MODEL

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HEWLETT-PACKARD 9862A CALCULATOR PLOTTER

SERVICE MANUAL

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MANUAL CHANGES

MANUAL TITLE: 9862A CALCULATOR PLOTTER SERVICE MANUAL
MANUAL PRINTED: January 1972
MANUAL PART NO. 09862-90011
CHANGE DATE: SEPTEMBER 28, 1976

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual. To use this supplement:

Make all ERRATA corrections.

Make all appropriate serial number related changes indicated in the tables below.

▲ Indicates new item.

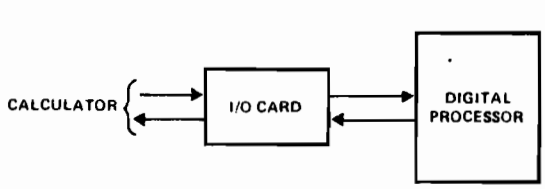
SERIAL PREFIX	MAKE CHANGE
1504	I
1540	I, II
1620	I, II, III
▲ 1641	I thru IV

SERIAL PREFIX	MAKE CHANGE

SERIAL PREFIX	MAKE CHANGE

ERRATA

Page 2-1, Figure 2, I/O card/Digital Processor, should appear as:



Page 3-2, Cleaning, delete paragraph 4, including steps A through F. Replace with the following:

4. Autogrip Table should be cleaned as follows:

   A. Remove pen and paper from the recorder.

   B. Select a clean soft cloth that will not scratch the Autogrip surface.

   C. Dampen the cloth with warm water and apply cleanser, HP Part Number 9310-0515. (A commercial cleanser like Comet or Ajax may be used.)

   D. Wipe the table surface until the Autogrip table is clean. Rinse out the cloth and wipe any remaining cleanser from the table.

CAUTION

NEVER LET WATER STAND ON THE AUTOGRIP SURFACE, OR ENTER THE ELECTRICAL HARDWARE AREA OF THE RECORDER.

   E. Wipe any moisture from the Autogrip surface.

   F. Allow the table to dry before recording.

WARNING

SCRATCHES OR PUNCTURES IN THE TABLE SURFACE MAY EXPOSE HIGH VOLTAGE CONDUCTORS. INSTRUMENTS DAMAGED IN THIS MANNER SHOULD NOT BE OPERATED.

Page 3-3, first paragraph, delete last five lines. Substitute the following:

moved. Do not lubricate the X or Y slidewire (potentiometer). For access to the slidewire, see General Disassembly.

Page 4-2. Table 6, Accessory Kit, delete slidewire lubricant, part number 5080-3935. Add new line after 1 Amp fuse as follows:

Fuse, 2 Amp (115V only)	2110-0303	1

Page 4-5, Figure 31. Change the HP Part Number for Item 5 from 09125-20010 to 09125-20100.

Page 4-7, Figure 32 (Sheet 2 of 2). Make the following changes:

1. Change the HP Part Number of Item 2 from 5060-6427 to 5060-6649.
2. Change the HP Part Number of Item 5 from 3030-0412 to 3030-0142.
3. Change the HP Part Number of Item 14 from 3050-0394 to 2190-0378, and the description from "No. 4" to "No. 5".
4. Change the HP Part Number of Item 35 from 1400-0340 to 1400-0304.
5. Delete the HP Part Number of Item 52 and change the description to "Not Used".
6. Below Item 69, add the following:

Not Shown	09125-20010	Slidewire, Y-Axis	1

Page C-3, Appendix C, add new steps 194 through 197 to read:

Step	Key
194	9
195	1
196	0
197	0

Old Step 194 is re-numbered to 198 and subsequent steps to 234, C4 are also changed to reflect the addition of the new steps: i.e.,

Step	Key
194 to 198	X⟶( )
195 to 199	3
196 to 200	↑
233 to 237	0
234 to 238	X⟶( )

Page C-4, Appendix C, change the following keys:

Step	Key
232 (Old 228)	↓
243 (Old 239)	1
244 (Old 240)	2

Page D-2, Mnemonics Glossary, SW is Chart Holding Disabling Switch.

Page F-12, Figure 46, Servo Board, Delete C7 and C25.

Page F13, Figure 47, Schematic, delete C7 and C25; change value of C8 and C26 to 30pF.

Page F26, Table 7, delete A6C7 and A6C25 and all data; change:

A6C8 A6C26	0160-2199	C:Fxd Mica 30pF 5% 300 VDCW	28480	0160-2199

Page F-26, Table 7. Make the following changes:

1. Change A6C5 data to read as follows:

A6C5	0160-4320	2	C:Fxd MET 0.47μF 10% 200 VDCW	28480	0160-4320

2. Add Quantity 2 to A6C13.

3. Change A6C23 data to read as follows:

A6C23	0160-4320	C:Fxd MET 0.47μF 10% 200 VDCW	28480	0160-4320

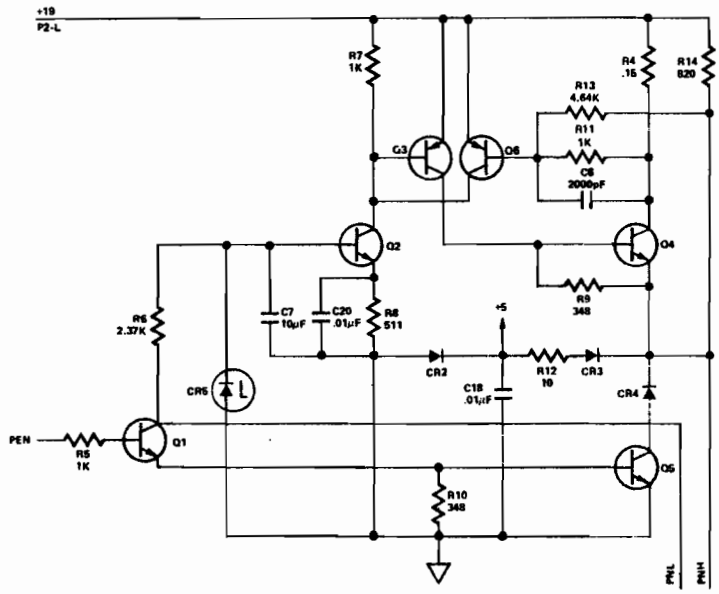
Page F-33, Table 7, add:

T1	09862-60180	Power Transformer Assy	28480	09862-60180

(SERIAL NUMBER 940-1060)

Page F-7, Figure 41, Control Flop Schematic, change value of C20 to 0.1μF.

Page F-7, Figure 41, Control Flop Schematic, change the following portion:



Page F-17, Figure 51, Rectifier Schematic, change F6 and F7 to .375A NB.

Page F-24, Table 7, change A3C20 to:

A3C20	0150-0121	C:Fxd Cer 0.1μF +80 -20% 50 VDCW	56289	5C50BIS-CML

Page F-31, Table 7, Change A8F6 and A8F7 to:

A8F6 A8F7	2110-0065	2	FUSE: CARTRIDGE, .375 amp, 250V	75915	312.375

(SERIAL NUMBER 1061-1180)

Page 4-3, Table 6, Circuit Board Assemblies subheading, add:

Support Assembly – Circuit Board	09862-60444
Support Assembly – Circuit Board	09862-60443

(SERIAL NUMBER 1181)

Page F-32, Table 7, Appendix F, change the following:

A15C1 A15C2 A15C3 A15C4	0160-3943	4	C:Fxd 1000pF 125 WVAC	28480	0160-3943
A15L1 A15L2	9100-3390	2	Coil	28480	9100-3390

CHANGE I

This change is designed to improve the reliability of the pen lift.

Page 4-7, Figure 32 (Sheet 2 of 2). Change the data for Items 32, 33, 37 and 69 to read as follows:

32 33 37	Not available separately. See Item 69		
69	09862-60450	Solenoid Assy – Pen Lift. (Includes Items 32, 33, & 37)	1

CHANGE II

This change is designed to increase the serviceability of the Plotter.

Page 4-7, Figure 32 (Sheet 2 of 2). Change Items 6, 7, 9 and 10 to read as follows:

6	0520-0164	Screw – Mach, 2-56 x .25, FL HD	2
7	09862-40060	Carriage Block – Pen	1
9	07200-60505	Wiper Plate Assy (Includes Limit Wiper)	1
10		Not Used	

CHANGE III

Page 4-3, Table 6, Circuit Board Assemblies, change part number from 09862-60110 to 09862-61110.

Page F-20, add new Figures 53A and 53B as shown.

Page F-32, Table 7, A11, delete Not Assigned and add parts as follows:

A11	09862-61110	1	Chart Hold Supply Board	28480	09862-61110
A11C1	0150-0119	2	Capacitor, .01 μF, 250V (Dual)	28480	0150-0119
A11C2	0150-0119		Capacitor, .01 μF, 250V (Dual)	28480	0150-0119
A11CR1	1901-0470	4	Diode, 1000 Piv	28480	1901-0470
A11CR2	1901-0470		Diode, 1000 Piv	28480	1901-0470
A11CR3	1901-0470		Diode, 1000 Piv	28480	1901-0470
A11CR4	1901-0470		Diode, 1000 Piv	28480	1901-0470
A11R1	0698-3945	1	Resistor, 390K 5% .5W	28480	0698-3945
A11R2	0698-8754	2	Resistor, 10 Meg 1%	28480	0698-8754
A11R3	0698-8754		Resistor, 10 Meg 1%	28480	0698-8754
A11Z	0360-1514	6	Square Pins	28480	0360-1514

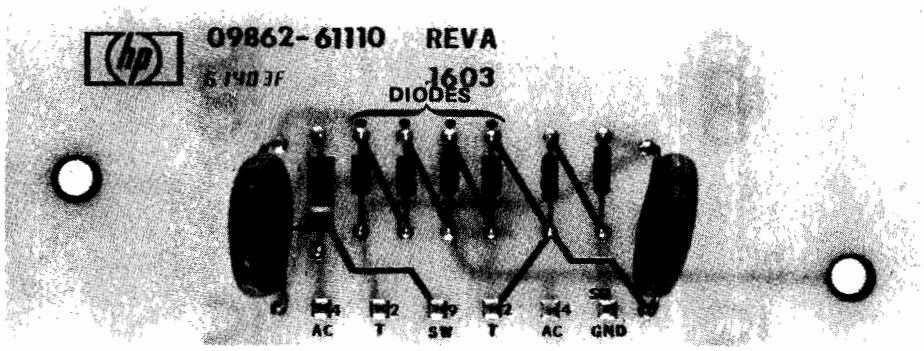


Figure 53A. Chart Hold Supply Board

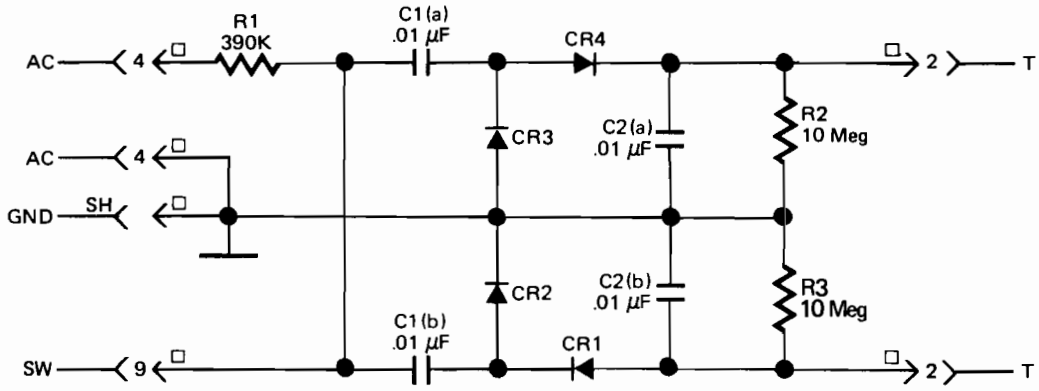


Figure 53B. Chart Hold Supply Schematic

▲CHANGE IV

Two resistors were added to limit short circuit output current.

Page F-20, Figures 53A and 53B, change to show the following.

Page 5-32, Table 7, A11, after A11R3, add resistors R4 and R5 as follows:

A11R4	0698-3453	2	Resistor, 196K, ±1%, .125W	Hewlett-Packard
A11R5	0698-3453		Resistor, 196K, ±1%, .125W	Hewlett-Packard

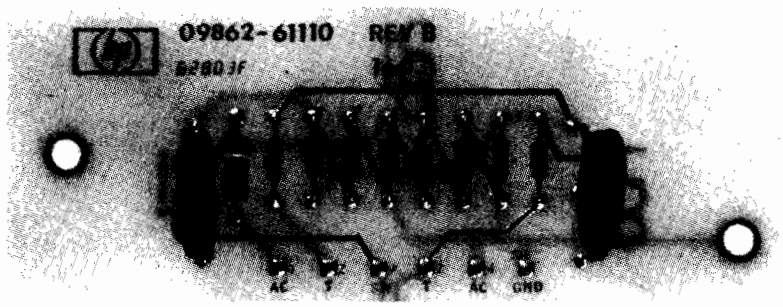


Figure 53A. Chart Hold Supply Board

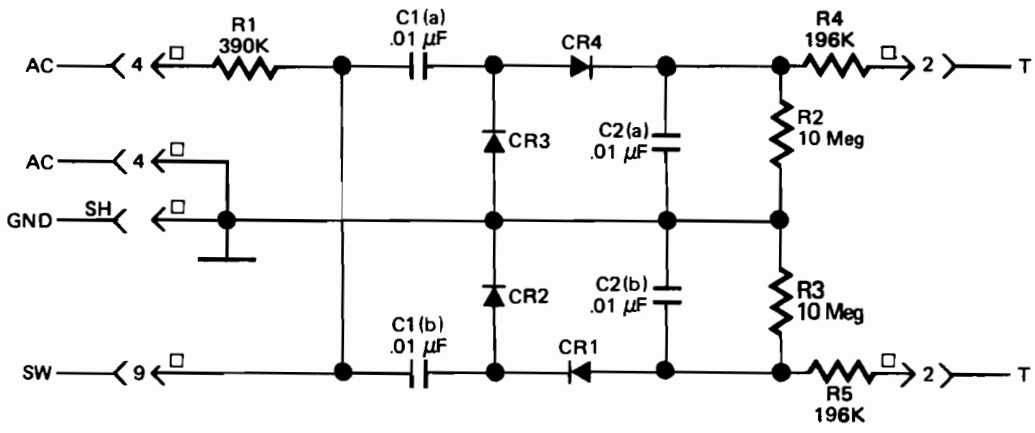


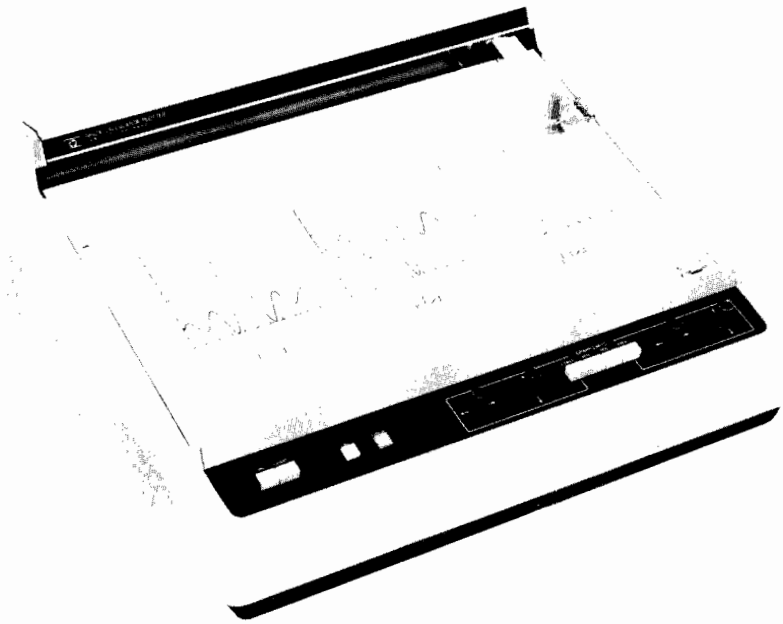
Figure 53B. Chart Hold Supply Schematic

SERVICE MANUAL

SERIAL PREFIX: 1128

This Service Manual applies to HP Model 9862A Calculator Plotters having Serial Prefix 1128.

HEWLETT-PACKARD 9862A



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INTRODUCTION

The Model 9862A Calculator Plotter is an X–Y Plotter intended for use only with the HP Model 9810A Calculator. All Plotter operation in this manual refers to the combination of the Calculator and Plotter.

SCOPE OF THE MANUAL

This manual provides the information necessary to provide on-site service on the 9862A Calculator Plotter. This manual assumes that the Field Service Engineer has read the 9862A Operating Manual and is thoroughly familiar with normal 9862A operation. This knowledge is necessary to decide whether a problem is caused by a hardware failure or is a pseudo hardware problem.

SERVICE CONCEPT

The 9862A Calculator Plotter is field maintained through the HP Red Stripe Exchange Program. The Red Stripe (rebuilt exchange) Program offers the customer and the HP customer service organization the ability to replace defective assemblies with rebuilt assemblies at minimal cost and minimum time. An initial set of exchange assemblies are provided in the 9862A Service Kit (Model 17129A).

MODEL–MANUAL INFORMATION

This Manual is applicable to the Model 9862A with a serial prefix of 1128. This serial prefix is the first four digits of a two-part, nine-digit serial number (0000A00000) used to identify each HP instrument (see Figure 1). The letter separating the prefix from the suffix identifies the country of origin.

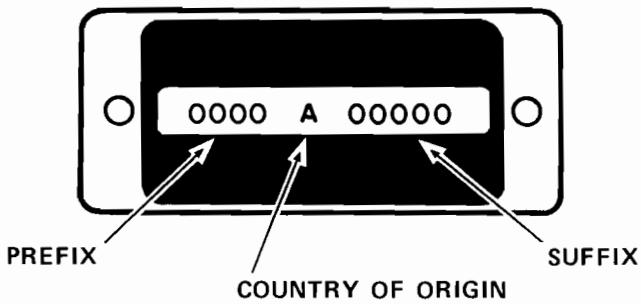


Figure 1. Instrument Identification

MANUAL CHANGE

Should any change in this manual be necessary, a new serial prefix will be assigned to the changed model and a change sheet will be supplied defining the difference between the changed model and the one described within this manual. Other corrections, due to any errors that existed when this manual was printed, will be provided. These changes are called Errata and will appear only on the change sheet (Manual Change). For additional information pertaining to this manual, or other HP instruments, contact the nearest Hewlett-Packard Sales/Service Office listed in the back of this manual.

MANUAL CONTENT

This manual contains sections covering theory of operation, maintenance, and troubleshooting. Sufficient information is provided so that all required mechanical maintenance and troubleshooting can be performed. Electrical maintenance and troubleshooting, however, is covered only on a circuit board or module level.

THEORY OF OPERATION

Each pen position within the graph limits is uniquely defined by a positive integer between 0 and 9999. The operation of the Plotter is controlled by the 9810A Calculator. The Calculator defines coordinate points within the graph limits as well as the pen UP/DOWN status. The Plotter produces a graph comprised of straight line segments between the points defined by the Calculator. The graph size is continuously variable from 0 in. x 0 in. to 10 in. x 15 in. (25 cm x 38 cm).

OPERATIONAL CHARACTERISTICS

POSITIONING TECHNIQUE

The pen X and Y position is controlled by an analog servo loop. The input to the servo is from a set of digital to analog converters (DAC) which are controlled by a digital processor (Figure 2). The processor enables the recorder to draw straight lines between any two points. Calculations are performed by the processor to determine which combination of small X and Y increments (a step out of DAC's) would best correspond with the path of the desired straight line. As the straight line is generated using digital techniques, it is possible to draw any length straight line on the plotting surface. Due to this combination of digital accuracy and analog continuity, all line segments are smooth straight lines independent of their angle.

