Film	8352105
C4	220 μF, 16V, Electrolytic, Radial	8327221
C5	220 μF, 16V, Electrolytic, Radial	8327221
C6	220 μF, 35V, Electrolytic, Radial	8327223
	DIODES	
CR1	1N5392, 100V, Silicon	8150392
CR2	1N5392, 100V, Silicon	8150392
CR3	1N5392, 100V, Silicon	8150392
CR4	1N5392, 100V, Silicon	8150392
CR5	1N4002, 100V, Silicon	8150002
CR6	1N4002, 100V, Silicon	8150002
CR7	1N5392, 100V, Silicon	8150392
CR8	1N5392, 100V, Silicon	8150392
CR9	1N5392, 100V, Silicon	8150392
CR10	1N5392, 100V, Silicon	8150392
	PLUGS	
P1	Socket, Connector	8159008
	Plug, Power (4 ea)	8159006

SYMBOL	DESCRIPTION	PART NUMBER
	TRANSISTORS	
Q1	I.C. Voltage Regulator, 7805	8050805
Q2	MJE3055. Power	8100601
	RESISTORS	
R1	0.33 ohm, 2W, 5%	8247833
R2	10K, 1/4W, 5%	8207210
R3	560 ohms, 1/4W, 5%	8207156
R4	2.2K, 1/4W, 5%	8207222
R5	3,300 ohms, 1/4W, 5%	8207233
R6	1,500 ohms, 1/4W, 5%	8207215
R7	1K, 30%, Variable	8278210
	SWITCH	
S1	DPDT	8489020
	TRANSFORMER	
T1	117/60Hz	8790012
	INTEGRATED CIRCUIT	
Z1	Voltage Regulator	8050723

NOTE: The 34-contact Feedthrough Connector (Part Number 8519004) is not listed or shown as part of the Power Supply. However, it interconnects the Power Supply and the Mini-Disk Drive P. C. B.

DISK CONTROLLER BOARD
PARTS LIST

SYMBOL	DESCRIPTION	PART NUMBER
	PRINTED CIRCUIT BOARD, DISK CONTROLLER	8709094
	CAPACITORS	
C1	2.2 μF, 35V	8395223
C2	470 pF, 50V	8381474
C3	68 pF, 50V	8381684
C4	0.47 μF, 50V	8384474
C5	0.47 μF, 50V	8384474
C6	0.01 μF, 50V	8383104
C7	0.47 μF, 50V	8384474
C8	0.47 μF, 50V	8384474
C9	4700 pF, 50V	8382474
C10	0.01 μF, 50V	8383104
C11	270 pF, 50V	8381274
C12	470 pF, 50V	8381474
C13	470 pF, 50V	8381474
C14	1200 pF, 50V	8382124
C15	0.1 μF, 20V	8394102
C16	0.1 μF, 20V	8394102
C17	4.7 μF, 20V	8315472
C18	0.01 μF, 50V	8383104
C19	0.01 μF, 50V	8383104
C20	0.01 μF, 50V	8383104
C21	0.01 μF, 50V	8383104
C22	0.01 μF, 50V	8383104
C23	0.01 μF, 50V	8383104
C24	Not Used	—
C25	0.01 μF, 50V	8383104
C26	6.8 μF, 35V	8335683
C27	0.01 μF, 50V	8383104
C28	0.01 μF, 50V	8383104
C29	0.01 μF, 50V	8383104
C30	6.8 μF, 35V	8335683
C31	0.01 μF, 50V	8383104
C32	0.01 μF, 50V	8383104
C33	0.01 μF, 50V	8383104
C34	0.01 μF, 50V	8383104
C35	0.01 μF, 50V	8383104
C36	4.7 μF, 20V	8315472
C37	4.7 μF, 20V	8315472
C38	6.8 μF, 35V	8335683
C39	6.8 μF, 35V	8335683
C40	330 pF, 50V	8381334
C41	330 pF, 50V	8381334
	DIODES	
CR1	*1N4446, Switching	8150446
CR2	1N4446, Switching	8150446
CR3	1N4446, Switching	8150446
CR4	1N4446, Switching	8150446
CR5	Not Used	—
↓	↓	↓
CR10	Not Used	—
CR11	1N4446, Switching	8150446
CR12	1N4446, Switching	8150446
CR13	1N4446, Switching	8150446
CR14	1N4446, Switching	8150446
CR15	1N4446, Switching	8150446
CR16	1N4446, Switching	8150446
CR17	1N4446, Switching	8150446
CR18	1N4446, Switching	8150446
CR19	1N4446, Switching	8150446
CR20	1N4446, Switching	8150446
CR21	1N4446, Switching	8150446
	INDUCTORS	
L1	390 μh	8419003
L2	390 μh	8419003
L3	680 μh	8419004
	INTEGRATED CIRCUITS	
3A	MC 1733	8050733
4A	NE 592A	8050592
2B	7406, Buffer and Interface Gate	8010406
3B	74LS20, Positive NAND Gate	8020020
4B	74LS20, Positive NAND Gate	8020020
5B	MLM 311EL Precision Comparator	8050311
2C	75463, Dual Peripheral Positive OR Driver	8050463
3C	74LS123, Retriggerable Monostable Multivibrator	8020123
4C	74LS74, Flip-Flop	8020074
5C	74LS74, Flip-Flop	8020074
3D	74LS04, Positive NAND Gate	8020004
4D	75462, Dual Peripheral Positive NAND Driver	8050462
5D	74LS86, Quadruple 2-input Exclusive OR Gate	8020086
1E	*DIP Shunt, 16-pin	8489001
2E	74LS14, Schmitt-Trigger Positive NAND Gate	8020014
3E	7407, Buffer and Interface Gate	8010407
4E	75462, Dual Peripheral Positive NAND Driver	8050462
5E	74LS221, Dual Monostable Multivibrator w/Schmitt-Trigger Inputs	8020221
1F	74LS38, Buffer and Interface Gate	8020038
2F	8-resistor Network	8290007
4F	74LS38, Buffer and Interface Gate	8020038

