



*Personal Computer
Hardware Reference
Library*

20MB Fixed Disk Drive

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Description

The IBM Personal Computer AT 20MB Fixed Disk Drive is a direct-access device that can store up to 20Mb of formatted data. The average access time is 40 milliseconds using a quasi closed-loop servo positioner.

Interfaces

The interfaces of this drive are divided into three categories: control, data transfer, and dc power.

The control interface is a 34 pin printed circuit board (PCB) edge connector. The following shows the signals and pin assignments.

Signal Name	Signal Pin	Ground Pin
-Head Select 3	2	1
-Head Select 2	4	3
-Write Gate	6	5
-Seek Complete	8	7
-Track 000	10	9
-Write Fault	12	11
-Head Select 0	14	13
Reserved	16	15
-Head Select 1	18	17
-Index	20	19
-Ready	22	21
-Step	24	23
-Drive Select 1	26	25
-Drive Select 2	28	27
-Drive Select 3	30	29
-Drive Select 4	32	31
-Direction In	34	33

Control Interface

The data transfer interface is a 20 Pin PCB connector. The signals and pin assignments are as follows:

Signal Name	Signal Pin
- Drive Selected	1
+MFM Write Data	13
-MFM Write Data	14
+MFM Read Data	17
-MFM Read Data	18
Ground	2, 4, 6, 8, 11, 12, 15, 16, 19

Data-Transfer Interface

The dc power interface is a 4-pin PCB connector. The signals and pin assignments follow.

Signal Name	Pin
+12 Vdc	1
+12 Vdc Return	2
+5 Vdc	4
+5 Vdc Return	3

DC Power Interface

Control Input Signals

The control input signals are of two types: those that are multiplexed in a multiple drive system, and those intended to do the multiplexing. These input signals have the following specifications.

- Active: 0.0 to 0.4 Vdc at 40 mA
- Inactive: 2.5 to 5.25 Vdc at 0 mA

The following are descriptions of the control input signals.

-Write Gate

The active level of this signal allows data to be written on the disk. The inactive level allows data to be read from the disk, and allows the step pulse to move the heads.

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-Head Select 0, 1, 2, and 3

These four signals enable the selection of each read/write head in a binary-coded sequence. '-Head Select 0' is the least significant. Heads are numbered 0 through 15. When all Head Select signals are inactive, head 0 is selected.

-Direction In

This signal defines the direction the read/write heads move when '-Step' is pulsed. An inactive level defines the direction as out, and if a pulse is applied to '-Step', the read/write heads move away from the center of the disk. An active level defines the direction as in, and the read/write heads move toward the center of the disk.

-Step

This signal causes the read/write heads to move in the direction defined by the '-Direction In' signal. The motion starts when the '-Step' signal changes from active to inactive (the trailing edge of this signal pulse). Any change in '-Direction In' is made at least 100 nanoseconds before the leading edge of the step pulse. This drive supports two methods of stepping or seeking:

Slow Seek The read/write heads move at the rate of incoming step pulses. The minimum time between successive steps is 3 milliseconds and the minimum pulse width is 2 microseconds.

Buffered Seek The adapter's controller may burst step pulses to the drive until the time after the last pulse exceeds 200 microseconds or the maximum number of step pulses is received (1 for each track). The drive starts motion of the heads after receiving the first step pulse. Step pulses are sent to the drive every 35 microseconds.

-Drive Select Signals 1 through 4

When one of these signals is active, it connects that drive to the control lines. Making the appropriate jumper connections at the drive determines which select line of the interface activates that drive.

The fixed disk drive provides a 220/230 ohm termination for a single 'drive select' signal. The signal lead that is terminated is the one that selects the drive based on the position of the drive select jumpers.

Output Control Signals

The drive control signals are open collector outputs that can sink a maximum of 40 mA in the active state, with a maximum output voltage of 0.4 Vdc. When the output is inactive, the collector's cutoff current is a maximum of 250 microamperes.

-Seek Complete

This signal goes active when the read/write heads settle on the final track at the end of a seek. Reading or writing is not attempted when '-Seek Complete' is inactive. The following situations force '-Seek Complete' inactive:

- When power-on starts a recalibration sequence because the read/write heads are not over track 0.
- When less than 5 microseconds have elapsed after the trailing edge of a step pulse or a series of step pulses.
- If the +5 or +12 Vdc fluctuates or is lost momentarily but restored.
- If the drive attempts to retry a seek after settling on a track.

