1.4 SPECIFICATIONS

Tape	
Width	0.25 in. (0.64 cm)
Length	450 ft (137.16 m)
Recording	
Recording Density	6400 bpi
Physical Tracks	4
Formatted Capacity	Up to 15 mb with 450 ft tape
Record Format	Single Track, serial
Tape Transport	
Tape Speed (Normal)	30 ips
Tape Speed (Rewind)	70 ips
Read Operation	Serial/Serpentine (see Figure 1-1)
Write Operation	Serial/Serpentine
Start/Stop Time	
Read/Write Operations	25 ms
Rewind/Search Operations	75 ms
Start/Stop Displacement	
Read/Write Operations	0.38 in. (0.97 cm)
Rewind/Search Operations	3.38 in. (8.59 cm)
Tape Head	
Recording Head	Serpentine Read after Write Selective Erase
Data Transfer Rate (drive to controller)	192,000 bits per second 24,000 bytes per second
Dimensions	
Height	6.69 in. (16.99 cm)
Width	15.38 in. (37.07 cm)
Depth	17.81 in. (45.24 cm)
Weight	28.5 lbs (12.96 kg)
Cables	
Model 2229	10 ft (3.05 m) parallel cable from Tape Drive to CPU
Models 2529V, 6529	25 ft (7.6 m) dual coaxial cable from Tape Drive to CPU (optional lengths up to 2000 ft (609.6 m)
Fuses	2 amp. @ 115V 1 amp. @ 230V

SPECIFICATIONS (continued)

Operating Environment	
Temperature	50°F to 90°F (20° C to 32° C)
Relative Humidity	35% to 65% noncondensing (recommended) 20% to 80% noncondensing (allowable)
Power Requirements	115Vac (98V to 128V allowable), 50/60 Hz 1.4 amp. to 2 amp. @ 115V 220Vac (196V to 256V allowable), 50/60 Hz 0.7 amp. to 1 amp. @ 220V
Controls	Power On/Off On-Line
Indicators	Power On On-Line Fault Tape Loaded

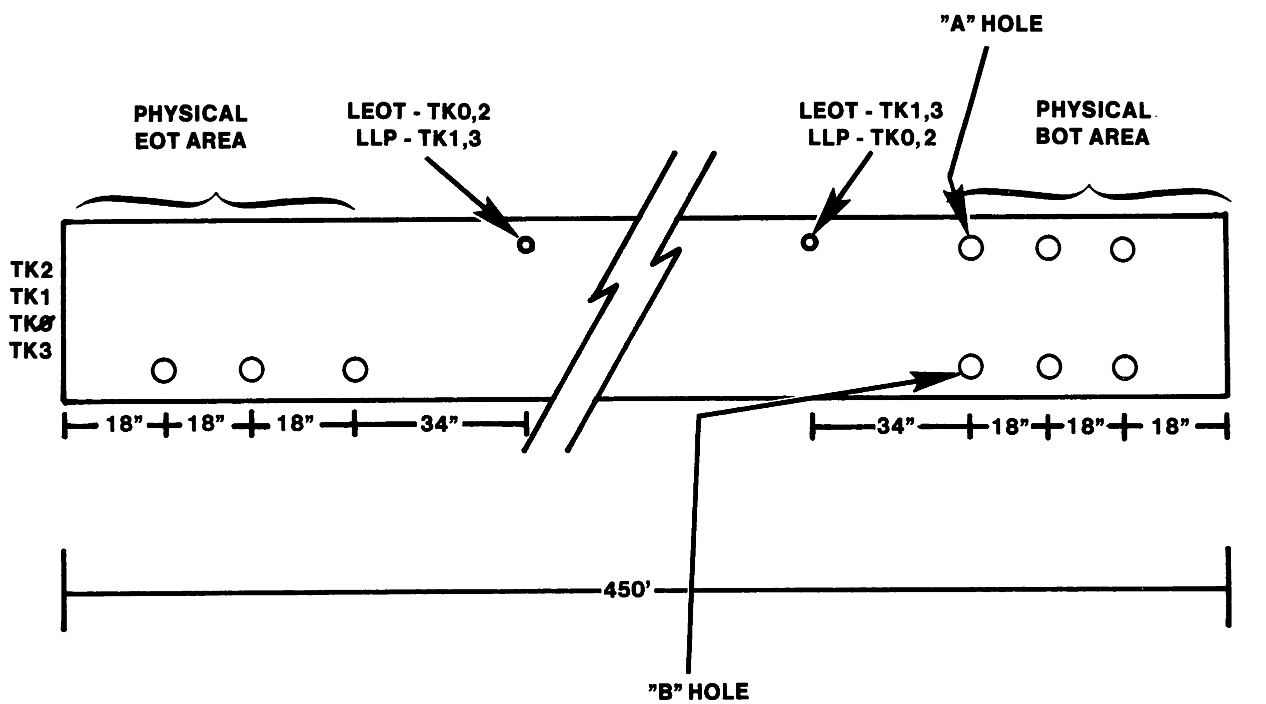


Figure 1-1 EOT/BOT Areas on Serial Serpentine Recorded Tape

The 8262 interfaces to the Kennedy cartridge tape system via the Kennedy Pico Bus Interface. This interface consists of two separate Write Data Latches, two Read Data Latches, and a bidirectional 8-bit data bus that uses odd write and read parity bits, four handshaking control signals, a data strobe, and a cable interlock signal (Cable Monitor, CMON) that indicates whether the cable between the slave and tape unit is connected. The tape interface can be tested via diagnostic loopback tests without actually being connected to an active tape unit.

Switches resident on the SW2 board provide four device type bits in the Status Word that inform the master that it is communicating with the 8262. SW1 Device Class Switches define additional 8262 characteristics to the master. The 8262 board has its eight device type switches set to a value of 0AH for use with the Kennedy Model 6455 and to 0BH for use with the Model 6470. The switch inputs are placed on the D0-7B bus to be read by the /IN07 command, enabling a Switch Buffer.

Model 6455, a 4-track, 6400-bit/in (30/70-ips) unit, can store a maximum of 23M bytes of unformatted data. Model 6470, a 7-track, 10,000-bit/in (45/90-ips) unit, can store a maximum of 63M bytes of unformatted data. Upward tape read compatibility allows the 6470 to read tapes written by the 6455; the 6455, however, cannot read tapes written on the 6470. Specifications for both models are listed in Table 2-1. (Model 6470 has not yet been released; therefore, its specifications are subject to change.)

Table 2-1: Kennedy Model 6455/6470 Specifications

Specifications Identical For Both Models

Cartridge Type	3M Type DC300A (300 ft), DC300XL (450 ft), DC600A (600 ft) Isoelastic Data Cartridge
Recording Head	Serpentine, Read-After-Write, with Selective Erase
Record Format	Single-Track, Serial
Data Reliability	
- soft error rate	1 in 10^{10} bits
- hard error rate	1 in 10^{11} bits
Power Requirements	5 $\pm$ 0.25 Vdc at 3 A avg and 5 A pk 24 $\pm$ 4 Vdc at 1.5 A avg and 3 A pk
Interface	
- Slave CPU	Pico Bus, TTL low-true, 34-pin 3M flat
- Power	6-pin molex
- Write Current Select	3-pin molex

Specifications Unique To Each Model

	Model 6455	Model 6470
Unformatted Capacity		
- 300 ft	11.5M bytes	31.5M bytes
- 450 ft	17.3M bytes	47.25M bytes
- 600 ft	23.0M bytes	63.0M bytes
Recording Density	6400 bits/in	10,000 bits/in
Number of Tracks	4	7
Normal Tape Speed	30 ips	45 ips
Fast Tape Speed	70 ips	90 ips
Start/Stop Time	25 ms @ 30 ips 65 ms @ 70 ips	50 ms @ 45 ips 75 ms @ 90 ips
Data Transfer Rate	24k bytes/s 41.7 us/byte	56.25k bytes/sl 17.8 us/byte
	Cannot read 6470 format	Can read either format

The POWER UP indicator on the front panel flashes throughout diagnostic testing. When diagnostics are completed, the I/O Decoder issues an /OUT03 command to turn the POWER ON light on continuously, de-select the PROM from memory space, enable the Data Link Receiver and force a HALT onto the bus to halt the CPU. If the diagnostics fail, the Data Link Receiver will not be enabled. Instead, the FAULT light will be go on and an error code will be issued to the Error LEDs. Fifteen error conditions can be represented in the Error LEDs (see TAble 8-1).

2.2.7 TAPE INTERFACE

The controller provides an interface to Kennedy Model 6455 and 6470 Cartridge Tape Units, both of which consist of a cartridge formatter and a tape drive. The formatter controls read and write operations in a self-clocking mode complete with serial error detection (CRC). It executes 19 commands, including generation of file marks and space one record in either forward or reverse direction.

Interface to the tape unit is provided by the Kennedy Pico Bus Interface which consists of a bidirectional 8-bit data bus using odd parity, write and read parity bits, four handshaking control signals, a data strobe and a cable monitor signal. Any information sent to the controller begins with a command and is followed either by data or the tape unit's response to the command. The tape unit determines whether it is receiving a command or data when it receives either CREQ (Command Request) or DRDY (Data Ready). /CMON (Cable Monitor) indicates whether the cable between the slave and tape unit is connected. When the cable is disconnected, /CMON is high.

The slave CPU initiates all transfers to and from the controller by issuing one of 19 possible commands. /OUT06 sets the Command Request (CREQ) control signal and, after a time delay, the controller responds with CBSY (Command Busy). CBSY remains active until the tape unit is through processing the present command. Commands must NOT be sent while CBSY is active. The controller's course of action after CBSY is set depends upon the particular command. It can return one or two status bytes and latch them into separate registers, it can write a track address to the tape unit, or it can transfer tape read or write data. Fig 2-6 displays a block diagram of the control signal generating logic. Fig 2-7 and 2-8 display block diagrams of the Tape Interface receive and transmit data paths.

During tape data read or write operations, an /IN05 or /OUT05 command sets Data Ready (DRDY), a control signal which is acknowledged by Data Busy (DBSY). The actual data transfer does not take place until DBSY goes active. /OUT05 also latches the next byte of data to be written to the tape unit. /IN05 reads the tape read data latch. Each byte of data (whether command, status, or data) is either clocked in by or acknowledged by a STROBE signal from the tape unit.

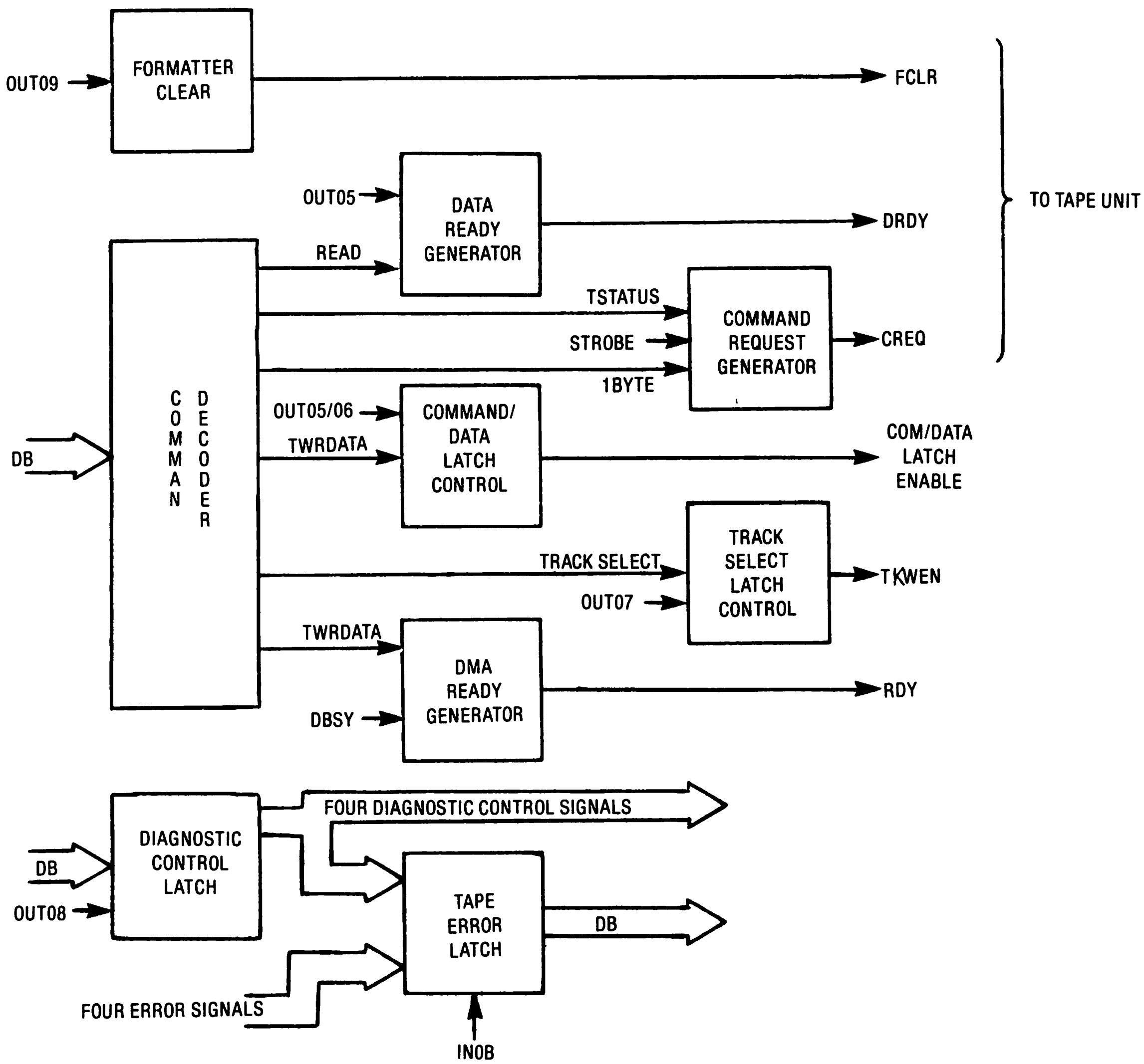


Figure 2-6 Tape Interface Control Block Diagram. Control signals for tape unit-tape interface interaction are generated by Tape Interface Command Decoder and associated logic. Logic decodes commands to issue appropriate control signals to tape unit and within the controller. Diagnostics Control Latch issues signals to control testing of the controller. Formatter Clear logic issues FCLR to clear tape unit via /OUT04 command.

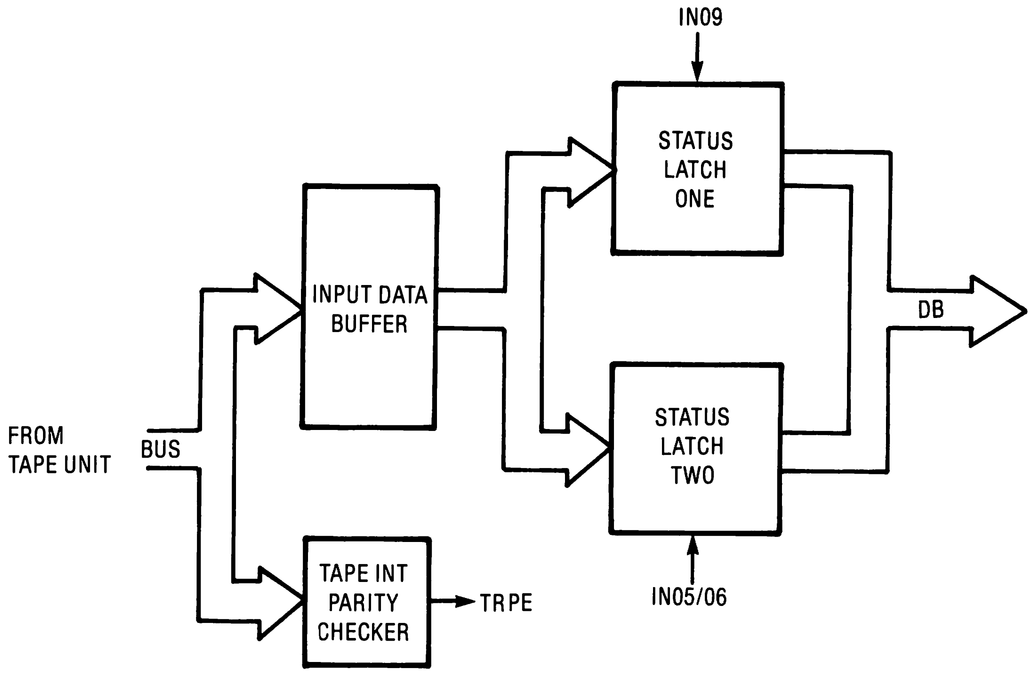


Figure 2-7   Tape Interface Receive Data Path Block Diagram. Data is read from memory into Input Data Buffer and through to Status Latches. All single-byte command data is read through Status Latch Two. Status Latch One is used only for SENSE STATUS Command where two bytes of data are requested. Data is passed from Status Latch to DB Data Bus upon receipt of ported input commands.

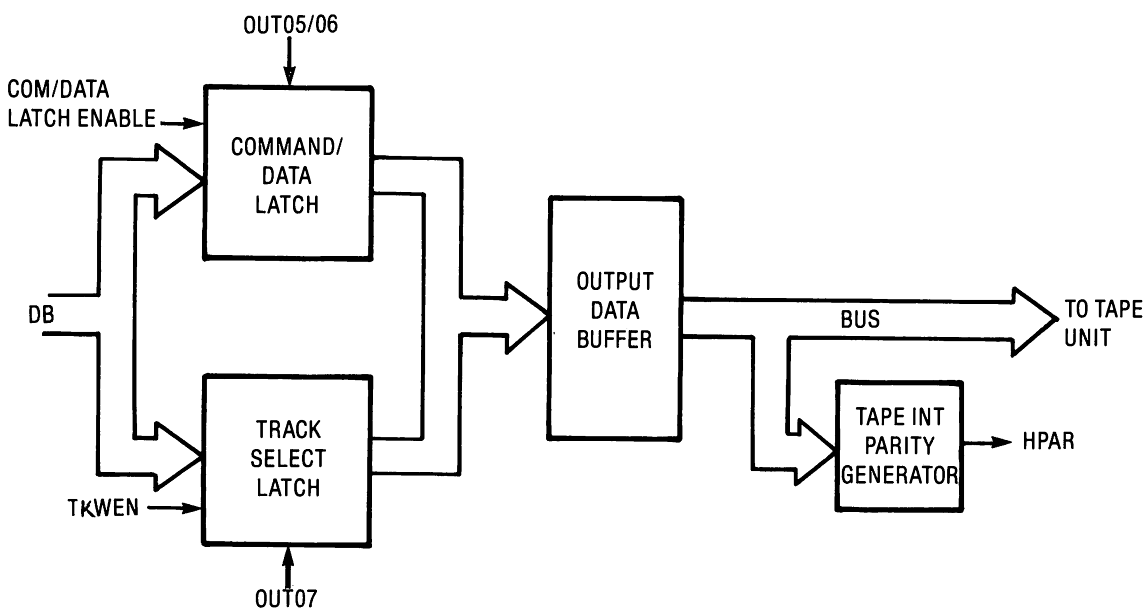


Figure 2-8   Tape Interface Transmit Data Path Block Diagram. Data from DB Data Bus is passed into Command/Data or Track Select Latch. Data is sent to tape unit in appropriate sequence via Output Data Buffer. Control of this operation depends on signals generated from Tape Interface Control logic. See Figure 2-6.