* If applicable

DISK CONTROLLER BOARD
PARTS LIST (Cont'd)

SYMBOL	DESCRIPTION	PART NUMBER
	RESISTORS	
R1	8.2 K, 1/4 W, 5%	8207282
R2	8.2 K, 1/4 W, 5%	8207282
R3	8.2 K, 1/4 W, 5%	8207282
R4	27 K, 1/4 W, 5%	8207327
R5	27 K, 1/4 W, 5%	8207327
R6	3.6 K, 1/4 W, 1%	8207236
R7	1 K, 1/4 W, 5%	8207210
R8	1 K, 1/4 W, 5%	8207210
R9	1 K, 1/4 W, 5%	8207210
R10	1 K, 1/4 W, 5%	8207210
R11	1 K, 1/4 W, 5%	8207210
R12	1 K, 1/4 W, 5%	8207210
R13	1.2 K, 1/4 W, 5%	8207212
R14	150 ohms, 1/4 W, 5%	8207115
R15	Not Used	—
R16	1 K, 1/4 W, 5%	8207210
R17	1 K, 1/4 W, 5%	8207210
R18	1 K, 1/4 W, 5%	8207210
R19	1 K, 1/4 W, 5%	8207210
R20	750 ohms, 1/4 W, 5%	8207175
R21	390 ohms, 1/4 W, 5%	8207139
R22	10 K, 1/4 W, 5%	8207310
R23	390 ohms, 1/4 W, 5%	8207139
R24	3.09 K, 1/4 W, 1%	8201230
R25	768 ohms, 1/4 W, 1%	8201176
R26	3.9 K, 1/4 W, 5%	8207239
R27	1 K, 1/4 W, 5%	8207210
R28	47 K, 1/4 W, 5%	8207347
R29	2.2 K, 1/4 W, 5%	8207222
R30	2.2 K, 1/4 W, 5%	8207222
R31	768 ohms, 1/4 W, 1%	8201176
R32	820 ohms, 1/4 W, 5%	8207182
R33	390 ohms, 1/4 W, 5%	8207139
R34	1.54 K, 1/4 W, 1%	8201215
R35	768 ohms, 1/4 W, 1%	8201176
R36	Not Used	—
R41	Not Used	—
R42	1 K, 1/4 W, 5%	8207210
R43	1 K, 1/4 W, 5%	8207210
R44	3 K, 1/4 W, 5%	8207230
R45	10 K, 1/4 W, 5%	8207310
R46	Not Used	—
R47	1 K, 1/4 W, 5%	8207210
R48	300 ohms, 1/4 W, 5%	8207130
R49	1 K, 1/4 W, 5%	8207210
R50	Not Used	—
R51	Not Used	—
R52	150 ohms, 1/4 W, 5%	8207115
R53	1 K, 1/4 W, 5%	8207210
R54	13.3 K, 1/4 W, 1%	8201313
R55	28.7 K, 1/4 W, 1%	8201328
R56	Not Used	—
R57	Not Used	—
R58	150 ohms, 2 W, 5%	8247115
R59	1 K, 1/4 W, 5%	8207210
R60	1 K, 1/4 W, 5%	8207210
R61	1 K, 1/4 W, 5%	8207210
R62	150 ohms, 1/4 W, 5%	8207115
R63	10 K, 1/4 W, 5%	8207310
R64	1 K, 1/4 W, 5%	8207210
R65	750 ohms, 1/4 W, 5%	8207175
R66	390 ohms, 1/4 W, 5%	8207139
R67	Not Used	—
R68	1 K, 1/4 W, 5%	8207210
R69	1 K, 1/4 W, 5%	8207210
	TRANSISTORS	
Q1	2N4124, NPN	8110124
Q2	2N4124, NPN	8110124
Q3	2N4124, NPN	8110124
Q4	2N4124, NPN	8110124
Q5	2N4125, PNP	8100125
Q6	Not Used	—
Q7	Not Used	—
Q8	2N4124, NPN	8110124
	MISCELLANEOUS	
	16-pin IC Socket (2)	8509003
	*16-pin DIP Shunt Socket	8489001
	5-pin Right Angle Header	8519054
	14-pin Right Angle Header (2)	8519060
	Staking Pin (13)	8529014
	Resistor, ØΩ value - Jumper (2)	8290000
	4-position PC Mount Housing	8519056