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-Seek Complete returns to the active level no later than 100 milliseconds (1 second if a seek retry occurs) after the trailing edge of the last -Step pulse.

-Track 000

This signal is at an active level when the drive's read/write heads are at the outermost track.

-Write Fault

This signal means that a condition at the drive is causing improper operation of the disk. An active level of this signal prevents further writing and stepping at the drive until drive power is switched off.

This signal goes active when any of the following conditions occur:

- Write current exists in the head without '-Write Gate' active, or no write current exists in the head with '-Write Gate' active and '-Drive Selected' active
- More than one seek retry between Seek commands from the controller
- A step pulse is received while '-Write Gate' is active.

-Index

The drive provides this output signal once each revolution to indicate the beginning of a track. This signal normally is inactive and goes active to indicate '-Index'. Only the change from inactive to active is valid (leading edge of the pulse).

-Ready

When this signal and '-Seek Complete' are active, the drive is ready to read, write, or seek, and the I/O signals are valid. An

inactive level of this signal prevents all writing and seeking.

'-Ready' is inactive four times during drive operation:

- At power-up time '-Ready' remains inactive until:
 - Access recalibration to track 0 is complete.
 - Spindle speed is stable within $\pm 0.5\%$ of nominal (10 revolution average).
 - Drive self-check is complete.
- Spindle speed deviates $\pm 0.5\%$ of nominal (10 revolution average).
- '-Write Fault' is active.
- DC voltages are out of tolerance.

Data-Transfer Signals

All signals associated with the transfer of data between the drive and the system are differential (pairs of balanced signals) and are not multiplexed.

Two pairs of balanced signals are used for the transfer of data: '-Write Data' and '-Read Data'. The following describes the data-transfer signals.

MFM Write Data

This is a differential pair that defines signal shifts written on the track. When '+MFM Write Data' goes more positive than '-MFM Write Data', flux reverses on the track, provided that '-Write Gate' is active. The system drives '-MFM Write Data' to an active level ('-MFM Write Data' more negative than '+MFM Write Data') when in the read mode.

To ensure data integrity, the controller applies a write-precompensation of ± 12 nanoseconds to all write data on cylinders 300 and greater.

MFM Read Data

Read data is sent to the system through the differential pair of MFM Read Data lines. When '+MFM Read Data' goes more positive than '-MFM Read Data', flux reverses on the track of the selected head.

Overlapped Seek

The drive supports overlapped-seek operations. An overlapped seek occurs when the drive is deselected 20 microseconds after the last step pulse is sent. Another drive is then selected, and the '-Step' and '-Direction In' signals are set by the operation desired. The controller provides at least 100 nanoseconds of hold time on '-Step' and '-Direction In' after '-Drive Select' is deactivated.

Specifications

The following figures list the internal and performance specifications of this drive.

Rotational speed	3573 rpm \pm 0.5%
Cylinders	615 + Landing Zone
R/W Heads	4
Index	1