2.3.1 2200/CONTROLLER INTERFACE

Communication between the 2200 and the controller is handled by the PIO. The PIO's A Port is dedicated to CBS byte transfers to the controller. Data transfers to and from the 2200 are handled through the B Port.

The Controller can use either of two methods to handle B Port data transfers to and from the 2200. In one method, the PIO is used to transfer data to the Z80 on an interrupt basis. In the second method, the PIO is used with the DMA to transfer bytes directly to RAM without interrupting the CPU until the end of the transfer.

When the controller receives a command byte which specifies the use of a block data transfer from the 2200, it can set up the DMA to handle the transfer. From that point the DMA chip will handle the block data transfer to or from the 2200 while the CPU is free for other processing. When the transfer is complete the DMA will interrupt the CPU.

2.3.1.1 Port B Data Transfers (DMA mode)

The PIO is used for a holding register during DMA transfers. The PIO receives the OBS strobe and latches the data. The Ready line from the B Port is used to generate a DMA transfer request. The DMA reads the PIO B port and moves the data to RAM. The PIO does not generate an interrupt of the CPU.

2.3.1.2 2200/Controller Data Transfers (Interrupt Mode)

In the interrupt mode, the A Port is set up for CBS characters and the B Port is used to interrupt the CPU when a byte is sent or received.

The CPU sets up the A port and enables interrupts on the A port only. The B Port is not allowed to interrupt the CPU until after being set up for the correct sequence.

2.3.2 TAPE INTERFACE

The Kennedy 6455 Tape Drive assembly consists of a Model 640 Tape Drive and a Model 650 Formatter. The Model 640 Tape drive is the mechanical tape transport and support electronics. The Model 650 Formatter is the microprocessor based electronics board to control the drive. The formatter handles the interfacing of signals and data between the host system and the tape drive system.

The tape drive configured for 2200 systems contains a small interface board (210-8261). This board supplies the power and ground signals for the front panel, separates the signals on the cable from the controller board into the group of signals going to and from the front panel and the tape drive. The board also contains the interface logic for the "On Line" Switch.

2.3.2.1 Control Signals

CREQ Signal -

The CREQ signal (Control Request) is used to indicate to the tape drive that a command or parameter byte transfer is being executed.

CBSY Signal -

The CBSY signal is used by the tape drive to indicate to the controller that the drive is executing a command sequence. This signal will remain active until completion of the command. In cases of one byte operations where no tape motion is involved, CBSY goes inactive shortly after STRB goes inactive. In cases where tape motion is involved, CBSY will not go inactive until after tape motion has stopped. This may be a time period of up to 90 seconds or more depending on the command. During read/write commands, CBSY will stay active after DBSY has gone inactive because tape motion will continue after data transfers are completed.

DBSY -

The DBSY signal is used by the tape drive to indicate to the controller that a transfer of data either to or from the tape drive is in progress. This signal will go active after CBSY to indicate a command sequence in progress. DBSY indicates data transfers within that command sequence.

STRB -

The STRB signal is used by the tape drive to acknowledge receipt of a command or parameter byte from the host, to acknowledge data byte transfers during write operations and as a strobe to transfer data to the controller during read operations.

2.3.2.2 Commmand Transfers to the Formatter

Signals -
- CREQ - (Control Request)
- CBSY - (Controller Busy)
- STRB - (Strobe)
- FCLR - (Formatter Clear)

Commands are sent to the formatter as part of an instruction sequence. The CBSY signal is active for the entire duration of an instruction. When the controller sends a command byte to the formatter, the CBSY line from the formatter goes active. If the command requires additional byte transfers or some activity by the drive, the CBSY line stays active until the last transfer or drive activity is completed. The total number of byte transfers, the direction of each byte, and type of drive activity is determined by the individual instruction.

When CBSY is inactive, the controller sets up the command byte on the data bus to the formatter, waits 150ns to allow for settling of the bus, and asserts CREQ to initiate the transfer to the formatter. The formatter accepts the command (if valid) and turns on CBSY to the controller. When the controller sees CBSY go active, it drops CREQ.

If additional bytes are to be transferred to or from the tape unit, the controller sets up the data bus for correct direction (input or output). If an output (to the formatter) is required, the controller sets up the byte on the bus to the formatter and asserts CREQ. The formatter sees STRB and drops CREQ. If a second byte is to be sent, the sequence repeats. If no additional transfers are required, the formatter turns off CBSY after completing the operation to indicate the end of the instruction. If STRB is not received from the formatter in less than 500us, the host disables CREQ and the sequence terminates.

2.3.2.3 Parameter Transfers to the Host

Signals -
- CREQ - (Control Request)
- CBSY - (Controller Busy)
- STRB - (Strobe)

After the command byte has been sent, the controller sets the data bus to input mode (to the controller) and again asserts CREQ. The formatter places it's data byte on the bus and asserts STRB. The controller acknowledges receipt of the data by turning off CREQ. On seeing CREQ turn off, the formatter turns off the data on the bus and drops STRB.

2.3.2.4 Data Transfers to the Formatter (Write)

Signals -
- DRBY - (Data Ready)
- DBSY - (Data Busy)
- CBSY - (Controller Busy)
- STRB - (Strobe)

The host places the first data byte on the bus, waits 150ns, and asserts DRDY to the formatter. When the formatter sees the DRDY line go active, it asserts DBSY to indicate that it is busy with a data transfer, and 1.5us later asserts STRB to acknowledge receipt of the byte. After this, the formatter sends STRB pulses to the controller every 42us. The STRB pulse causes the controller to set up the next data byte on the bus. When the last byte has been transferred, the controller turns off DRDY to indicate the end of transfer to the formatter. The formatter responds by turning off DBSY. After the formatter completes the write operation including writing the gap, CBSY is turned off.

2.3.2.5 Data Transfers to the Host (Read)

Signals -
DRDY - (Data Ready)
DBSY - (Data Busy)
CBSY - (Controller Busy)
STRB - (Strobe)

The host asserts DRDY to the formatter to indicate that it is ready to receive data. When the formatter sees the DRDY line go active, it asserts DBSY to indicate that it is busy with a data transfer, sends the first byte to the controller, and asserts STRB to indicate transfer of the byte. After this, the formatter continues to send bytes and STRB pulses to the controller every 42us. The STRB pulse latches the data byte in the controller and generates a tape transfer DMA request to move the byte to RAM. When the last byte has been transferred, the tape drive stops sending STRB pulses and drops DBSY. After the formatter completes the read operation, CBSY is dropped.

2.3.3 CONTROLLER OPERATIONS

There are three basic groups of operations between the controller and the drive. These groups are:

a. The identity group which transfers status and identifying data from the drive to the controller. No tape motion is involved.

b. The positioning group which involves selecting the head or positioning tape. Tape may be moved to different positions, however no data is transferred.

c. The data transfer group which includes the read and write commands involving data and file marks.

2.3.3.1 The Identity Group

a. SENSE IDENTITY (Code - 00000)
Drive transfers 1 byte of data identifying type of device. Tape drive identifying byte is 0000 0001.

b. SENSE CONFIGURATION (Code - 00001)
Drive transfers 1 byte of data indicating the version number of the particular device.

c. SENSE STATUS (Code - 00010)
Drive transfers 2 bytes of data indicating the status of the device.

2.3.3.2 The Positioning Group

a. REWIND (Code - 00011)
   Drive rewinds tape to LLP of Track 0.

b. LOAD (Code - 001000)
   Drive establishes tape tension, positions tape at LLP, and after successful self-test, sets status bit 7 (not ready) false. Approx. 1 to 90 secs for execution of LOAD command.

c. UNLOAD (Code - 00101)
   Drive rewinds and positions tape off BOT.
   Approx. 1 to 90 secs for execution of UNLOAD command.

d. TRACK SELECT (Code - 00110)
   Drive selects track and moves tape to position specified by track address/placement byte at a 70 IPS rate. The position status byte is updated.

e. ERASE (Code - 00111)
   Drive erases tape at 30 IPS in forward direction. Drive motion stops at LEOT.

f. SPACE FORWARD (Code - 01000)
   Drive spaces forward to the next Inter Block Gap at 30 IPS. File marks are sensed and drive motion stops at LEOT.

g. SPACE REVERSE (Code - 01001)
   Drive spaces backward to the next Inter Block Gap at 30 IPS. File marks are sensed and drive motion stops at LLP.

h. SPACE FORWARD FM (Code - 01010)
   Drive spaces forward to the next File Mark at 30 IPS and stops in the IBG following. If no FM is found, drive motion stops at LEOT.

i. SPACE REVERSE FM (Code - 01011)
   Drive spaces backward to the next File Mark at 30 IPS and stops in the IBG following. If no FM is found, drive motion stops at LLP.

2.3.3.3 The Data Transfer Group

a. READ (Code - 01100)
   Drive reads one record in forward direction.

b. WRITE (Code - 01101)
   Drive writes one record with standard IBGs. Performs read-after-write check. Write commands from LLP will start 3 inches from LLP. Write command attempted while cartridge is write protected will cause command status error.

c. WRITE EXTENDED (Code - 01110)
Drive erases forward approximately 3 inches and then writes one record with standard IBGs. Same as WRITE except for 3 inch spacing before write operation.

d. WRITE FM (Code - 01111)
Drive writes standard file mark with IBGs on either side.

e. WRITE FM EXTENDED (Code - 10000)
Drive erases forward approximately 3 inches and then writes one file mark with standard IBGs on either side. Same as WRITE FM except for 3 inch spacing before write operation.

f. EDIT (Code - 10001)
Drive determines distance between block to be edited and the head: If necessary, the tape is then repositioned to allow the unit to ramp up the speed and edit the block properly.

2.4 TAPE DRIVE POWER SUPPLY

The power supply for the Archiving Cartridge Tape Drive circuitry provides +23V, +5V and -5V to meet various circuit requirements. Conventional series regulator designs were employed for the circuitry. The schematic drawing of the power supply (part no. 210-7770) is provided in chapter 6.

The main power transformer has two 115V primary windings which are connected in parallel for 115V operation and in series for 230V operation by the line voltage switch, SW1. There are two center-tapped secondary windings - one providing 26Vac to the 23V circuits and the other providing 7.6Vac to the 5V ciruits.

2.4.1 THE 23V SUPPLY

The 26Vac from the transformer is rectified and filtered and the unregulated dc is then fed to a LM350T regulator module. An output voltage control for the 23V supply is designated as R20 on the 210-7770 Regulator Board (see Figure 4-2). A LED to indicate the presence of 23V and a 23V test point are also shown on Figure 4-2.

2.4.2 THE -5V SUPPLY

The +5V and -5V supplies are both fed from the 7.6Vac winding on the transformer. For the -5V supply the 7.6Vac is rectified and filtered and the unregulated dc is fed to a 79MO regulator module. A LED is provided to indicate presence of -5V (see figure 4-2) but no votage adjustment is provided.

5.2.1.3. <u>210-7770 Regulator Board</u>

Figure 5-3 shows the location of the power supply components (the OIS model is shown in the figure but power supply layout is the same for all models). Figure 5-4 shows the layout of the 210-7770 Regualtor Board. The board is held in place by the two mounting screws shown and two grooved mounting posts which are gripped by tabs which are bent up from the chassis. To remove the board, first remove the two mounting screws and then pull the board straight up out of the tabs.

5.2.1.4 <u>Control Panel and Power Switch</u>

The Control Panel (see Figure 5-5) is attached to the chassis by four screws. The Power Switch is secured to the panel by 4 squeeze tabs.

5.2.1.5 <u>Line Filter</u>

The Line Filter (see Figure 5-3) is attached to the back panel by two studs which also support the power cable connector.

5.2.1.6 <u>210-8262 Interface Board (Model 6529/2529V only)</u>

The Interface Board (see Figure 5-5) is held in place by two screws (one by L47 and one by L150) and four plastic pins. After removing the screws, the board may be swung upward by bending two plastic clips on the pins that secure the front. The two pins that hold the rear of the board have locking splines. The splines will recede when squeezed so that the pins will pass through the holes in the board.

5.2.1.7 <u>Fan</u>

The fan is secured by four screws. The nuts on these screws are not captive. Therefore, care must be taken to retrieve the nuts and lock washers when the screws are removed.

5.2.1.8 <u>Kennedy Tape Drive</u> (278-4029)

The Kennedy tape drive is not to be field serviced and must be replaced as a unit when repairs are required. The drive is secured by five screws in the Model 2229 and by seven screws in the Model 6529/2529V. In all models, the drive is secured to the bottom chassis by four screws indicated in Figure 5-6. Figure 5-3 shows another mounting screw that is common to all models. The tape drive in the Model 6529/2529V is secured by two additional screws which are shown in Figure 5-5. The part numbers of Field Service Center (FSC) replaceable parts are given below:

Wang Part Number	OEM Part Number	Description
726-6202	190-5663-001	F650 Formatter
726-6203	190-4876-001	Infrared Sensor Assembly
726-6204	190-5516-002	Head Assembly
726-6205	190-6478-001	Control/Read/Write Board
726-6206	190-4799-002	Capstan Motor Assembly
726-6207	190-5380-001	Interlock Assembly

