



PRODUCT SPECIFICATIONS
MINI SINGLE- AND DOUBLE-SIDED RECORDINGS
FLEXIBLE DISK DRIVES
MODEL NUMBERS TM100-1 AND TM100-2
48 TRACKS PER INCH

INTRODUCTION

Tandon Corporation's Model Numbers TM100-1 and TM100-2, 5.25-inch flexible disk drives, are full feature drives. They are compact data storage devices that use an IBM-formatted Industry Standard 5.25-inch (133.44 millimeter) diskette.

The TM100-1 disk drive is a forty-eight tracks per inch, single-sided recording device. The TM100-2 disk drive has the same number of tracks per inch, and is a double-sided recording device.

The TM100-1 flexible disk drive is capable of reading and writing in single-density format on a diskette, using a proprietary read/write head developed and patented by Tandon Corporation. This disk drive has a double density capability when a Modified Frequency Modulated (MFM) or other appropriate recording technique is used. The encoding and decoding of the data is done by the user's controller. The TM100-2 flexible disk drive doubles data storage capabilities by using both sides of the diskette.

Track positioning is accomplished by utilizing a metal band driven by a stepper motor that provides a five millisecond track-to-track step interval.

SCOPE OF THE DOCUMENT

This product specification contains the major features, specifications, mounting, and power requirements, an interface description, and typical electrical interface and timing characteristics of the TM100-1 and TM100-2, 5.25-inch flexible disk drives.

MAJOR FEATURES

WRITE PROTECT (STANDARD)

When a write protected diskette is inserted in the flexible disk drive, the write electronics are disabled.

DAISY CHAIN CAPABILITY (STANDARD)

The disk drive provides address selection and gating functions necessary to daisy chain a maximum of four units at the user's option. The last disk drive on the daisy chain terminates the interface. The terminations are accomplished by a resistor array plugged into a DIP socket.

INTERNAL TRIM ERASE (STANDARD)

The flexible disk drive provides the necessary control signals internally for proper trim erasure of data.

INDUSTRY STANDARD INTERFACE COMPATIBILITY

The disk drive is compatible with controllers that employ the industry standard interface.

ACTIVITY INDICATOR (STANDARD)

An activity indicator, located on the front panel, is automatically illuminated when the flexible disk drive is selected.

3. **PERFORMANCE SPECIFICATIONS**

3.1 **HEADS AND HEAD WEAR GUARANTEE**

Heads: Two double-sided recording heads, Tandon patented design

Head Wear Guarantee: 20,000 media contact hours

3.2 **MEDIA AND MEDIA LIFE**

Media: 133.4 millimeter (5.25-inch) Industry Standard diskette

Wear Life (For Reference Only): 4×10^6 passes per track

3.3 **CAPACITY**

Tracks Per Inch: 48 TPI, both models

Tracks Per Drive: 40 for TM100-1
80 for TM100-2, 40 per surface

Spacing: .529 mm (20.8 milinches), Side 0, both models

3.4 **ACCESS TIMES**

Track-To-Track: 5 milliseconds

Head Settling Time: 15 milliseconds

Average Access Time, including head settling time: 90 milliseconds

3.5 **DISK ROTATIONAL SPEED**

Motor Start Time: 250 milliseconds

Average Rotational Latency: 100 milliseconds

Motor Stop Time: 150 milliseconds maximum

Disk Rotational Speed: 300 RPM \pm 1.5%

Instantaneous Speed Variation (ISV): \pm 3%

3.6 **RECORDING CAPACITY AND METHOD**

Flux Reversals Per Inch, Inside Track:

5535 FRPI, Side 0, both models

5877 FRPI, Side 1, TM100-2 only

Transfer Rates: 250K BPS

Unformatted Recording Capacity:

2.0 megabits per diskette, unformatted double density, TM100-1

4.0 megabits per diskette, unformatted double density, TM100-2

3.7 **ELECTROMAGNETIC CHARACTERISTICS**

Tandon Corporation's Model Numbers TM100-1 and TM100-2, 5.25-inch flexible disk drives are designed to minimize electrical interference that is generated internally and propagated through space or on associated conductors.

4. **RELIABILITY**

4.1 **ERROR RATES**

Error rates are exclusive of external sources, e.g.: electronics, defective diskettes, contaminated diskettes, etc.

One recoverable error in 10^9 bits read

One non-recoverable error in 10^{12} bits read

One seek error in 10^6 seeks

4.2 **MEAN TIME BEFORE FAILURE**

MTBF: 8,000 power-on hours

4.3 **MEAN TIME TO REPAIR**

MTTR: 30 minutes

4.4 **PERIODIC MAINTENANCE**

Periodic maintenance is not required.

5. **ENVIRONMENTAL SPECIFICATIONS**

The disk drive meets its operational specifications under the environmental conditions listed below.

5.1 **TEMPERATURE**

Operating Temperature: 10°C to 44°C (50°F to 112°F)

Storage Temperature: -40°C to 71°C (-40°F to 160°F)

5.2 **RELATIVE HUMIDITY**

Noncondensing Operating Humidity: 20% to 80%

Noncondensing Nonoperating Humidity: 5% to 95%

5.3 **SHIPMENT**

When prepared for shipment by Tandon Corporation, the 5.25-inch flexible disk drive will meet the requirements of NSTA Pre-Shipment Test Procedure Project 1A.

5.4 ALTITUDE

304.8 m (500 feet) below sea level to 15,240 m (50,000 feet) above sea level, operating or nonoperating.

6. MECHANICAL SPECIFICATIONS AND MOUNTING

6.1 MECHANICAL SPECIFICATIONS

Height: 85.85 millimeters (3.25 inches)

Width: 149.1 millimeters (5.75 inches)

Length: 203.2 millimeters (8.0 inches), excluding front panel

Weight: 2.04 kilograms (4.5 pounds)

6.2 MOUNTING

The 5.25-inch flexible disk drive may be mounted upright, horizontally or vertically. When mounted horizontally, the large circuit board must be on top.