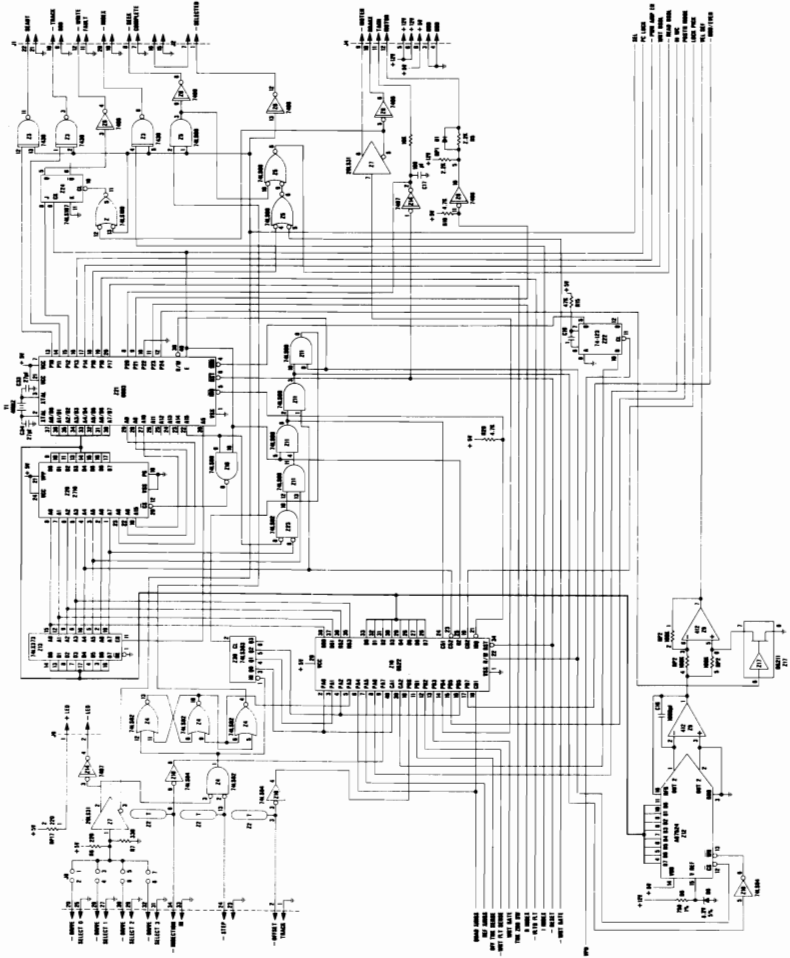
Internal Specifications

Formatted Capacity	20Mb
Bytes/Sector	512
Sectors/Track	17
Transfer Rate	5M Bits/Second
Access Time	
Track-to-Track	2 ms
Average	40 ms
Maximum	85 ms
Settling	12 ms
Average Latency	8.4 ms
Track Density	750 TPI