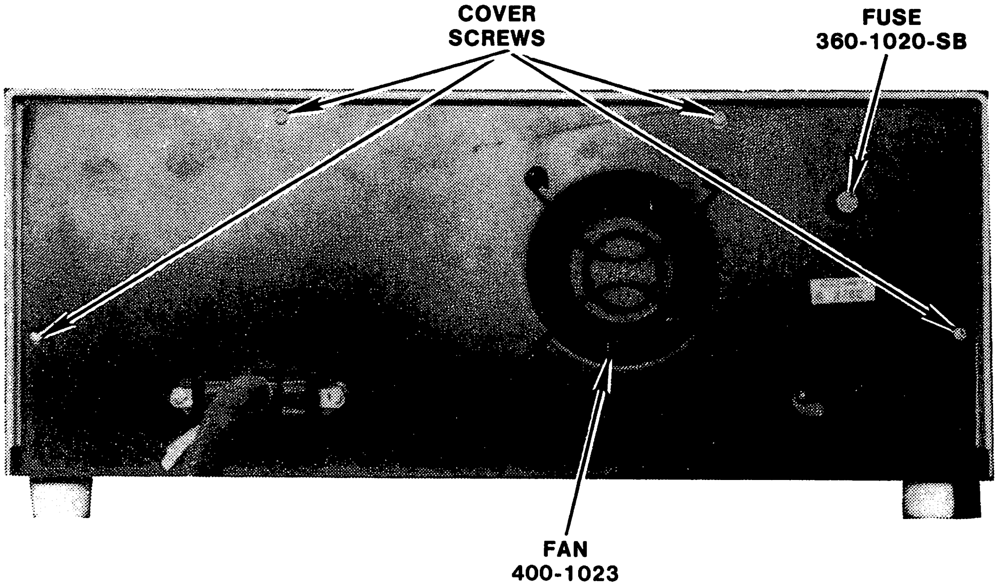


Figure 5-1   Cabinet Cover Screws

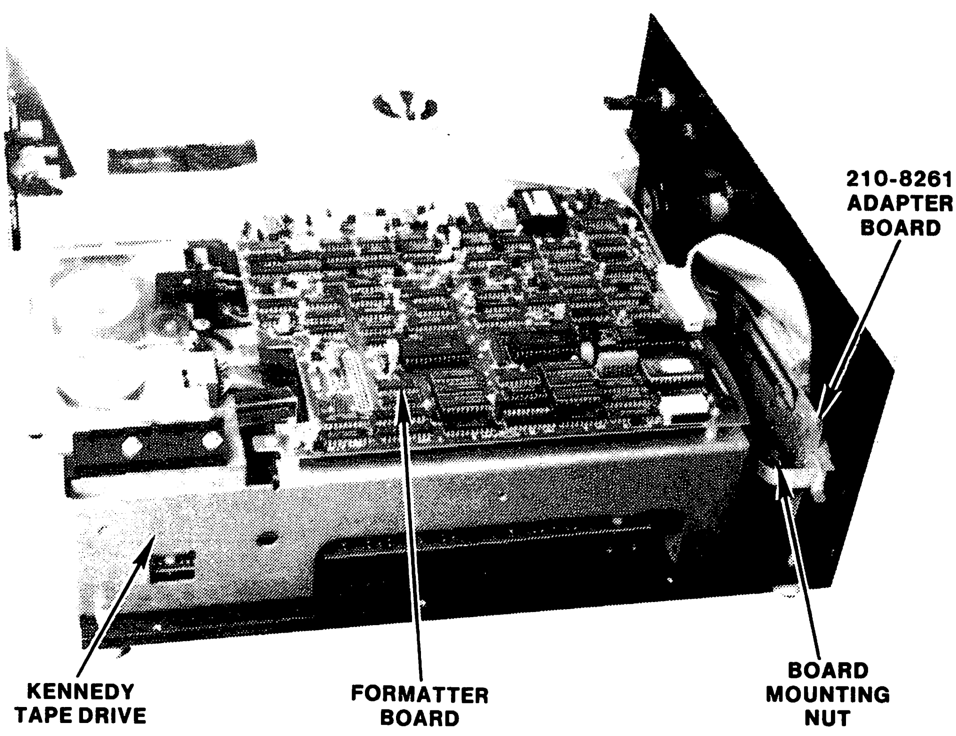


Figure 5-2   Internal Components - Model 2229

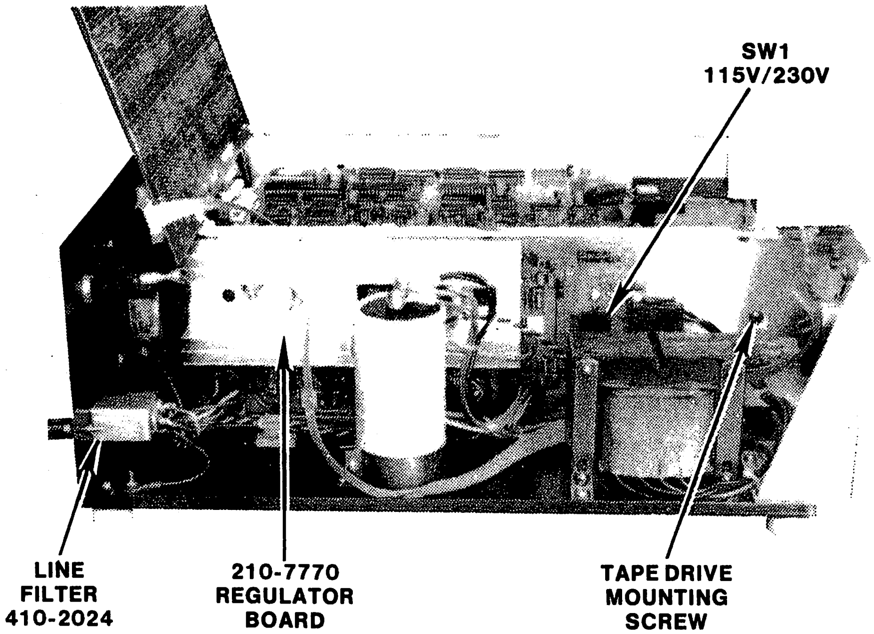


Figure 5-3 Power Supply Components

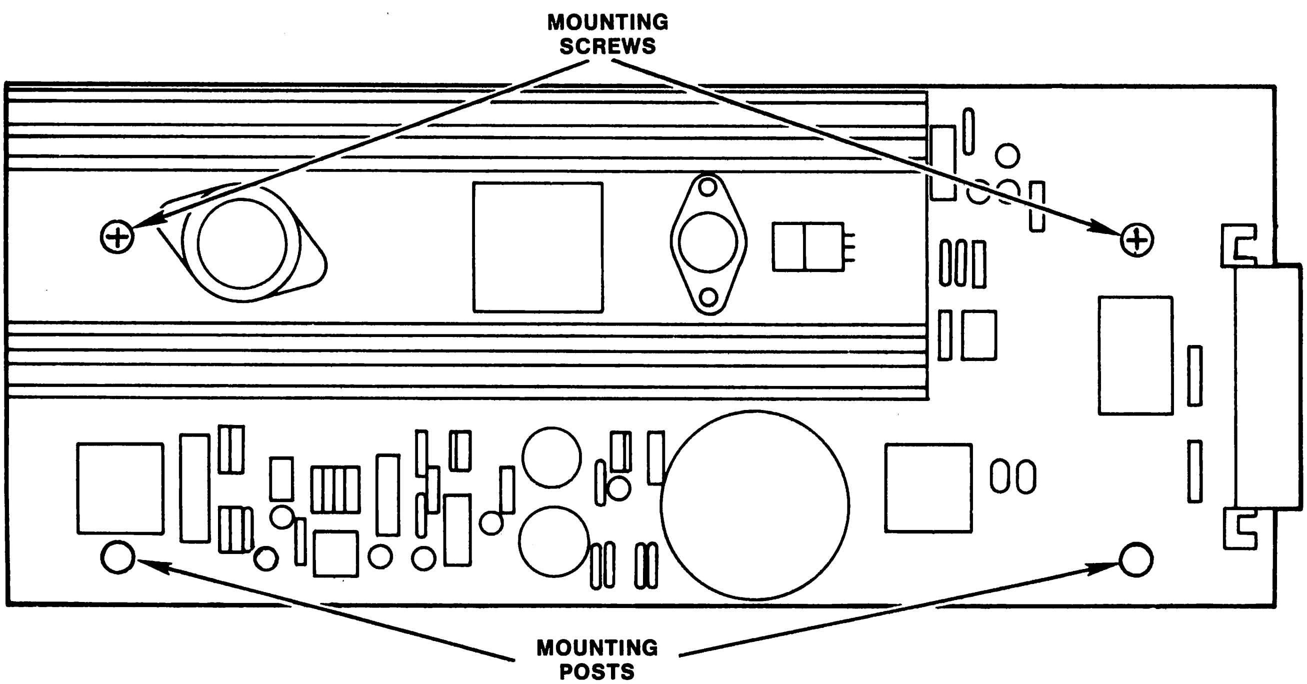


Figure 5-4 210-7770 Regulator Board Mounting

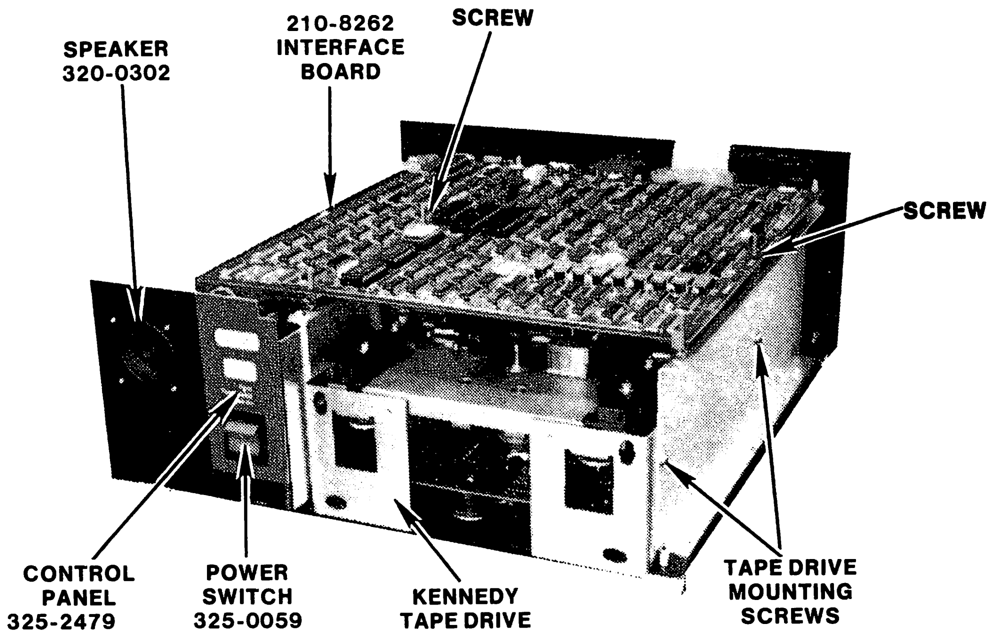


Figure 5-5 Internal Components - Model 6529/2529

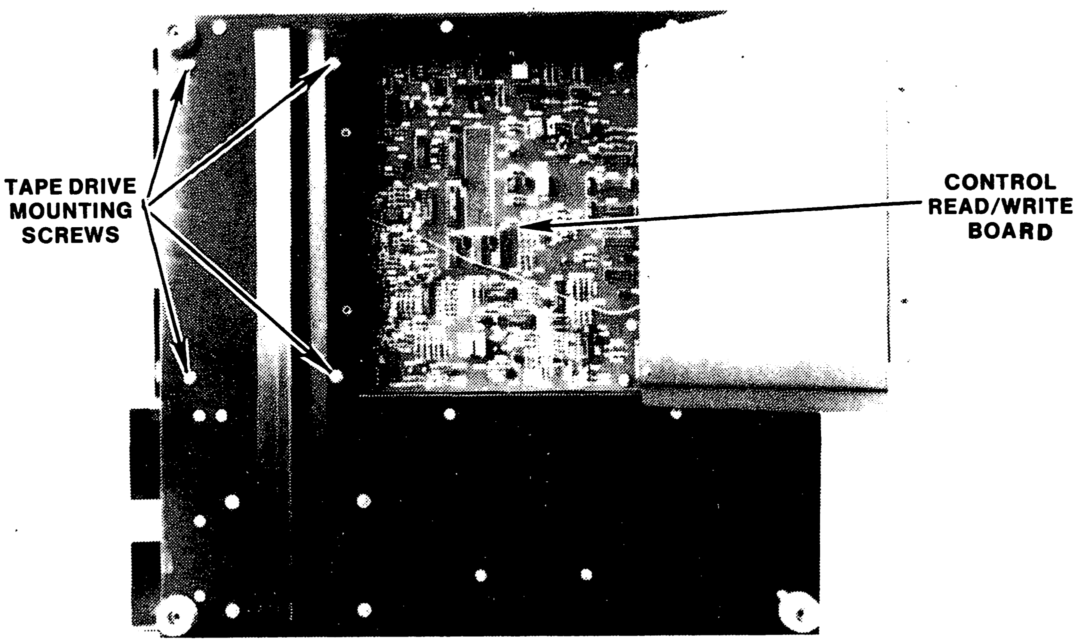


Figure 5-6 Chassis Bottom

5.2.1.8.1 Kennedy Parts Replacement

In order to access the Kennedy replaceable parts it is first necessary to remove the 210-8262 Interface Board (6529/2529V only) and to remove the Kennedy drive from the chassis (see section 5.2.1.8). Ensure that the Interface cable is disconnected but leave the power connector plugged in.

Adjustments and any precautions which should be exercised are described in the procedures which follow. Parts discussed below are shown in Figure 5-7.

5.2.1.8.1.1 Formatter Board Replacement

The formatter board can be removed after removing its four mounting nuts (one in each corner) and all attached cables.

5.2.1.8.1.2 EOT/BOT Infrared Sensor Replacement

a. Remove the formatter PCB (see section 5.2.1.8.1.1).

b. Disconnect the sensor molex connector.

c. Loosen the two sensor retaining screws and remove the sensor.

d. Replace with the new sensor assembly, connecting the sensor molex connector but leaving the retaining screws loose enough for the sensor to be moved.

e. Replace the Formatter PCB.

f. Insert a cartridge and run the "continuous load" test discussed in section 5.2.2.3. When the tape reaches the load point, stop the test and remove the tape.

g. Moving the tape by hand, center the "A" & "B" holes (see Figure 1-1) in front of the reflecting mirror in the cartridge.

h. Place the tape back into the drive. Using an oscilloscope or a voltmeter attached to test point A on the Control/Read/Write board, align the sensor so that the maximum voltage is displayed. (The Control/Read/Write board is located behind the hinged cover on the bottom of the chassis and test points A and B are shown in Figure 5-8).

i. Repeat for hole B using test point B on the Control/Read/Write board.

j. Tighten the sensor retaining screws.

5.2.1.8.1.3 Capstan Motor Replacement

a. Disconnect the motor molex connector from the Control/Read/Write board, located at the bottom of the unit.

b. Using a long Allen wrench (#99-764) loosen the motor clamp screw by gaining access to it via one of the side holes provided for this purpose in the frame (see Figure 5-7).

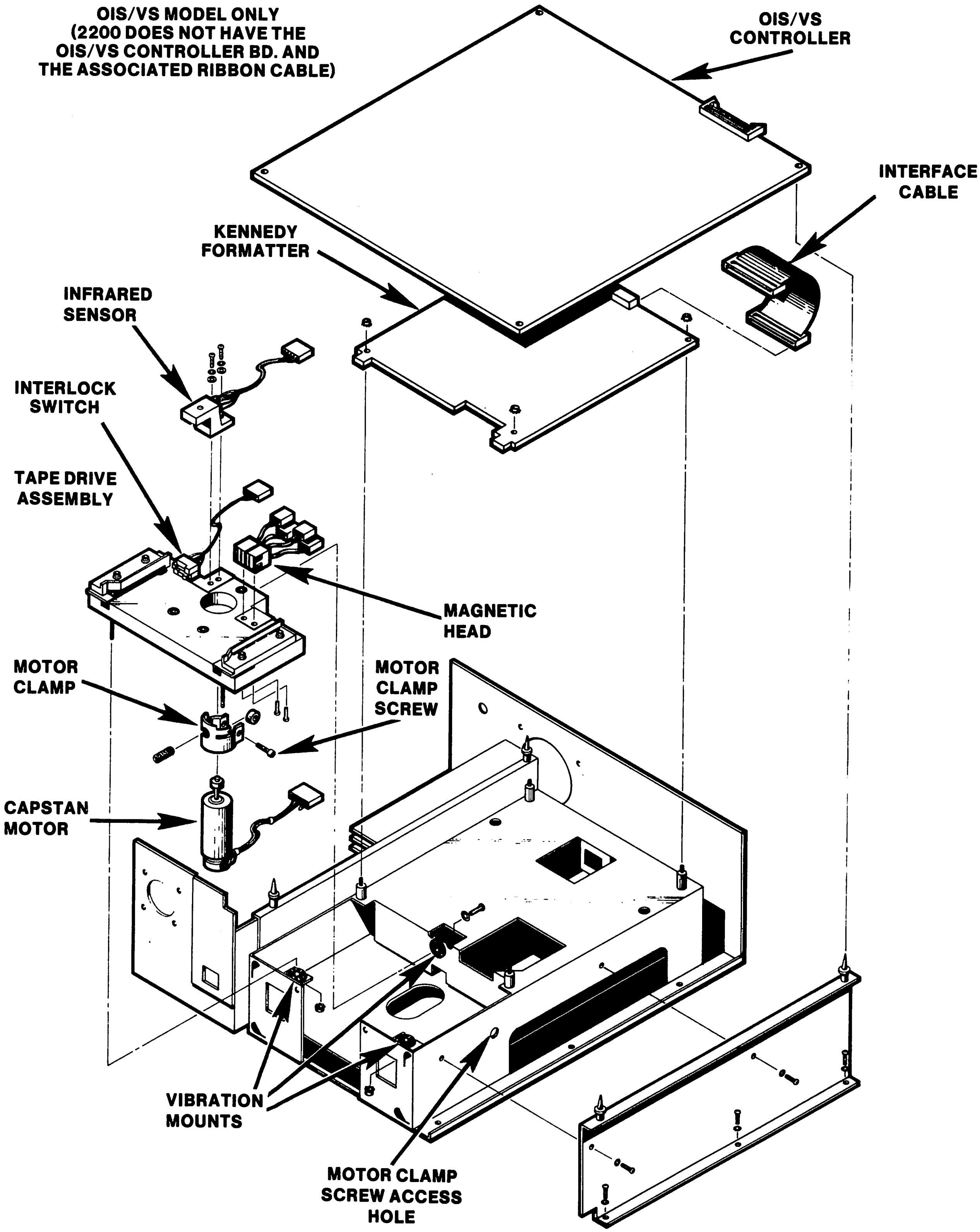


Figure 5-7 Kennedy Replaceable Parts Assembly

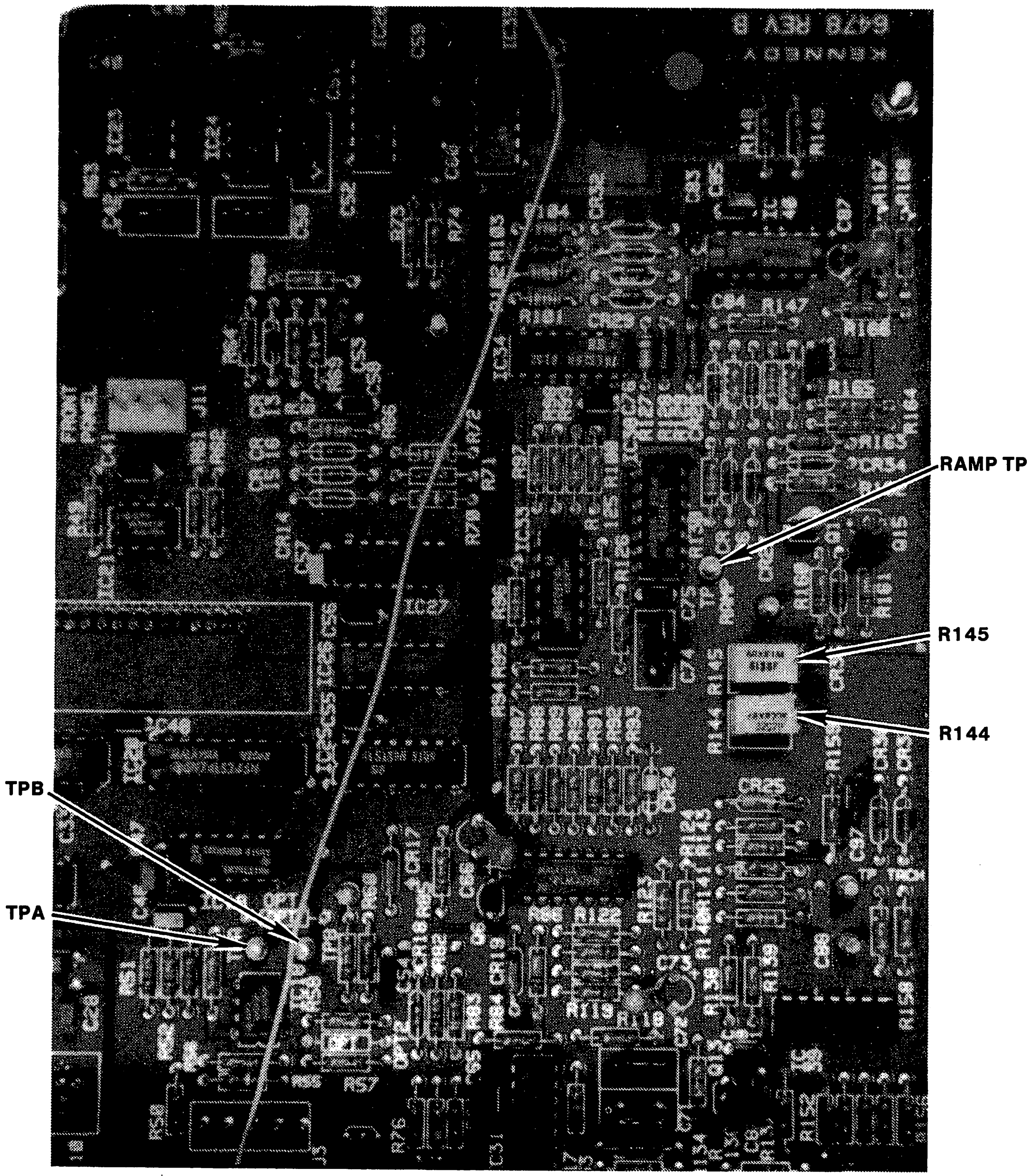


Figure 5-8 Portion of Control/Read/Write Board

c. Slide the old motor out and replace with a new motor, taking care to properly insert the helical tension spring.

d. Insert the tape cartridge and align the motor capstan with the center of the cartridge capstan.

e. Tighten the motor clamp screw, and reconnect the molex connector.