Four 8-32 tapped mounting holes are provided on the bottom of the disk drive, as are two 8-32 tapped mounting holes on each side of it for attachment to user-supplied mounting brackets (see Figure 1). When mounted in any of the above positions, only two holes per side are required to securely hold the drive in place.

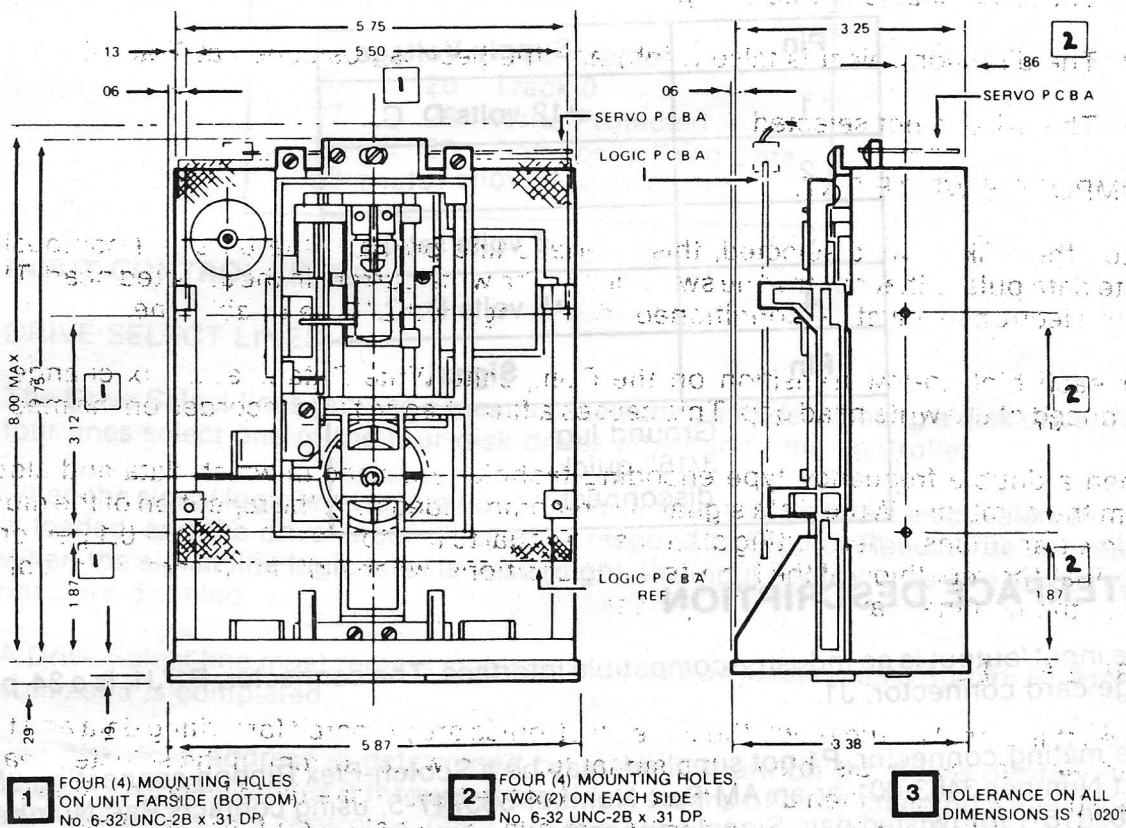


Figure 1

Disk Drive Outline Drawing

7. POWER REQUIREMENTS

7.1 D. C. POWER SEQUENCING

A maximum of one second is required from the time power is applied to the disk drive until the time at which a command can be accepted.

7.2 PRIMARY POWER

+12 V D.C. Power: +12 volts \pm 0.6 volt @ 900 mA, average maximum

+ 5 V D. C. Power: +5 volts \pm 0.25 volt @ 600 mA, average maximum with less than 100 mv P/P ripple.

7.3 D. C. CONNECTOR

D. C. power is supplied to the 5.25-inch flexible disk drive through a four-pin AMP connector, Part Number 350211-1, connected to the printed circuit board (J3). The mating connector, not supplied, is AMP Part Number 1-480424-0, using AMP contact Part Number 60619-1. Pin assignments are found in Table 1.

The chassis should be connected to earth ground to ensure proper operation.

Table 1

D. C. Power Connector Pin Assignments, P3, J3

Pin	Supply Voltage
1	+12 volts D. C.
2	12 volts return
3	5 volts return
4	+5 volts D. C.
Pin	Signal
Ground lug 3/16" quick disconnect	

8. INTERFACE DESCRIPTION

The input/output is an industry-compatible interface. The connector, P1/J1, is a 34-pin edge card connector, J1.

The mating connector, P1 not supplied, may be a Scotch-Flex Ribbon connecting 3M Part Number 3463-001 or an AM Part Number 583717-5, using contacts Part Number 1-583616-1 for twisted pair. Signal connector pin assignments can be found in Table 2.

Table 2**Drive Interface Lines and Pin Connectors**

Input Control Lines (Controller-To-Disk-Drive)		
Ground	Pin	Signal
1	2	Connector Clamp
3	4	Spare
5	6	Drive Select 3
9	10	Drive Select 0
11	12	Drive Select 1
13	14	Drive Select 2
15	16	Motor On
17	18	Direction Select
19	20	Step
21	22	Composite Write Data
23	24	Write Enable
31	32	Side One Select
Output Status Lines (Disk Drive-To-Controller)		
Ground	Pin	Signal
7	8	Index/Sector
25	26	Track 0
27	28	Write Protected
29	30	Composite Read Data
33	34	Connector Clamp

8.1 INPUT CONTROL LINES**8.1.1 DRIVE SELECT LINES**

The Drive Select lines provide a means of selecting and deselecting a disk drive. These four lines 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, the head is loaded, and the drive is conditioned to respond to Stop or Read/Write commands. When the signal line logic level is false (high), the input control lines and output status lines are disabled.