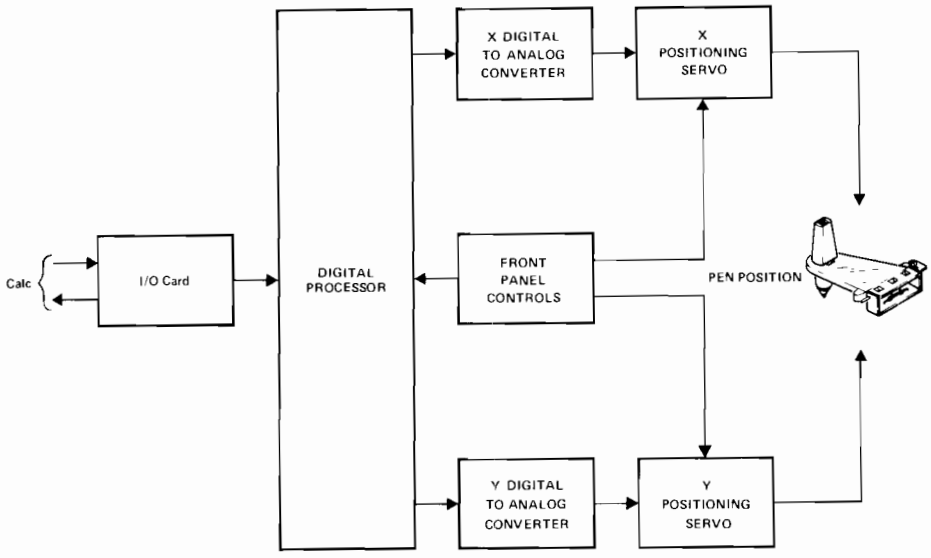


Figure 2. Block Diagram, Model 9862A

THEORY OF OPERATION

PROFILING

A high overall plotting speed is maintained through careful control of pen position, velocity and acceleration. The acceleration characteristic is independent of the move length. As seen in Figure 3, the slewing velocity (10 in./sec) is attained in minimal time, which is approaching the ideal conditions. It is seen in Figure 3 that for the moves which take less than .02 second (.01 second to accelerate and .01 second to decelerate), slewing velocity is not reached. However, the acceleration is the same as that for the 15 in. long move. Hence, by profiling the acceleration and velocity, a high overall plotting speed is realized. A .04 second time delay is added at the end of every position maneuver to allow the servo loop to settle.

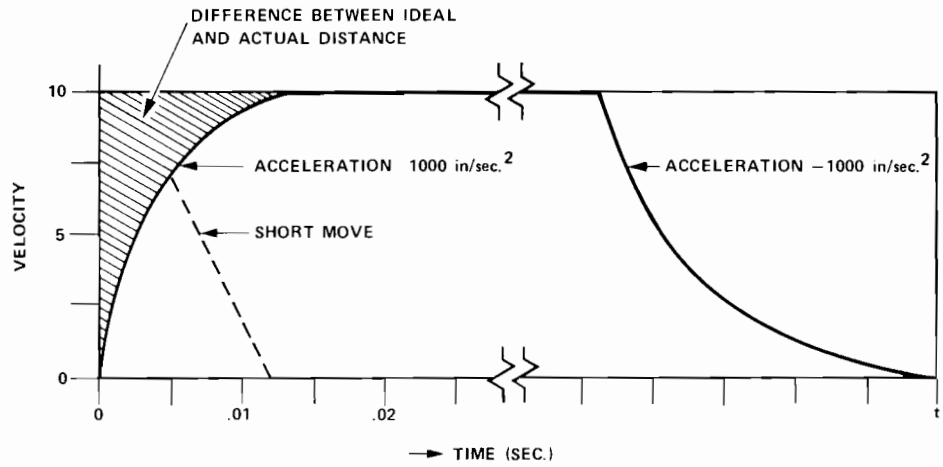


Figure 3. Performance Profile

DIGITAL CAPABILITIES

The pen maneuvers (lift or lower) are given with the position maneuvers. Both are controlled through Command Lines to the Plotter processor. Command lines are discussed on page 2-7.

INPUT DATA RANGE

The 9862A is a first quadrant plotter. Locations on the platen correspond to positive integer values from 0 to 9999. The information input from the Calculator must have the same magnitude range.

NUMERICAL CODE

The numerical position information is accepted in BCD 8421 code.

POSITION MODE

Position maneuvers are performed in what is called an Absolute Mode. This mode proceeds exactly as hand-generated graphs are constructed on a Cartesian coordinate system. The plotting surface may be represented as shown in Figure 4.

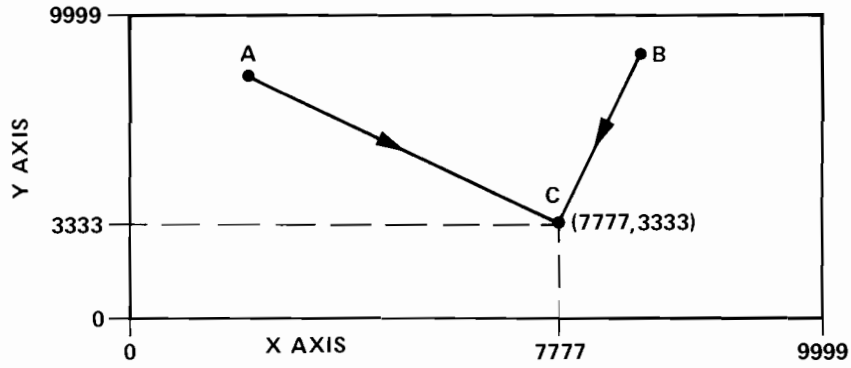


Figure 4. Absolute Mode

The length of each X and Y axis is divided into 10,000 equally spaced points. Each point corresponds to integer values from 0 to 9999 as shown. Points within the plotting surface are described by ordered pairs of these X and Y values.

If the pen is commanded to proceed to Point C (at 7777, 3333) from Point A or B, the results are as shown.

ERROR SEQUENCE

This sequence is a subroutine performed by the Plotter to indicate it has received some form of improper excitation. The possible errors that would force the Plotter to resort to this sequence are:

1. Oversized input. This condition may occur when a number greater in magnitude than 9999 is input to the Plotter.

2. Incorrect formatting of input. As described on page 2-5, information input to the Plotter is transmitted in four passes of a particular bit size. The Plotter uses a command line to determine which of the four passes it is receiving. If the Plotter finds this input passing out of sequence, it calls upon the error sequence.

   Upon detection of these conditions, the Plotter resorts to an Error Sequence, described as follows:

   A. Remain at the last properly described position.

   B. Lift the pen.

   C. Indicate error on the Format status line and front panel indicator.

   D. Monitor the input lines for the next position input which contains no errors. Perform this maneuver.

ERROR SEQUENCE (continued)

E. Indicate correct on the Format status line.

F. Perform a pen maneuver to conform with the last specified pen command.

G. Continue normal operation.

OVERSCALE SEQUENCE

This sequence is called upon when the numerical position is correct (within the range 0 to 9999), but the plotting surface has been located (through the front panel Lower Left and Upper Right controls) such that the pen position falls off the platen. Numerical information is not in error so the Error Sequence is not called upon; however, it is advantageous to avoid the problems of servo overload, erroneous lines along the margins, and wasted time plotting offscale.

Upon encountering the edge of the platen, a limit switch is activated causing the following sequence:

1. Lift the pen.
2. Place the positioning servos in a low performance condition (clamped condition with 2.5 V maximum on motor) to prevent damage.
3. Indicate set on the clamp status line and front panel error indicator.
4. Continue to perform position maneuvers with pen up, but with a low performance servo. At the end of each maneuver, detect if the pen has come on-scale away from the edge of the platen.

When the pen is moving to a point away from the edge of the platen:

1. Allow additional settling time for pen to assume proper end point with positioning servo in a medium performance condition (clamped condition with 6 V maximum on motor).
2. Replace the positioning servos in a high performance condition (clear the clamp).
3. Indicate "clear" on the clamp status line.
4. Perform a pen maneuver to conform with the last specified pen command.
5. Resume normal operation after 1.3 second total delay.

> **NOTE**
>
> To allow for sufficient settling time after completing either error or overscale sequence, a 1.3 second pause occurs prior to responding to the next input.

INPUT INFORMATION SPECIFICATIONS

The Plotter performs two basic maneuvers: pen maneuvers and position maneuvers. Control of the maneuvers is accomplished by the following Processor Control Lines:

2 Transfer Lines	Transfer Information (Input)
7 Command Lines	Command Information (Input)
8 Data Lines	Data Information (Input)
2 Status Lines	Status Information (Output)

These control lines are all received in negative logic form (+5 volts — logical 0 = False).

TRANSFER LINES

The Transfer Lines are called FLAG and CONTROL. The Calculator and the Plotter use these lines to continuously communicate the status of information being transferred and processed between them. No input line can pass its information to the Plotter without the proper use of the transfer lines. The meaning and use of these lines is defined below in true logic terms:

FLAG — A transfer line, originating at the Plotter, which informs the Calculator when the Plotter has completed all previous instructions and is Ready for more information or is Busy completing previous instructions.

CONTROL — A transfer line, originating at the Calculator, which informs the Plotter when the remaining input lines are settled out and contain valid information. The logical significance of this line at any given time is a function of the FLAG status.

TRANSFER CYCLE

The transfer cycle, Figure 5, has the following stages:

Stage A

The Calculator (seeing the Plotter is ready) places new command and data information on the Calculator Control lines which arrives in some form on the Processor Control lines. When the information is settled and valid, Stage A is completed by placing CONTROL in a "read" condition. This signals the Plotter that information is propagating down the input lines. Total time in Stage A is T_a.

Stage B

After some time, T_b (comprised of propagation delays and plotter logic cycle times) the FLAG responds, transiting to a "Busy" condition. The Calculator then places CONTROL in a "Wait" condition some time T_c after FLAG goes "Busy." After some propagation time T_d the Plotter recognizes CONTROL is in the "Wait" condition, completing Stage B. Since information has propagated over the transfer lines three times, the other Processor Control lines are stable and ready to be read in Stage C.

TRANSFER CYCLE (continued)

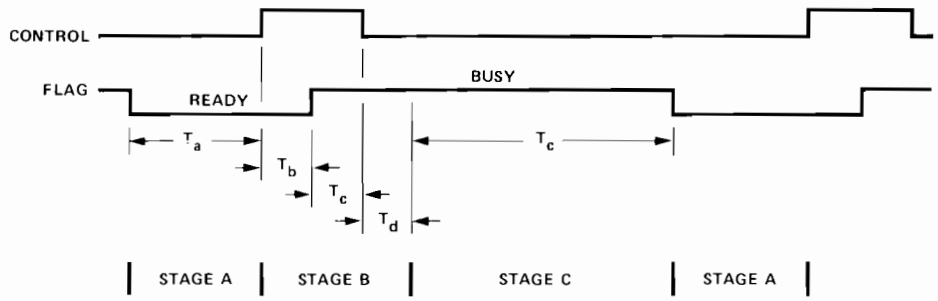


Figure 5. Transfer Cycle

Stage C

The Plotter scans the input lines and performs the prescribed task. After some total time T_e, the task is complete and the FLAG is placed in a "ready" condition. This initiates another Stage A.

The actual time specifications are shown in Table 1.

Table 1. Transfer Cycle Times

Time Period	Minimum	Nominal	Maximum
T_a	0	–	Unlimited
T_b	19 us	–	46 us
T_c	0	–	Unlimited
T_d	13 us	14.5 us	16 us
T_e	1 ms	–	3 sec

COMMAND LINES

The command lines control the transfer through the following:

1. SYC – Synchronize (Trailing/Lead = Ø/1)

   Function — Synchronize the first pass of information transmitted on the Processor Control lines with the information received as the first pass by the Plotter.

   True — Accompanying information on input lines is either the leading or first pass of a pen or position maneuver transmission.

   False — Accompanying information on input lines is a trailing pass (second, third, or fourth pass) of position maneuver information.

2. MVR – Maneuver (Position/Pen = Ø/1)

   Function — Specify which type of maneuver is to be performed, pen or position. This allows proper interpretation of the accompanying and following data.

   True — Pen Maneuver.

   False — Position Maneuver.

3. PNC – Pen Command (Up/Down = Ø/1)

   Function — Specify the pen status when the maneuver (MVR) is pen.

   True — Pen Down.

   False — Pen Up.

   PNC information is monitored in the first pass of a pen maneuver. If this line becomes open, PNC will indicate pen "Up."

4. CDE – Code (Not Connected)

5. MDE – Mode (Not Connected)

6. DXS – Delta X Sign (Not Connected)

7. DYS – Delta Y Sign (Not Connected)

When the Plotter recognizes its read cycle is out of phase with the incoming information (not the same pass), it will resort to the Error Sequence. Through monitoring the SYC line, the Plotter determines when the next correct transmission of a pen or position maneuver is to begin; hence, only one data point would be lost if the Plotter and Calculator should drop out of phase.

STATUS LINES

Two status lines, ready and pen, are monitored by the Calculator. All information transmitted on the status lines is in negative logic form (+5 volts = Logical 0 = False).

1. RDY – Ready (Not Ready/Ready = Ø/1)

   Function — Indicate to the Calculator when the power in Plotter is on and it is ready to run.

   True — Ready.

   False — Not Ready.

   If the Plotter is not plugged in, or not turned on, RDY will indicate "Not Ready."

2. PEN – Pen (Up/Down = Ø/1)

   Function — Indicate instantaneous pen status.

   True — Pen Down.

   False — Pen Up.

INTERFACE

An internal board interfaces the Calculator to the Plotter. Figure 6 defines the rear panel connector pin assignments as well as the information in each pass. An asterisk (*) in a bit position indicates it is not monitored and is then a "don't care" condition.

Pass No.	REAR PANEL CONNECTOR PIN NUMBER														
	8	7, 9	10	11	12	13	14	16	17	18	19	20	21	22	P
1	Prot GND	Sig Com	Con-trol	Flag	SYC	MVR	PNC	X_{15}	X_{14}	X_{13}	X_{12}	X_{11}	X_{10}	X_9	X_8
2								X_7	X_6	X_5	X_4	X_3	X_2	X_1	X_0
3								Y_{15}	Y_{14}	Y_{13}	Y_{12}	Y_{11}	Y_{10}	Y_9	Y_8
4								Y_7	Y_6	Y_5	Y_4	Y_3	Y_2	Y_1	Y_0

Information available to Calculator: Ready (Pin R), Standby (Pin S), Clamp (Pin T), Pen (Pin U), Format (Pin V), +5V (Pin W).
All information at the rear connector is negative logic (+5 = Logical Ø = False).
*Indicates bit will not be monitored (Don't Care Condition).

Figure 6. Information Scan Sequence

MAINTENANCE, PERFORMANCE CHECKS, AND ADJUSTMENTS

> NOTE
>
> Because of multiple references to illustrations, all illustrations for this chapter are contained on fold-outs in Appendix A.

This chapter provides information for maintenance, performance testing, functional checks, and adjustment of the 9862A Calculator Plotter. Maintenance procedures, tests and adjustments will ensure that the instrument conforms to specifications. Functional checks maintain the instrument in an operational condition. If the instrument fails to meet specifications, or is inoperable, refer to the Troubleshooting Chapter on page 5-1.

PREVENTIVE MAINTENANCE

The Model 9862A Calculator Plotter must be maintained properly to obtain accurate, trouble-free operation. This requires periodic lubrication, performance checks, and visual and electrical checks. In accordance with good maintenance procedures for all precision measuring instruments, Hewlett-Packard recorders should be protected from dust. Use furnished dust cover P/N 4040-0477, when not in use.

ENVIRONMENTAL OPERATION

This instrument is designed to operate over an ambient temperature range of 5° C to 55° C. Operation under other conditions will produce inaccurate results and may cause damage to the Plotter. In areas with high humidity, graph paper may become distorted, affecting the accuracy of the grid lines. The area of operation should also be as free as possible of air contamination (soot, smoke, fumes, etc.). Excessive air contamination will require more frequent cleaning.

CLEANING

Thorough cleaning should be performed periodically. Intervals are determined by type of operation, local air contamination, and climatic conditions. Generally, under normal use and conditions, cleaning intervals should be nine to twelve months. Cleaning routine should include the following:

1. Remove platen and raise hinged top casting. The top casting may be raised after removing the two screws located under bottom front lip of Plotter. The platen may be removed as follows:

   A. Raise hinged top casting as outlined above.

   B. Remove Autogrip leads shown in Figure 7.

   C. Remove four No. 8-32 and two No. 6-32 mounting screws holding platen.

   D. Place carriage arm at far right of travel.

CLEANING (continued)

E. Pull up on upper left hand corner of platen and slide platen out to left.

Be sure to replug Autogrip leads when replacing platen.

2. In inaccessible areas and where there is only dust accumulation, cleaning can be accomplished with an air gun. In more accessible areas and where the air gun will not remove dirt, dust, or ink, accumulations should be removed with a sponge or cloth moistened in plain soap and warm water, then wiped dry.

3. Every eighteen to twenty-four months, gears should be cleaned thoroughly with a solvent and re-lubricated (recommended lubricant, HP part number 6040-0272). Do not use soap or water on these components.

4. Platen should be cleaned as follows:

   A. Carefully select a soap for cleaning. A mild liquid soap is preferable. Do not use any product with abrasives or corrosive chemicals; do not use solvents or silicone-based cleaners of any type.

   B. Also be careful in selecting a cleaning cloth. Use a soft cloth that will not scratch the surface but will readily absorb water.

   C. Saturate the cloth in warm, soapy water. Wring the cloth until the majority of the water has been removed.

   D. Wipe the table surface with this damp cloth until the Autogrip table is clean.

> **CAUTION**
>
> NEVER LET WATER STAND ON AUTOGRIP SURFACE. IT MAY PERMANENTLY DAMAGE THE TABLE.

   E. Wipe any moisture from surface.

   F. Allow a few minutes to dry before using.

5. Clean slidewires. See Potentiometer Cleaning.

POTENTIOMETER CLEANING

Irregular or "jumpy" plots produced on a properly adjusted recorder may indicate worn or dirty balance potentiometers or wipers. To clean the potentiometers, spray the potentiometer and limit switch along their entire length with Slidewire Cleaner (Part No. 5080-3605). Rapidly move the carriage arm or pen carriage several full scale excursions. Spray the wipers directly with Slidewire Cleaner. Thoroughly saturate a Kimwipe (Kimberly-Clark Type 900-S) or a cotton swab with Slidewire Cleaner. Rub the potentiometer

(mandrel and return strip) and limit switch along their entire length, using the moistened tissue or swab (see Figure 8). Note any discoloration of the tissue or swab after rubbing. Repeat the cleaning procedure until there is no stain, then clean once more to ensure that all contaminants have been removed. After cleaning, the potentiometer (mandrel and return strip) and limit switch must be lubricated with the furnished Slidewire Lubricant (Part No. 5080-3635). This lubrication will reduce wear and chemical contamination of the assembly (see Figure 9). For access to the slidewire, see General Disassembly.

LUBRICATION

The Model 9862A is a precision instrument. Gears and other moving parts have very close tolerances. Lubricate gears sparingly; overlubrication may produce more friction than no lubrication. Intervals between periodic lubrication are determined by the type of operation, local air contamination, and climatic conditions. Generally, under normal use and conditions, the Plotter should be lubricated every nine to twelve months. Relubricate completely every two years. All ball bearings are prelubricated by the manufacturer and require no further lubrication.

1. Apply a thin film of lubricant on X and Y drive gears (including idler gear). Recommended grease: HP 6040-0222.

> **CAUTION**
>
> LUBRICANT MUST NOT SPILL ONTO X–AXIS DRIVE BELT OR CABLE, OR Y–AXIS DRIVE CABLE.

VISUAL INSPECTION

During periodic cleaning and lubrication, a planned visual inspection should be performed. The following general list can be used as a guide:

1. Check both X and Y drive gears for proper adjustment (minimal backlash), and any worn or damaged teeth.
2. Inspect X-axis drive cable pulleys for any binding.
3. Ensure that both servo motors are mounted securely.
4. Move pen carriage, listening for scrapes, grinding noises, etc., while feeling for any binding in movement. Repeat this procedure for carriage arm.
5. Check cables of both axes for evidence of fraying or rubbing.
6. A check of components should include inspection for evidence of overheating, loose connections, cracked circuit boards, etc.

PERFORMANCE TESTS

The following procedures test the Plotter's performance for periodic evaluation, calibration, and troubleshooting.

TEST EQUIPMENT

Instruments and accessories required for adjusting and testing are listed in Table 2.