5.2.1.8.1.4 Magnetic Head Replacement

a. Remove the Control/Read/Write board (see section 5.2.1.8.1.6).

b. From underneath the head plate, loosen the head retaining screws and remove the head.

c. Place new head in position, keeping the screws loose enough to allow the head to be relocated.

d. Align the head so that both of its edges are equidistant from the edges of the head plate.

e. Insert the tape cartridge. The tape should make even contact with the read and write head surfaces, and should have equal clearance from the erase head surfaces on both sides.

f. Tighten the head retaining screws, and replace the Control/Read/Write board.

5.2.1.8.1.5 Interlock Assembly Replacement

The interlock assembly is removed by removing the two screws which attach it to the tape drive assembly and then unplugging it from the tape drive assembly.

5.2.1.8.1.6 Control/Read/Write Board Replacement

The Control/Read/Write board board can be removed after removing its four mounting nuts (one in each corner) and all attached cables.

5.2.2 DIAGNOSTICS AND ADJUSTMENTS

5.2.2.1 General

This section describes the on-line and off-line diagnostic routines used to isolate faults within the tape drive.

5.2.2.2 On-Line Diagnostics

The formatter performs a self-test routine prior to each LOAD command. Successful completion of the self-test is required before the rest of the load sequence is allowed to continue. The self-test routine is a loop write to read of a file mark. This effectively stimulates about 80 percent of the formatter circuitry including the data separation circuit. If the self-test fails, further off-line testing is necessary.

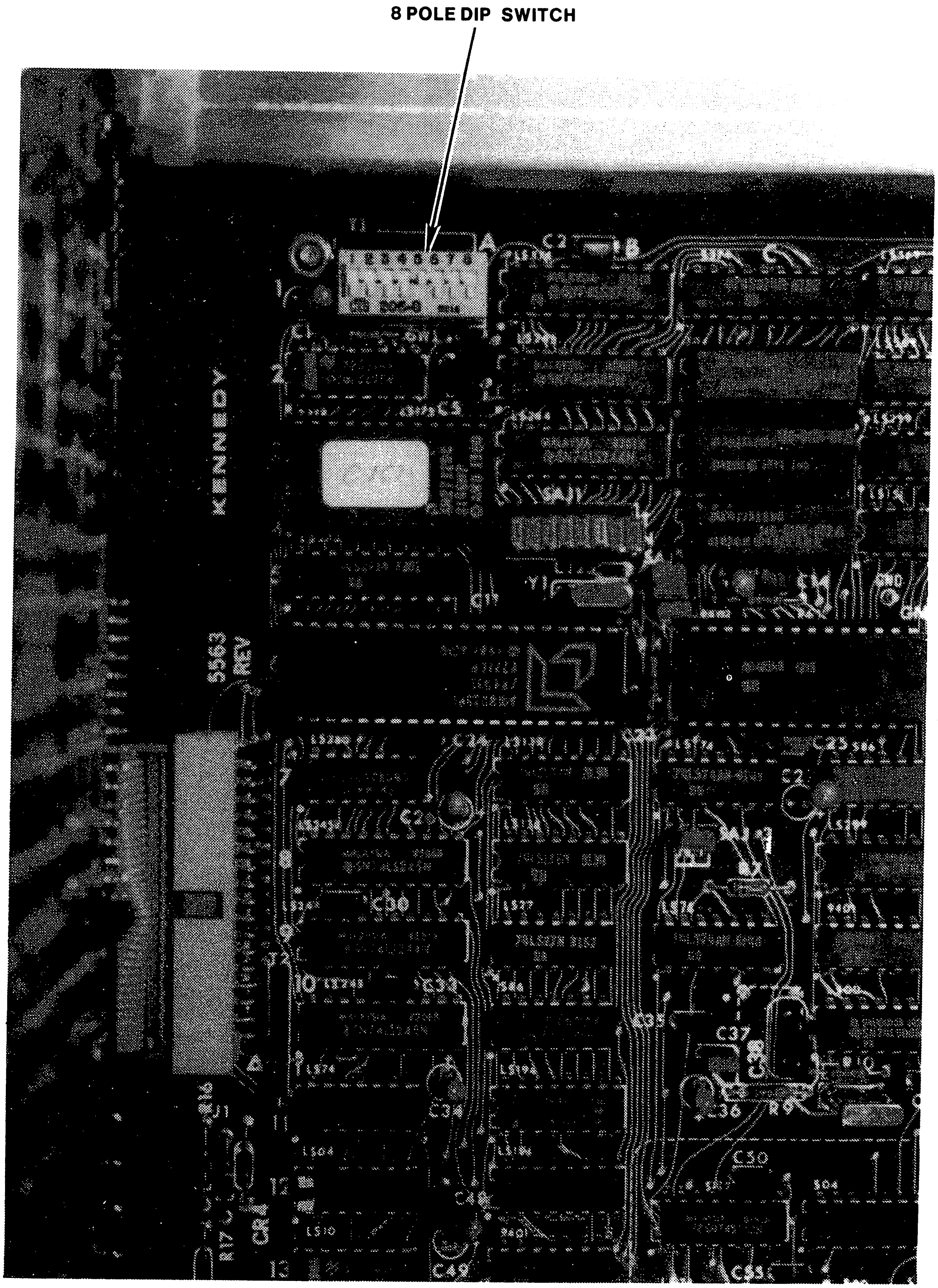


Figure 5-9 Portion of Formatter Board

5.2.2.3 Off-Line Diagnostics

5.2.2.3.1 General

To select the off-line diagnostics, switch 7 of the eight position DIP switch (see Figure 5-9) located on the formatter must be set to the ON position. Ten test routines are then available, as listed in table 5-2. When running the "Continuous Load" test a built-in test is run by the Kennedy formatter to verify the integrity of the 8035 microprocessor and associated PROM. This test asertains that the heart of the system is functional, and ready to execute the selected diagnostics.

a. Set switch 7 to the ON position.

b. Disconnect the interface cable (see Figure 5-7) from the host to protect the formatter interface drivers.

c. Check the tape cartridge to verify that it is NOT in the SAFE position.

d. To run a different test, switch 8 must be set ON then OFF to reset the formatter.

Table 5-2 Off Line Diagnostics Switch Setting Chart

Tape Drive Tests

Test	Switch Setting SW 4321
Continuous Load	0000
Ramp Adjust	0001
Tape Speed Adjust	0010

System Tests

Test	Switch Setting SW 4321
Write File Mark, Continous	0011
Read Continuous	0100
Write Continuous	0101

Formatter Tests
(Remove the tape before running formatter diagnostics)

Test	Switch Setting SW 4321
Controller SA	0110
Read Sequencer SA	0111
Write Sequencer SA	1000
Continous Self-Test	1001

A "1" indicates that the switch should be in the ON position.

5.2.2.3.2 Tape Drive Diagnostics

Continous Load (Switch Setting = 0000)

This routine performs up to 16 continuous LOAD sequences (without the self-test routine). It tests the basic functioning of the 6455 control electronics which allows for the measurement of the duration of the A and B hole signals.

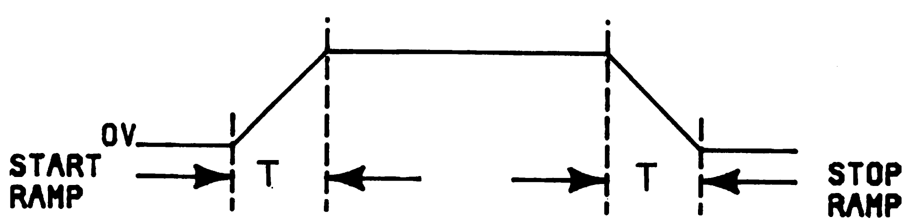
Ramp Adjust (Switch Setting = 0001)

The tape is brought up to speed at a constant, linear acceleration. To control tape velocity, a ramp voltage is generated by the Control/Read/Write board. The voltage rises linearly to the running speed level and falls linearly to zero volt at stop. Ramp time is 25 +0/-3 msec at 30 ips, and varies inversely with speed. The ramp time (T) for different speeds (S) is given by the following formula:

$$T = 30 \times \frac{25}{S} \text{ msec}$$

The ramp adjustment procedure is greatly simplified by using the ramp adjust test in conjunction with potentiometer R145 (see Figure 5-8) which is located on the Control/Read/Write board. NOTE: In some units it may be necessary to remove the tape drive from the Wang chassis (keeping power connected) to access R145. To adjust the ramp, set the diagnostic switch to 0001 and adjust potentiometer R145 until the transport shuttles the tape back and forth. When ramp setting is incorrect, the transport will move the tape in the forward direction only.

Alternately, the ramp time may be observed by placing an oscilloscope probe on the ramp test point (see Figure 5-8) on the Control board and initiating rapid start/stop mode (via the Write Continuous test) long enough to allow the ramp voltage to reach a level. The ramp time is then adjusted using R145 to equal 25 msec as shown below. Make sure the tape is being written in the FORWARD direction before attempting ramp time adjustment with the oscilloscope.



Tape Speed Adjust (Switch Setting = 0010)

This routine initiates continuous writing of file marks to allow for the adjustment of the tape speed using speed adjustment potentiometer R144 (see Figure 5-8) on the Control/Read/Write board. The tape will move in the forward direction until proper speed is achieved, at which point it will shuttle back and forth.

An alternate procedure for setting the speed is described below:

a. Connect channel 1 probe of a dual trace oscilloscope to the write data input. A convenient location would be J1-4 on the Control/Read/Write board, or IC12, pin 17 on the same board (see Figure 5-10). Trigger the scope on channel 1 and select 2 msec/cm time constant and 2V/div. vertical amplitude.

b. Connect channel 2 probe to test point TP1 on the same board and initiate the writing of short blocks (via Write Continuous test) on channel 1, one to ten characters long.

c. Adjust potentiometer R144 on the Control/Read/Write board (clockwise to increase delay or counterclockwise to decrease delay) so that the delay between the leading edges of the read and write data blocks is 10 msec at 30 ips. NOTE: On some units it may be necessary to remove the tape drive from t he Wang chassis (keeping power connected) to access R144. For machines operating at other tape speeds the formula for deriving the proper delay time is:

$$\frac{0.3}{S} = \text{delay in seconds}$$

where S = tape speed in inches per second.

Write File Mark Continous (Switch Setting = 0011)

This routine will write file marks continuously on all tracks. If a bad file mark is written, a space reverse will be performed and a write FM extended.

Read Continuous (Switch Setting = 0100)

This routine will read blocks of data or file marks on all tracks continuously.

Write Continuous (Switch Setting = 0101)

This routine will write short blocks of data on all tracks continuously. If a bad block is written, a space reverse will be performed followed by a write extended routine. This will be repeated, if necessary, until a good block is written.

5.2.2.3.3 Formatter Diagnostics

The formatter diagnostics take advantage of the power of signature analysis (SA) to isolate faults to the component level. Certain jumpers are required to set up the SA tests. These are documented in the user's manual. An HP 5004A signature analyzer is required for these tests as well as for the kernal test for the 8035 processor. The formatter to the drive interface cable must be disconnected to perform SA tests and self-tests. The tape should be removed from the cartridge before operating the following diagnostics.

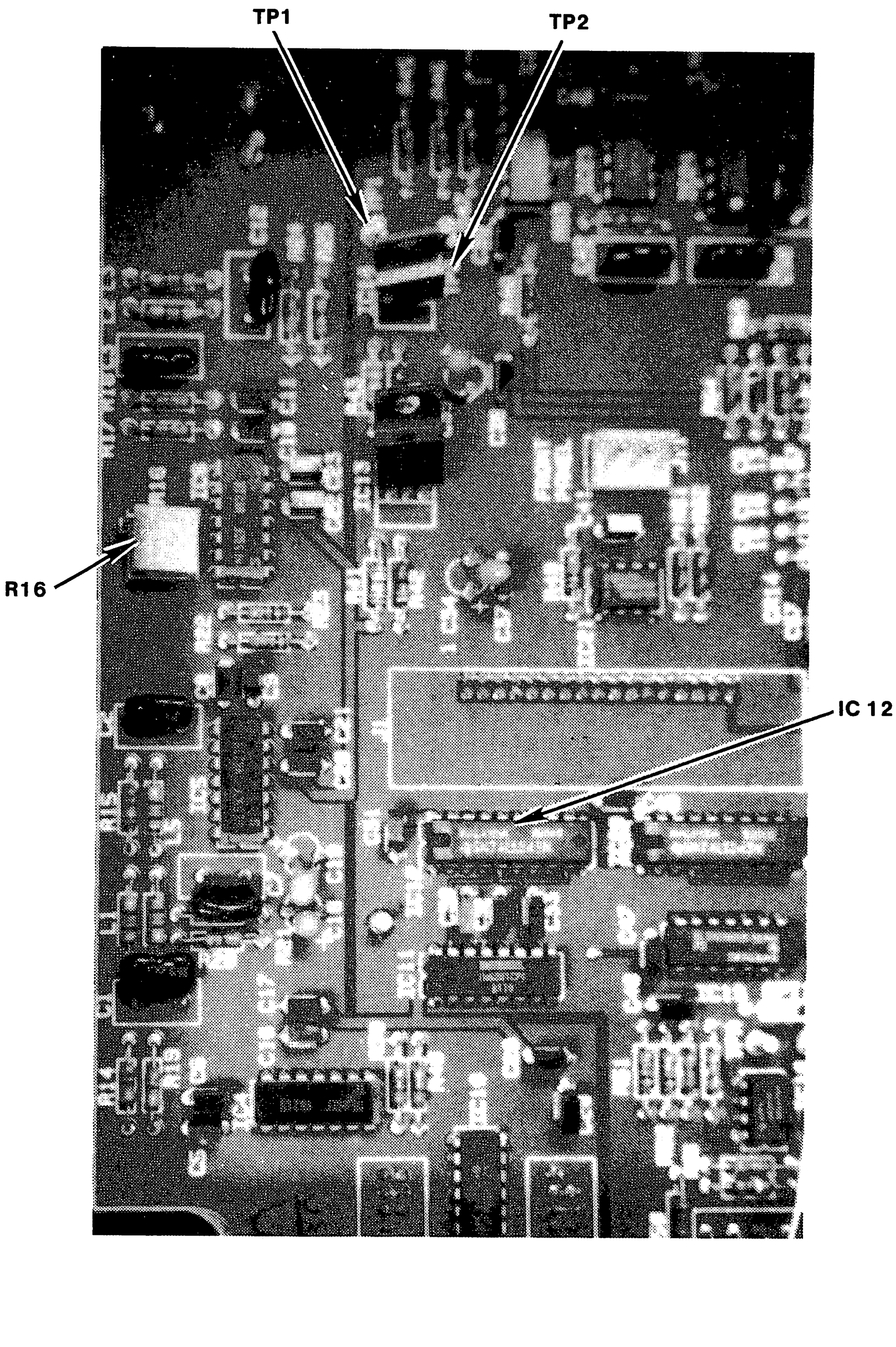


Figure 5-10 Portion of Control/Read/Write Board

Control SA (Switch Setting = 0110)

This routine stimulates all the nodes in the controller section of the formatter so that any faults in this section can be isolated down to the component responsible.

Read Sequencer SA (Switch Setting = 0111)

This routine stimulates all the nodes in the read sequencer section of the formatter so that any faults in this section can be isolated down to the component responsible.

Write Sequencer SA (Switch Setting = 1000)

This routine stimulates all the nodes in the write sequencer section of the formatter so that any fault in this section can be isolated down to the component responsible.

Continuous Self-Test (Switch Setting = 1001)

This routine performs continuous self-test routines that allow the data separator section, including the phase lock loop, to be tested and adjusted. This is also a good verification of the functioning of the formatter as a whole.

Short and Long Loads (Switch Setting = 1xxxxx)

In the ON position, this switch selects the short mode of tape loading. In the OFF position, the long, or normal mode, is selected. In the normal mode, the transport will move the tape forward in high speed to the end of the tape; then rewind it to beginning of tape, optimizing tape tension for data transfer operations. In the short load mode, used in testing and diagnostics, the transport will rewind the tape directly to the load point.

5.2.2.4 Formatter and Deck Adjustment Procedures

5.2.2.4.1 Formatter VCO Center Frequency Adjustment Procedure

Required equipment: frequency counter and adjustable DC power supply.

a. Remove jumpers at SAJ6 and JP1 (see Figure 5-11) on the Formatter board.

b. Measure the regulated output of VCO voltage regulator RG2 and adjust the DC power supply output to the measured value minus 0.8V. Thus, if RG2 ouput measures 5.1V, adjust the power supply to 4.3V.

c. Connect the power supply to top pin of JP1.