A Drive Select line must remain stable in the true (low) state until a Step or Read/Write command is completed.

The disk drive address is determined by a select shunt on the Servo printed circuit board. Drive Select lines 0 through 3 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 Drive Select lines are in the true (low) state simultaneously.

8.1.2 MOTOR ON

When this signal is true (low), the drive motor accelerates to its nominal speed of 300 RPM, and stabilizes at this speed in less than 250 milliseconds. When the signal line logic level goes false (high), the disk drive decelerates to a stop in less than 150 milliseconds. This signal is not gated with select.

8.1.3 DIRECTION SELECT AND STEP LINES (TWO LINES)

When the disk drive is selected, a true (low) pulse with a time duration greater than one (1) microsecond but less than two (2) milliseconds on the Step line initiates the access motion. The direction of motion is determined by the logic state of the Direction Select line when a step pulse is issued. The motion is toward the center of the disk if the Direction Select 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 Select line is in the false (high) state when a step pulse is issued.

To ensure proper positioning, the Direction Select line should be stable at least one (1) microsecond prior to issuing a corresponding step pulse, and remain true (low) for one (1) microsecond after the step pulse.

The access motion is initiated on the trailing edge of the step pulse. The time period between consecutive trailing edges of step pulses should be at least five (5) milliseconds.

The drive electronics ignore step pulses when one of three conditions exists:

1. The write enable is true (low).
2. The direction select is false (high) and the head is positioned at Track 0.
3. The drive is not selected.

8.1.4 COMPOSITE WRITE DATA

When the disk drive is selected, this interface line provides the bit serial composite write data pulses that control the switching of the write current in the selected head. The write electronics must be conditioned for writing by the Write Enable line.

For each high-to-low transition on the Composite Write Data line, a flux change is produced at the write head gap. This causes a flux change to be recorded on the media.

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, and that the repetition of the high-to-low transitions, when writing all ones, be equal to twice the nominal data rate ± 0.1 percent.

8.1.5 WRITE ENABLE

When this signal is true (low), the write electronics are prepared for writing data and the read electronics are disabled. This signal turns on write current in the selected read/write head. Data is written under the control of the Composite Write Data and Side One Select input lines. It is recommended that changes of state on the Write Enable line occur before the first write data pulse. When the Write Enable line is false (high), all write electronics are disabled.

When a write-protected diskette is installed in a drive, the write electronics are disabled irrespective of the state of the Write Enable or Side One Select lines.

8.1.6 SIDE ONE SELECT (TM100-2 ONLY)

The Side One Select interface line defines which side of a two-sided diskette is used for information transfer.

A false (high) level on this line selects the read/write head on the Side Zero surface of the diskette. A true (low) level on this line selects the read/write head on the Side One surface of the diskette.

8.2 OUTPUT STATUS LINES

8.2.1 INDEX/SECTOR

The Index/Sector signal is a composite of the index pulse and sector signals.

An index pulse is provided once every revolution, 200 milliseconds nominal, to indicate the beginning of a track to the controller. The leading edge of this signal must always be used to ensure timing accuracy. The Index/Sector line remains in the true (low) state for the duration of the index/sector pulse, which is nominally 3.5 milliseconds.

The Index/Sector signal portion appears only when using hard-sectored diskettes.

8.2.2 TRACK 0

When the disk drive is selected, the Track 0 interface signal indicates to the controller that the read/write head is positioned on Track 0. The Track 0 signal remains true (low) until the head is moved away from Track 0.

8.2.3 WRITE PROTECTED

When the Write Protected line goes true (low), the diskette is write protected and the write electronics are disabled. It is recommended that the controller not issue a Write command when the Write Protect signal is true (low).

When the Write Protected line is false (high), both write electronics and write operations are enabled.

8.2.4 COMPOSITE READ DATA

This interface line transmits the readback data to the controller when the drive is selected. It provides a pulse for each flux transition detected and recorded on the diskette. The Composite Read Data output line goes true (low) for a duration of $1 \pm .25$ microseconds for each flux change recorded on the diskette.

The leading edge of the Composite Read Data output pulse represents the true position of the flux transitions on the diskette's surface.

9. TYPICAL INTERFACE CHARACTERISTICS

Lines between the controller and the disk drive have the following characteristics:

True = $V_{out} + 0.4$ volt maximum at $I_{out} = 48$ mA maximum

False = $V_{out} + 2.4$ volts minimum open collector at I_{out}
= 250 mA maximum

Figure 2 contains the characteristics of the electrical interface. Figure 3 contains the control and data timing requirements for Tandon's Model Numbers TM100-1 and TM100-2.