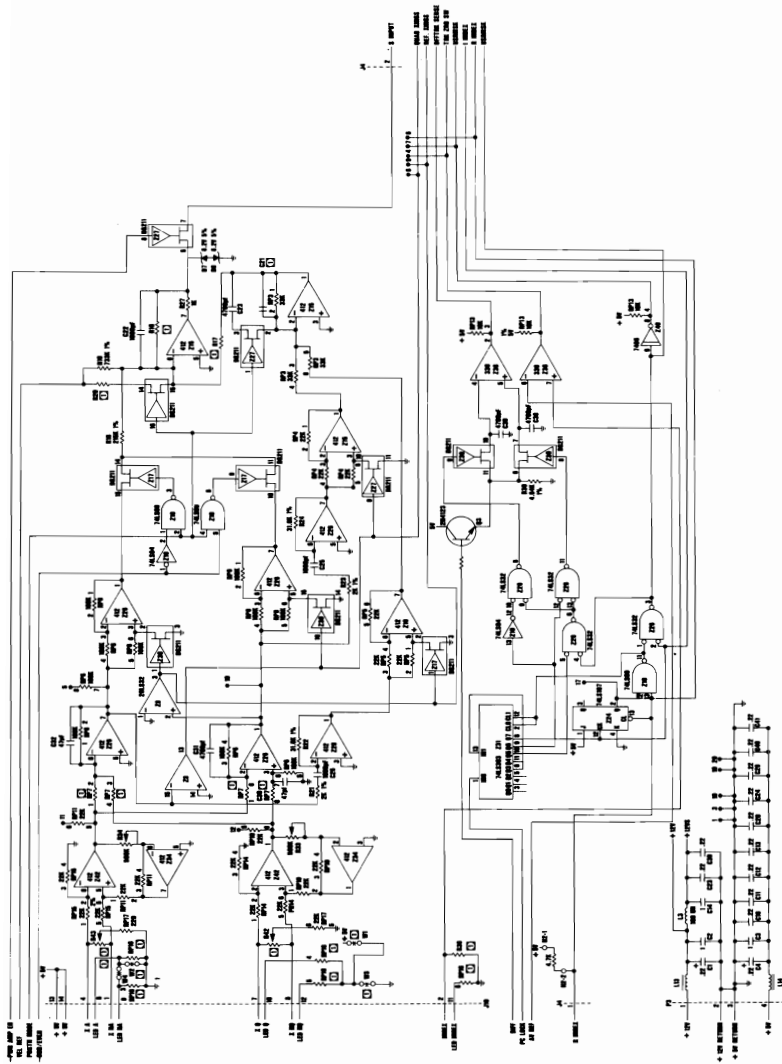
Performance Specifications

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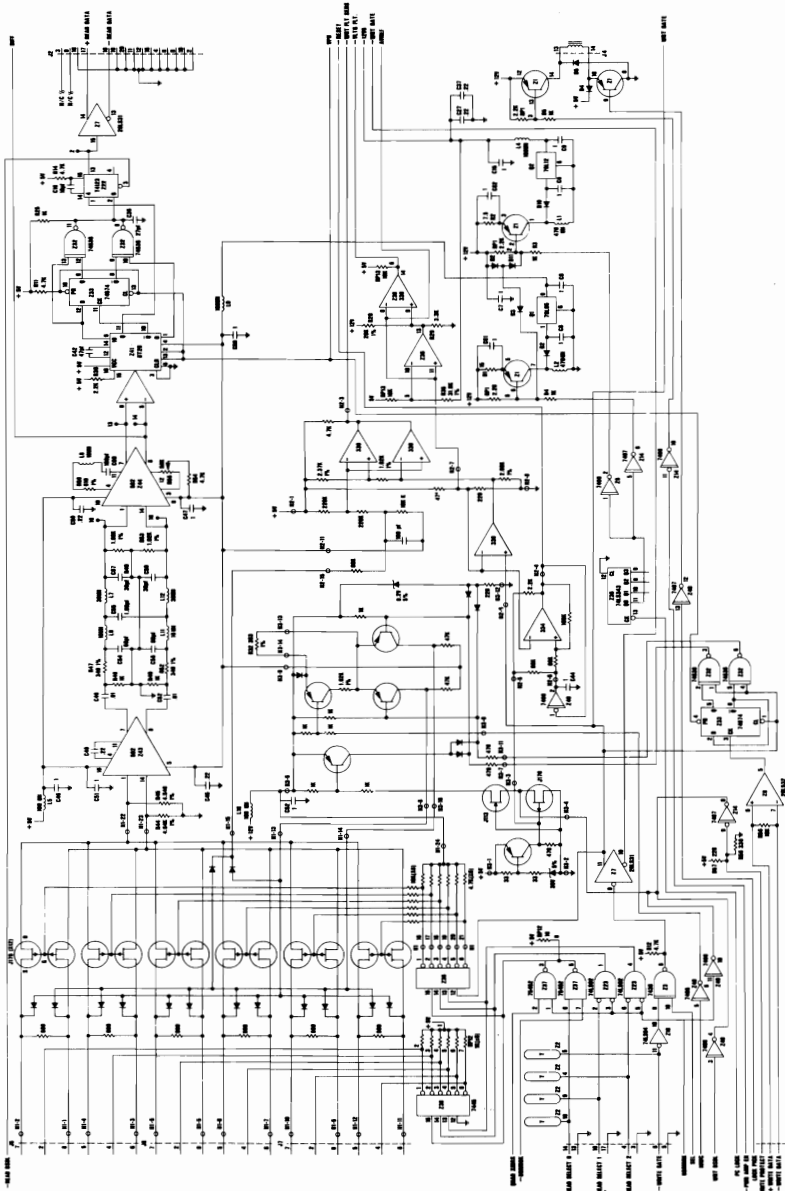
Logic Diagrams