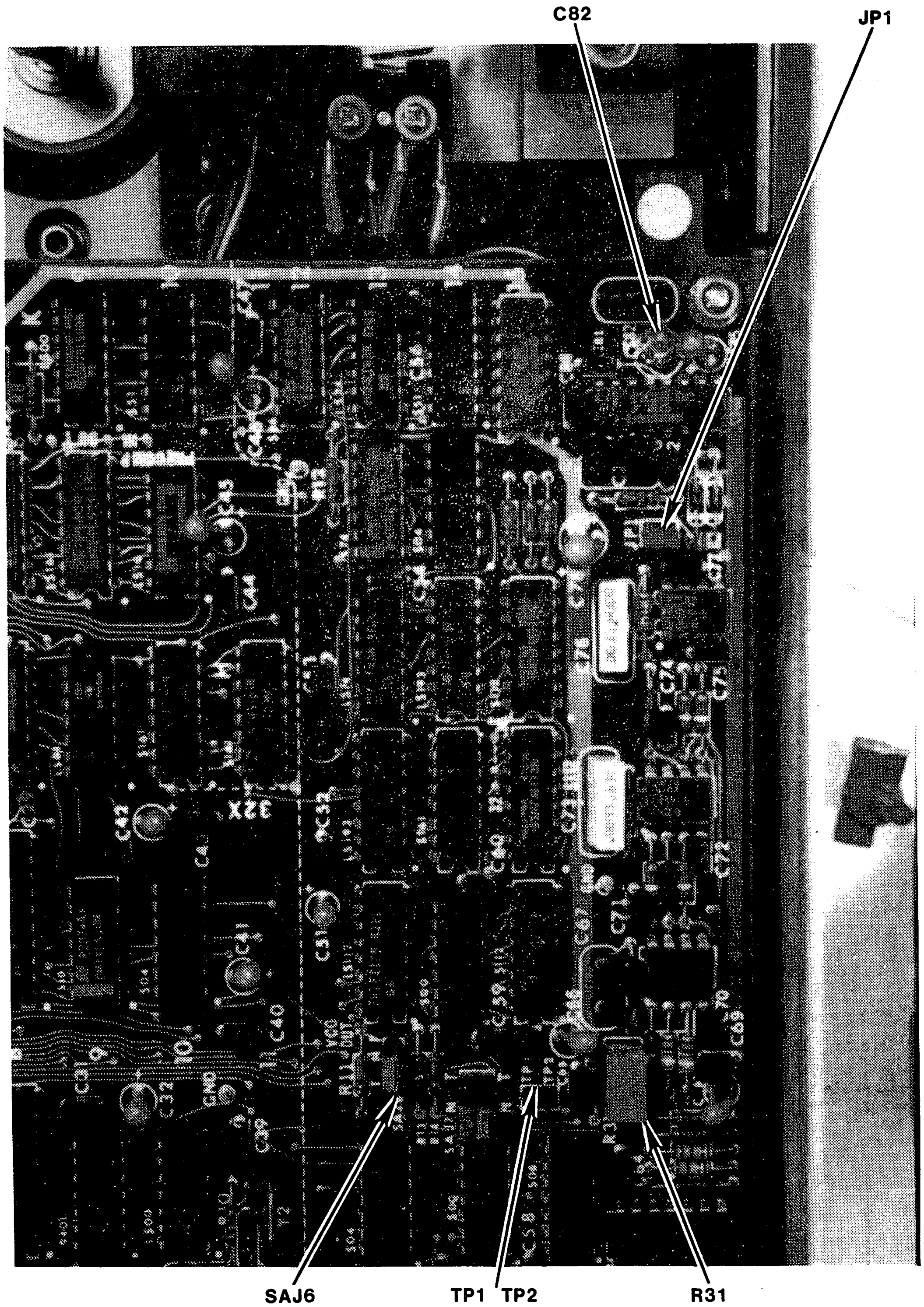


Figure 5-11 Portion of Formatter Board

d. Connect the frequency counter to the left most pin of SAJ6 and adjust trimmer capacitor C82 (see Figure 5-11) until the VCO center frequency measures 3.84 MHz +/-10 KHz.

e. Replace the jumpers at JP1 and SAJ6, the latter in the "normal" N position.

5.2.2.4.2 Formatter Integrator Offset Adjustment

Required equipment: oscilloscope.

a. Set the oscilloscope to 0.1 usec/division, 2V/division, and display channels 1 and 2.

b. Connect oscilloscope probes to TP1 and TP2 (see Figure 5-11) on the Formatter board.

c. Adjust potentiometer R31 (see Figure 5-11) on the Formatter board until the leading edges of the two displayed waveforms coincide.

5.2.2.4.3 Recorder Read Amplitude Adjustment Procedure

Required equipment: oscilloscope.

a. Set switches 1, 2 and 8 of the eight position diagnostic switch located on the Formatter board to the ON position then reset switch 8 OFF.

b. Set the oscilloscope to 0.5V/division, invert channel 2, add channels 1 and 2.

c. Connect the oscilloscope probes to test points 1 and 2 (see Figure 5-10) on the Control/Read/Write PC board located on the bottom of the unit.

d. Adjust potentiometer R16 (see Figure 5-10) on the Control/Read/Write PC board until displayed voltage measures 3V peak to peak (individual channels should read 1.5V). NOTE: On some units it may be necessary to remove the tape drive from the Wang chassis (keeping power connected) to access R16.

5.2.2.4.4 Infrared Sensor Check

The infrared sensors detect the A and B holes in the tape. The sensors are designed for maximum reliability and immunity to ambient light conditions. If the EOT or BOT are not properly detected, check the sensors as follows:

a. Disconnect the capstan motor by unplugging the molex connector.

b. Insert a tape cartridge.

c. Connect an oscilloscope probe or a voltmeter to test point A (see Figure 5-8) of the Control/Read/Write board.

d. Turn the capstan by hand until the small A hole is opposite the A sensor. Voltage at test point A should measure approximately 4 volts.

e. Connect the oscilloscope probe or voltmeter to test point B on the Control/Read/Write board.

f. Turn the capstan by hand to the double set of large holes. Voltage at test point B should measure approximately 4 volts.

g. Reconnect the capstan motor.

5.2.2.4.5 Interlock Switch Check and Adjustment

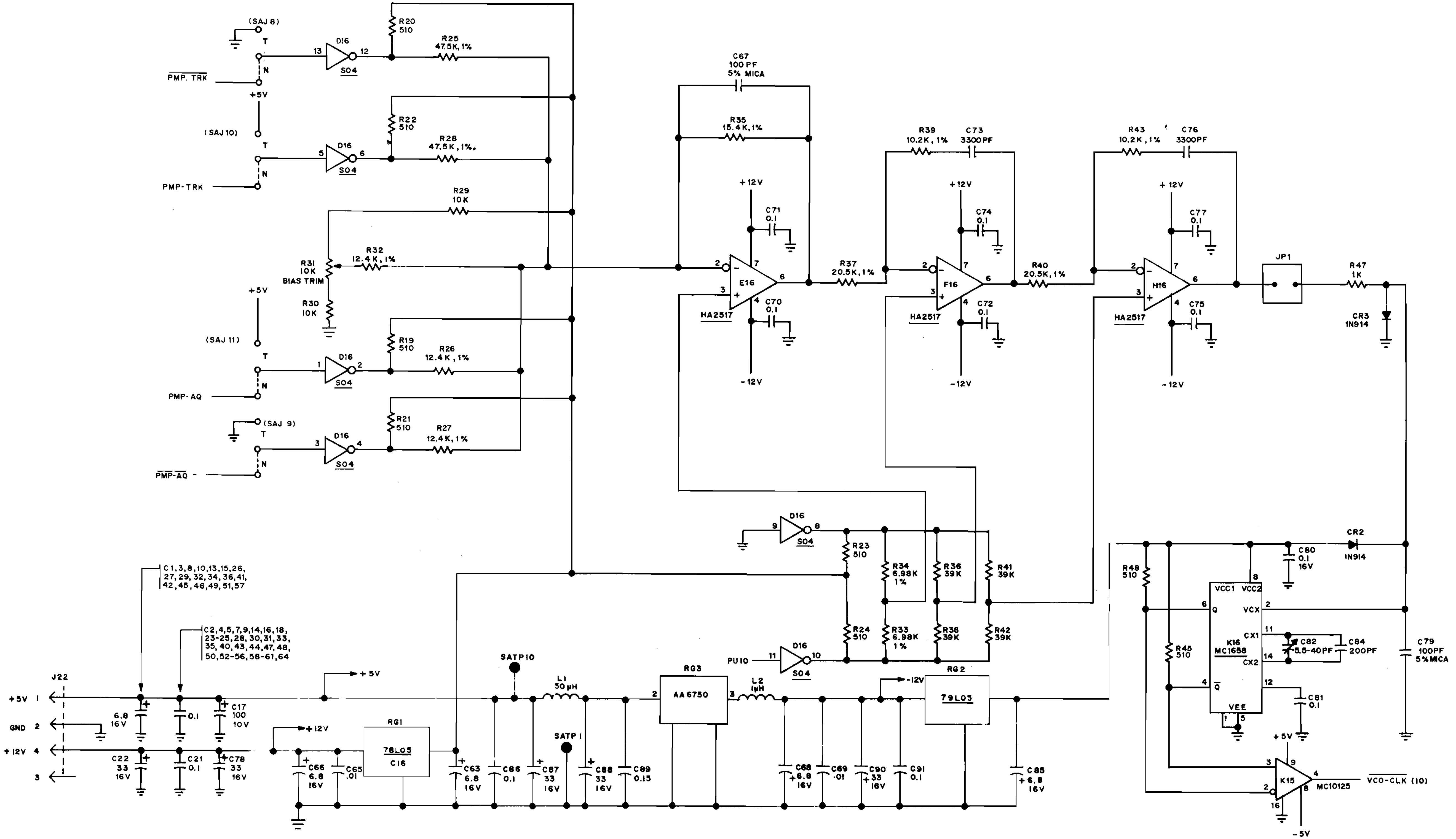
If the CARTRIDGE IN PLACE (CIP) signal does not go true when the cartridge is inserted:

a. Insert the tape cartridge until it begins to engage with the latching mechanism. Contacts on both interlock switches should begin to open.

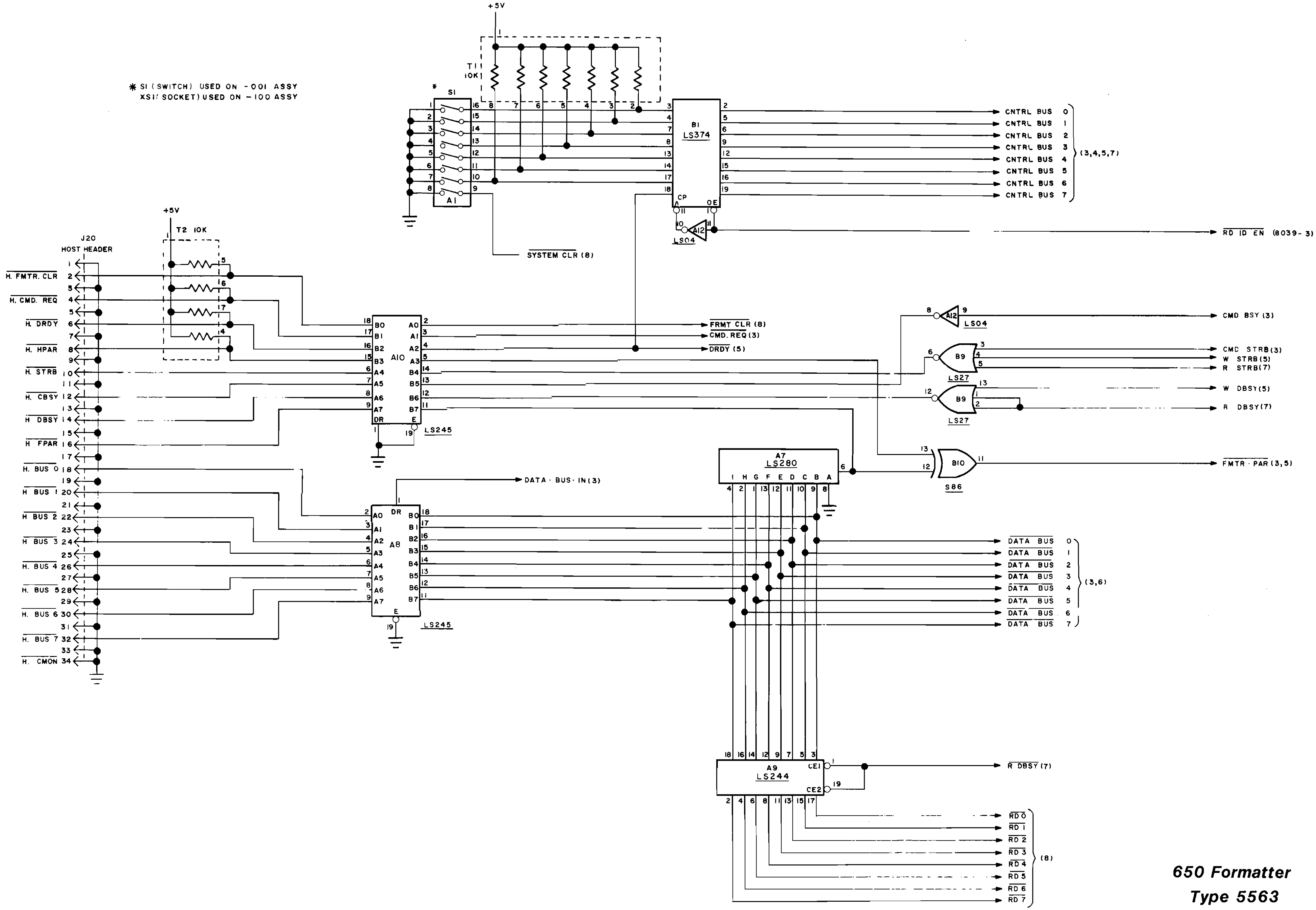
b. Press the cartridge inward until it locks in place. Switch contacts should close completely. (This can be checked by gently pressing the switch contact toward the switch body. Any movement indicates contact is not completely closed.)

Adjustment

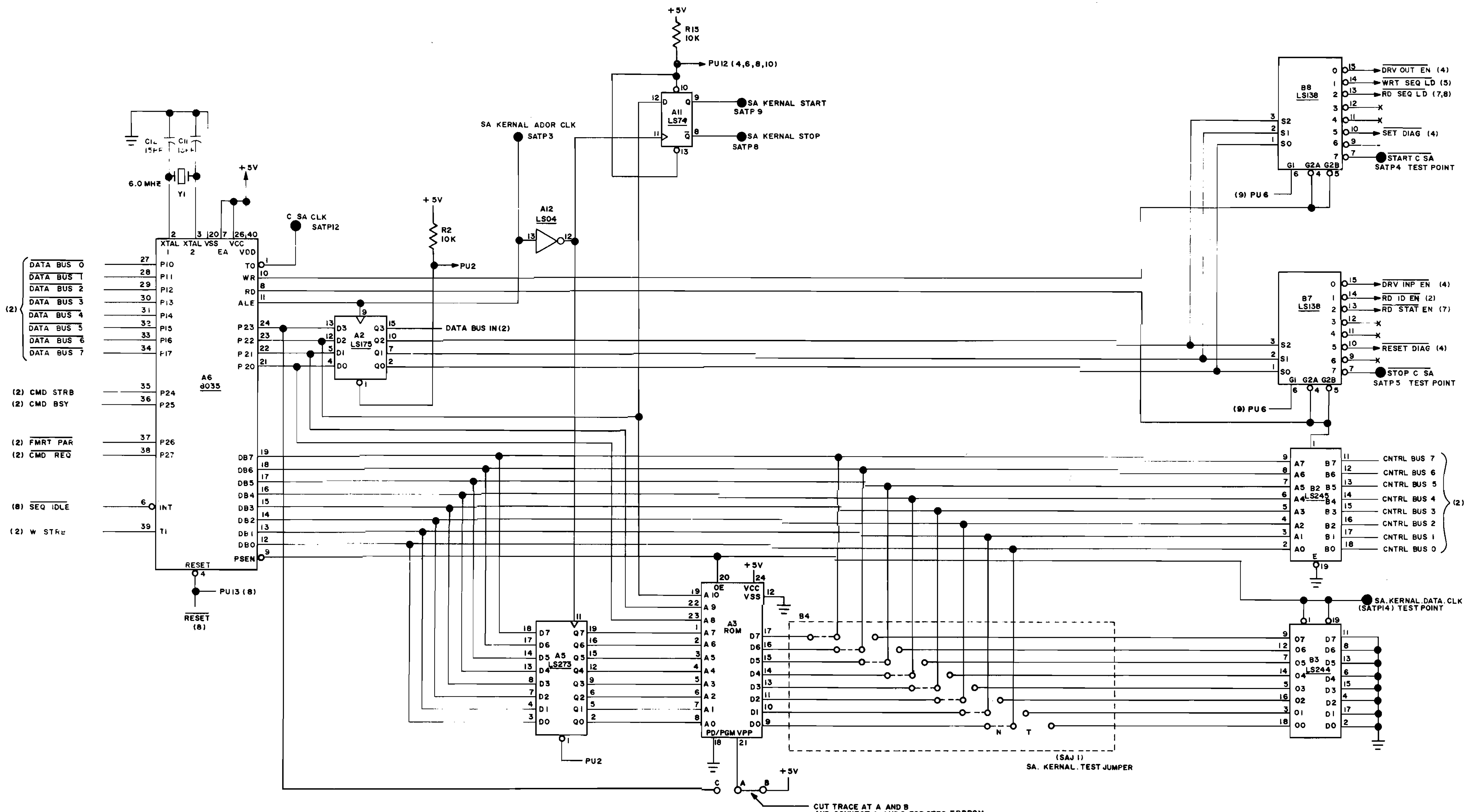
If the contact will not close completely, loosen the switch mounting screw and readjust the switch position for complete contact closure.