* If Applicable

SERVO (MOTOR CONTROL) BOARD PARTS LIST

SYMBOL	DESCRIPTION	PART NUMBER
	PRINTED CIRCUIT BOARD, SERVO (MOTOR CONTROL)	8709096
	CAPACITORS	
C1	1 μF, 35 V	8335103
C2	1 μF, 35 V	8335103
C3	1 μF, 35 V	8335103
C4	1 μF, 35 V	8335103
C5	0.047 μF, 80 V	8393474
C6	0.47 μF, 35 V	8394473
	DIODES	
CR1	1N4002, Rectifier, Low Power	8150002
	INDUCTORS	
L1	3.3 μh, 10%	8419005
	INTEGRATED CIRCUITS	
U1	LM2917N, Frequency to Voltage Converter	8050917
	RESISTORS	
R1	20 K, 1/4 W, 5%	8207320
R2	1 M, 1/4 W, 5%	8207510
R3	1 K, 1/4 W,5%	8207210
R4	1 K, Trim Potentiometer	8289210
R5	1 K, 1/4 W, 5%	8207210
R6	43.2 K, 1/4 W, 1%	8201343
R7	470 ohms, 1/4 W, 5%	8207147
R8	470 ohms, 1/4 W, 5%	8207147
R9	18 ohms, 1/4 W, 5%	8207018
R10	1 K, 1/4 W, 5%	8207210
R11	1 ohm, 1/2 W, 5%	8217001
R12	2.2 K, 1/4 W, 5%	8217222
R13	2.2 K, 1/4 W, 5%	8207222
	TRANSISTORS	
Q1	TIP110, Power	8110110
Q2	2N4124, NPN	8110124
	MISCELLANEOUS	
	10-pin Right Angle Header	8519057
	4-40 x 1/4" Screw, Pan Head	8569032
	4-40 Hex Nut	8579001

DISK DRIVE PARTS AND SUBASSEMBLIES

SYMBOL	DESCRIPTION	PART NUMBER
	Drive Motor Assembly	8852015
	Track "00" Switch Assembly	8852016
	Write Protect Switch Assembly	8552017
	Belt Drive	8852018
	Index Assembly	8552019
	LED Assembly (Panel)	8552020
	Cone Assembly	8552021
	Latch Assembly	8552022
	Right Hand Guide	8552023
	Left Hand Guide	8552024
	Front Panel	8552025
	Front Panel Bushing	8552026
	Upper Bearing	8552027
	Lower Bearing	8552028
	Module Assembly SSR	8552029
	* Stepper Motor Assembly	8552030
	* Head Carriage Assembly SSR	8552031
	* Drive Band Stepper	8552032

* Included in Module Assembly SSR.