Table 2. Recommended Test Equipment

Model 141A Oscilloscope, or any equivalent storage scope.
Model 3460B Digital Voltmeter.
Model 9810A Calculator.
Magnetic card with exerciser program (Part No. 09862-90002).

SYSTEM CHECK

The following procedure confirms the Plotter is operating properly and is correctly installed. Confirm 9810A Calculator is operating by executing Calculator exerciser routine. To perform the exerciser routine, turn the Calculator OFF. Place the Plotter next to the Calculator (see Figure 10) and insert the Signal Cable into the appropriate connector on the rear of the Plotter and into any of the four connector slots on the rear of the Calculator. Set the line voltage selector switch on the back of the Plotter to agree with the line voltage used. Check that proper fuse is installed. Connect the Plotter's power cord to an appropriate power receptacle.

The following procedure confirms proper operation of the Plotter when it is correctly installed in the System:

1. Confirm the Model 10 Calculator is operating by executing the Calculator exerciser routine (see your Model 10 Operating Manual).

2. On the Plotter, press LINE; LINE indicator should light.

3. Place a sheet of the plotter paper supplied with the Model 62 (10 in. x 15 in. grid) on the plotter platen locating it firmly against the bottom paper guide and left edge paper stop. Depress CHART HOLD, smooth paper to the platen.

4. Calibrate the Plotter using the following steps:

   STEP 1. Press LOWER LEFT, then PEN DOWN to mark the lower left graph limit on the chart. Adjust LOWER LEFT controls to align mark exactly with lower left corner of preprinted grid.

   STEP 2. Press UPPER RIGHT, then PEN DOWN to mark the upper right graph limit. Adjust UPPER RIGHT controls to align mark exactly with upper right corner of preprinted grid. Plotter is now ready to operate.

5. On the Calculator:

   Press (FMT) (GO TO).

   Insert Model 62 Exerciser Card (either end but printed side front) into upper slot of magnetic card reader (see Figure 11).

Proper execution of the exerciser routine results in a plot as indicated. The plot verifies performance as follows:

1. Alignment Verification – all vertical and horizontal lines (6) align within 0.010 in. of preprinted grid.

2. Linearity Verification – all dots (26) are within 0.030 in. of major divisions of preprinted grid.

3. Retrace Verification – all retraced lines (10 radiating from bottom center and one diagonal from lower left) are open less than 0.015 in.

4. Servo Matching Verification – the single trace diagonal (from upper left) has inflections less than 0.015 in. in amplitude.

5. All angular lines bowed no more than 0.040 in. from the true straight line between end points.

If the Plotter fails to execute the program properly, refer to the Trouble-shooting Chapter on page 5-1.

MECHANICAL MAINTENANCE

GENERAL DISASSEMBLY

Access to the various components of the 9862A can be accomplished as follows:

1. Remove ac power cord.

2. Access to X axis slidewire and limit switch assembly is obtained by removing rear hood, which is held in place by two screws. To remove, turn each screw one full turn counterclockwise.

3. For access to Y-axis slidewire and limit switch assembly:

   A. Remove rear hood.

   B. Turn the black tab at upper end of scale 90° counterclockwise.

   C. Lift pen holder back to detent position and open slidewire cover.

4. Slidewire cover on the Y arm may be removed by pushing back on upper cover support with thin-bladed screwdriver (see Figure 12). This disengages cover and fully exposes Y axis slidewire limit switch and drive components.

GENERAL DISASSEMBLY (continued)

5. Access to electronic components may be obtained by raising hinged top casting. Top and bottom castings are secured together by two screws located under bottom front lip of Plotter.

6. X-axis drive system may be reached by removing recording platen as follows:

   A. Raise hinged top casting as outlined in step 5.

   B. Remove Autogrip leads shown in Figure 7.

   C. Remove four No. 8-32 and two No. 6-32 mounting screws holding platen.

   D. Place carriage arm at far right of travel.

   E. Pull up on upper left hand corner of platen and slide platen out to left.

   Be sure to replace Autogrip leads when replacing platen.

7. To gain access to Y arm's lower slider block, remove paper alignment bar as follows:

   A. Raise hinged top casting as outlined in step 5.

   B. Near front edge of top casting locate three No. 6-32 and three No. 8-32 screws – remove only the three No. 8-32 screws.

   C. Close top and carefully lift alignment bar up and out.

REMOVAL OF CARRIAGE ARM

The carriage arm may be removed for replacement or service as follows:

1. Remove pen from holder.

2. Remove rear hood.

3. Remove X-axis potentiometer to prevent its being damaged. The potentiometer assembly and mounting channel is an integral unit and may be removed as follows:

   A. Unsolder six wires, noting the order in which leads connect to assembly (see Figure 13). Top two wires are for the limit switch, bottom four wires are for the slidewire.

   B. Remove two screws mounting assembly to frame.

   C. Lift assembly up and out.

   D. When reinstalling assembly, observe color codes and take extreme care not to bridge any gaps with solder.

4. Release Y slidewire cover and remove from arm (see Figure 12).

5. The arm is held by two shouldered screws at upper end and one screw at its lower end (see Figure 14).

   A. Remove screws (1), (2), and (3) and lift arm off of its motor block (refer to Figure 14).

   B. Lift arm up, separating it from lower carriage mount. Be careful not to damage wires connecting slidewire/limit switch assembly to motor block.

6. Reassemble carriage arm.

7. Align Y-axis as follows:

   A. Raise hinged top casting and loosen screw securing stringing on lower slider bracket (Figure 15).

   B. Loosen the two screws securing Y arm to motor block.

   C. Install pen and sheet of graph paper. Make sure graph paper is properly aligned against bottom paper stop.

   D. Set GRAPH LIMIT controls for 10 in. x 15 in. plotting area.

   E. Press [END].

   F. Enter program in 9810A Calculator from Model 62 Exerciser Card.

   G. Press [END] [CONTINUE].

   H. All vertical lines (3) must align within 0.010 inch of preprinted grid. Move lower end of arm to right or left to effect alignment (see Figure 16).

   I. Tighten screws on motor block and tighten screw securing stringing on lower slider bracket.

REMOVAL OF PEN CARRIAGE

The pen carriage may be removed for replacement or service as follows:

1. Remove pen from holder.

2. Remove X-axis potentiometer to prevent its being damaged. The potentiometer assembly and mounting channel is an integral unit and may be removed as follows:

   A. Unsolder six wires, noting the order in which leads connect to assembly (see Figure 13). Top two wires are for the limit switch, bottom four wires are for the slidewire.

REMOVAL OF PEN CARRIAGE (continued)

B. Remove two screws mounting assembly to frame.

C. Lift assembly up and out.

D. When reinstalling assembly, observe color codes and take extreme care not to bridge any gaps with solder.

3. Release Y slidewire cover and remove from arm (see Figure 12).

4. Remove carriage arm from recorder. The arm is held by two shouldered screws at upper end and one screw at its lower end (see Fig. 14).

5. Remove nylon drive cord from around drive and return pulleys.

6. Remove retaining block and return pulley at lower end of carriage arm.

7. Slide carriage out of the arm.

8. Reassemble and adjust pen carriage by moving pen carriage to upper end of arm so that 2-56 setscrew in carriage is aligned with notch inside of arm (see Figure 17). Adjust setscrew to minimize side-play of carriage within arm.

9. Move pen block to the lower end of arm so as to align lower setscrew with notch at lower end of arm, and repeat operation.

> **NOTE**
>
> Care should be taken not to adjust out all side-play. This will cause mechanical drag and result in a poor trace.

WIPER REPLACEMENT (Y–AXIS)

The wiper is located on and is part of the pen carriage (Part No. 5080-8135). New carriage assemblies should be obtained from the local Sales/Service Office. When replacing the wiper/pen carriage assembly, care must be taken to avoid bending the wiper.

> **CAUTION**
>
> DAMAGE MAY RESULT IF OTHER THAN THE FACTORY-SUPPLIED WIPER IS USED.

1. Remove carriage arm from recorder as follows:

   A. Remove pen from holder.

   B. Remove rear hood.

   C. Remove X-axis potentiometer to prevent its being damaged. The potentiometer assembly and mounting channel is an integral unit and may be removed as follows:

      1) Unsolder six wires, noting the order in which leads connect to assembly (see Figure 13). Top two wires are for the limit switch, bottom four wires are for the slidewire.

      2) Remove two screws mounting assembly to frame.

      3) Lift assembly up and out.

      4) When reinstalling assembly, observe color codes and take extreme care not to bridge any gaps with solder.

   D. Release Y slidewire cover and remove from arm (see Figure 12).

   E. The arm is held by two shouldered screws at upper end and one screw at its lower end (see Figure 14).

2. Remove pen carriage as follows:

   A. Remove nylon drive cord from around drive and return pulleys.

   B. Remove retaining block and return pulley at lower end of carriage arm.

   C. Slide carriage out of the arm.

3. Remove wiper assembly from pen block by removing No. 0-80 screw and nut.

4. Install new wiper (Part No. 09125-60110) using same screw and nut.

5. Reassemble and adjust pen carriage by moving pen carriage to upper end of arm so that 2-56 setscrew in carriage is aligned with notch inside of arm (see Figure 17). Adjust setscrew to minimize side-play of carriage within arm.

6. Move pen block to the lower end of arm so as to align lower setscrew with notch at lower end of arm, and repeat operation.

WIPER REPLACEMENT (Y–AXIS) (continued)

> **NOTE**
>
> Care should be taken not to adjust out all side-play. This will cause mechanical drag and result in a poor trace.

WIPER REPLACEMENT (X–AXIS)

The wiper is located on the pen motor block at the upper end of the carriage. arm. New wiper assemblies should be obtained from the local Sales/Service Office and installed as described in the following paragraphs. When replacing the wiper, care must be taken to avoid bending the wiper.

> **CAUTION**
>
> DAMAGE TO THE SLIDEWIRE MAY RESULT IF OTHER THAN THE FACTORY-SUPPLIED WIPER IS USED.

1. Remove rear hood.
2. Snap pen lift solenoid out of its spring holder and remove holder by removing one mounting screw.
3. Remove wiper assembly mounting screw and install new wiper (Part No. 5080-8127). Protect slidewire using technique shown in Figure 18.
4. Reassemble holder and solenoid.

POTENTIOMETER REPLACEMENT (Y–AXIS)

This unit is located in the carriage arm and is part of the carriage channel. The channel and potentiometer are replaced as one unit. Proceed as follows:

1. Remove pen from holder.
2. Remove X-axis potentiometer to prevent its being damaged. The potentiometer assembly and mounting channel is an integral unit and may be removed as follows:
   A. Unsolder six wires, noting the order in which leads connect to assembly (see Figure 13). Top two wires are for the limit switch, bottom four wires are for the slidewire.
   B. Remove two screws mounting assembly to frame.
   C. Lift assembly up and out.
   D. When reinstalling assembly, observe color codes and take extreme care not to bridge any gaps with solder.
3. Release Y slidewire cover and remove from arm (see Figure 12).

4. Remove carriage arm from recorder. The arm is held by two shouldered screws at upper end and one screw at its lower end (see Fig. 14).

5. Remove pen carriage as follows:

   A. Remove nylon drive cord from around drive and return pulleys.

   B. Remove retaining block and return pulley at lower end of carriage arm.

   C. Slide carriage out of the arm.

6. Remove all remaining components, i.e., upper idler pulley, etc., from assembly.

7. Unsolder six wires, noting order in which leads connect to slidewire (see Figure 13).

8. To install new slidewire/limit switch and arm assembly (Part No. 5060-6536), pass bundle of leads through the small hole at top of arm and put arm assembly in place.

9. Install pen carriage.

10. Reinstall two shouldered screws at top taking care to also reinstall slidewire cover hinge and carriage stop.

11. Replace screw at bottom, securing it to lower slider block.

12. Resolder wires to the limit switch and slidewire.

13. Reinstall X-axis slidewire.

14. Reinstall Y-axis slidewire cover.

15. Check Y-axis alignment. Realign as necessary (see Y-axis Alignment).

POTENTIOMETER REPLACEMENT (X–AXIS)

The slidewire/limit switch assembly and their mounting channel are an integral unit and available only as a single item. Replace as follows:

1. Remove rear hood.

2. Remove X-axis wiper as follows:

   A. Snap pen lift solenoid out of its spring holder and remove holder by removing one mounting screw.

   B. Remove wiper assembly mounting screw and install new wiper (Part No. 5080-8127). Protect slidewire using technique shown in Figure 18.

POTENTIOMETER REPLACEMENT (X–AXIS) (continued)

3. Unsolder six wires, noting the order in which leads connect to assembly (see Figure 13). Top two wires are for the limit switch, bottom four wires are for the slidewire.

4. Remove two screws mounting assembly to frame.

5. Lift assembly up and out.

6. Install new slidewire/limit switch assembly (Part No. 5060-6537). Secure it with two screws.

7. Resolder wires. When soldering, observe color codes and take extreme care not to bridge any gaps with solder.

Y–AXIS RESTRINGING

MATERIAL REQUIRED: Y–axis cable assembly, Part No. 07005-60600.

RESTRINGING PROCEDURE. (Refer to Figure 15.)

1. Remove carriage arm from recorder as follows:

   A. Remove pen from holder.

   B. Remove rear hood.

   C. Remove X-axis wiper as follows:

      1) Snap pen lift solenoid out of its spring holder and remove holder by removing one mounting screw.

      2) Remove wiper assembly mounting screw and install new wiper (Part No. 5080-8127). Protect slidewire using technique shown in Figure 18.

   D. Remove X-axis potentiometer as follows to prevent its being damaged:

      1) Unsolder six wires, noting the order in which leads connect to assembly (see Figure 13). Top two wires are for the limit switch, bottom four wires are for the slidewire.

      2) Remove two screws mounting assembly to frame.

      3) Lift assembly up and out.

   E. Release Y slidewire cover and remove from arm (see Figure 12).

   F. The arm is held by two shouldered screws at upper end and one screw at its lower end (see Figure 14).

2. Remove pen carriage as follows:

   A. Remove nylon drive cord from around drive and return pulleys.

   B. Remove retaining block and return pulley at lower end of carriage arm.

   C. Slide carriage out of the arm.

3. Install a new nylon drive cord assembly, consisting of a cable spring and nylon cord.

   A. Attach free end of tension spring to hook on the pen carriage. Insert knotted end of cord in groove of pen block.

   B. Slide pen carriage into carriage arm, making sure cable is between pen carriage and slidewire and to the right of wipers. Care should be taken not to damage wiper.

   C. Loop cord around upper and lower pulleys.

   D. Test for proper tension. The Y cable tension may be verified by measuring the force required to move the pen carriage downscale while the motor is locked. This required force shall be between the limits of 14 ounces and 20 ounces (see Figure 19). If the string tension is not correct, the string must be lengthened or shortened to attain the desired tension. This can be accomplished by removing the pen block from the pen arm and retying the knot on the end of the string.

   E. Reassemble remaining parts.

X–AXIS RESTRINGING

DISASSEMBLY. When restringing the X-axis, the recording platen and paper alignment bar must be removed.

1. Remove platen and raise hinged top casting. The top casting may be raised after removing the two screws located under bottom front lip of Plotter. The platen may be removed as follows:

   A. Raise hinged top casting as outlined above.

   B. Remove Autogrip leads shown in Figure 7.

   C. Remove four No. 8-32 and two No. 6-32 mounting screws holding platen.

   E. Pull up on upper left hand corner of platen and slide platen out to left.

   Be sure to replug Autogrip leads when replacing platen.

X–AXIS RESTRINGING (continued)

2. Remove paper alignment bar as follows:

   A. With hinged top casting raised, locate three No. 6-32 and three No. 8-32 screws that are near the front edge of top casting. Remove only the three No. 8-32 screws.

   B. Close top and carefully lift alignment bar up and out.

MATERIALS REQUIRED: X-axis Stringing Kit, Part No. 5080-7717.

RESTRINGING PROCEDURE. (Refer to Figure 15.)

1. Loosen screw securing stringing plate on lower slider bracket. Access to screw is accomplished by raising upper casting and positioning arm over the access hole in bottom plate.

2. Remove old cable and adjust bottom two pulleys (J and E, Figure 15) to their innermost position.

3. Secure the carriage arm in a convenient position to prevent movement.

4. Form a small loop of the new cable by inserting it through the cable crimp and doubling the end back.

5. Crimp cable crimp securely. This operation can be performed with a pair of wire cutters.

6. Place loop over stud in center of stringing bracket (Point A).

7. Pass cable around end of bracket (Point B) from back to front.

8. Pass cable across front of bracket to Pulley C and around Pulley C (½ turn) in a counterclockwise direction to Drive Sheave D.

9. Place one turn around Drive Sheave in a counterclockwise direction, passing cable under itself and continue to Pulley E.

10. Place ½ turn around Pulley E in a clockwise direction and continue to lower slider bracket.

11. Pass wire around stringing guide Point F (½ turn) in a counterclockwise direction, passing in front of Screw G while keeping it under plate and then around stringing guide H (½ turn) in a counterclockwise direction.

12. Pass cable back across lower slider bracket passing over itself to Pulley J in a clockwise direction and continue to Drive Sheave D.

13. Make one turn around Drive Sheave in a counterclockwise direction, above previous turn, and passing cable under itself to Pulley K.

14. Make ½ turn around Pulley K in a counterclockwise direction, continuing to front of stringing bracket above cable already there, and around end of bracket (Point L) to screw M.

15. Place one turn around screw M in a clockwise direction passing cable under itself.

16. Tighten screw lightly.

17. Make stringing taut. To make taut, grasp end of cable with a pair of long nose pliers placing several turns around end. Using motor block for support, continue wrapping cable around pliers until cable is taut (see Figure 20).

18. Tighten screw M securely and check cable tension by measuring the force required to displace it a given distance. With the arm at the extreme right, measure the force required to displace the center of the longest span of the cable ¼ inch past the vertical wall of the motor assembly trough. The measured force must be between the limits of 14 ounces and 20 ounces (see Figure 21).

19. If the X-axis cable tension must be readjusted, move the two pulleys nearest the paper alignment bar in their elongated mounting holes. If enough adjustment is not present, restring the X-axis.

20. Cut off remaining portion of cable leaving approximately ½ inch.

21. Replace paper alignment bar and platen.

22. Tighten screw G.

23. Align the X-axis as follows:

    A. Loosen two end screws on paper alignment bar. Remove two No. 6-32 screws at bottom edge of platen and loosen the other four platen screws.

    B. Install pen and sheet of graph paper. Make sure graph paper is properly aligned against bottom paper stop.

    C. Set GRAPH LIMIT controls for 10 in. x 15 in. plotting area.

    D. Press END.

    E. Enter program in 9810A Calculator from Model 62 Exerciser Card.

    F. Press END CONTINUE.

X–AXIS RESTRINGING (continued)

G. All horizontal lines (3) must align within 0.010 inch of preprinted grid. Move one end of paper alignment bar up or down to effect alignment (see Figure 16).

NOTE
After X alignment, Y axis must be realigned.

24. Align the Y-axis as follows:

A. Loosen the two screws securing Y arm to motor block.

B. Set GRAPH LIMIT controls for 10 in. x 15 in. plotting area.

C. Press END.

D. Enter program in 9810A Calculator from Model 62 Exerciser Card.

E. Press END CONTINUE.

F. All vertical lines (3) must align within 0.010 inch of preprinted grid. Move lower end of arm to right or left to effect alignment (see Figure 16).

G. Tighten screws on motor block and tighten screw securing stringing on lower slider bracket.

Y CABLE TENSION CHECK

The Y cable tension may be verified by measuring the force required to move the pen carriage downscale while the motor is locked. This required force shall be between the limits of 14 ounces and 20 ounces (see Figure 19).

Y CABLE TENSION ADJUSTMENT

If the string tension is not correct, the string must be lengthened or shortened to attain the desired tension. This can be accomplished by removing the pen block from the pen arm and retying the knot on the end of the string.

X CABLE TENSION CHECK

X cable tension should be verified by measuring the force required to displace it at a given distance. With the arm at the extreme right, measure the force required to displace the center of the longest span of the cable ¼ inch past the vertical wall of the motor assembly trough. The measured force must be between the limits of 14 ounces and 20 ounces (see Figure 21).