650 Formatter
Type 5563
Schematic Diagram



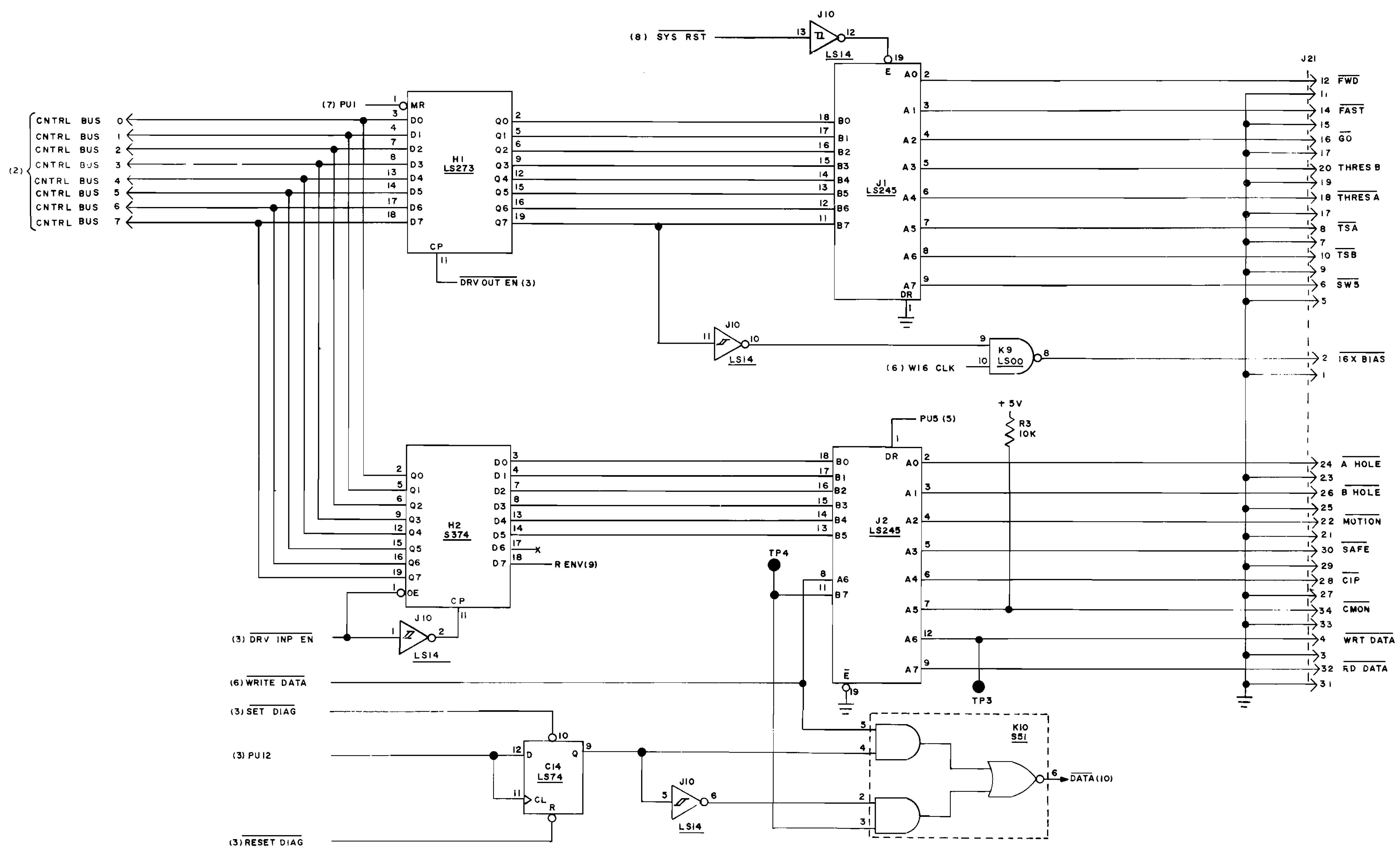
650 Formatter
Type 5563
Schematic Diagram



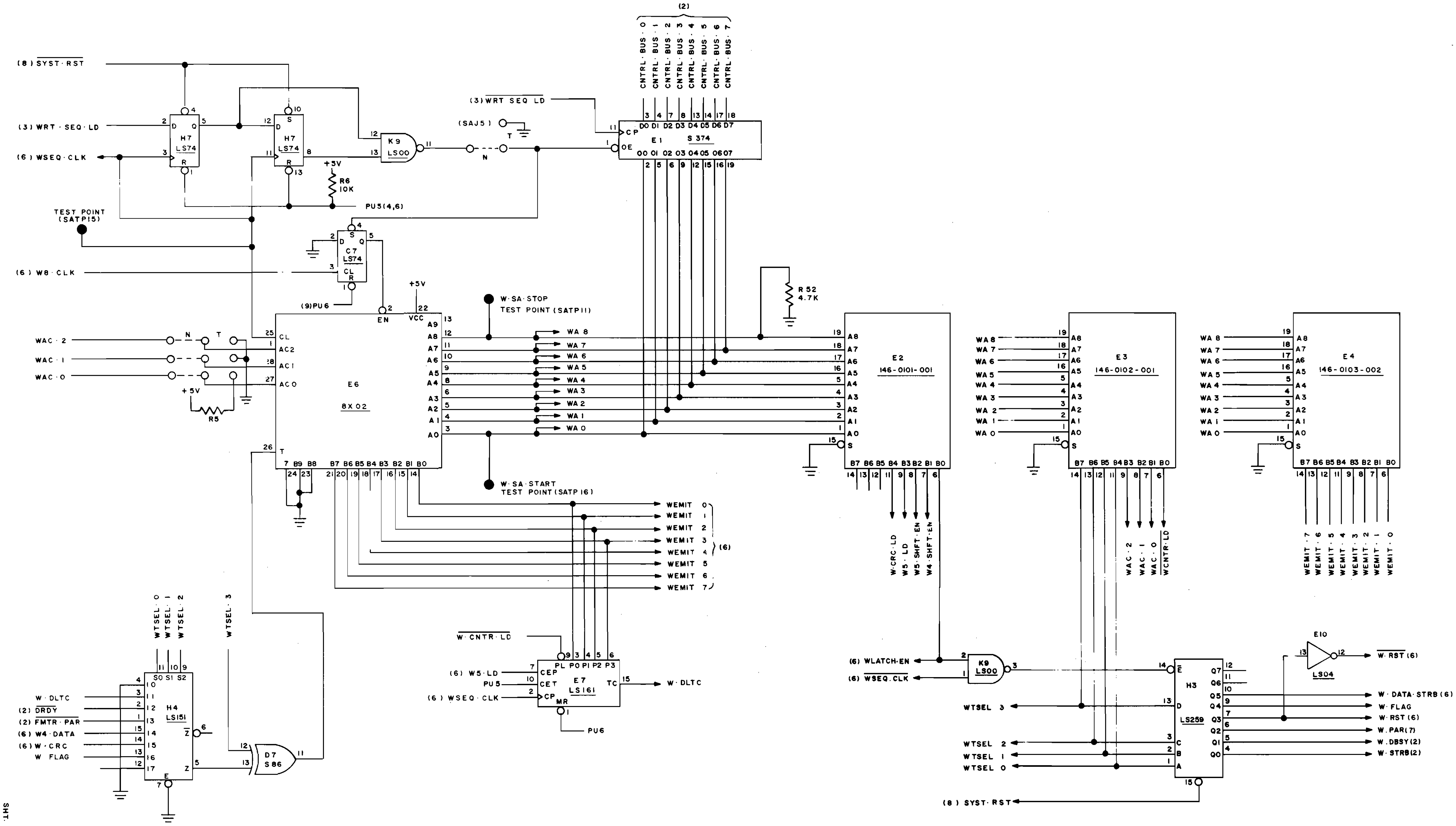
650 Formatter

Type 5563

Schematic Diagram

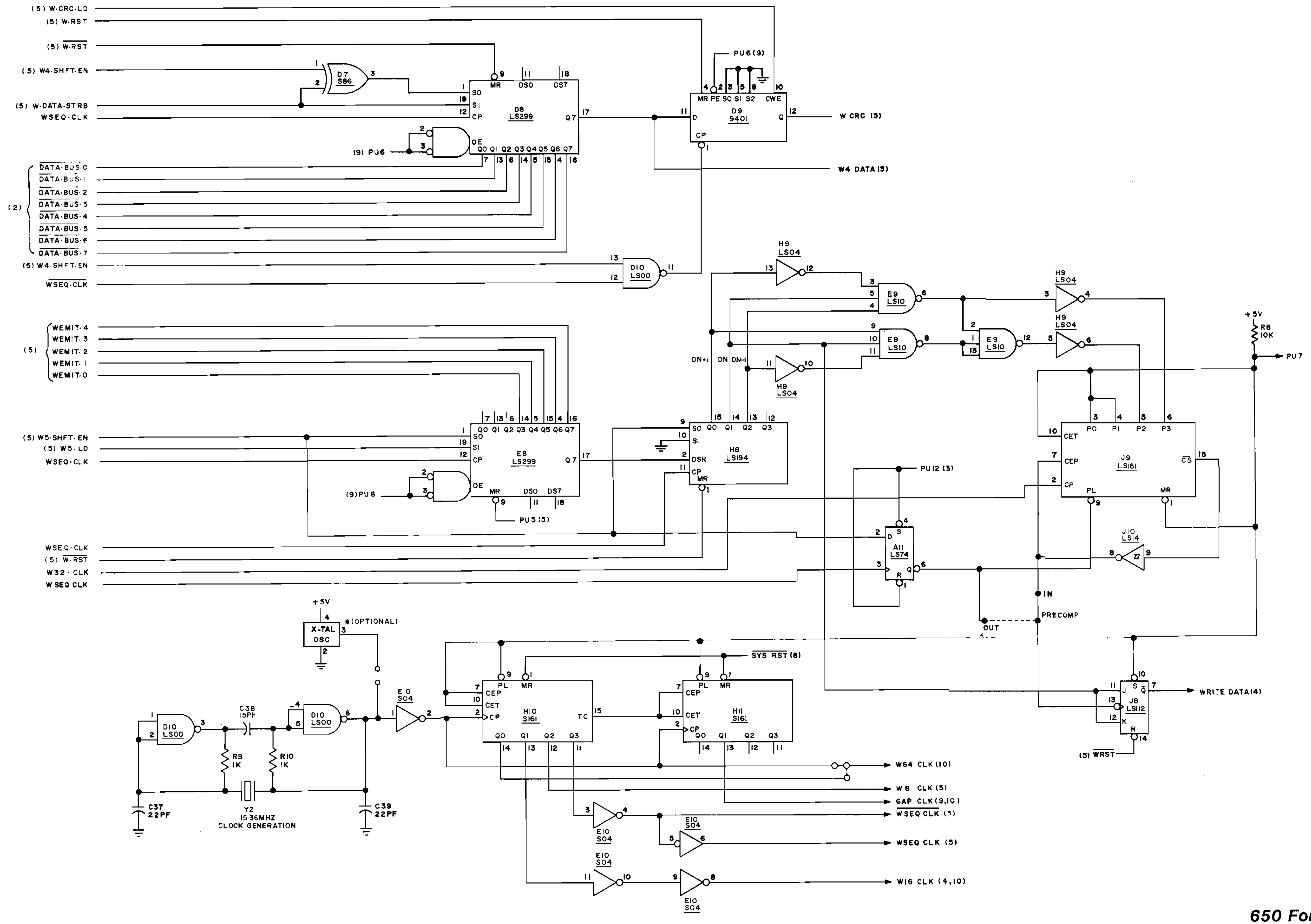


650 Formatter
Type 5563
Schematic Diagram



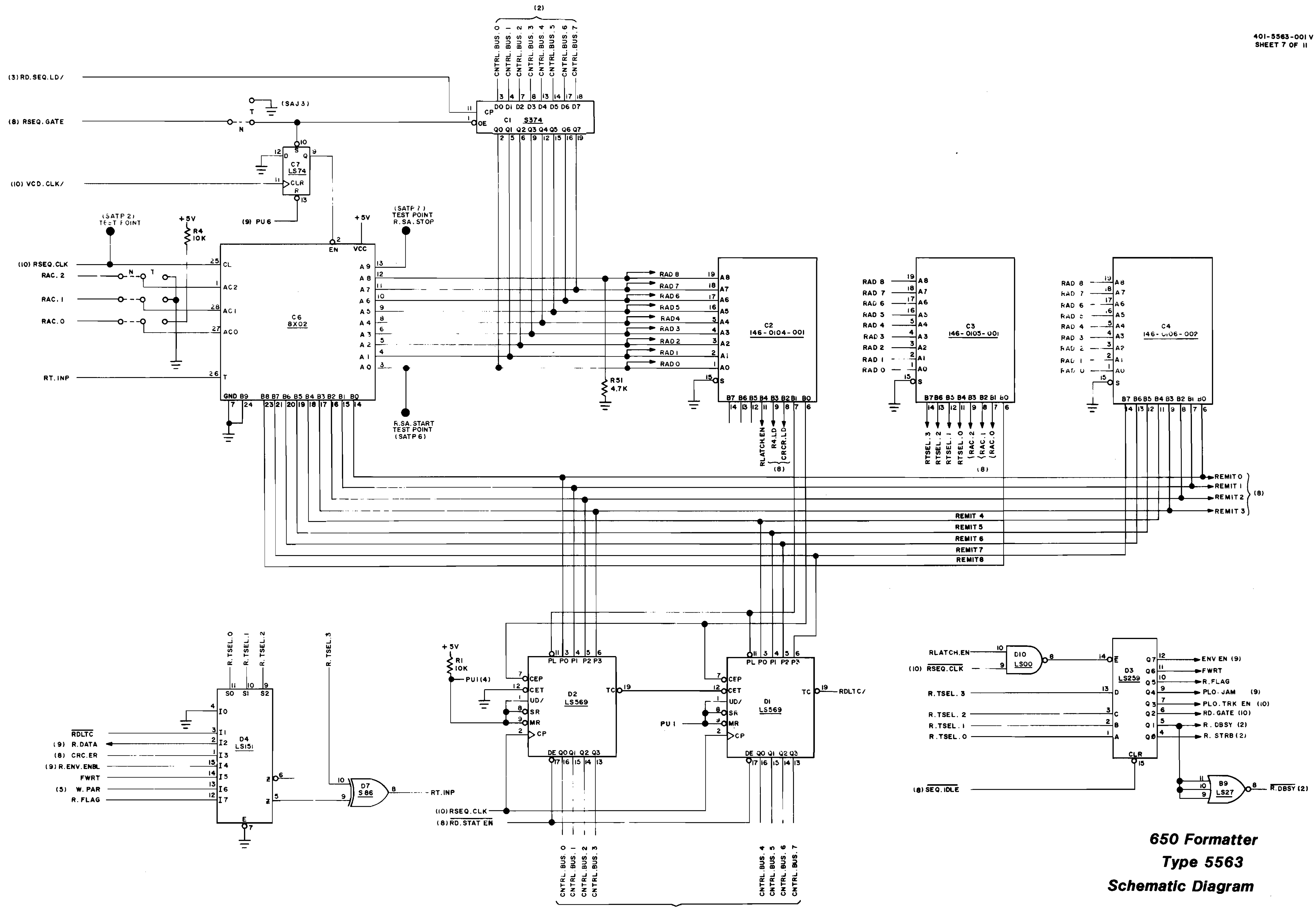
SHT. 5 OF 11

650 Formatter
Type 5563
Schematic Diagram

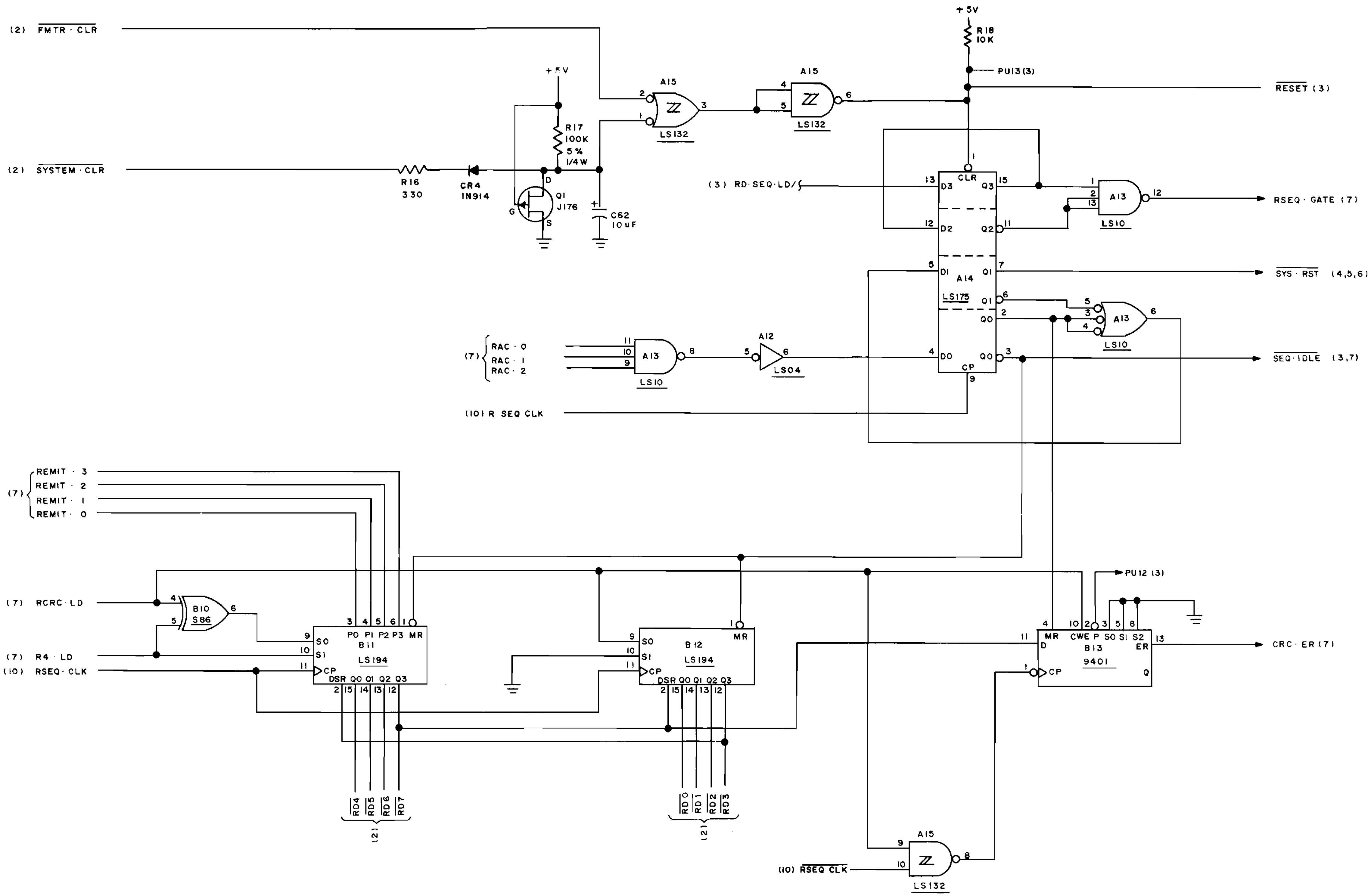


* NOTE: IF X-TAL OSC IS USED REMOVE R9, R10, C37, C38, C39 & Y2.