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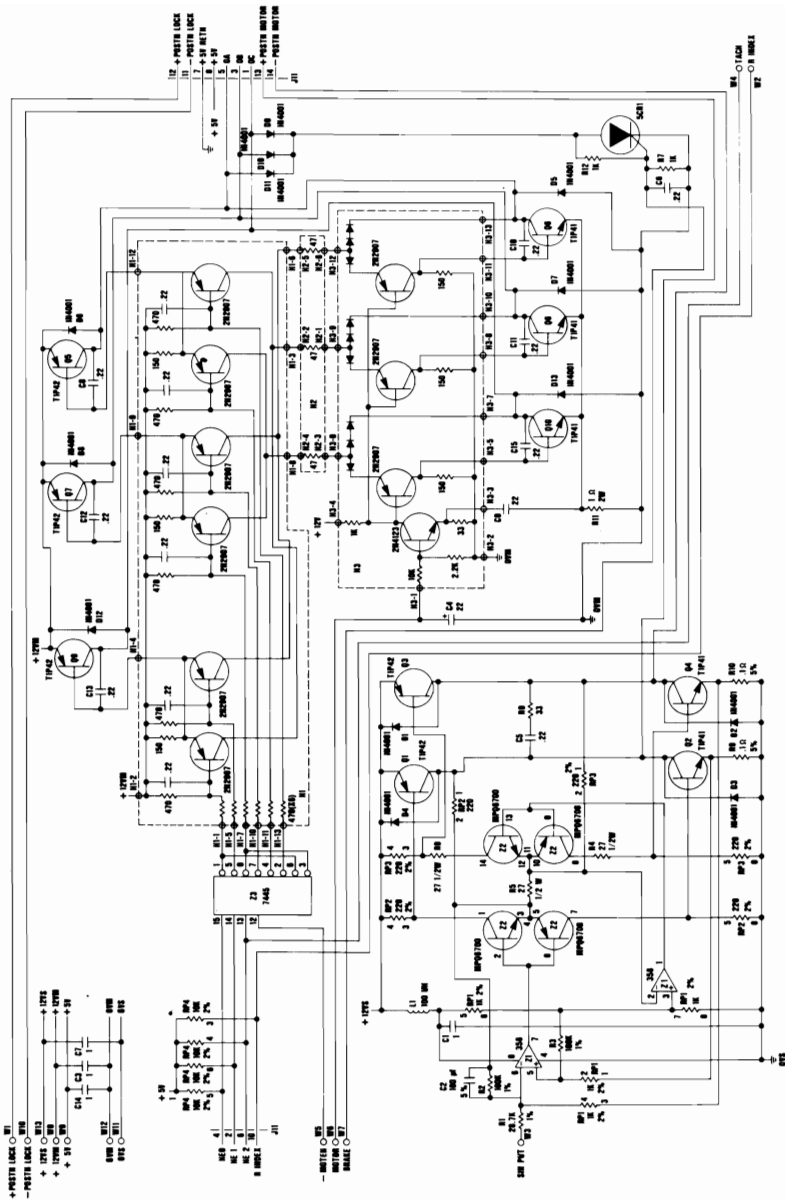