X CABLE TENSION ADJUSTMENT

X-axis cable tension can be adjusted by moving the two pulleys nearest the paper alignment bar in their elongated mounting holes. If enough adjustment is not present, restring the X-axis per X-axis Restringing.

X DRIVE BELT TENSION CHECK

The force required to move the carriage arm with the motor pulley held stationary should be between 6 and 7 pounds (see Figure 22).

X DRIVE BELT TENSION ADJUSTMENT

The X-axis mylar drive belt tension may be adjusted as follows:

1. Raise hinged top casting and loosen screws holding motor.
2. Move motor to adjust belt tension.
3. Tighten motor screws.
4. Measure tension, readjust if necessary. The force required to move the carriage arm with the motor pulley held stationary should be between 6 and 7 pounds (see Figure 22).
5. Replace platen and rear hood.

X DRIVE BELT REPLACEMENT

The X-axis mylar belt may be replaced as follows:

1. Remove platen.
2. Raise hinged top casting and loosen screws holding motor and eccentric adjustment.
3. Loosen motor clamp screw and rotate motor until belt is as loose as possible.
4. Close top and lift belt off servo pulley.
5. Remove eccentric assembly and old belt.
6. Install new belt (Part No. 1500-0216) and replace eccentric assembly.
7. Readjust backlash as follows:
   A. Loosen two screws securing the knurled eccentric adjustment (Figure 23).
   B. Move arm back and forth in short strokes and adjust eccentric by turning Knurled Knob until there is no discernible backlash. If backlash is too tight, a grinding sound will be evident when moving the arm a distance. If backlash is too loose, a knocking or clicking sound will be evident.
8. Tighten screw holding eccentric adjustment.
9. Recheck X belt tension by verifying that the force required to move the carriage arm with the motor pulley held stationary should be between 6 and 7 pounds (see Figure 22).

X DRIVE BELT REPLACEMENT (continued)

10. If necessary, readjust the belt tension as follows:
    A. Loosen screws holding motor.
    B. Move motor to adjust belt tension.
    C. Tighten motor screws.
    D. Measure tension, readjust if necessary.
11. Replace platen and rear hood.

X DRIVE BEARING REPLACEMENT

To replace any of the X-axis drive bearings, the X-axis drive cable must be partially or completely removed, depending on which bearing is affected. (See Figure 24.)

1. To replace a pulley bearing, proceed as follows:
    A. Remove rear hood and platen.
    B. Move pen carriage to its extreme position away from the affected pulley.
    C. Apply masking tape to remaining pulleys and drive sheave so as to prevent cable from slipping off when tension is removed.
    D. Raise hinged top casting.
    E. While holding pulley nut on bottom side, remove No. 6-32 screw mounting pulley and remove pulley and its mounting stud.
    F. Press out defective bearing and replace with a new bearing (Part No. 1410-0215).
    G. Reassemble Plotter, making sure that pulley is reinstalled with same side up.
    H. Check the cable tension. With the arm at the extreme right, measure the force required to displace the center of the longest span of the cable ¼ inch past the vertical wall of the motor assembly trough. The measured force must be between the limits of 14 ounces and 20 ounces (see Figure 21).
2. To replace drive sheave bearings, proceed as follows:
    A. Remove rear hood and platen.
    B. Remove X-axis drive cable.

C. Remove retaining ring and slip sheave/gear assembly upwards and off of stud.

D. Separate gear from sheave by removing four No. 2-56 pan head mounting screws.

E. Push one bearing out bottom of sheave and other out top of sheave and replace defective bearing(s) with new bearing(s) (Part No. 1410-0277).

F. Reassemble.

3. Restring the X-axis using X-axis stringing kit, Part No. 5080-7717, and proceed as follows: (Refer to Figure 15.)

A. Loosen screw securing stringing plate on lower slider bracket. Access to screw is accomplished by raising upper casting and positioning arm over the access hole in bottom plate.

B. Remove old cable and adjust bottom two pulleys (J and E, Figure 17) to their innermost position.

C. Secure the carriage arm in a convenient position to prevent movement.

D. Form a small loop of the new cable by inserting it through the cable crimp and doubling the end back.

E. Crimp cable crimp securely. This operation can be performed with a pair of wire cutters.

F. Place loop over stud in center of stringing bracket (Point A).

G. Pass cable around end of bracket (Point B) from back to front.

H. Pass cable across front of bracket to Pulley C and around Pulley C (½ turn) in a counterclockwise direction to Drive Sheave D.

I. Place one turn around Drive Sheave in a counterclockwise direction, passing cable under itself and continue to Pulley E.

J. Place ½ turn around Pulley E in a clockwise direction and continue to lower slider bracket.

K. Pass wire around stringing guide Point F (½ turn) in a counterclockwise direction, passing in front of Screw G while keeping it under plate and then around stringing guide H (½ turn) in a counterclockwise direction.

X DRIVE BEARING REPLACEMENT (continued)

L. Pass cable back across lower slider bracket passing over itself to Pulley J in a clockwise direction and continue to Drive Sheave D.

M. Make one turn around Drive Sheave in a counterclockwise direction, above previous turn, and passing cable under itself to Pulley K.

N. Make ½ turn around Pulley K in a counterclockwise direction, continuing to front of stringing bracket above cable already there, and around end of bracket (Point L) to screw M.

O. Place one turn around screw M in a clockwise direction passing cable under itself.

P. Tighten screw lightly.

Q. Make stringing taut. To make taut, grasp end of cable with a pair of long nose pliers placing several turns around end. Using motor block for support, continue wrapping cable around pliers until cable is taut (see Figure 20).

R. Tighten screw M securely and check cable tension by measuring the force required to displace it a given distance. With the arm at the extreme right, measure the force required to displace the center of the longest span of the cable ¼ inch past the vertical wall of the motor assembly trough. The measured force must be between the limits of 14 ounces and 20 ounces (see Figure 21).

S. If the X-axis cable tension must be readjusted, move the two pulleys nearest the paper alignment bar in their elongated mounting holes. If enough adjustment is not present, restring the X-axis.

T. Cut off remaining portion of cable leaving approximately ½ inch.

U. Replace paper alignment bar and platen.

V. Tighten screw G.

4. Align the X-axis as follows:

A. Loosen two end screws on paper alignment bar. Remove two No. 6-32 screws at bottom edge of platen and loosen the other four platen screws.

B. Install pen and sheet of graph paper. Make sure graph paper is properly aligned against bottom paper stop.

C. Set GRAPH LIMIT controls for 10 in. x 15 in. plotting area.

D. Press END.

E. Enter program in 9810A Calculator from Model 62 Exerciser Card.

F. Press END CONTINUE.

G. All horizontal lines (3) must align within 0.010 inch of preprinted grid. Move one end of paper alignment bar up or down to effect alignment (see Figure 16).

NOTE
After X alignment, Y axis must be realigned.

5. Align the Y-axis as follows:

   A. Loosen the two screws securing Y arm to motor block.

   B. Set GRAPH LIMIT controls for 10 in. x 15 in. plotting area.

   C. Press END.

   D. Enter program in 9810A Calculator from Model 62 Exerciser Card.

   E. Press END CONTINUE.

   F. All vertical lines (3) must align within 0.010 inch of preprinted grid. Move lower end of arm to right or left to effect alignment (see Figure 16).

   G. Tighten screws on motor block and tighten screw securing stringing on lower slider bracket.

6. Readjust the X-axis gear train backlash as follows:

   A. Loosen two screws securing the knurled eccentric adjustment (Figure 23).

   B. Move arm back and forth in short strokes and adjust eccentric by turning Knurled Knob until there is no discernible backlash. If backlash is too tight, a grinding sound will be evident when moving the arm a distance. If backlash is too loose, a knocking or clicking sound will be evident.

   C. Tighten screws.

7. Check X-axis mylar drive belt tension by verifying that the force required to move the carriage arm with the motor pulley held stationary is between 6 and 7 pounds (see Figure 22).

X DRIVE BEARING REPLACEMENT (continued)

8. If necessary, adjust the belt tension as follows:

   A. Loosen screws holding motor.

   B. Move motor to adjust belt tension.

   C. Tighten motor screws.

   D. Measure tension, readjust if necessary. The force required to move the carriage arm with the motor pulley held stationary should be between 6 and 7 pounds (see Figure 22).

9. Replace belt pulley bearings as follows:

   A. Remove rear hood and platen.

   B. Raise top hinged casting.

   C. Loosen motor clamping screws and rotate motor until the belt is as loose as possible.

   D. Remove two clamps holding eccentric pulley housing, slip drive belt off of pulley and pull assembly out of its hole from bottom.

   E. Remove retaining ring from belt pulley shaft and slide shaft out of housing.

   F. Remove defective bearing(s) and replace with a new bearing (Part No. 1410-0277).

   G. Reassemble and reinstall pulley.

10. Adjust belt tension as follows:

   A. Loosen screws holding motor.

   B. Move motor to adjust belt tension.

   C. Tighten motor screws.

   D. Measure tension, readjust if necessary. The force required to move the carriage arm with the motor pulley held stationary should be between 6 and 7 pounds (see Figure 22).

11. Reassemble Plotter.

MECHANICAL ADJUSTMENTS

Y–AXIS PEN CARRIAGE ADJUSTMENT

The pen carriage rolls in the carriage arm on four plastic rollers. To adjust rollers, remove rear hood, rotate black tab at upper end of scale 90° counter-clockwise, pull pen holder back, and open scale. Move pen carriage to upper end of arm so that 2-56 setscrew in carriage is aligned with notch in side of arm (see Figure 17). Adjust setscrew to minimize side-play of carriage within arm.

Move pen block to the lower end of arm so as to align lower setscrew with notch at lower end of arm, and repeat operation.

> **NOTE**
>
> Care should be taken not to adjust out all side-play. This will cause mechanical drag and result in a poor trace.

Y–AXIS BACKLASH ADJUSTMENT

There are two gear meshes involved in the Y axis drive system. They must be adjusted in the proper sequence for best results. The backlash of the gear drive system may be adjusted as follows:

1. Remove rear hood.
2. Snap pen lift solenoid out of its holder.
3. Move arm to left until the rear adjusting setscrew at rear of motor block is in line with large access hole in rear wall.
4. Loosen gear locking screw in upper left corner of pen motor block.
5. Lightly pushing idler gear toward pen drive, turn adjusting screw in or out to attain minimum backlash between the two gears (see Figure 25).
6. Tighten gear locking screw.
7. Slightly loosen motor clamping screw located in center of motor block (Figure 26). Rotate motor slightly, first in one direction and then the other, while moving pen gear back and forth, until motor pinion rotates freely with minimum backlash. This procedure varies mesh between motor pinion and pen drive gear due to an eccentric mounting shoulder. A slight amount of backlash is desirable for optimum operation.
8. Tighten motor clamping screw and recheck for optimum backlash.
9. Reassemble Plotter.

X GEAR TRAIN BACKLASH ADJUSTMENT

Backlash is the amount of distance one gear tooth may move before encountering another gear face. The adjustment should accomplish minimal backlash with no binding. Backlash of the gear drive system may be adjusted as follows:

1. Remove platen.
2. Raise hinged top casting.
3. Loosen two screws securing the knurled eccentric adjustment (Figure 23).
4. Move arm back and forth in short strokes and adjust eccentric by turning Knurled Knob until there is no discernible backlash. If backlash is too tight, a grinding sound will be evident when moving the arm a distance. If backlash is too loose, a knocking or clicking sound will be evident.
5. Recheck X belt tension by verifying that the force required to move the carriage arm with the motor pulley held stationary should be between 6 and 7 pounds (see Figure 22).
6. If necessary, readjust the belt tension as follows:
   A. Loosen screws holding motor.
   B. Move motor to adjust belt tension.
   C. Tighten motor screws.
   D. Measure tension, readjust if necessary.
7. Replace platen and rear hood.

X–AXIS TRACK BEARING ADJUSTMENT

Adjustment of the X-axis track bearing is accomplished as follows:

1. Remove rear hood, and raise top casting.

> **CAUTION**
>
> CARE MUST BE TAKEN NOT TO DAMAGE POWER CONNECTORS OR FUSE HOLDER WHEN TOP IS TILTED TOO FAR BACK.

2. Move pen arm until it is opposite access slot in rear left corner of mechanical assembly (Figure 27).
3. Using a Phillips screwdriver, turn bearing adjusting screw until slight amount of clearance is detectable between five ball bearings and track rod.

4. Reassemble recorder.

> **CAUTION**
>
> DO NOT OVERTIGHTEN THIS ADJUSTMENT. THIS COULD RESULT IN BEARING AND TRACK ROD DAMAGE.

Y–AXIS ALIGNMENT

The Y axis may be aligned as follows:

1. Remove rear hood.
2. Raise hinged top casting and loosen screw securing stringing on lower slider bracket (Figure 15).
3. Loosen the two screws securing Y arm to motor block.
4. Install pen and sheet of graph paper. Make sure graph paper is properly aligned against bottom paper stop.
5. Set GRAPH LIMIT controls for 10 in. x 15 in. plotting area.
6. Press END.
7. Enter program in 9810A Calculator from Model 62 Exerciser Card.
8. Press END CONTINUE.
9. All vertical lines (3) must align within 0.010 inch of preprinted grid. Move lower end of arm to right or left to effect alignment (see Figure 16).
10. Tighten screws on motor block and tighten screw securing stringing on lower slider bracket.

X–AXIS ALIGNMENT

The X-axis may be aligned as follows:

1. Loosen two end screws on paper alignment bar. Remove two No. 6-32 screws at bottom edge of platen and loosen the other four platen screws.
2. Install pen and sheet of graph paper. Make sure graph paper is properly aligned against bottom paper stop.
3. Set GRAPH LIMIT controls for 10 in. x 15 in. plotting area.
4. Press END.
5. Enter program in 9810A Calculator from Model 62 Exerciser Card.

X–AXIS ALIGNMENT (continued)

6. Press END CONTINUE.
7. All horizontal lines (3) must align within 0.010 inch of preprinted grid. Move one end of paper alignment bar up or down to effect alignment (see Figure 16).

> **NOTE**
>
> If X alignment is changed, Y axis must be realigned.

ELECTRICAL CHECKS

INPUT POWER CIRCUIT

Table 3. Input Power Circuit Check

Instrument Status:

1. Power cord plugged into 9862A only.
2. Two-amp fuse installed.
3. All printed circuit cards installed.

FUNCTION	MEASUREMENT POINTS	RESISTANCE LIMITS* (OHMS) MIN	NOM	MAX
Power Switch OFF	Power cord high to low	>500 Meg		
Power Switch ON Voltage range 230V	Power cord high to low	4.5		9.5
Power Switch ON Voltage range 200V	Power cord high to low	4		8
Power Switch ON Voltage range 115V	Power cord high to low	1.1		3.3
Power Switch ON Voltage range 100V	Power cord high to low	1		3

*Use 427A VTVM or equivalent.

POWER SUPPLY FILTER

Table 4. Power Supply Filter Check

Instrument Status:

1. Power cord disconnected.
2. All plug-in circuit boards removed.

FILTER CAPACITOR ASSEMBLY	PINS ON MOTHER BOARD	APPROXIMATE RESISTANCE
C6 – 2100 uF	901 to Chassis*	2200 Ohms 5%
C5 – 15000 uF	97 to Chassis*	560 Ohms 5%
C8 – 4000 uF	92 to Chassis*	2200 Ohms 5%
C7 – 2100 uF	98 to Chassis†	2200 Ohms 5%
C9 – 4000 uF	90 to Chassis†	2200 Ohms 5%

*Connect low side of meter to chassis.
†Connect high side of meter to chassis.

POWER SUPPLY VOLTAGE

Table 5. Power Supply Voltage Check

Instrument Status:

1. Power cord connected between Variac and 9862A. Variac turned to zero.
2. Boards A8 and A9 installed.
3. Slowly increase Variac to line voltage: Measure "Min" at 103V, "Max" at 127V.

SUPPLY	MEASUREMENT POINTS	LIMITS (VOLTS) MIN	MAX
+17V	A8 Board +17V T.P.	+16.0	+18.0
-17V	A8 Board -17V T.P.	-16.0	-18.0
+19V	A8 Board Fuse Clip	+17	+24
-19V	A8 Board Fuse Clip	-17	-24
+5V	A9 Board +5V T.P.	+4.75	+5.25

FRONT PANEL CHECKOUT

INSTRUMENT STATUS

To perform the Front Panel Checkout, the status of the instruments should be as follows:

1. All circuit boards installed.
2. Interface cable NOT connected.
3. 11 in. x 17 in. graph paper on platen and aligned with lower and left paper guides.

STAND–BY CIRCUIT TEST

To test the Stand-By Circuit, perform the following procedures:

1. Depress CHART HOLD, then POWER. The pen position remains unchanged and the paper is held firmly in place.
2. The servo is in a stand-by status. Manually displace the pen affirming this condition.
3. Depress LOWER LEFT. The unit comes out of stand-by and establishes a tight notch. Manually affirm.

MANUAL PEN CONTROL

To test the Manual Pen Control, perform the following procedures:

1. Manually move the pen to the left-hand margin; release and depress CHART HOLD, then depress PEN DOWN four or five times rapidly.
2. The pen will very rapidly strike the platen and return to the initial position without any hesitation each time.

LOWER LEFT CONTROL

To test the Lower Left Control, perform the following procedures:

1. Depress LOWER LEFT. The servo comes out of stand-by condition and establishes a tight notch. Manually affirm.
2. Check the range of the lower limit by rotating the X and Y LOWER LEFT controls. Make sure the paper is still referenced against the left edge of the platen.
3. Press PEN DOWN. As the pen passes the lower or the left edge, it will run in to the limit switch, causing the pen to rise and the error light to turn ON.

   A. X Range 0.050 in. to the left of the left margin to past the 10.25 in. mark.

   B. Y Range 0.050 in. below the bottom margin to past the 5.25 in. mark.

UPPER RIGHT CONTROL

To test the Upper Right Control, perform the following procedures:

1. Reference the lower limit position in the lower left corner of the 10 in. x 15 in. plot area.

2. Release and depress the CHART HOLD switch. Manually check to see that the servo is in stand-by condition.

3. Depress the graph limit switch labeled UPPER RIGHT. The servo comes out of stand-by condition and the pen moves to the upper right area of the graph paper.

4. Check the range of the upper limit by rotating the X and Y UPPER RIGHT controls.

   A. X Range From left edge to the right mechanical stop.

   B. Y Range From lower edge to the upper mechanical stop.

LIMIT SWITCH CHECK

To check the Limit Switch, perform the following procedures:

1. Check the lower limit switching by positioning the pen in the lower left corner of the Plotter and manually displace the pen into the mechanical stops in both the X and Y directions. The servo will go into low gain status every time the pen goes into the limit switch. The servo will come out of low gain status in 1.3 seconds after pressing either LOWER LEFT or UPPER RIGHT buttons. In each case, as the pen nears the mechanical stop, the correcting force should reduce and the error light should come ON.

2. Check the upper right limit switching by positioning the pen near the upper right corner of the Plotter and manually displace the pen into the mechanical stops in both X and Y directions. In each case, as the pen nears the mechanical stop, the correcting force should reduce and the error light should come ON.

ELECTRICAL ALIGNMENT

INSTRUMENT STATUS

To effect the Electrical Alignment, all circuit boards must be installed (see Figure 28) and the following adjustments performed in the order given. The Plotter is completely operable from the front panel.

1. Center all the adjustment pots on the servo amplifier board except Y Gain which should be extreme counterclockwise (viewed from the top).

2. Scale the graph limits for 10 in. x 15 in. plot.

3. Enter Test Program into Calculator (see Appendix C).

SERVO COMPENSATION ADJUSTMENT

To adjust the Servo Amplifier, perform the following procedures:

1. Press GO TO LABEL 1 CONTINUE.
2. Connect the 141A Oscilloscope to the AG (analog ground) and TPX (X test point) to see the X-error signal.

> **NOTE**
>
> The signal between TPX and AG and TPY and AG is the error signal for X-axis and Y-axis respectively.

3. Adjust the XC potentiometer such that the X-error signal has a flat top (see Figure 29) on both sides.
4. Connect the oscilloscope to TPY and adjust the YC such that the Y error signal has flat top (see Figure 29) on both sides.
5. Press STOP.