DRIVE ASSEMBLY PARTS LIST

SYMBOL	DESCRIPTION	PART NUMBER
	Drive Assembly	7000009
	Disk Controller Board Assembly	7000007
	Servo Board Assembly	7000008
	Disk Drive	8790104
	6-32 x 1/2" Screw, Phillips (2)	8569046
	4-40 x 1/4" Screw (2)	8569032
	#6 Spacer, Nylon (2)	8589025

SECTION V
MINI-DISK SERVICE MANUAL
(MINI 25060 – xx)

INTRODUCTION

This manual provides service information for the Mini-Disk Power Supply, Termination Resistor Package, DIP Shunt, Jumper Wire and Cable Connectors (for Serial Numbers MINI25060 - xx).

Service information for this system can be found in the SA400 Minifloppy Diskette Storage Drive Service Manual, published by Shugart Associates, dated March 1977. The Shugart Manual follows these pages.

Resistor Termination, DIP Shunt and Jumper (refer to Figure 15).

1. The Resistor Termination in the IC socket is used in Drive number zero only. It must be removed for Drives one, two and three.
2. The DIP Shunt package is used in all Drives and must be punched and seated as illustrated.
3. The Jumper Wire between pins 10 and 32 of J1 is used on all Drives.

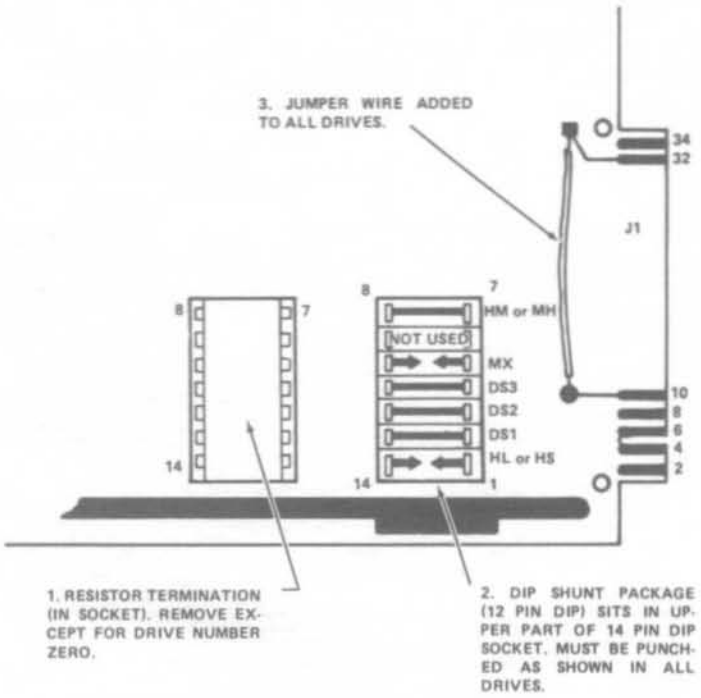

FIGURE 15. RESISTOR TERMINATION, DIP SHUNT AND JUMPER.

Flat Ribbon Cable Assembly (see Figure 16).

Pins must be removed from Drive connectors on the Cable Assembly as follows and as illustrated:

1. Connector for Drive number zero – pins 12, 14 and 32.
2. Connector for Drive number one – pins 10, 14 and 32.
3. Connector for Drive number two – pins 10, 12 and 32.
4. Connector for Drive number three – pins 10, 12 and 14.

Do not remove any pins from the connector to the Expansion Interface.

DRIVE NUMBER ZERO	DRIVE NUMBER ONE	DRIVE NUMBER TWO	DRIVE NUMBER THREE
12	10	10	10
14	14	12	12
32	32	32	14

FIGURE 16. CABLE ASSEMBLY – CONNECTOR PIN REMOVAL CHART.

RADIO SHACK A DIVISION OF TANDY CORPORATION

U.S.A.: FORT WORTH, TEXAS 76102
CANADA: BARRIE, ONTARIO L4M 4W5

TANDY CORPORATION

AUSTRALIA	BELGIUM	U. K.
280-316 VICTORIA ROAD RYDALMERE, N.S.W. 2116	PARC INDUSTRIEL DE NANINNE 5140 NANINNE	BILSTON ROAD WEDNESBURY WEST MIDLANDS WS10 7JN

380

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