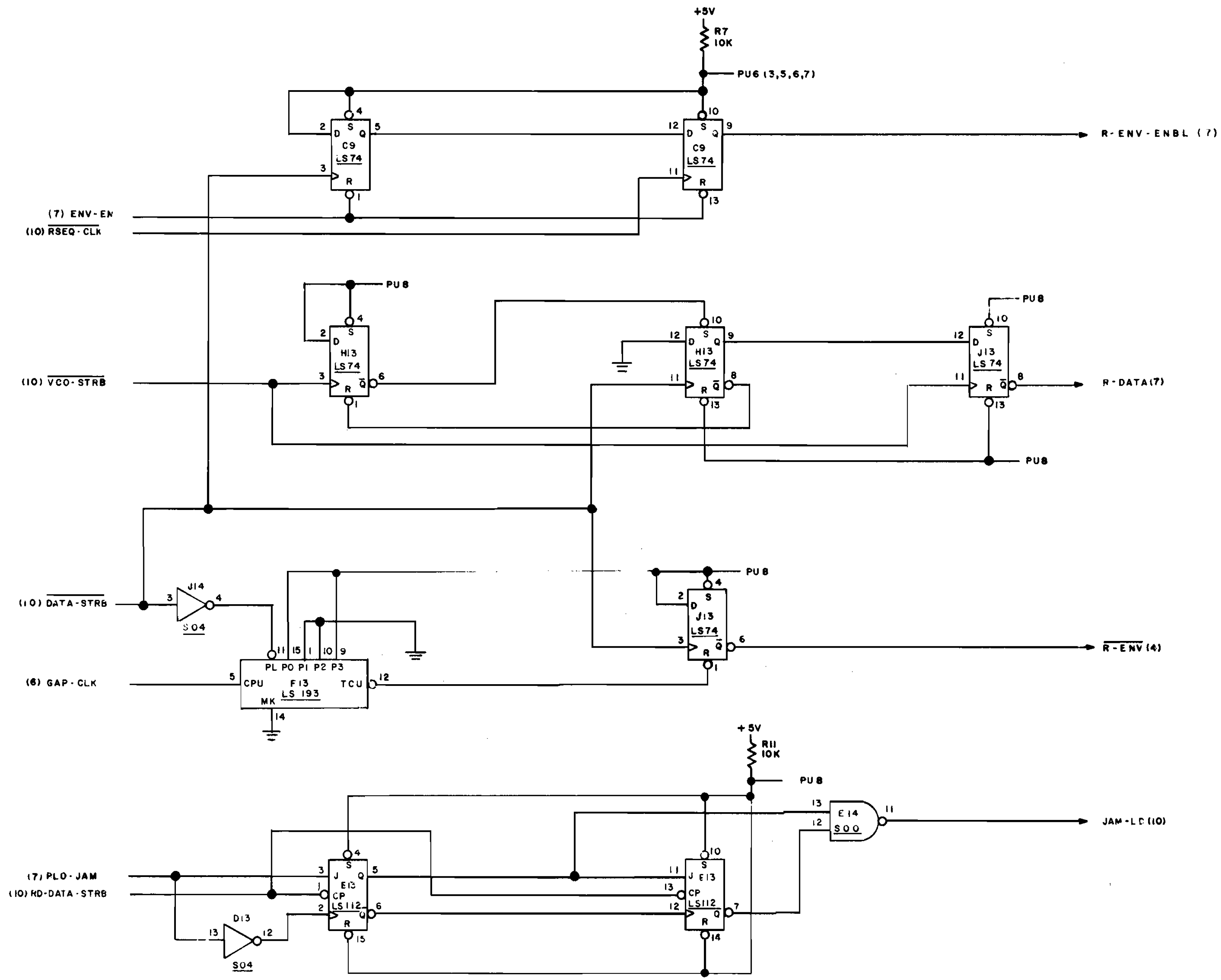
650 Formatter
Type 5563
Schematic Diagram



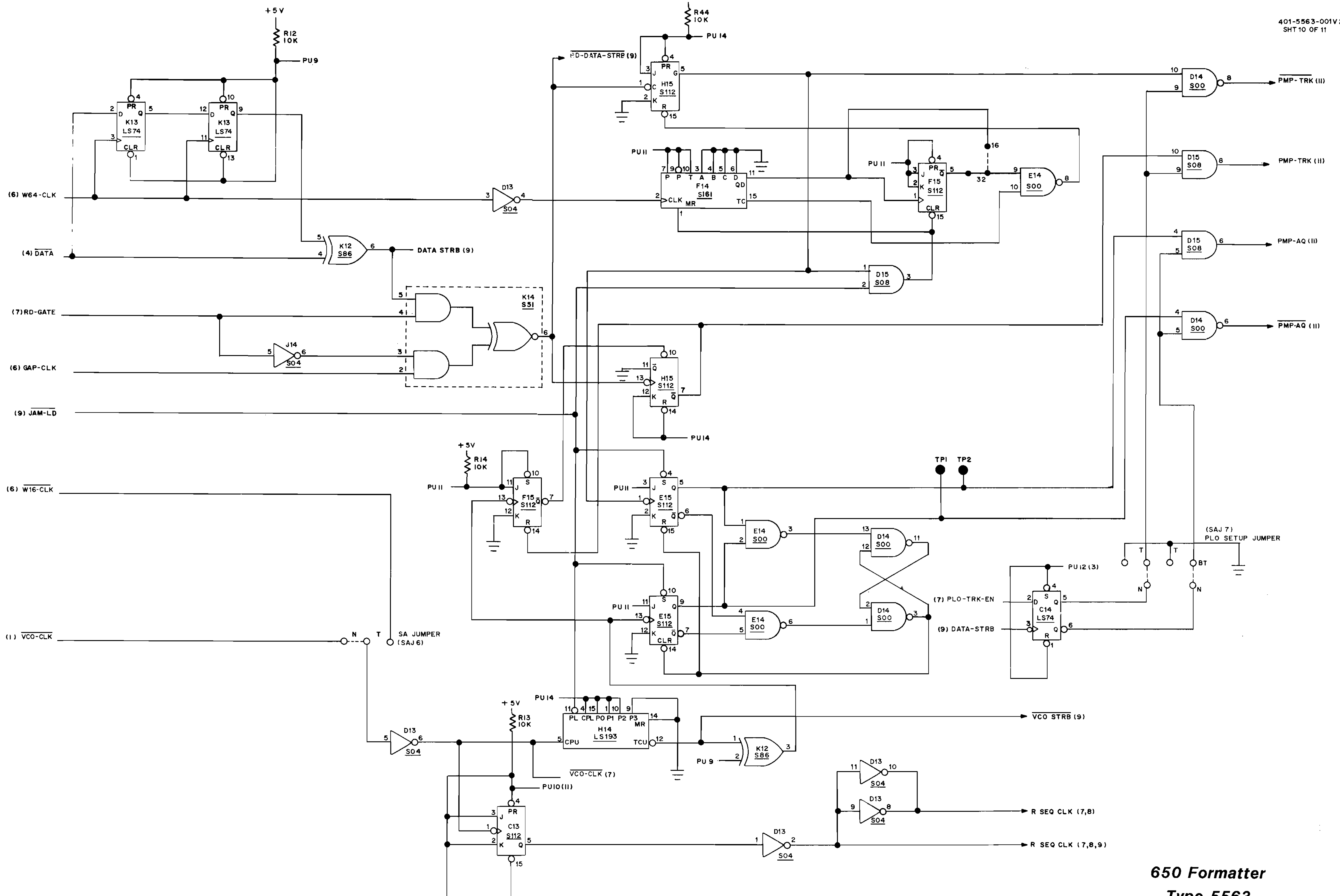
650 Formatter
Type 5563
Schematic Diagram



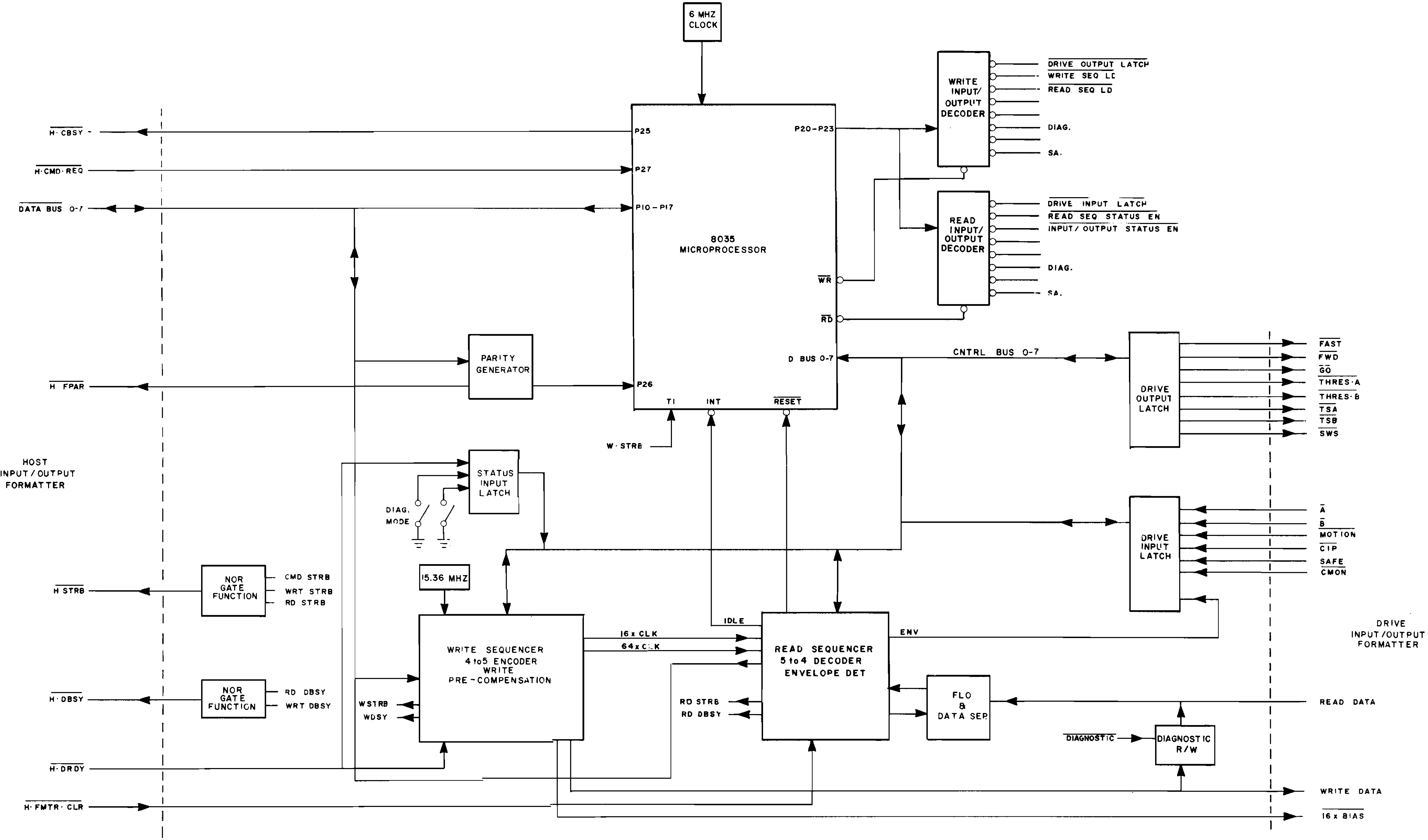
650 Formatter
Type 5563
Schematic Diagram



650 Formatter
Type 5563
Schematic Diagram



650 Formatter
Type 5563
Schematic Diagram



650 Formatter

Type 5563

Schematic Diagram

NOTES:

1. INK STAMP DASH NO. AND LATEST B/M REVISION LETTER.

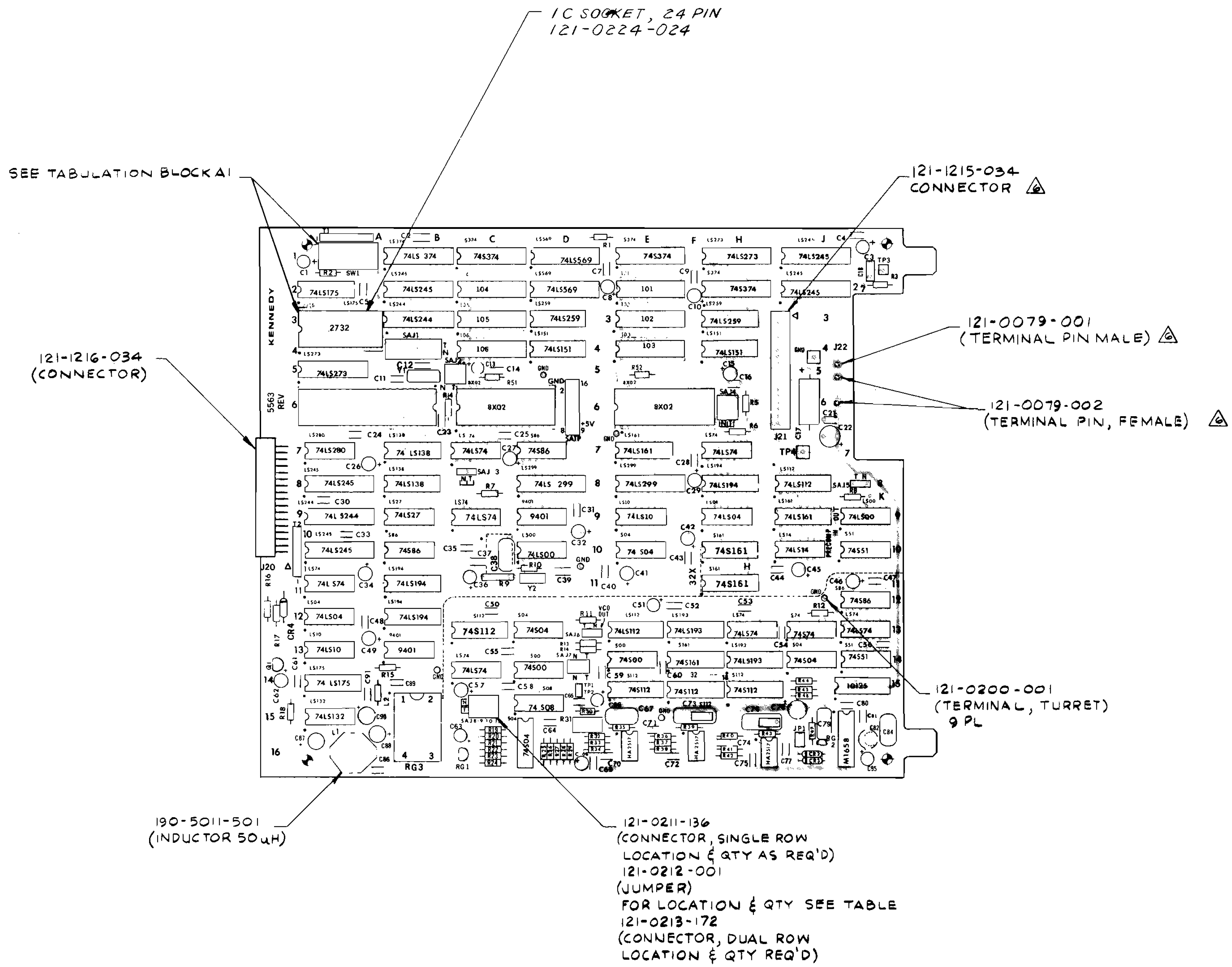
~~[illegible]~~

2. REFERENCE: P.C. BOARD 391-5563-001
   PHOTOMASTER 405-5563-001
   BILL OF MAT'L 190-5563-001
   SCHEMATIC 401-5563-001

⚠5 INSTALL AT TEST LEVEL

⚠6 MOUNT ON FARSIDE

KENNEDY P/N	DESCP.	LOCATION
115-0016-101	100pF	C67, 79
115-0016-150	15pF	C11, 12, 38
115-0016-201	200pF	C84
115-0026-003	0.01	C65, 69
115-0026-005	0.1	C2, 4, 5, 7, 9.
115-0026-005	0.1	C14, 16, 18, 21, 23,
115-0026-005	0.1	C24, 25, 28, 30, 31,
115-0026-005	0.1	C33, 35, 40, 43, 44,
115-0026-005	0.1	C47, 48, 50, 52, 53,
115-0026-005	0.1	C54, 55, 56, 58, 59,
115-0026-005	0.1	C60, 61, 64, 70, 71,
115-0026-005	0.1	C72, 74, 75, 77, 80,
115-0026-005	0.1	C81, 86, 91
115-0026-011	0.15	C89
115-0026-015	22pF	C37, 39
115-0199-106	10 16V	C62
115-0204-002	6.8 16V	C1, 3, 8, 10, 13,
115-0204-002	6.8 16V	C15, 26, 27, 29, 32,
115-0204-002	6.8 16V	C34, 36, 41, 42, 45,
115-0204-002	6.8 16V	C46, 49, 51, 57, 63,
115-0204-002	6.8 16V	C66, 68, 85
115-2516-336	33 16V	C22, 78, 87, 88, 90
115-0278-002	5.5-40pF	C82
115-1510-107	100	C17
115-5040-332	0.0033	C73, 76
118-0002-026	6.00MHz	Y1
118-0002-027	15.36MHz	Y2
118-0006-101	1.00uH	L2
140-0013-001	-12VDC REG	RG3
146-0101-001	PROM 101	E2
146-0102-001	PROM 102	E3
146-0103-002	PROM 103	E4
146-0104-002	PROM 104	C2
146-0105-002	PROM 105	C3
146-0106-003	PROM 106	C4
147-0002-102	1K	R9, 10, 47
147-0002-103	10K	R1, 2, 3, 4, 5,
147-0002-103	10K	R6, 7, 8, 11, 12,
147-0002-103	10K	R13, 14, 15, 18, 29,
147-0002-103	10K	R30, 44
147-0002-104	100K	R17
147-0002-331	330	R16
147-0002-393	39K	R36, 38, 41, 42
147-0002-472	4.7K	R51, 52
147-0002-511	510	R19, 20, 21, 22, 23,
147-0002-511	510	R24, 45, 48
147-0009-274	6.98K	R33, 34
147-0009-290	10.2K	R39, 43
147-0009-298	12.4K	R26, 27, 32
147-0009-307	15.4K	R35
147-0009-319	20.5K	R37, 40
147-0009-354	47.5K	R25, 28
147-0036-103	SIP 10K	T1, 2
147-0037-103	POT 10K	R31
148-0177-001	J176	Q1
148-7500-001	1N914	CR2, 3, 4
149-0045-003	74S51	K10, K14
149-0108-101	74LS194	B11, B12, H8
149-0126-001	74S00	D14, E14
149-0126-002	74LS00	D10, K9
149-0132-001	74LS112	E13, J8
149-0132-002	74S112	C13, E15, F15, H15
149-0136-002	74LS27	B9
149-0138-002	74LS138	B7, B8
149-0151-002	74LS151	D4, H4
149-0154-002	74LS14	J10
149-0161-001	74LS161	E7, J9
149-0170-001	74S74	J13
149-0170-002	74LS74	A11, C7, C9, C14, H7,
149-0170-002	74LS74	H13, K13
149-0175-002	74LS175	A2, A14
149-0176-001	74LS280	A7
149-0178-001	2517	E16, F16, H16
149-0183-001	74S374	C1, E1, H2
149-0183-002	74LS374	B1
149-0186-001	74S86	B10, D7, K12
149-0189-001	74LS259	D3, H3
149-0191-001	74LS244	A9, B3
149-0192-001	74LS245	A8, A10, B2, J1, J2
149-0193-001	74LS193	F13, H14
149-0194-001	74LS299	D8, E8
149-0196-001	74LS569	D1, D2
149-0198-001	8X02	C6, E6
149-0201-001	9401	B13, D9
149-0204-001	74S04	D13, D16, E10, J14
149-0204-002	74LS04	A12, H9
149-0208-001	74S08	D15
149-0210-002	74LS10	A13, E9
149-0261-001	74S161	F14, H10, H11
149-0273-001	74LS273	A5, H1
149-0332-002	74LS132	A15
149-1125-001	MC10125	K15
149-1658-001	MC1658	K16
149-7805-001	78L05	RG1(C16)
149-7905-001	79L05	RG2(J16)
149-8035-001	8035	A6