DAC ALIGNMENT

To effect the DAC Alignment, perform the following steps:

1. Press GO TO LABEL 2.
2. Adjustments (2) in this section are on DAC boards.
3. Connect the 141A to see the Y error signal.
4. Adjust the potentiometer on A7 Y-DAC board such that the error signal looks flat on the top on both sides.
5. Connect 141A to see the X-error signal and repeat the procedure in step 4 adjusting the X-DAC potentiometer.
6. Press STOP.

X OFFSET ADJUSTMENT

To effect the X Offset Adjustment, perform the following steps:

1. Press GO TO LABEL 3.
2. Connect 141A to see the X-error signal. Use 0.5 V/cm vertical sensitivity.
3. Adjust the zero in the center of the oscilloscope.
4. Adjust XOF such that the error signal is symmetrical about the zero line on the oscilloscope. (See Figure 30.)
5. Press STOP.

Y OFFSET ADJUSTMENT

To effect the Y Offset Adjustment, perform the following steps:

1. Press GO TO LABEL 4.
2. Connect 141A to see the Y-error signal. Use 0.2 V/cm vertical sensitivity.
3. Adjust the zero in the center of the oscilloscope.
4. Adjust YOF such that the error signal is symmetrical about the zero line on the oscilloscope (Figure 30).
5. Press STOP.
6. Repeat Servo Compensation Adjustment. Readjust XC and YC if necessary.

Y–DEADBAND ADJUSTMENT

To effect Y Deadband Adjustment, perform the following steps:

1. Disconnect oscilloscope.
2. Place the alignment plot on the platen reference to the lower left guide. Install a pen.
3. Turn YD potentiometer all the way clockwise looking from the top.
4. Press GO TO LABEL 5.
5. The first line retraced should be open, parallel to each other and should not be wavy. If it is wavy – Y-axis has uneven friction. Check to see whether the carriage block or the gears are binding. Adjust if necessary.
6. Adjust YD such that the retrace closes completely.
7. Press STOP.

X–DEADBAND ADJUSTMENT

To effect X Deadband Adjustment, perform the following steps:

1. Turn XD potentiometer all the way clockwise looking from the top.
2. Press GO TO LABEL 6.
3. The first line retraced should be open and parallel to each other. It should not be wavy. If it is wavy, X-axis has uneven friction. Check to see whether the mylar belt, the backlash between gears and the carriage block is causing any binding. Adjust if necessary.
4. Adjust XD potentiometer such that the retrace closes completely.
5. Press STOP.

Y–GAIN ADJUSTMENT

To effect the Y Gain Adjustment, perform the following steps:

1. Turn YG potentiometer all the way counterclockwise looking from the top.
2. Press GO TO LABEL 7.
3. The first line retraced should be open, and parallel to each other.
4. Adjust YG such that the retrace closes completely. Readjust XC and YC if necessary.

The electrical alignment is now completed. None of the above adjustments should be changed.

MECHANICAL PARTS LISTS

This chapter contains mechanical parts lists. The parts lists are supplemented by exploded views to aid in parts identification. Consistent with the maintenance and troubleshooting procedures presented in this manual, the electrical parts list in this chapter indicates only assemblies rather than individual components. The electrical component parts lists are included in Appendix F.

ORDERING INFORMATION

To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Sales/Service Office (see rear of manual for address of nearest HP office). Order should include part number and description used in this chapter. If required part is not listed in this chapter, provide model and serial numbers, description of part, and function and location of part.

MECHANICAL PARTS LISTS

PARTS LIST

Table 6. Parts List

Accessory Kit (HP Part No. 09862-80010)		
Description	Part Number	Quantity
Disposable Pen, Red	5081-1190	Pkg. of 3
Disposable Pen, Blue	5081-1191	Pkg. of 3
Disposable Pen, Black	5081-1193	Pkg. of 3
Exerciser Card	09862-90002	1 Card
Slidewire Cleaner	5080-3605	1 Can
Slidewire Lubricant	5080-3935	1 Bottle
Fuse, 1 Amp (230V only)	2110-0312	1

Paper Supplies Available

The following papers are 11 in. by 16.5 in. (28 cm by 42 cm) or 8.5 in. by 11 in. (21.6 cm by 28 cm) overall and are packaged 100 sheets per box.

	Plot Area	Part No.
LINEAR:	10 in. x 15 in.	9270-1004
	25 cm x 38 cm	9270-1024
	7 in. x 10 in.	9270-1006
	18 cm x 25 cm	9270-1023
SEMI–LOG	10 in. x 2 cycle	9280-0159
	10 in. x 3 cycle	9280-0160
	2 cycle x 15 in.	9280-0169
	3 cycle x 15 in.	9280-0168
LOG–LOG:	2 cycle x 3 cycle	9280-0167
	3 cycle x 2 cycle	9280-0165
	3 cycle x 4 cycle	9280-0171
BLANK (WITH SCALING POINTS)	10 in. x 15 in.	9280-0180

Table 6. Parts List (Continued)

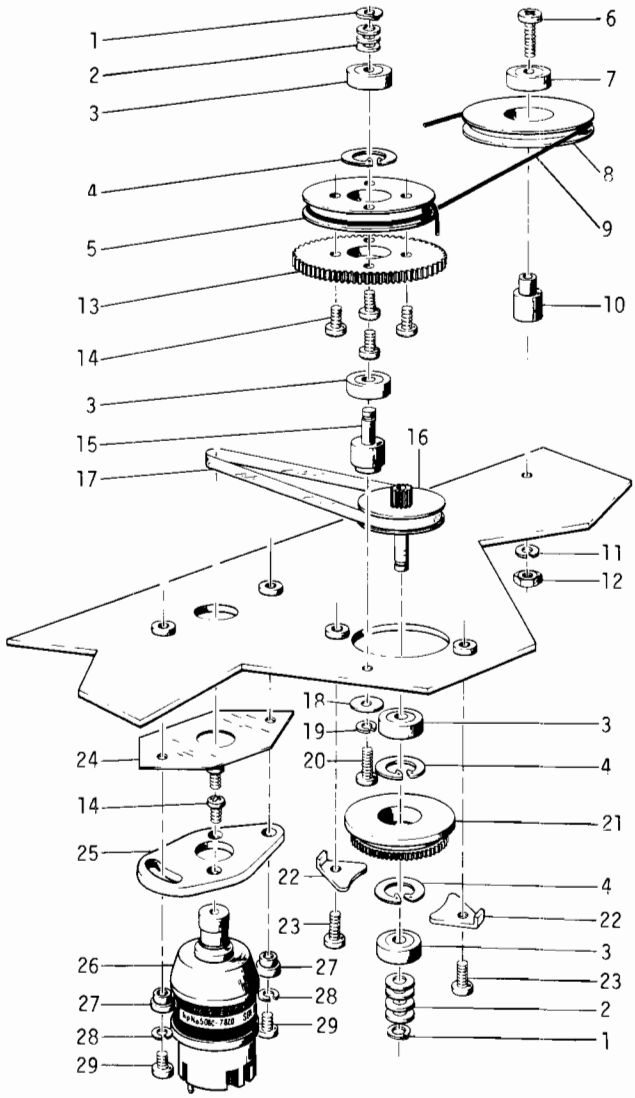
Pen Supplies Available	
Description	Part Number Fiber Tip
Package of 3 red pens	5081-1190
Package of 3 blue pens	5081-1191
Package of 3 green pens	5081-1192
Package of 3 black pens	5081-1193

Circuit Board Assemblies			
Circuit Symbol	Description		Part Number
A1	Interface Board	New Rebuilt	09862-60010 09862-60310
A2	ROM Control Board	New Rebuilt	09862-60020 09862-60320
A3	Control Flop Board	New Rebuilt	09862-60030 09862-60330
A4	Memory Board	New Rebuilt	09862-60040 09862-60340
A5	Time Cycle Board	New Rebuilt	09862-60050 09862-60350
A6	Servo Board	New Rebuilt	09862-60070 09862-60370
A7	DAC Board	New Rebuilt	09862-60060 09862-60360
A8	Rectifier Board	New Rebuilt	09862-60080 09862-60380
A9	Power Driver Board	New Rebuilt	09862-60090 09862-60390
A10	Mother Board	New Only	09862-60100
A11	Chart Hold Supply Board	New Only	09862-60110
A16	Cable Board	New Rebuilt	09862-60130 09862-60430

PARTS LIST
(continued)

Table 6. Parts List (Continued)

Miscellaneous Parts	
Description	Part Number
Knob, Panel	0370-1095
Fuseholder	1400-0084
Lens Cap, White	1450-0484
Lens Cap, Yellow	1450-0485
Lamp Holder Assembly	1450-0496
Dust Cover	4040-0477
Power Cord	8120-1378
Shipping Carton Assembly (Consisting of the following four parts)	09125-80210
Insert, Top Half	9220-1685
Insert, Bottom Half	9220-1686
Outer Box	9221-0972
Plastic Bag, 30 in. x 30 in.	9222-0322
Autogrip Table	09125-80250
Case Assembly – Top Casting	09125-60330



Item	HP Part No.	Description
1	0510-0238	Ring – Retaining
2	2190-0181	Washer – Shim, .191 ID x .311 OD
3	1410-0277	Bearing-Ball
4	0510-0742	Ring - Retaining
5	09125-20010	Sheave X-Axis
6	2460-0017	Screw-Mach, 6-32 x 3/4, PH, PD
7	1410-0215	Bearing-Ball
8	17999-06494	Pulley-Cable
9	5080-7717	X-Axis Restringing Kit
10	09125-20090	Stud-Pulley
11	2190-0007	Washer, No. 6, LK WASH
12	2420-0002	Nut-Hex, 6-32, SST
13	07035-20940	Gear-Clutch, 123T, X-Axis
14	0520-0065	Screw-Mach, 2-56 x 3/16, PH, SST, PD
15	09125-20130	Stud-Gear Mount
16	07035-62160	Clutch Assembly, X-Axis
17	1500-0216	Belt-Drive
18	3050-0399	Washer-Flat, .138 ID x 3/8 OD
19	2190-0105	Washer-Lock, No. 6
20	2460-0033	Screw-Mach, 6-32 x 5/16, PH, SST, PD
21	07035-22120	Housing-Bearing
22	07035-02090	Clamp-Housing
23	2360-0062	Screw-Mach, 4-40 x 3/8, PH, SST, PD
24	07035-22440	Insulator-Motor Plate
25	07035-22450	Motor-Plate
26	5080-7820	Motor Assembly
27	07035-22430	Washer-Motor Plate
28	2190-0108	Washer-Lock, No. 4
29	2200-0048	Screw-Mach, 4-40 x 3/8, PH, SST, PD

Figure 31. X–Axis Drive Assembly

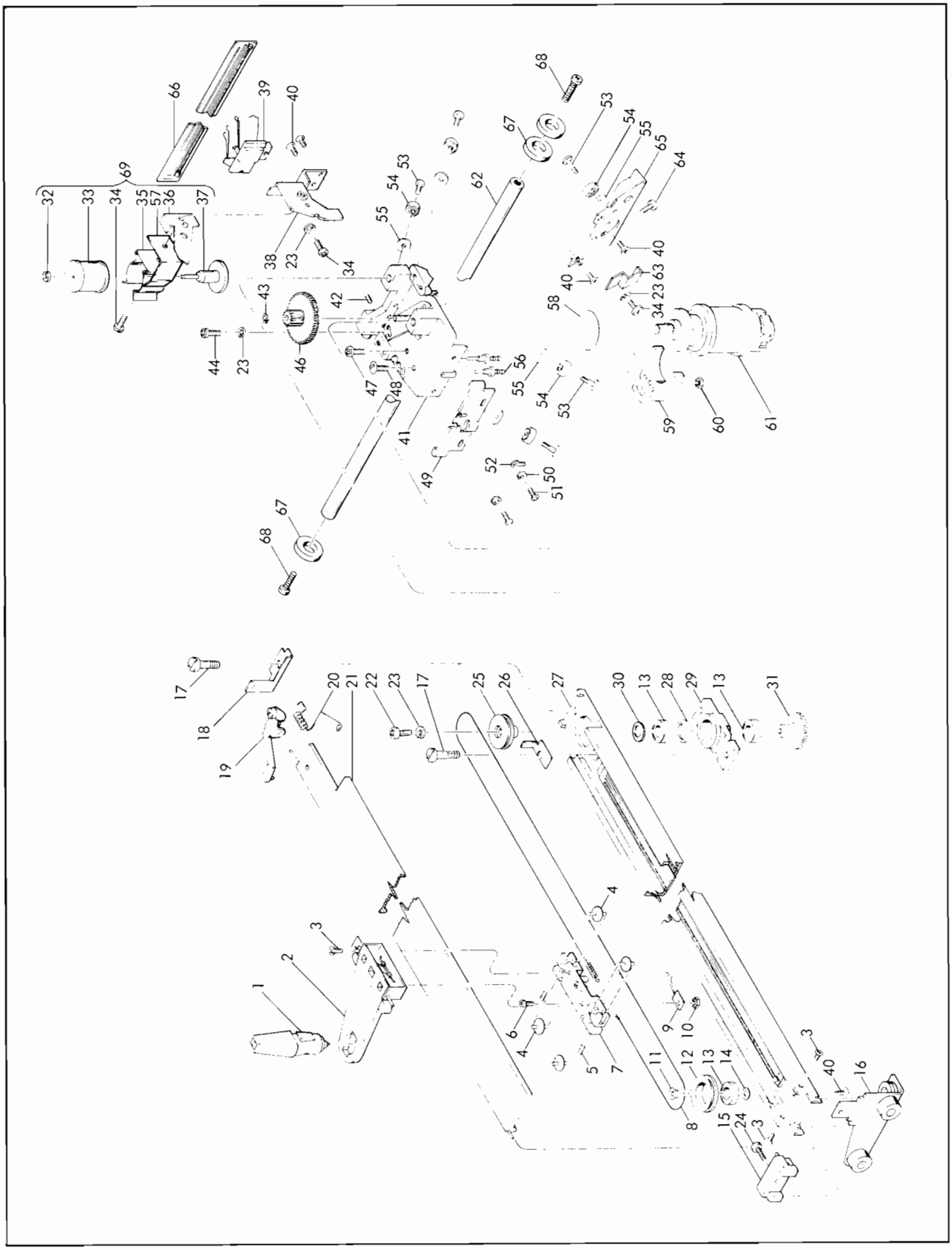


Figure 32. Pen Arm Assembly (Sheet 1 of 2)

Ref. Desig.	Part Number	Description	Quantity
1	5081-1190	Pen – Disposable, red (package of 3)	As Required
	5081-1191	Pen – Disposable, blue (package of 3)	As Required
	5081-1192	Pen – Disposable, green (package of 3)	As Required
	5081-1193	Pen – Disposable, black (package of 3)	As Required
2	5060-6427	Holder, Pen	1
3	0525-0059	Screw - Mach, ss, 2-56 x .188 FH POZI D	4
4	07035-60860	Wheel Assembly, Pen Carriage	4
5	3030-0412	Screw - Set. 2-56 x .125, Allen	2
6	0570-0190	Screw - Mach. ss, 0-80 x .125 Fill H PD	1
7	5080-8135	Carriage Block and Wiper Assembly	1
8	07200-60280	Cable Assembly, Pen Carriage	1
9	09125-60110	Wiper Assembly (Y axis Limit Switch)	1
10	0590-0419	Nut - Hex, 0-80	1
11	07035-20240	Stud, Return Pulley	1
12	07035-20200	Pulley, Return	1
13	1410-0269	Ball Bearing	3
14	3050-0394	Washer - No. 4, Flat	2
15	09125-40060	Block Assembly, Pen Arm	1
16	07005-60260	Bracket Assembly - Slider	1
17	07035-20350	Screw, Shouldered	2
18	07035-00230	Mount - Rear, Scale	1
19	5060-6538	Pen Lift Assembly	1
20	1460-1201	Spring, Pen Lift	1
21	09125-60140	Slidewire Cover	As Required
22	2200-0145	Screw - Mach. ss, 4-40 x 7/16, PH POZI D	1
23	2190-0108	Washer - Lock, No. 4	4
24	2220-0726	Screw, Mach, 4-40 x 5/16, Fill, SSTL	1
25	07035-22180	Pulley, Drive	1
26	07005-20410	Stop, Pen Carriage	1
27	5060-6536	Pen Arm Assembly	1
28	0510-0940	Retaining Ring	1
29	07035-20330	Block, Arm Mounting	1
30	2190-0125	Shim - ss, 0.093 ID, 0.156 OD, 0.012 THK	As Required
31	07004-60070	Pen Drive Assembly	1
32	0510-0810	Retaining Ring	1
33	09862-60160	Solenoid Assembly	1
34	2270-0022	Screw - Mach. ss, 4-40 x .188, PH PD	1
35	1400-0340	Holder, Solenoid Assembly	1
36	07005-00730	Pointer, Index	1
37	09125-20350	Plunger Assembly, Solenoid	1
38	5060-4569	Bracket Assembly - Coil and Wiper	1
39	5080-8127	Wiper Assembly, X axis	1
40	2200-0164	Screw - Mach, ss, 4-40 x 3/16 FH PD	5
41	09125-60270	Motor Block Assembly	1
42	3030-0208	Screw - Set, 4-40 x .125, Allen	3
43	0510-0724	Retaining Ring	1
44	2200-0139	Screw - Mach. ss, 4-40 x .25 PH POZI D	1
45	3050-0394	Washer - Flat, .130 ID, .25 OD, .02 THK	1
46	07004-60060	Gear Assembly, Pen Drive	1
47	2200-0145	Screw - Mach. ss, 4-40 x .438, PH POZI D	1
48	2200-0710	Screw - Mach. ss, 4-40 x .375, TH SD	1
49	5020-4225	Yoke, Cable	1
50	2190-0094	Washer - Lock, No. 2	2
51	0520-0066	Screw - Mach. ss, 2-56 x .188 PH PD	2
52	0360-0243	Terminal Lug	1
53	0570-1103	Screw, Shoulder	5
54	1410-0941	Ball Bearing	5
55	3050-0367	Washer - Flat, .105 ID, ¼ OD, 1/64 THK	5
56	0360-1626	Stud, Terminal	2
57	09862-00110	Shield, Solenoid	1
58	07035-22440	Insulator, Mylar	1
59	09125-40030	Cleat, Motor	1
60	2260-0007	Nut, 4-40	1
61	5080-7966	Servo Motor	1
62	09125-20210	Rod, Track	2 in.
63	07004-00350	Clamp, Trailing Cable	1
64	2200-0048	Screw - Mach. ss, 4-40 x .375 PH PD	1
65	09125-60280	Bearing Adjustment Assembly	1
66	5060-6537	X axis Slidewire and Limit Switch Assembly	1
67	09125-20070	Bumper	3
68	2360-0209	Screw - Mach. 6-32 x 1.00, SST, Pan, POZI	2
69	09862-60200	Pen, Solenoid, Complete	1

Figure 32. Pen Arm Assembly (Sheet 2 of 2)

TROUBLESHOOTING

CONTENT

This Chapter contains instructions for troubleshooting the 9862A. A Printed Circuit Board Location drawing (Figure 28, Appendix A), a Troubleshooting Chart (Figure 33) and a Wiring Diagram are supplied to aid in troubleshooting. Schematics are contained in Appendix F.

REQUIREMENTS

Troubleshooting of the 9862A should be performed in a logical manner. The concept of bracketing should be employed such as establishing which section is not operational or operating abnormally. This is generally the fastest method to locate trouble in a unit. The Block Diagram (Figure 2) and Logic Flow Diagram (Appendix E) may be utilized to assist troubleshooting. However, the Troubleshooting Chart should serve as the prime troubleshooting guide.

TROUBLESHOOTING CHART

Malfunctions not caused by improper adjustments may be detected by referring to the Troubleshooting Chart (Figure 33).