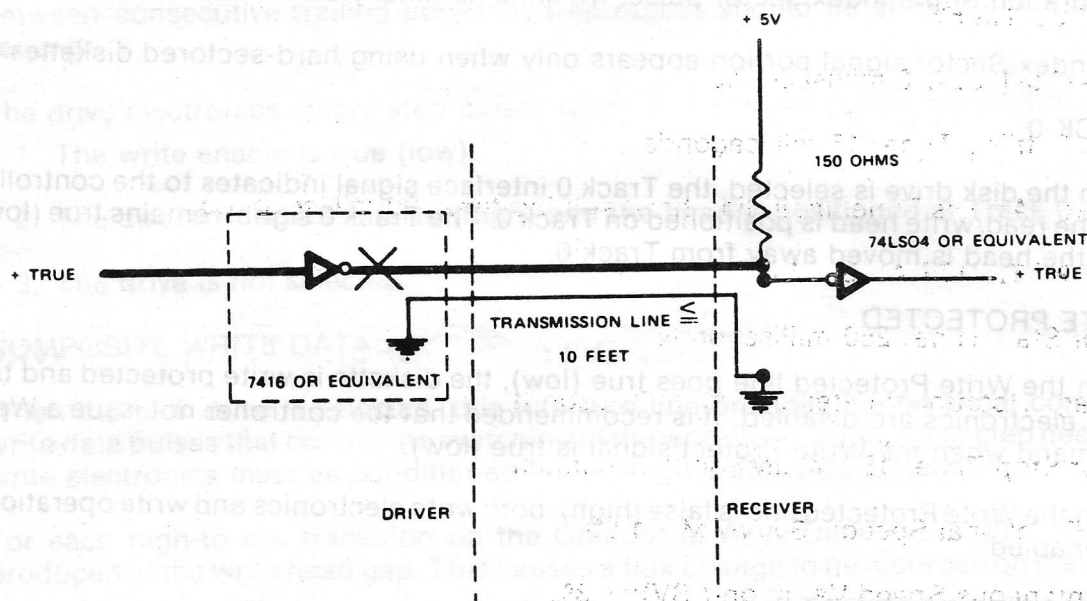


FIGURE 2
ELECTRICAL INTERFACE CHARACTERISTICS