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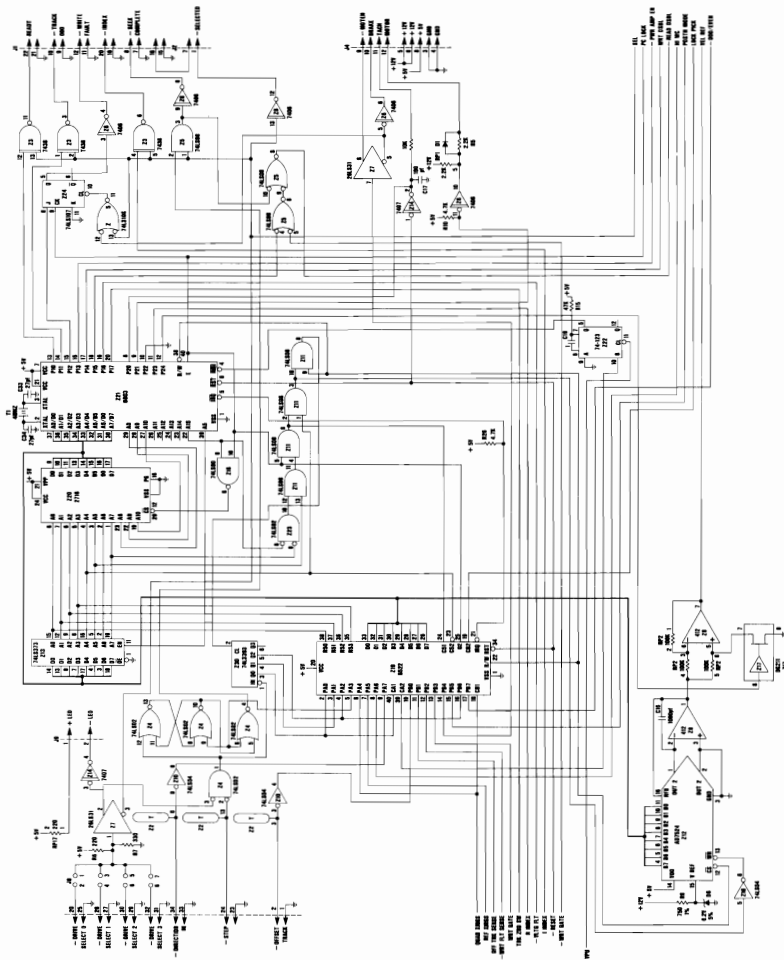
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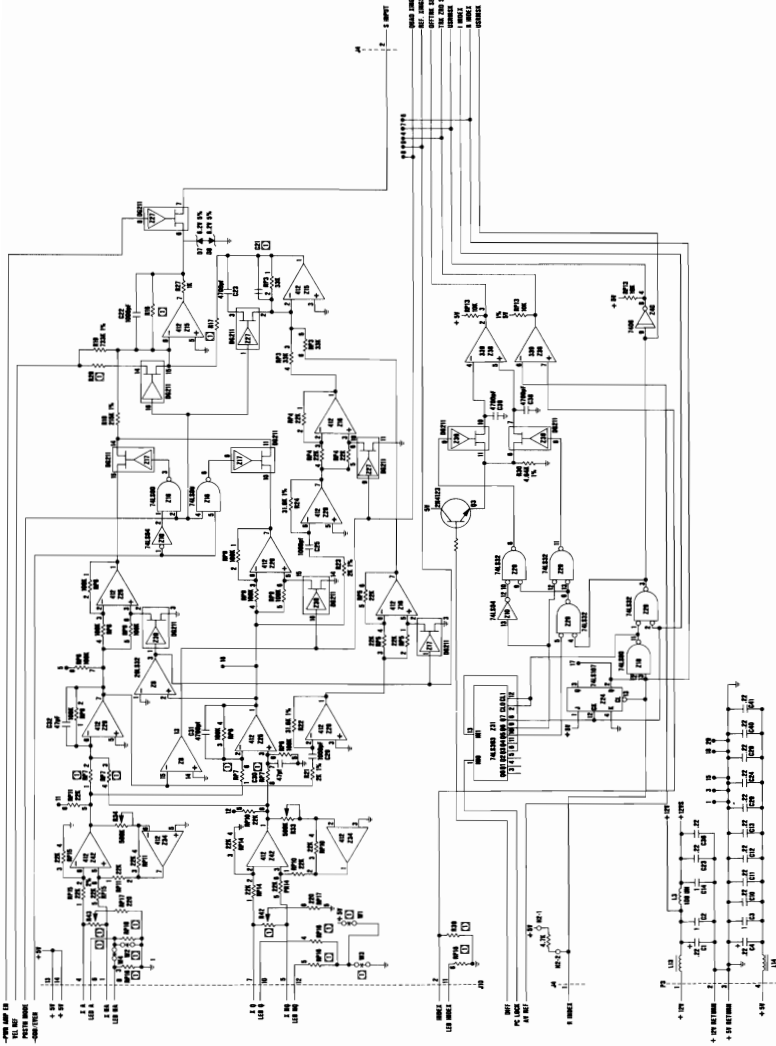
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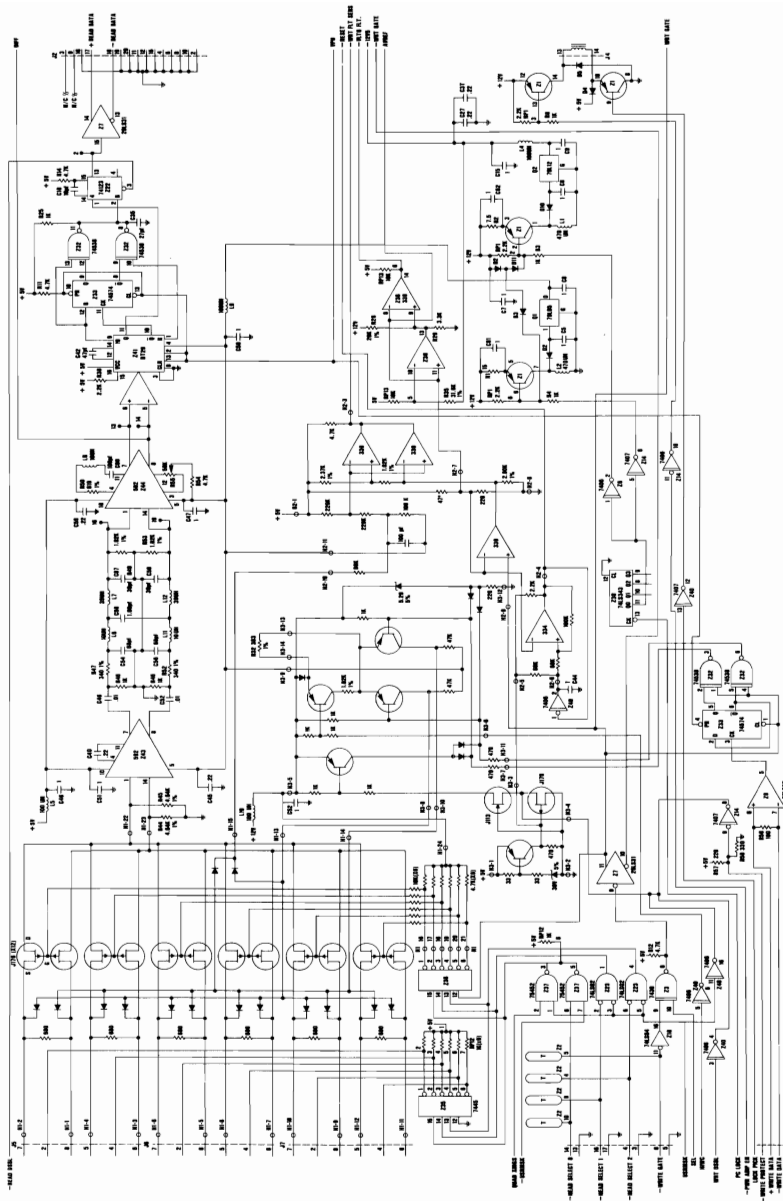
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AS WELL.