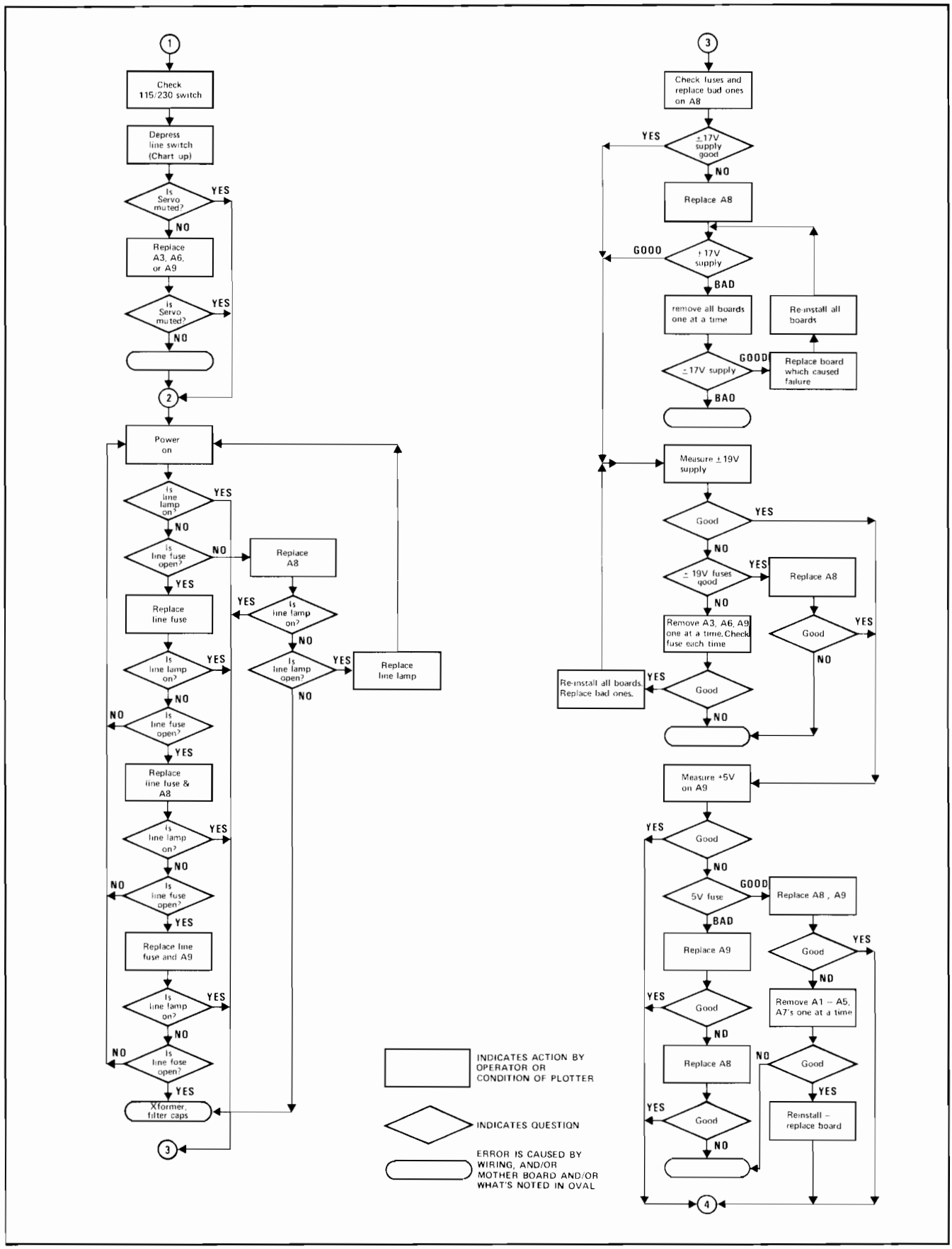


Figure 33. Troubleshooting Chart (Sheet 1 of 5)

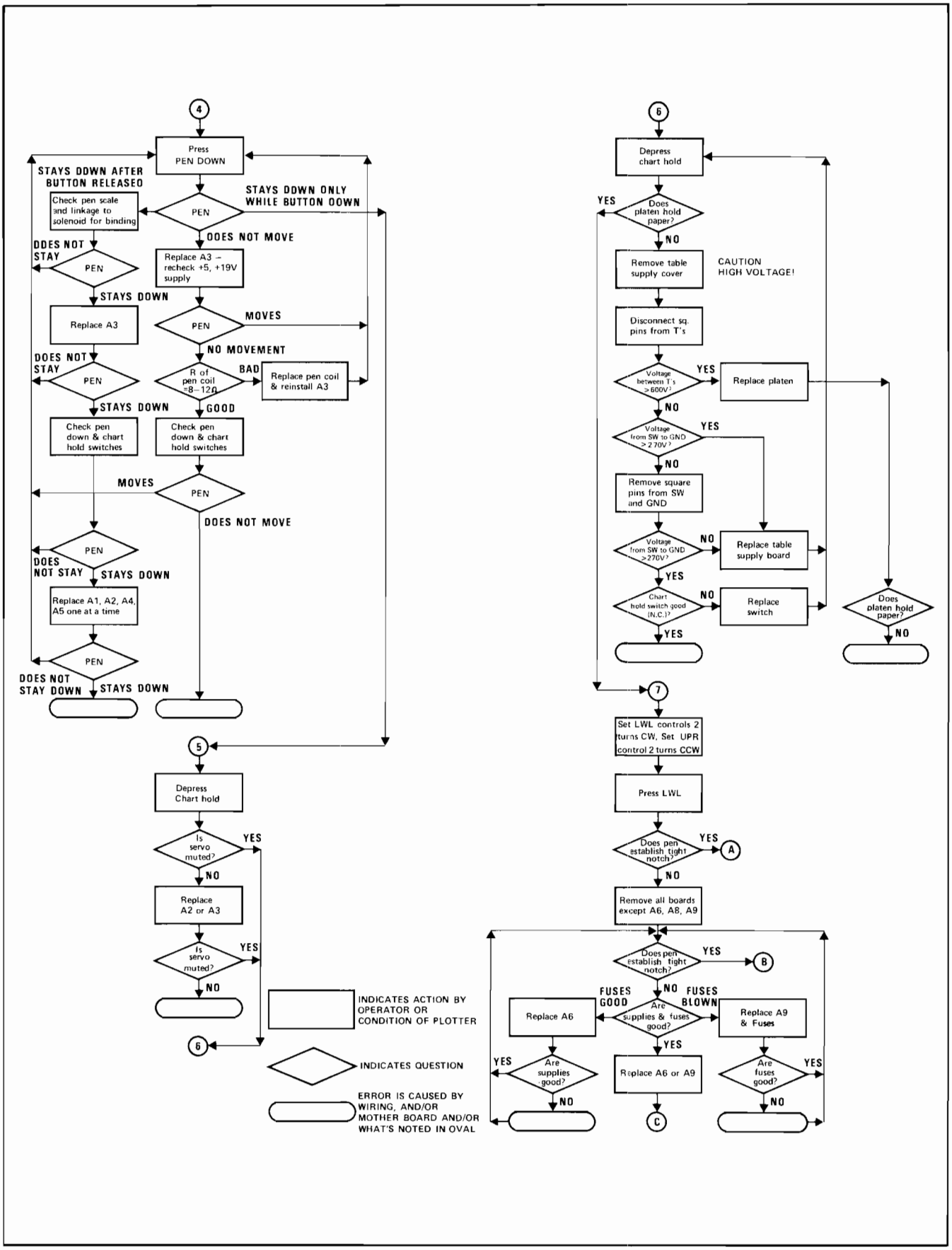


Figure 33. Troubleshooting Chart (Sheet 2 of 5)

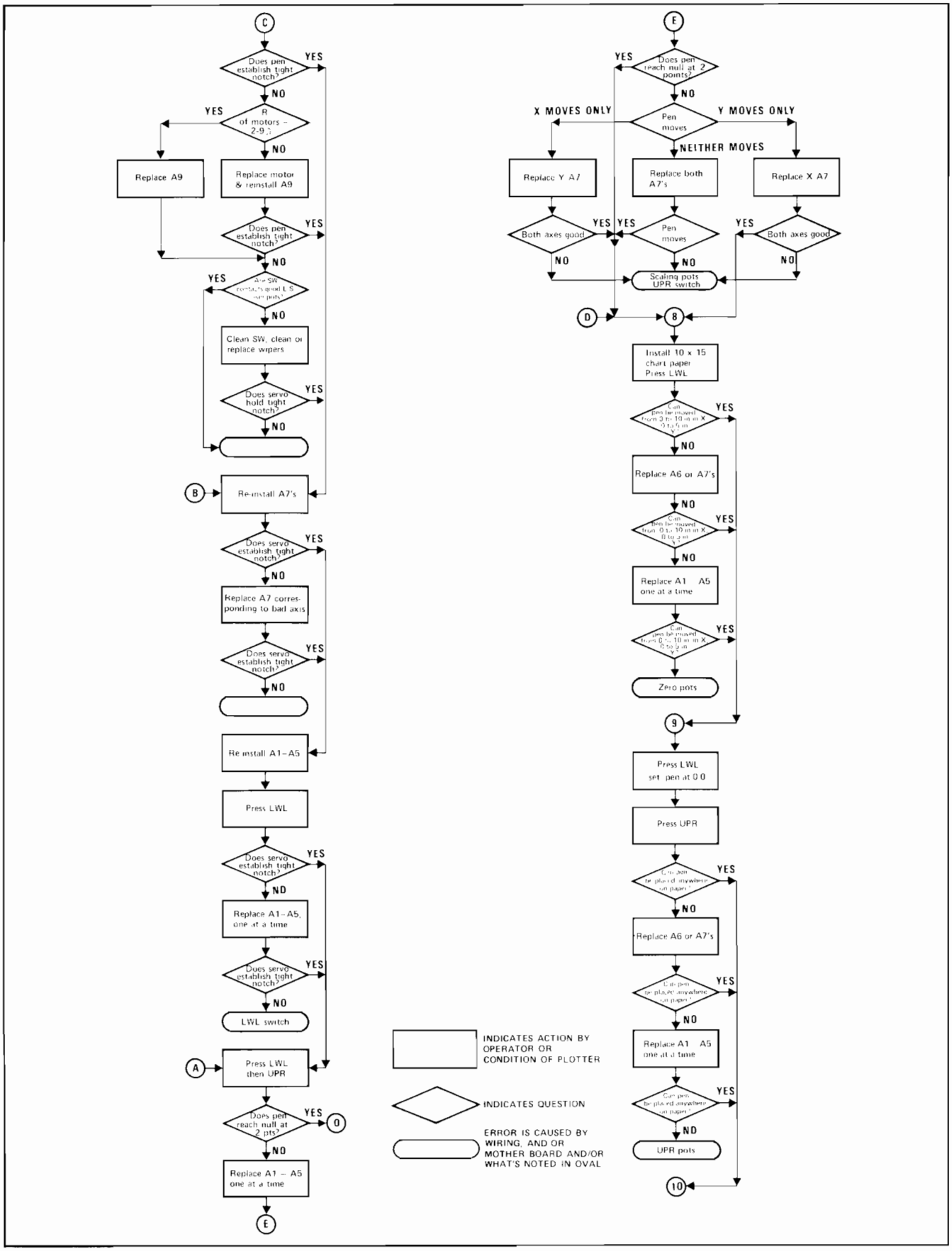


Figure 33. Troubleshooting Chart (Sheet 3 of 5)

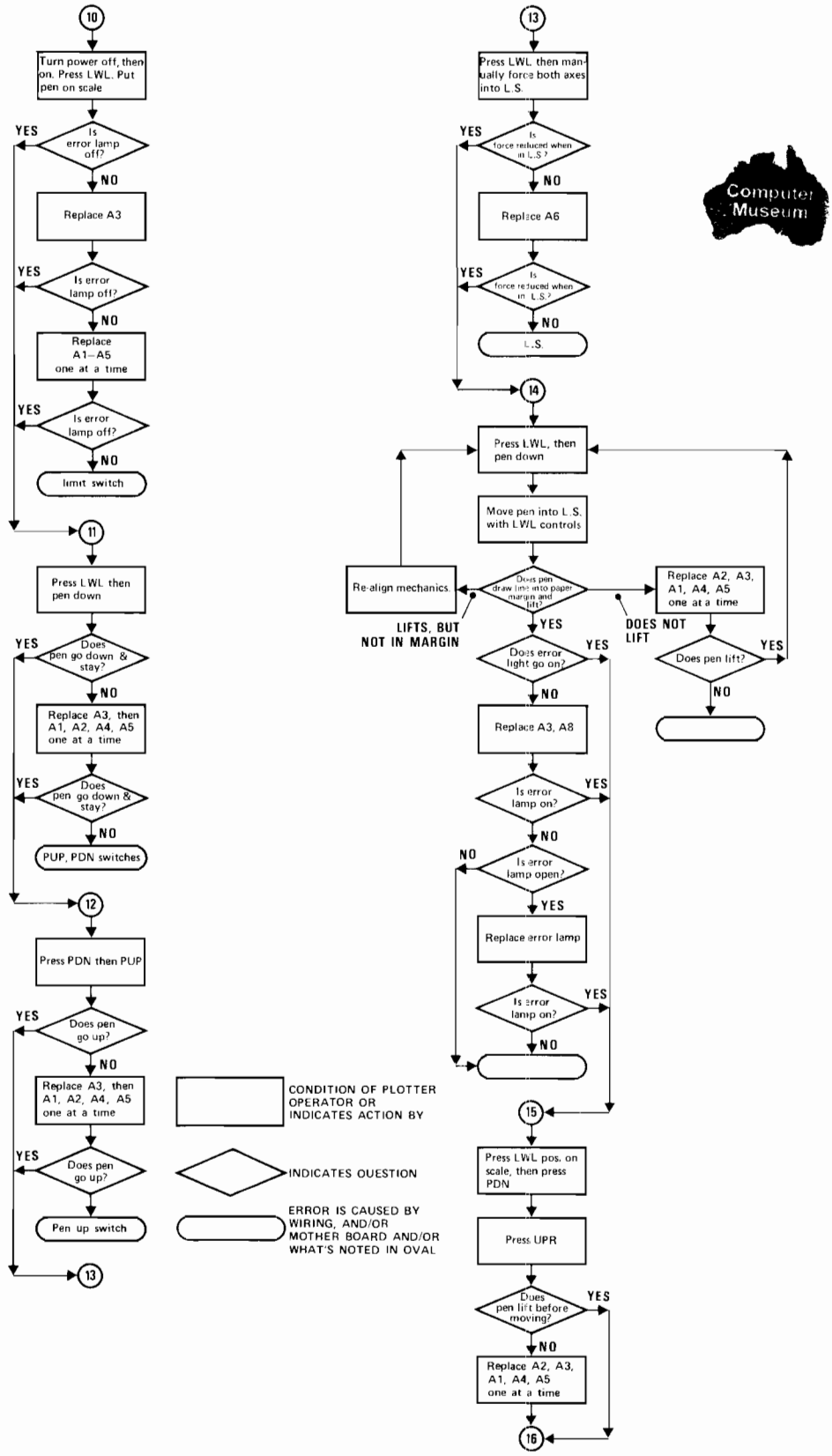


Figure 33. Troubleshooting Chart (Sheet 4 of 5)

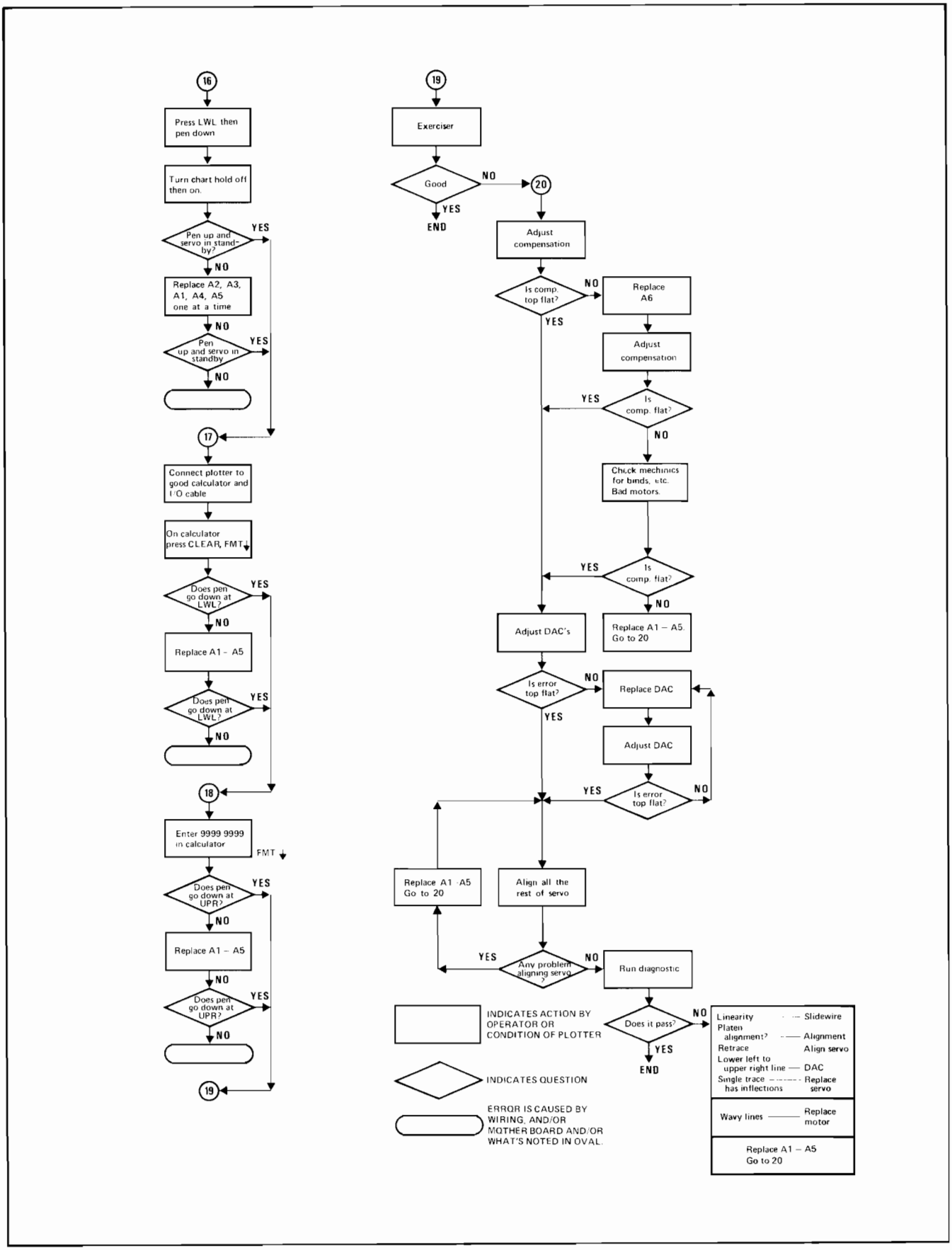


Figure 33. Troubleshooting Chart (Sheet 5 of 5)