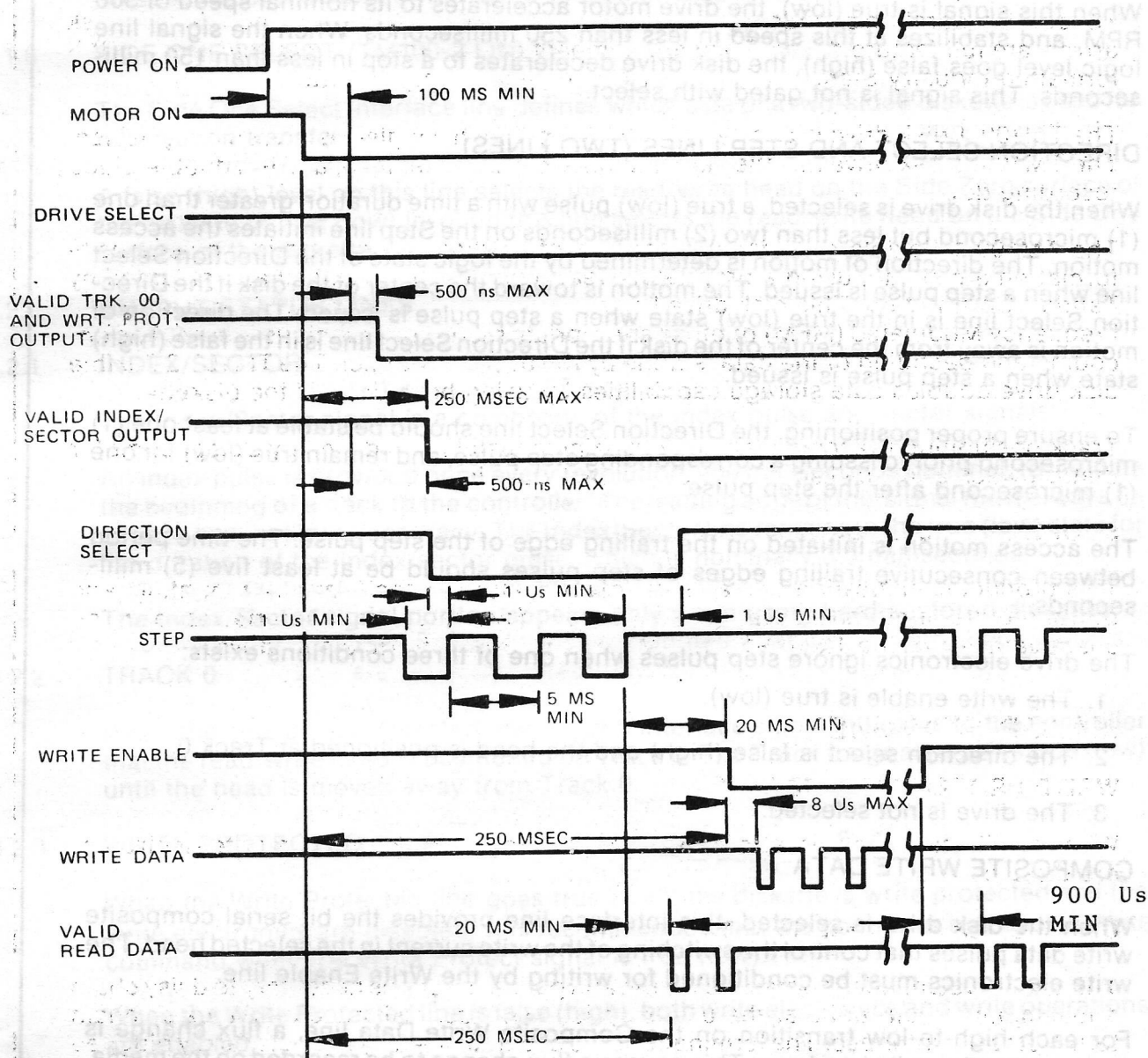
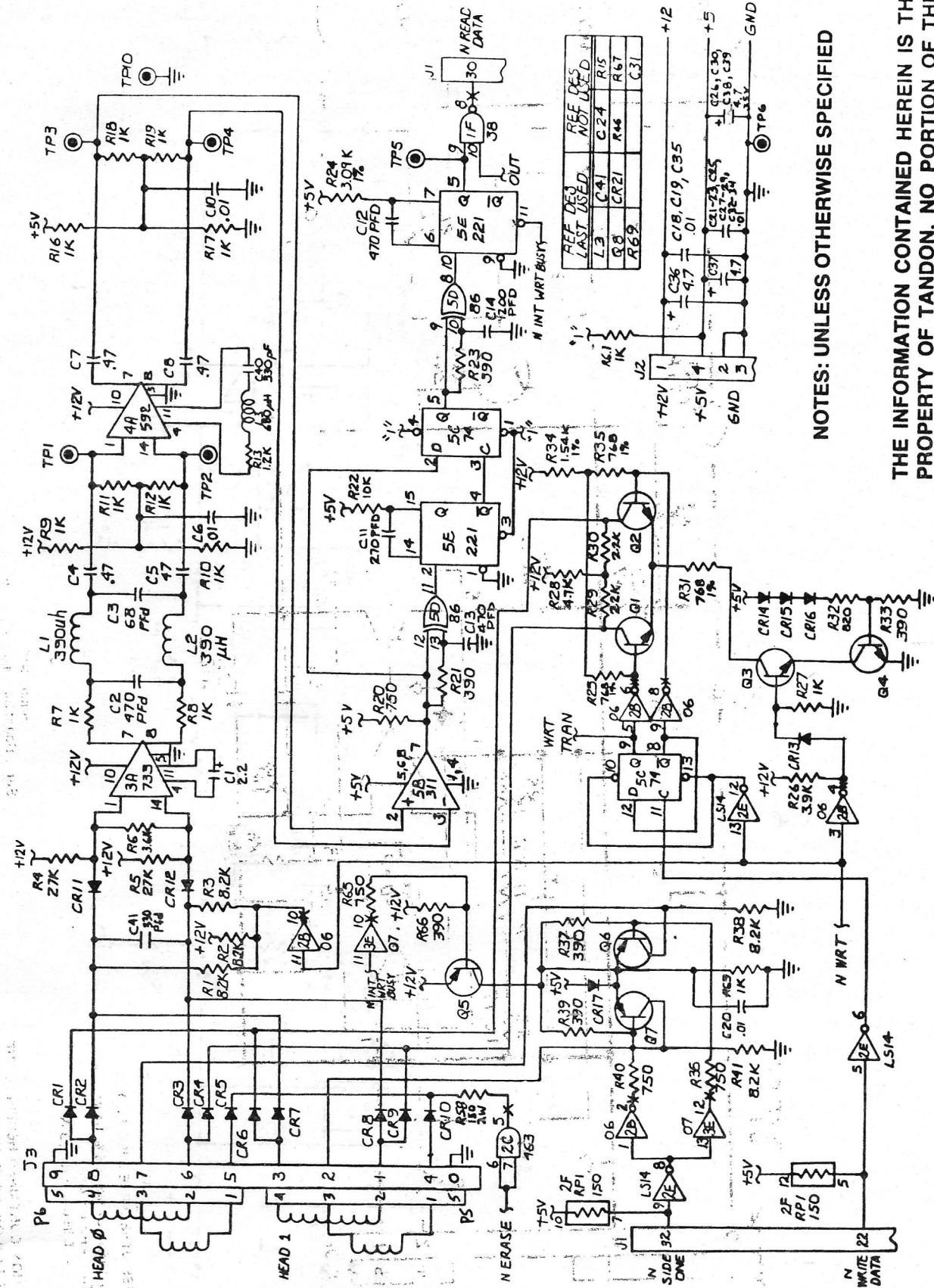