Logic Diagrams

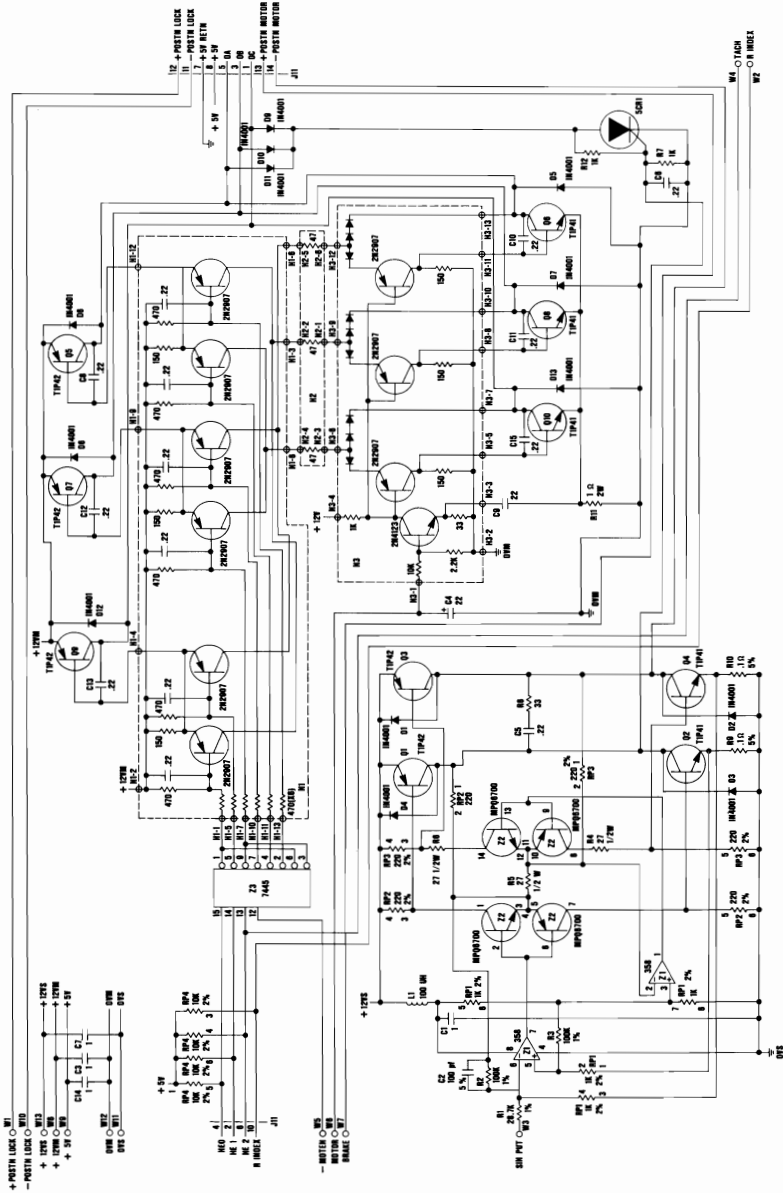




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