9. Slidewire Lubrication

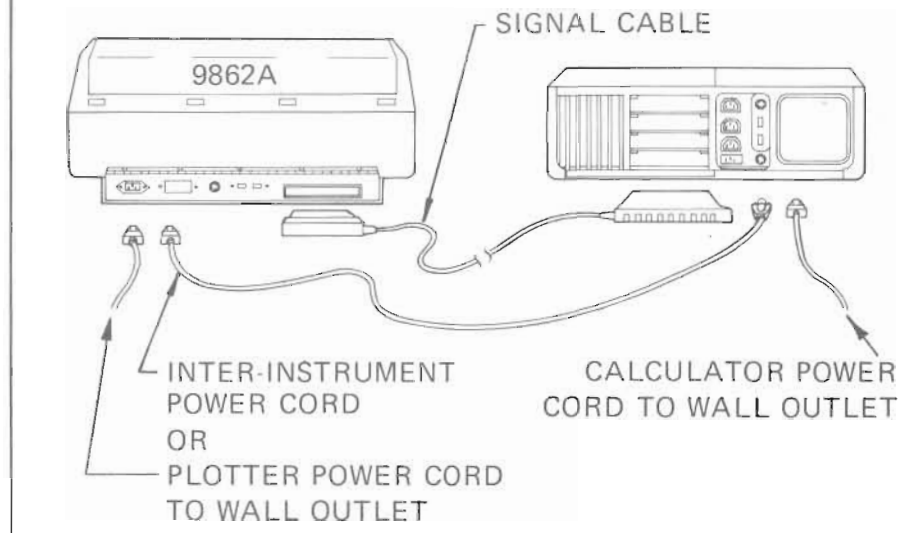


Figure 10. Instrument Interconnections

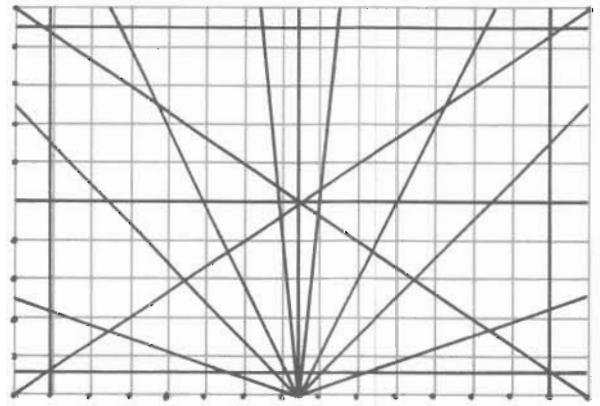


Figure 11. Diagnostic Plot

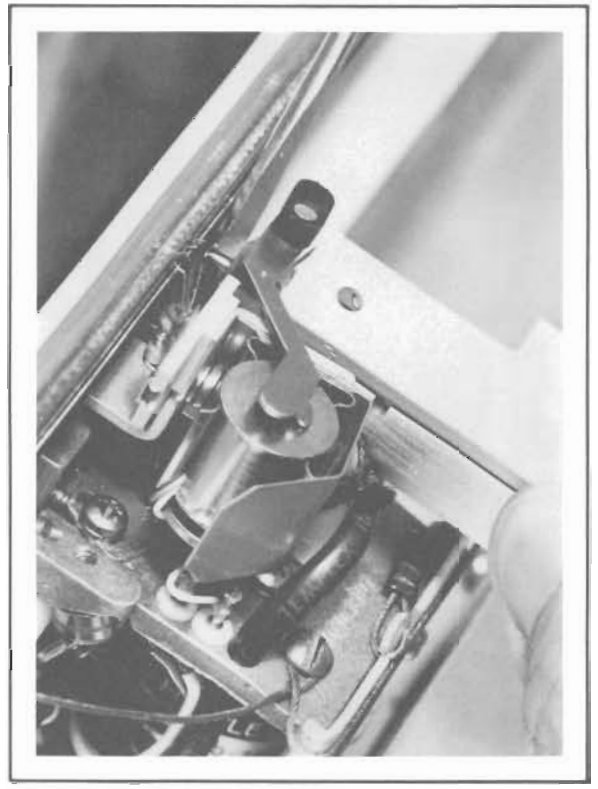


Figure 12. Y Slidewire Cover Removal

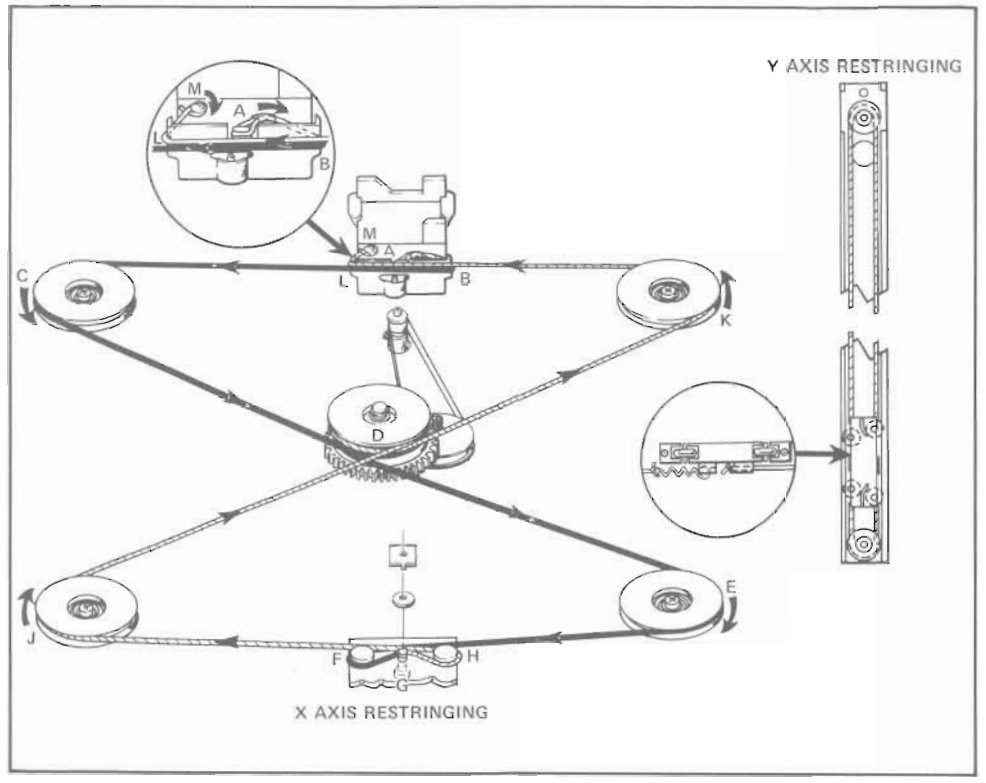


Figure 15. X and Y Axis Restringing

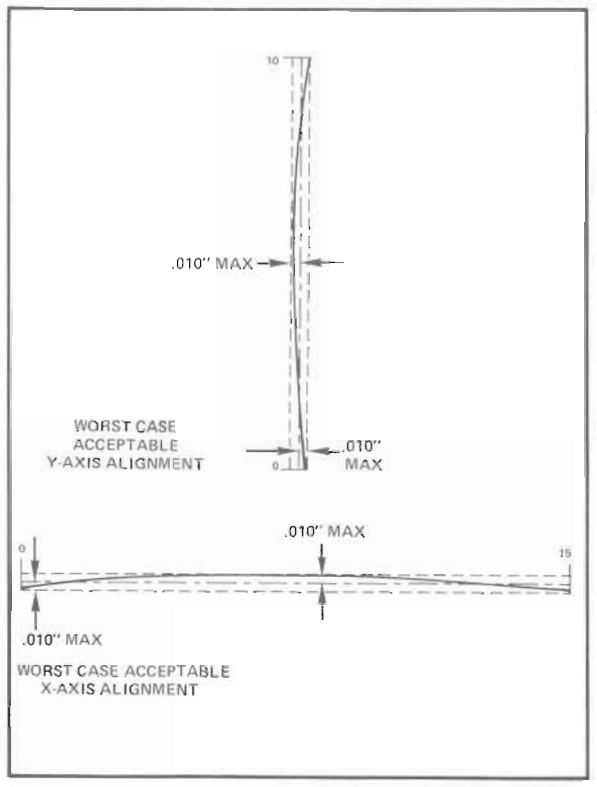


Figure 16. Worst Case Acceptable Alignment (X-Axis and Y-Axis)

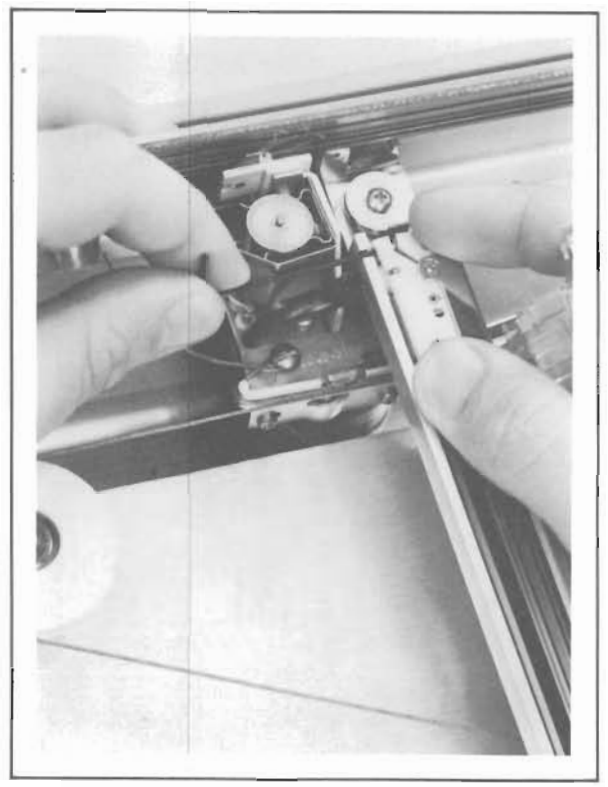


Figure 17. Pen Carriage Adjustment

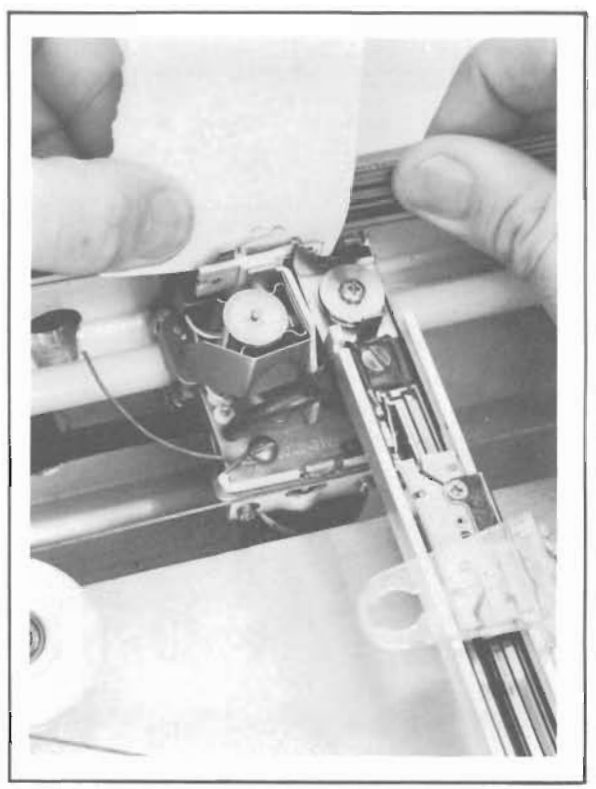


Figure 18. Wiper Protection

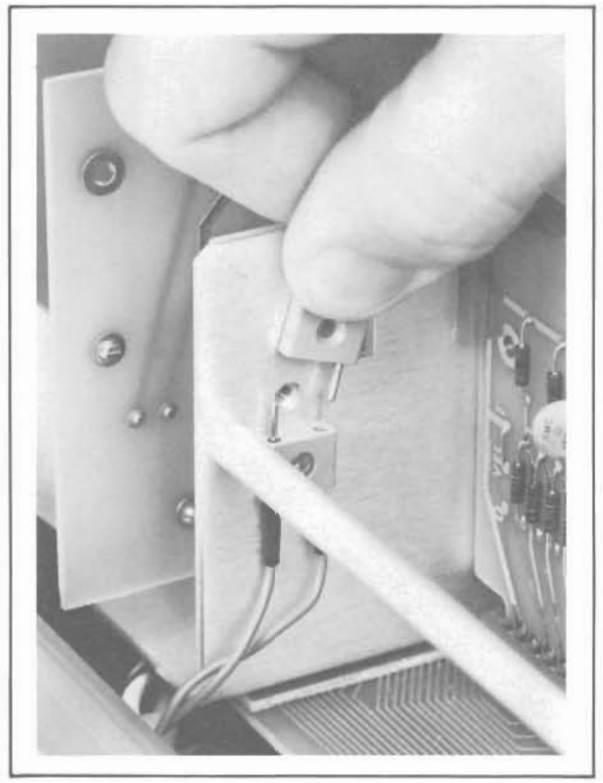


Figure 7. Autogrip Lead Removal

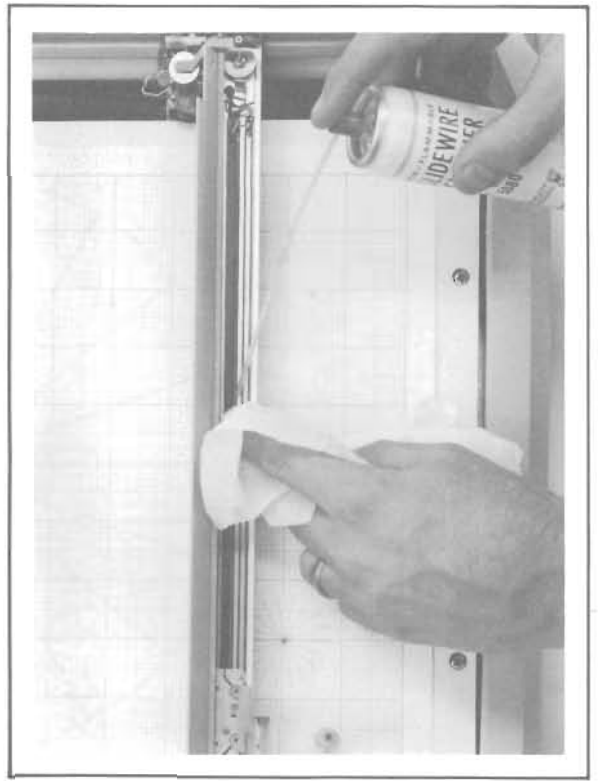


Figure 8. Slidewire Cleaning

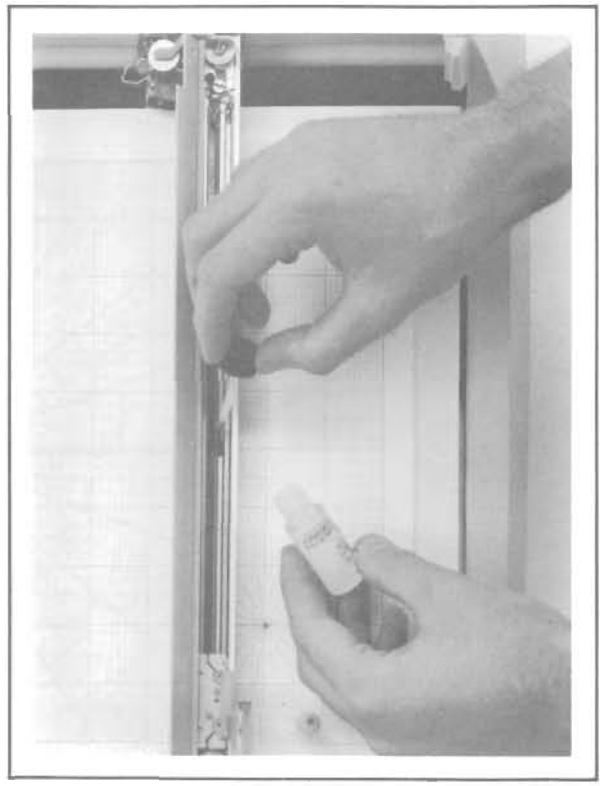


Figure 9. Slidewire Lubrication

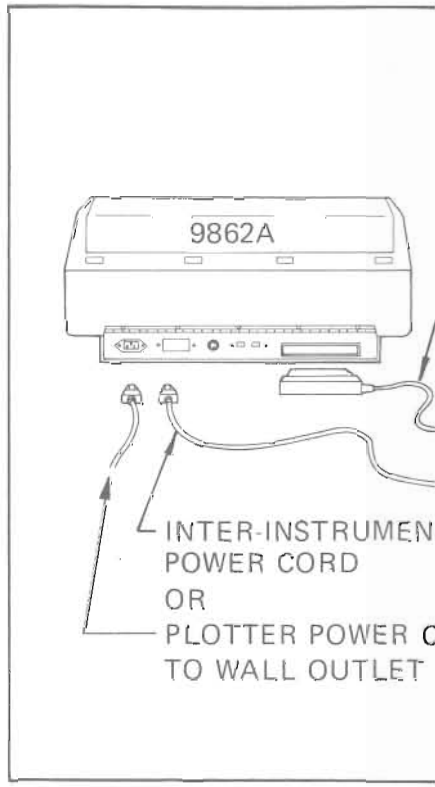


Figure 10. Inst

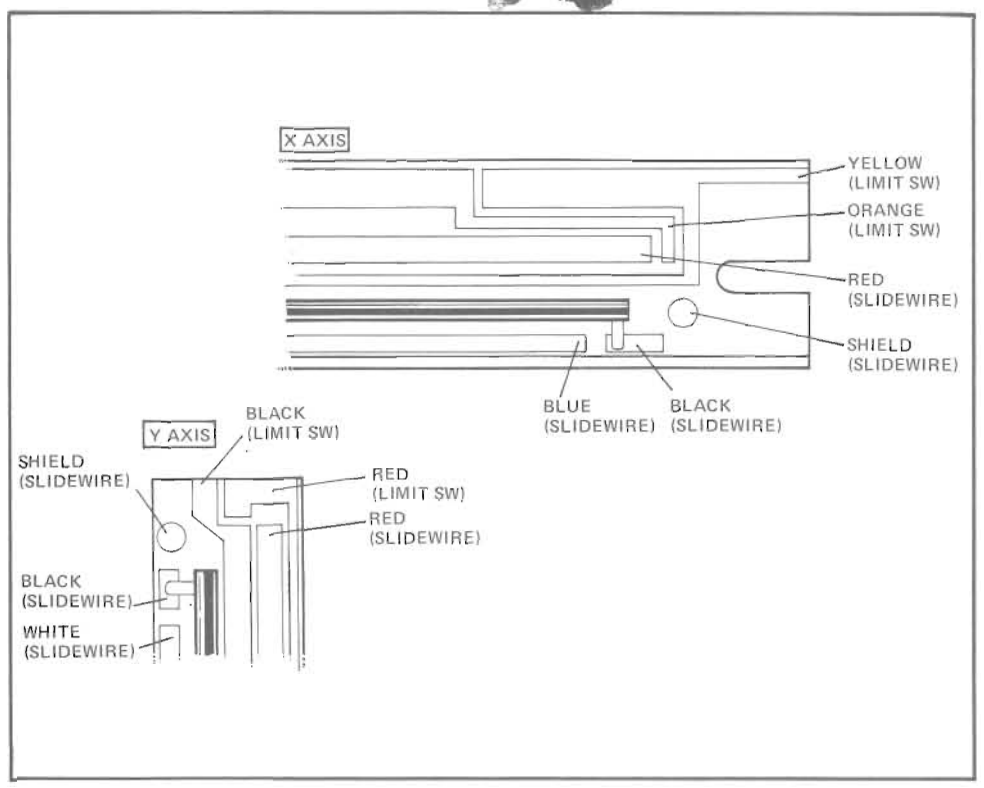


Figure 13. Slidewire Lead Connections

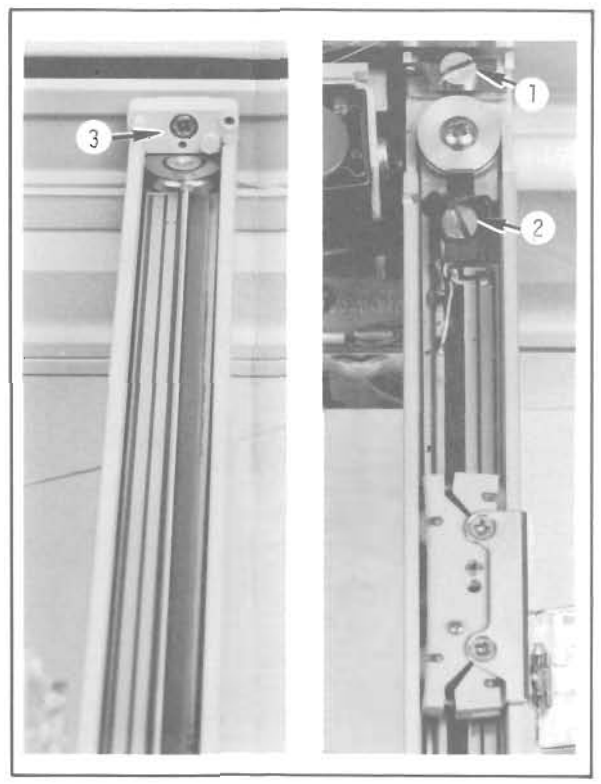


Figure 14. Carriage Arm Removal

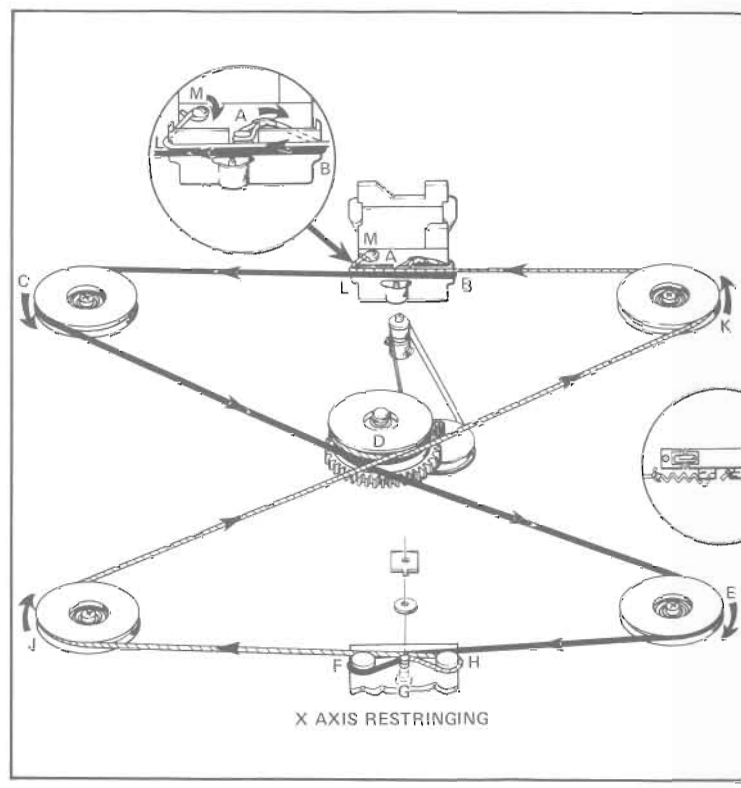
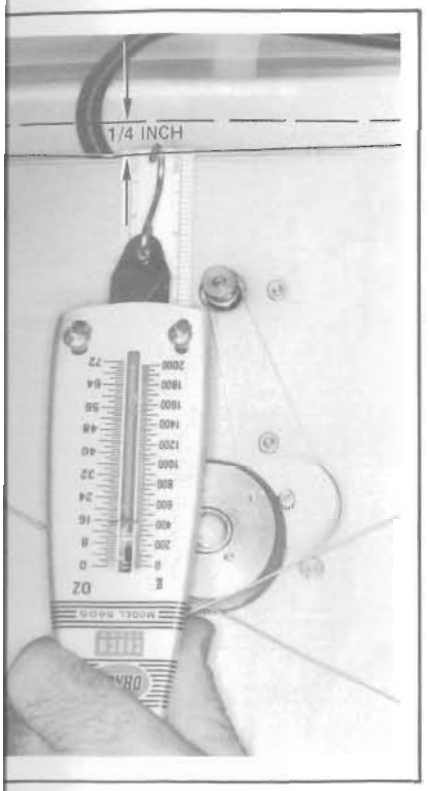