Figure 3

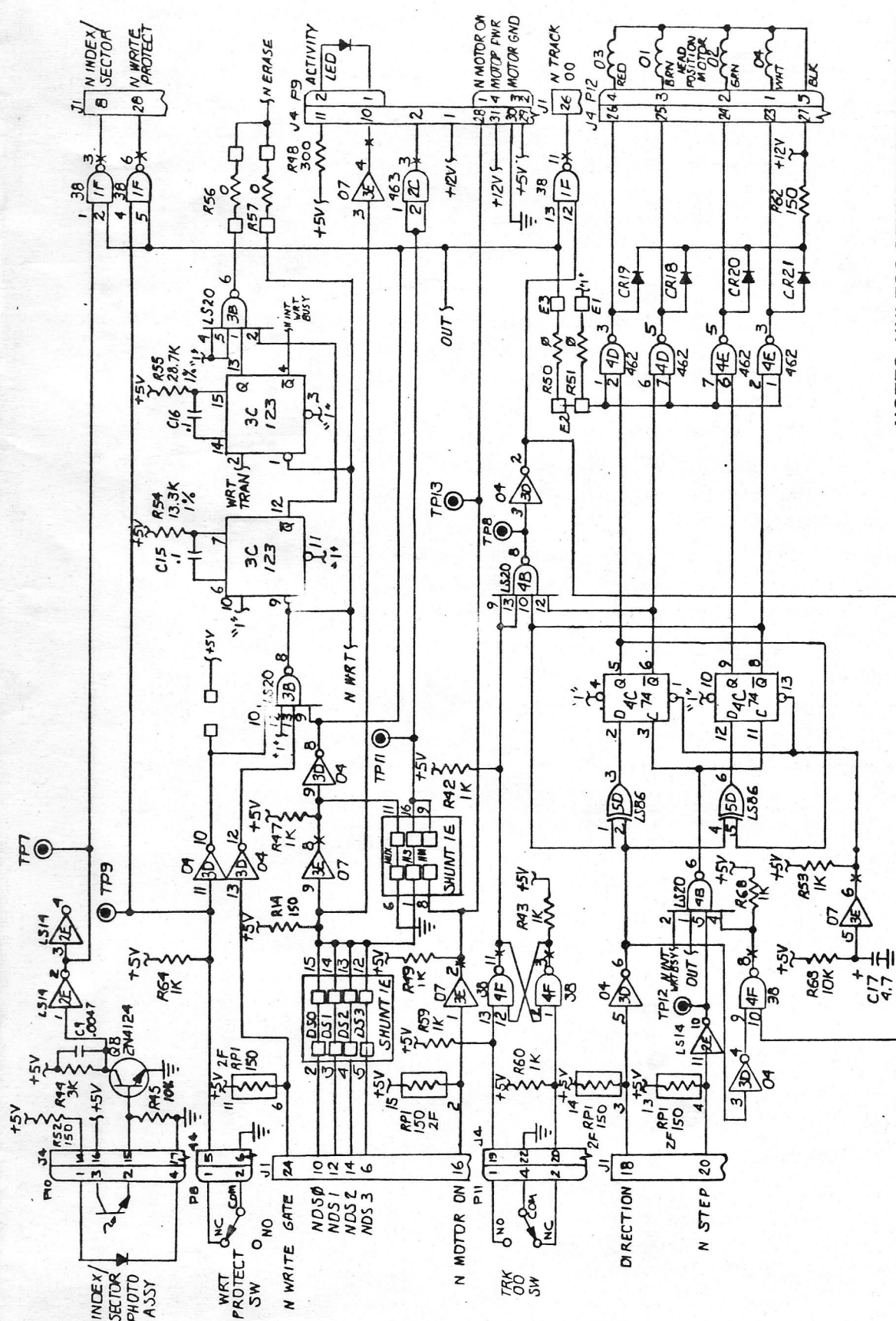
Control and Data Timing Requirements



NOTES: UNLESS OTHERWISE SPECIFIED

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LOGIC SCHEMATIC



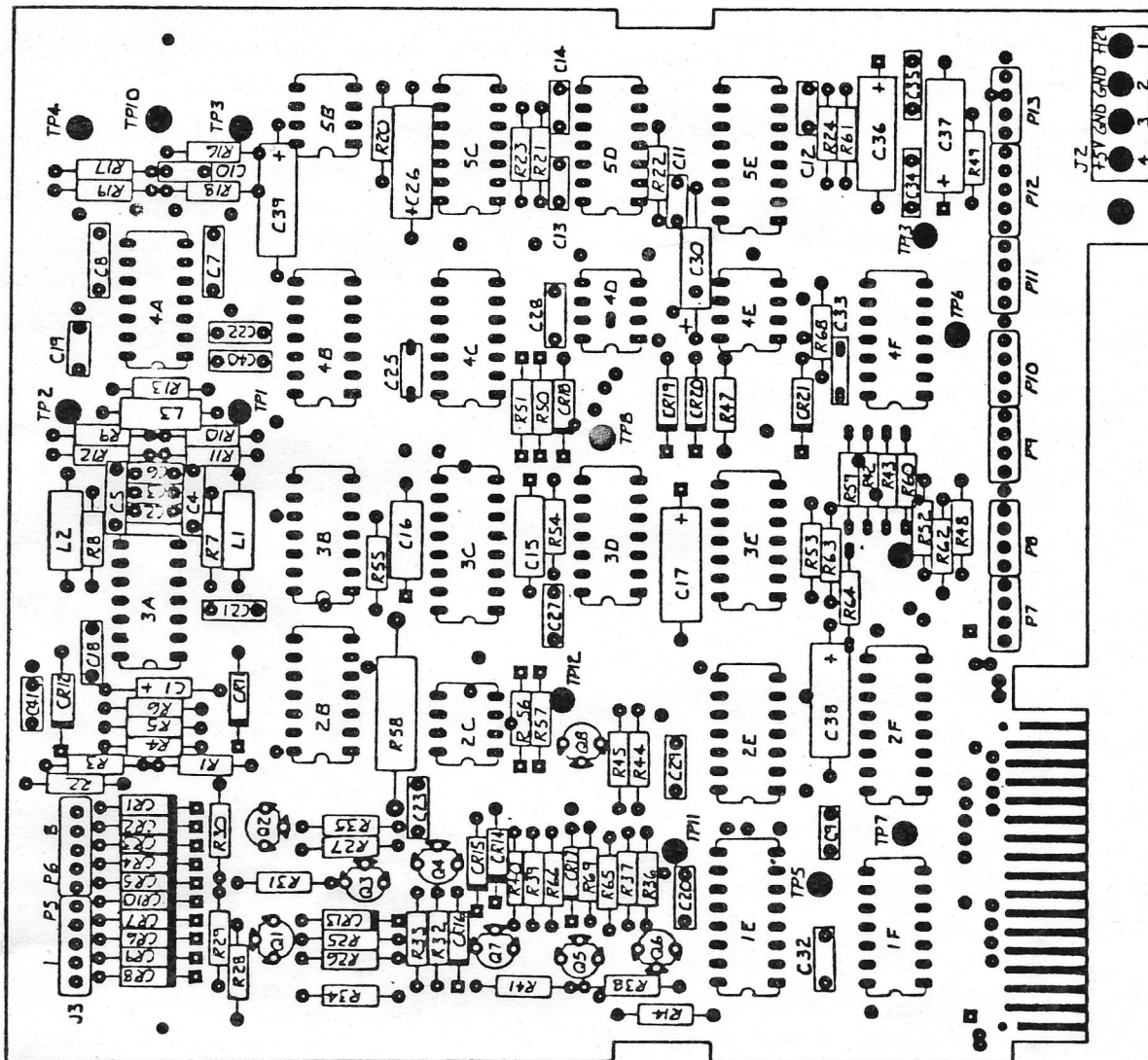
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LOGIC SCHEMATIC