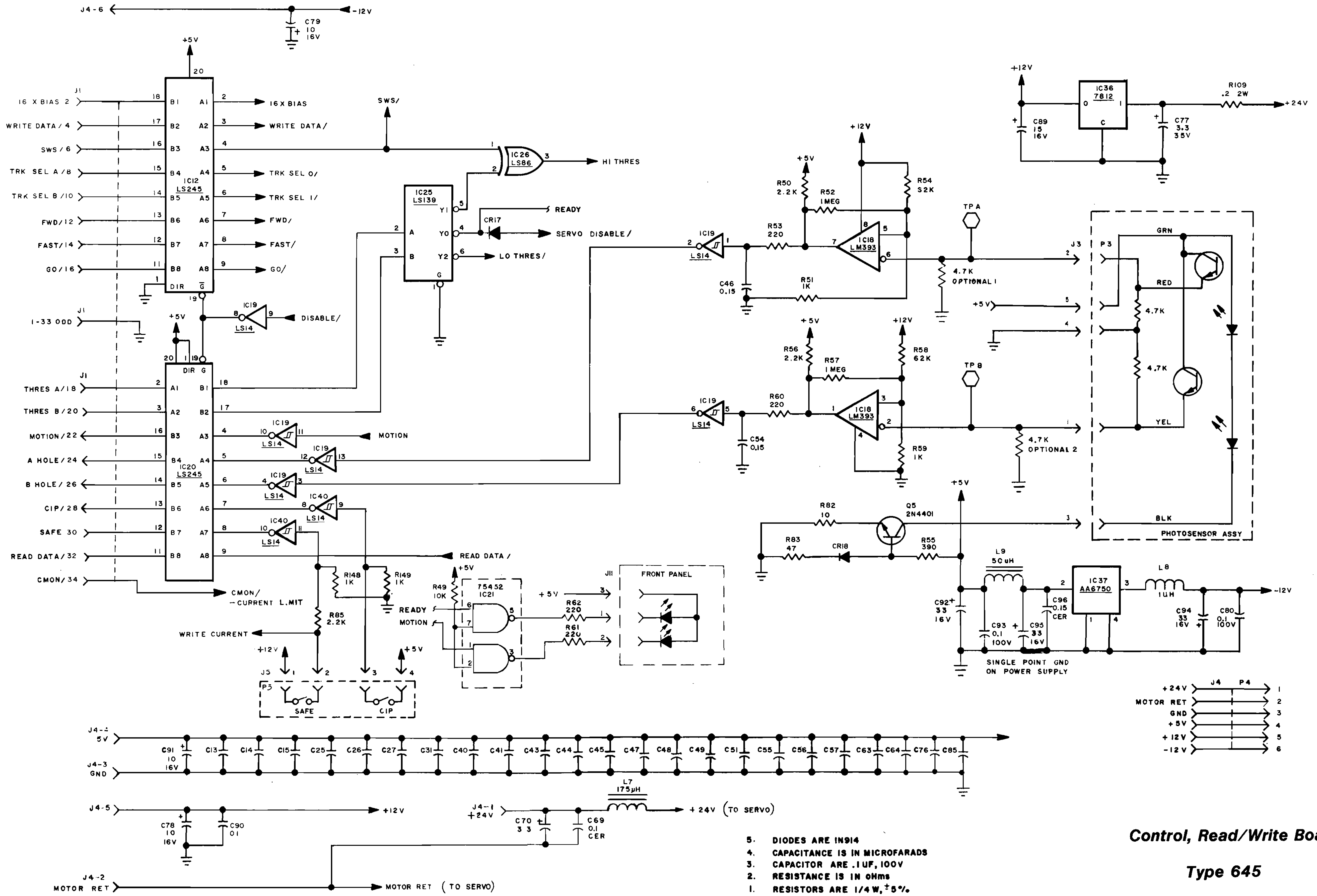


FORMATTER BOARD

JUMPER INSTL. TABLE		
LABEL	LCTN	QTY
SAJ1	B4	8
SAJ2	C5	3
SAJ3	C8	1
SAJ4	H6	3
SAJ5	K8	1
SAJ6	D13	1
SAJ7	D14	2
SAJ8	C15	1
SAJ9	C15	1
SAJ10	C15	1
SAJ11	C15	1
JP1	J16	1

TYPICAL SA JUMPER INSTL

N = NORMAL
T = TEST

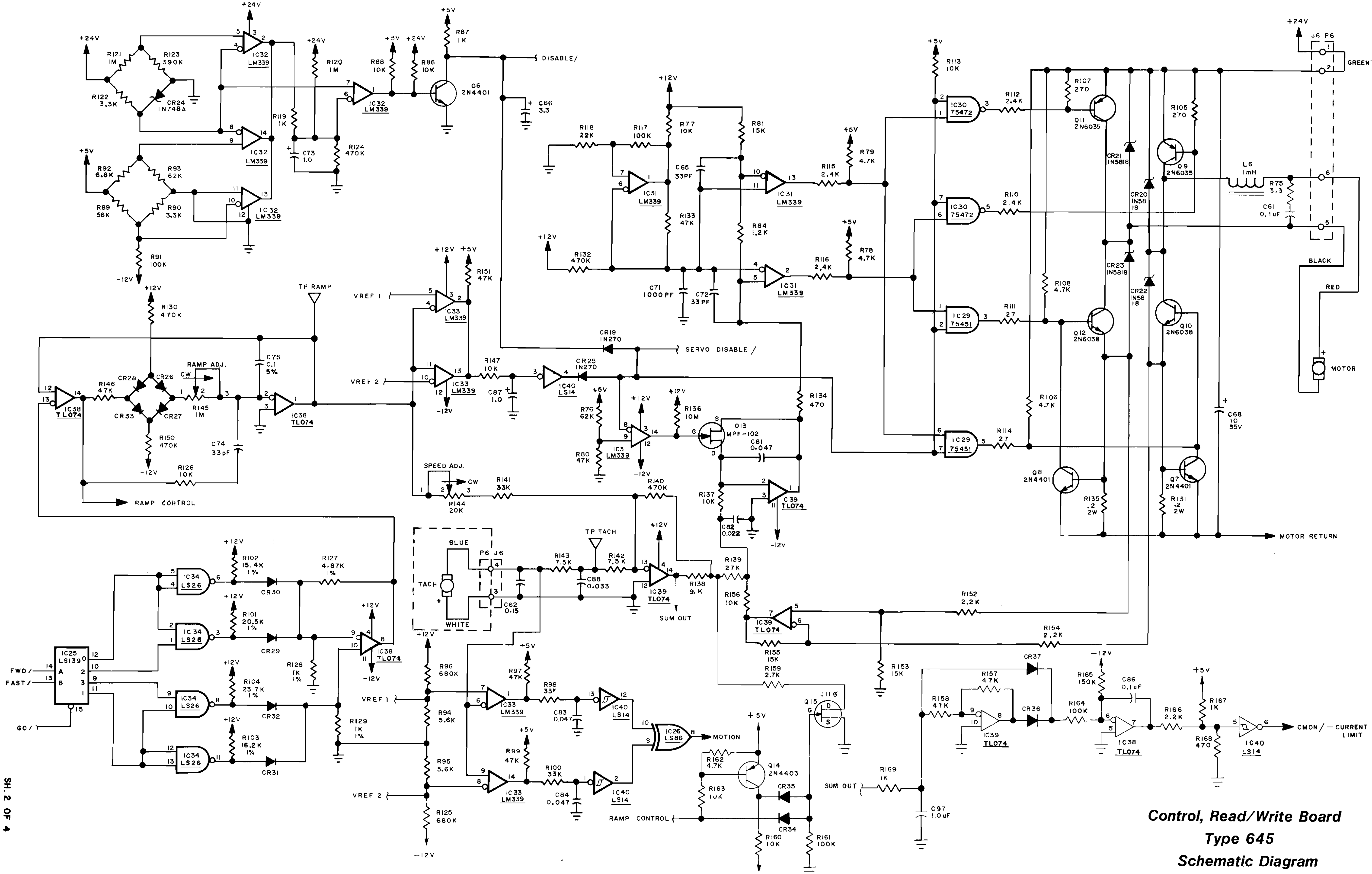


NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTORS ARE 1/4W, ±5%.
2. RESISTANCE IS IN OHMS
3. CAPACITOR ARE .1UF, 100V
4. CAPACITANCE IS IN MICROFARADS
5. DIODES ARE IN914

Control, Read/Write Board

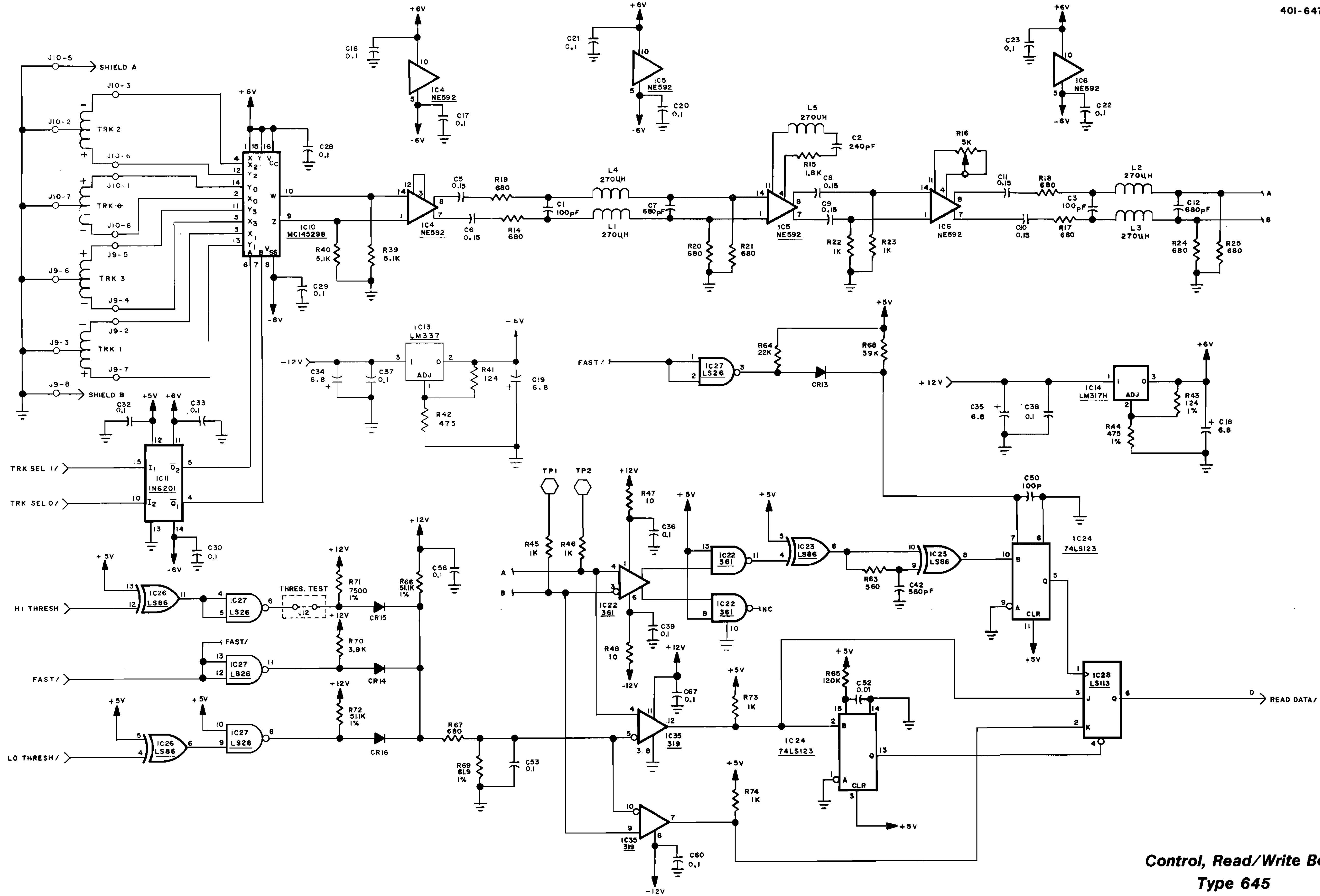
Type 645

Schematic Diagram



Control, Read/Write Board
Type 645
Schematic Diagram

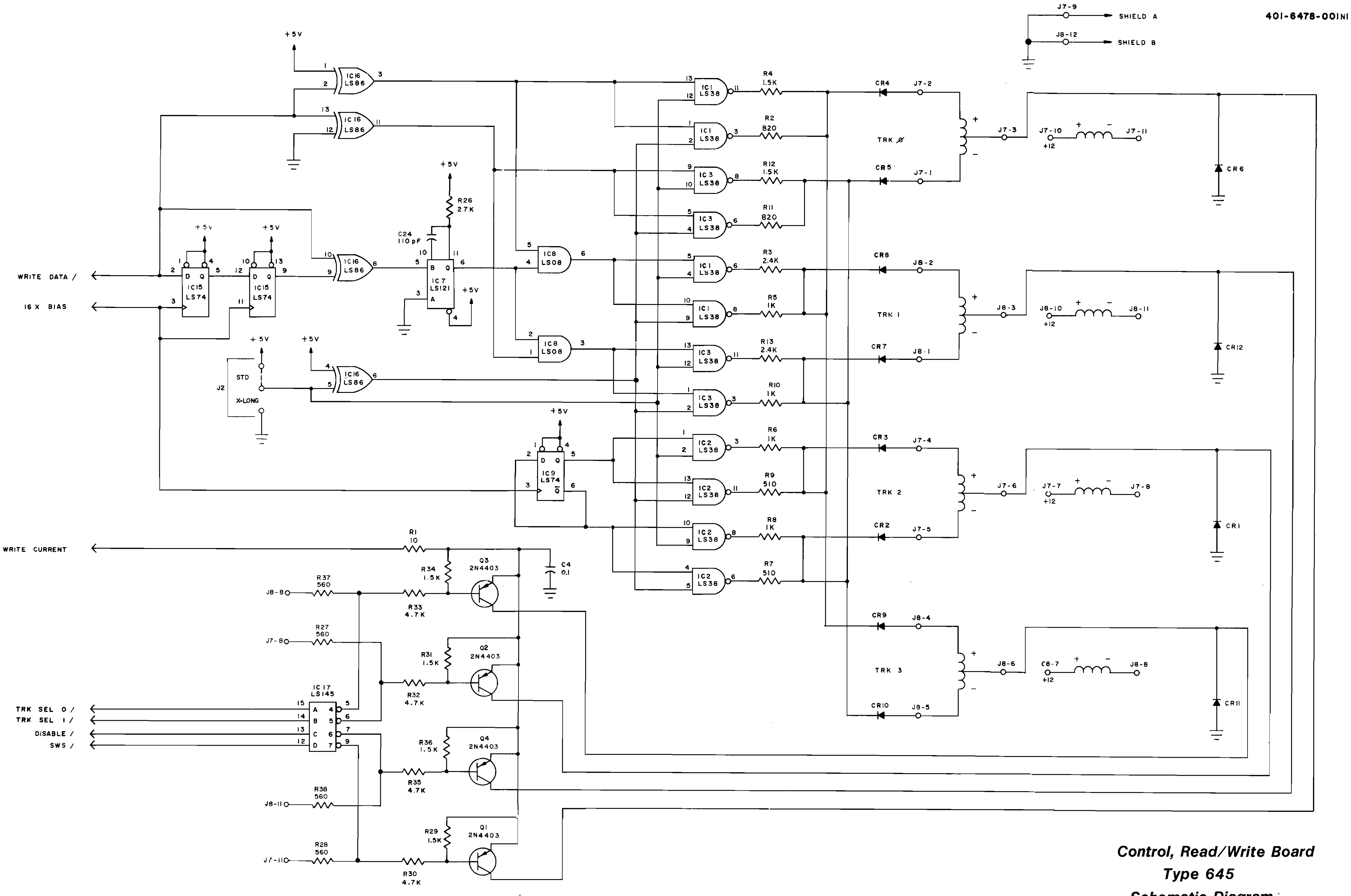
401-6478-001NI



Control, Read/Write Board
Type 645
Schematic Diagram

SH. 3 OF 4

401-6478-00INI



SH. 4 OF 4

Control, Read/Write Board
Type 645
Schematic Diagram