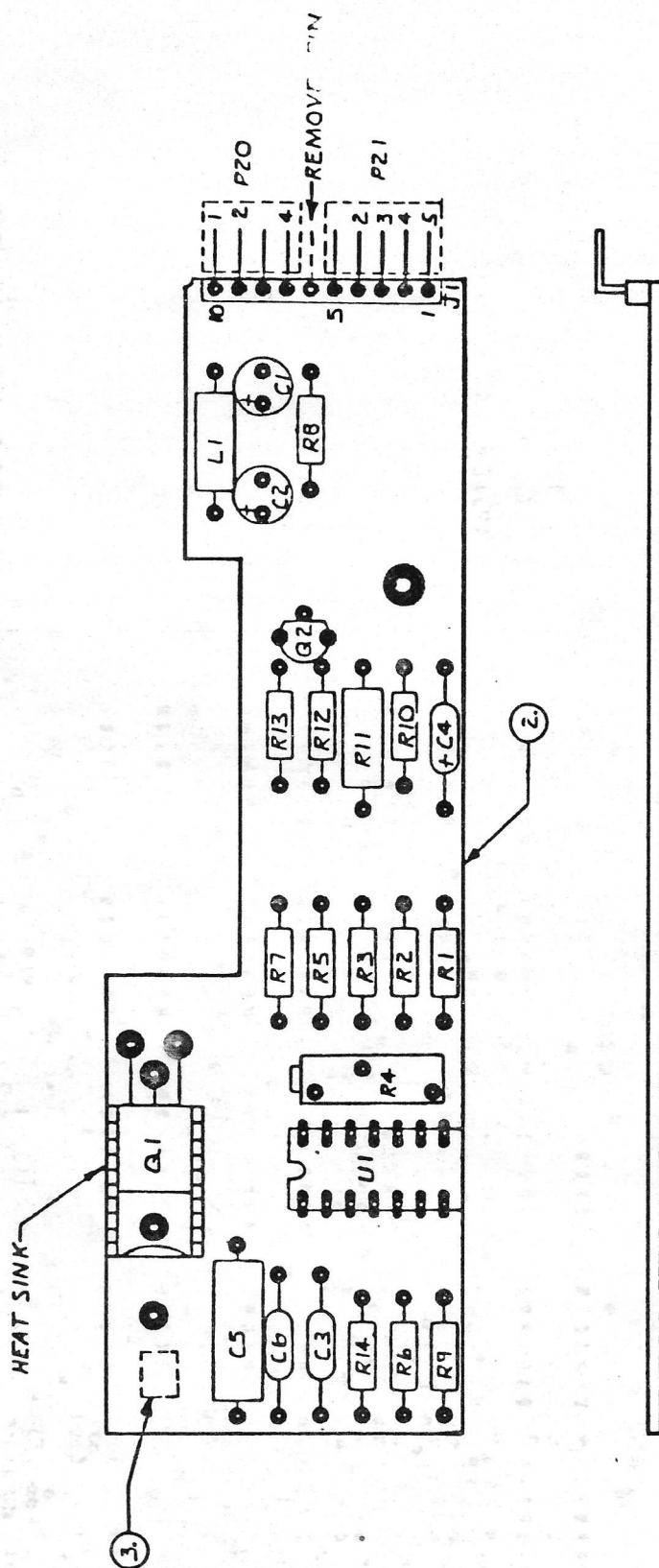
- NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS, 1/4 W, 5%
 2. ALL CAPS ARE IN uFD.
 3. ALL DIODES ARE IN 4446.
 4. ALL TRANSISTORS NPN ARE 2N4124 & PNP ARE 2N4125.

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- NOTES: UNLESS OTHERWISE SPECIFIED
1. COMPONENT HEIGHT NOT TO EXCEED .35 ABOVE P.C. BOARD.



LOGIC PCBA ASSEMBLY
DRAWING



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- NOTES: UNLESS OTHERWISE SPECIFIED
1. ASSEMBLE PER STANDARD MANUFACTURING METHODS.
 2. THIS ASSEMBLY SHALL BE MADE FROM PCB DETAIL 178901-001, REVISION A.

SERVO PCBA,
LINEAR

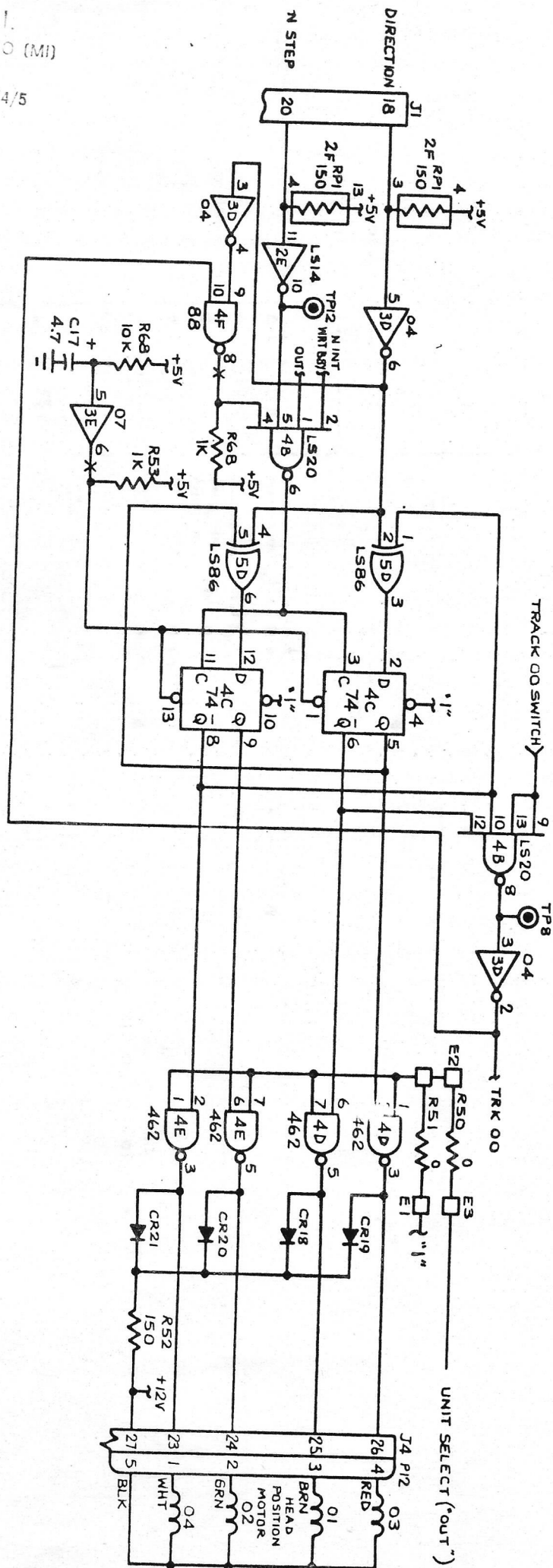


Figure 3-5
 Direction and Step Lines Schematic Diagram

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- NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTORS ARE IN OHMS, $\pm 5\%$, $1/4$ W.
 2. 1% RESISTORS ARE $1/8$ W.
 3. CAPACITORS ARE IN μ F, $\pm 20\%$, 35V.

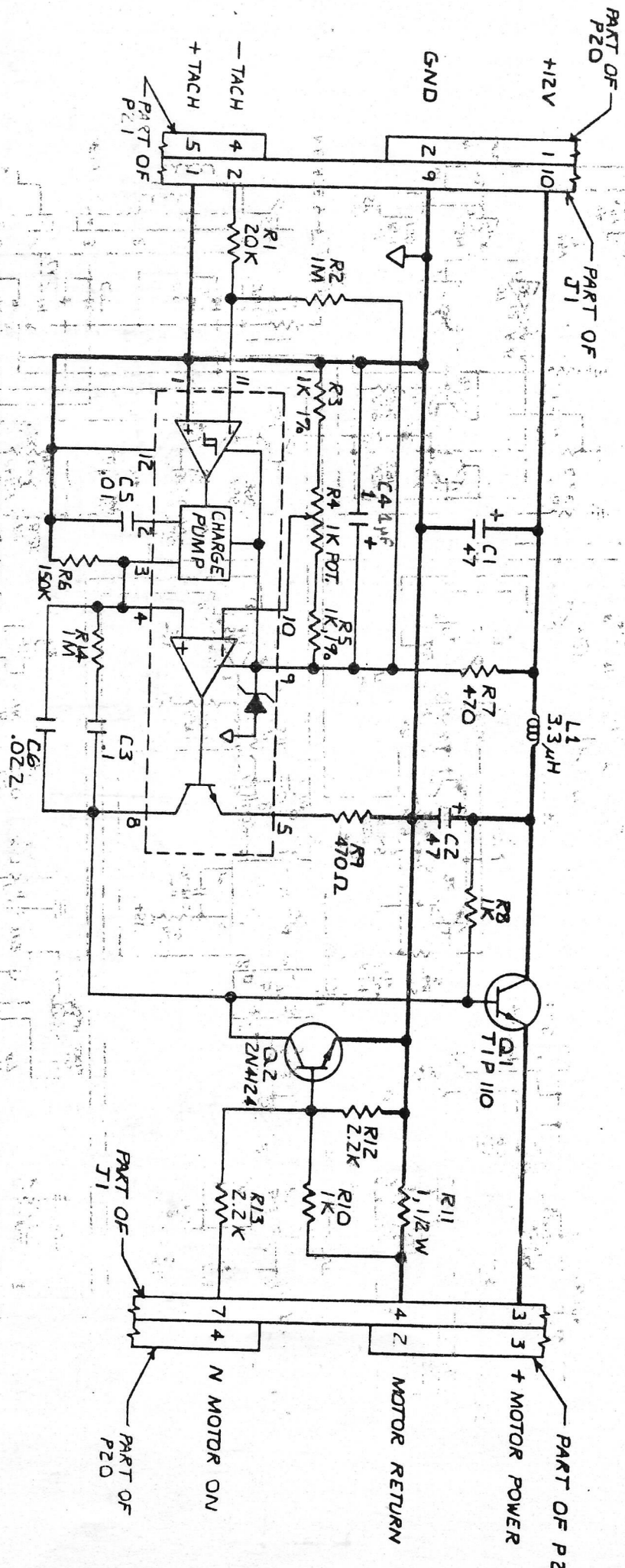


Figure 3-16
Servo Board Schematic Diagram

7 C 00016

SEE FIG. 3-16 FOR
SERVO BOARD
AT START BE OF
INFO. SE. 1.2
14P 15P 16P 17P 18P 19P 20P 21P 22P 23P 24P 25P 26P 27P 28P 29P 30P 31P 32P 33P 34P 35P 36P 37P 38P 39P 40P 41P 42P 43P 44P 45P 46P 47P 48P 49P 50P 51P 52P 53P 54P 55P 56P 57P 58P 59P 60P 61P 62P 63P 64P 65P 66P 67P 68P 69P 70P 71P 72P 73P 74P 75P 76P 77P 78P 79P 80P 81P 82P 83P 84P 85P 86P 87P 88P 89P 90P 91P 92P 93P 94P 95P 96P 97P 98P 99P 100P 101P 102P 103P 104P 105P 106P 107P 108P 109P 110P 111P 112P 113P 114P 115P 116P 117P 118P 119P 120P 121P 122P 123P 124P 125P 126P 127P 128P 129P 130P 131P 132P 133P 134P 135P 136P 137P 138P 139P 140P 141P 142P 143P 144P 145P 146P 147P 148P 149P 150P 151P 152P 153P 154P 155P 156P 157P 158P 159P 160P 161P 162P 163P 164P 165P 166P 167P 168P 169P 170P 171P 172P 173P 174P 175P 176P 177P 178P 179P 180P 181P 182P 183P 184P 185P 186P 187P 188P 189P 190P 191P 192P 193P 194P 195P 196P 197P 198P 199P 200P 201P 202P 203P 204P 205P 206P 207P 208P 209P 210P 211P 212P 213P 214P 215P 216P 217P 218P 219P 220P 221P 222P 223P 224P 225P 226P 227P 228P 229P 230P 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