Figure 15. X and Y Axis Restringing



X-Axis Cable Tension Check

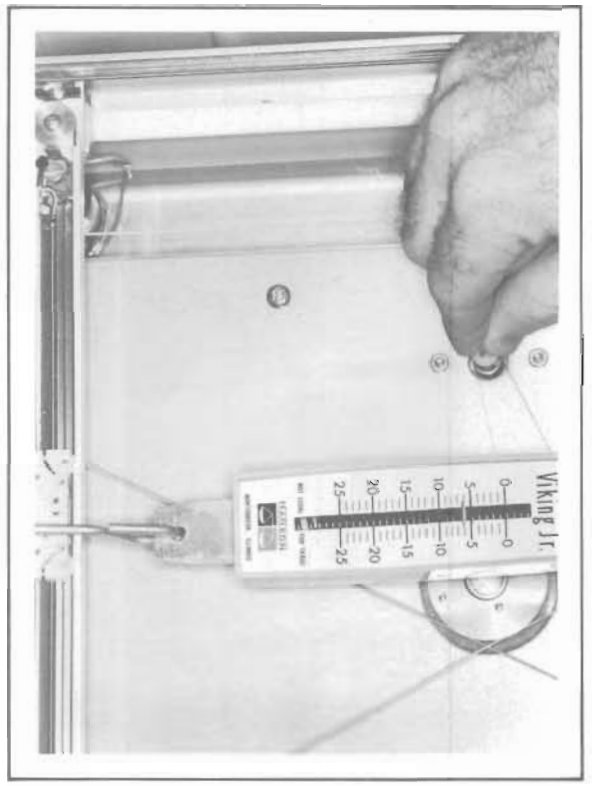


Figure 22. X-Axis Belt Tension Check

Figure 23. X-Axis Gear Train Backlash Adjustment

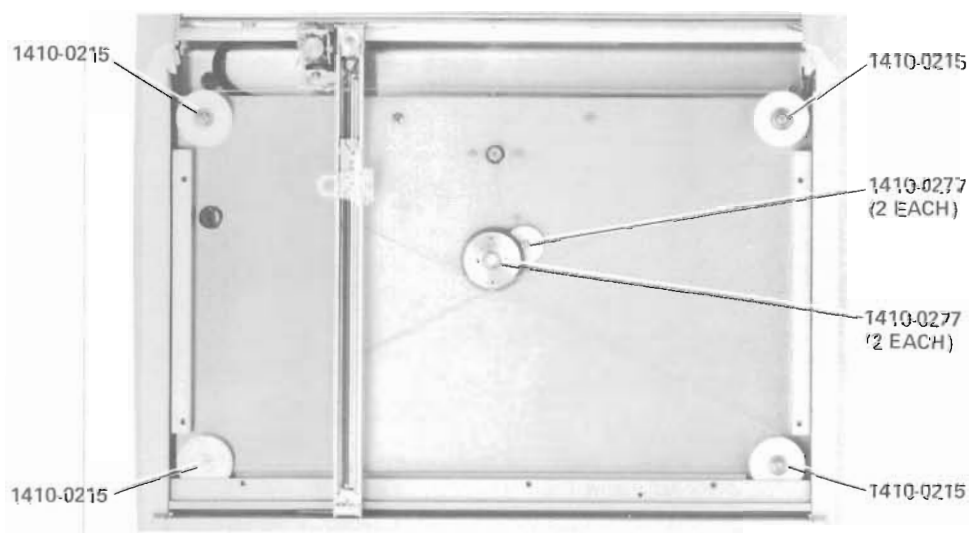


Figure 24. X-Axis Drive Train Bearing Locations

X-Axis Track Bearing Adjustment

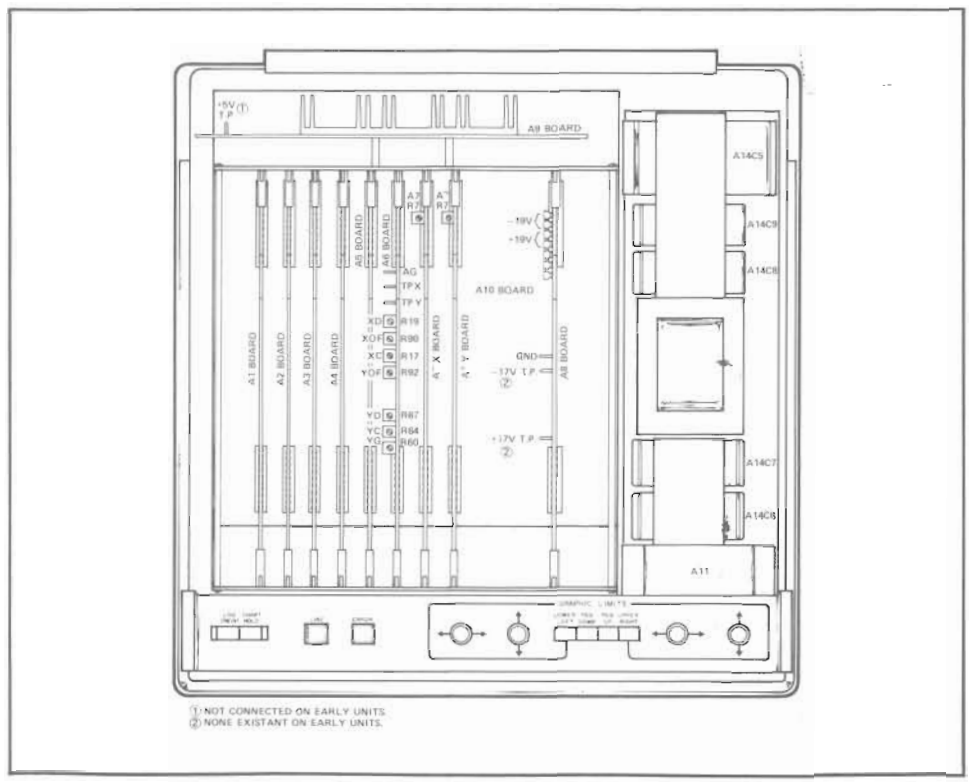


Figure 28. Circuit Board Location

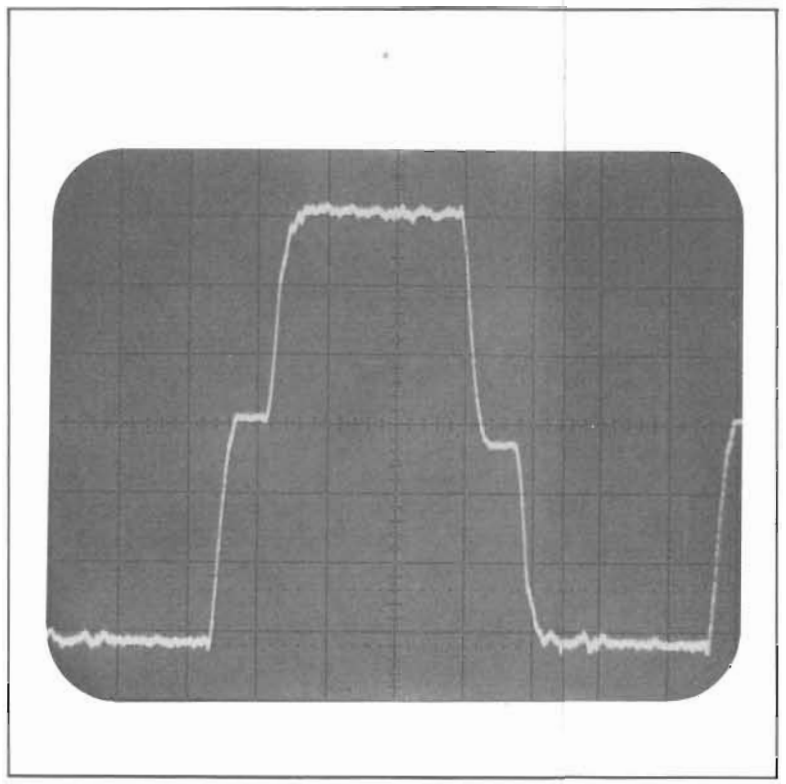


Figure 29. XC and YC Adjustment

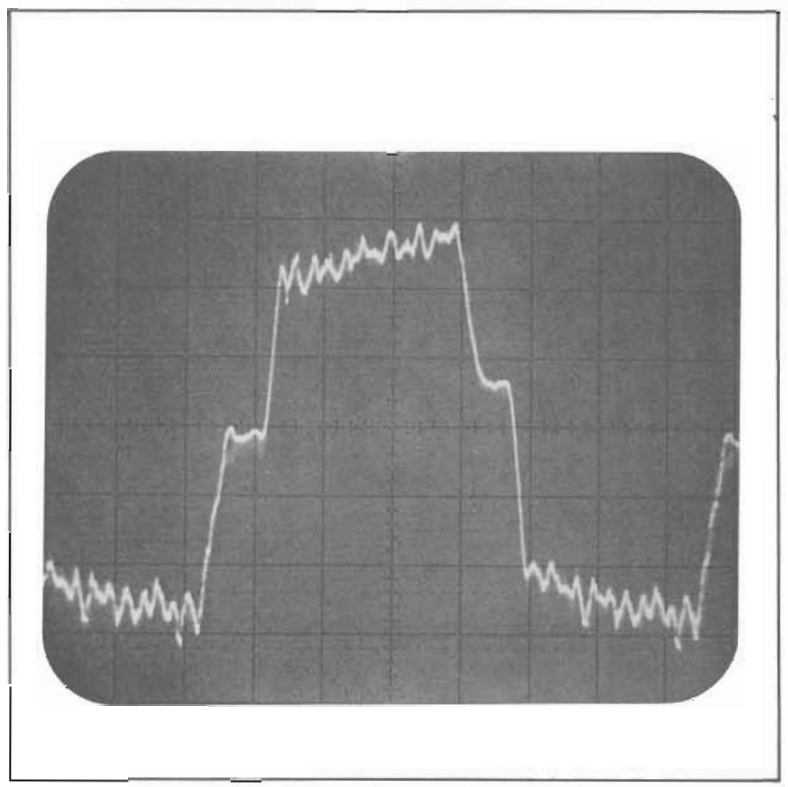


Figure 30. XOF and YOF Adjustment

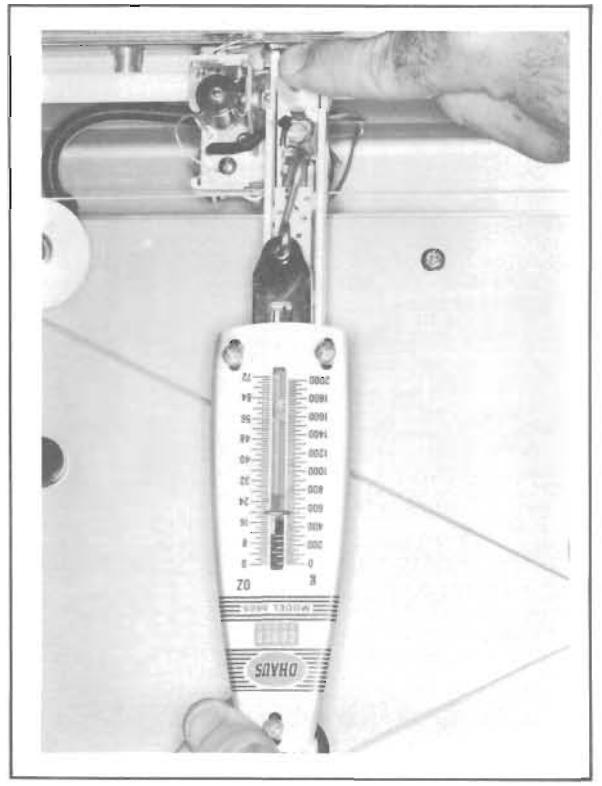


Figure 19. Y-Axis Drive String Tension Check

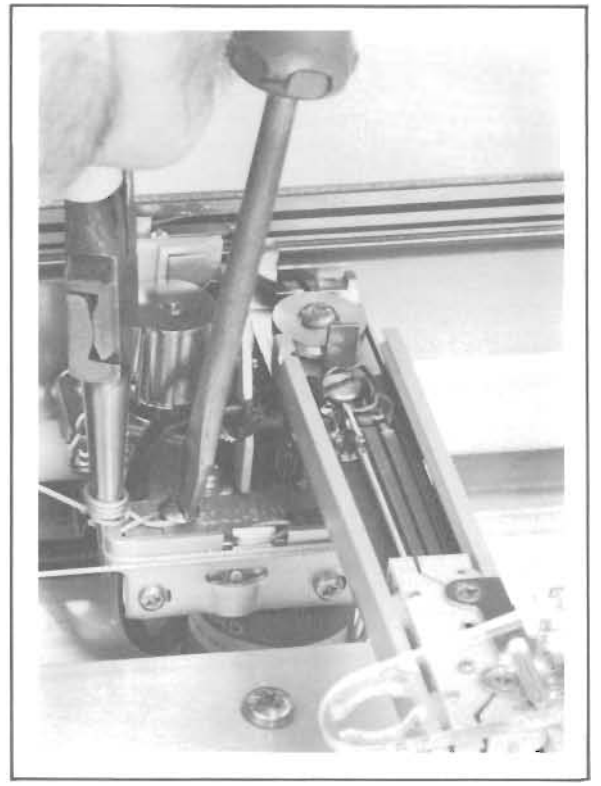


Figure 20. X-Axis Cable Tightening

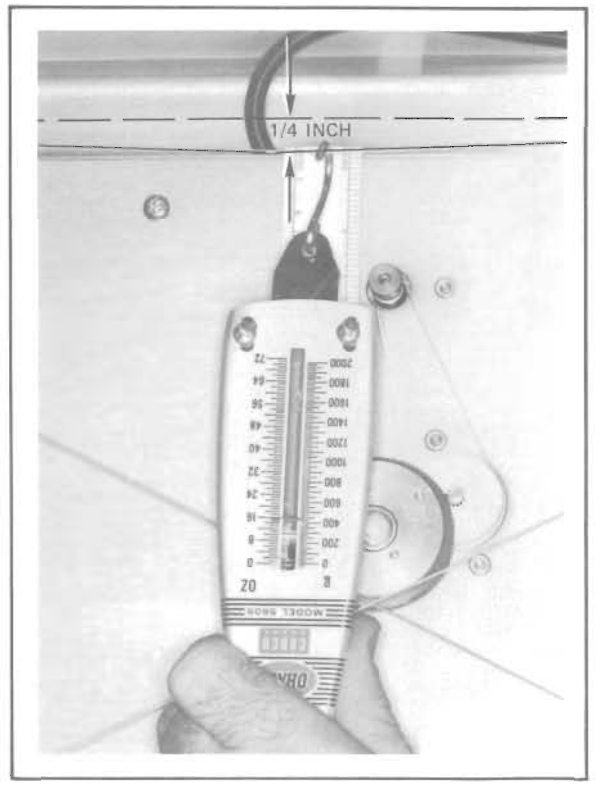


Figure 21. X-Axis Cable Tension Check

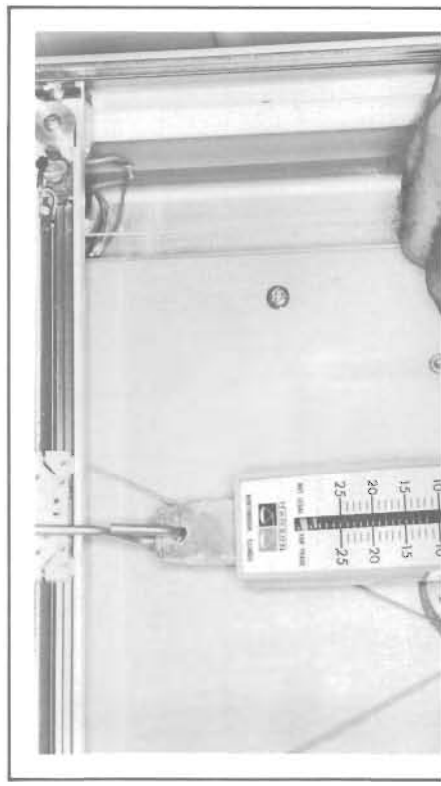


Figure 22. X-Axis Belt Tension

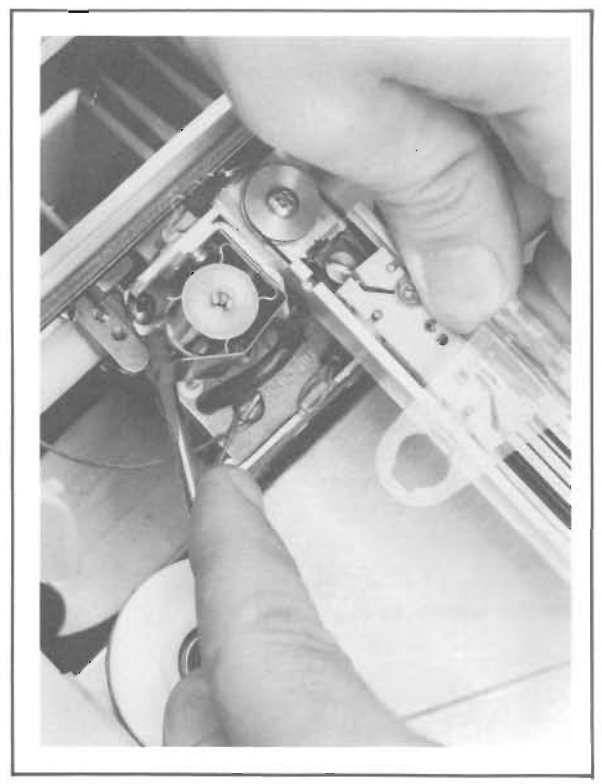


Figure 25. Y-Axis Gear Train Backlash Adjustment

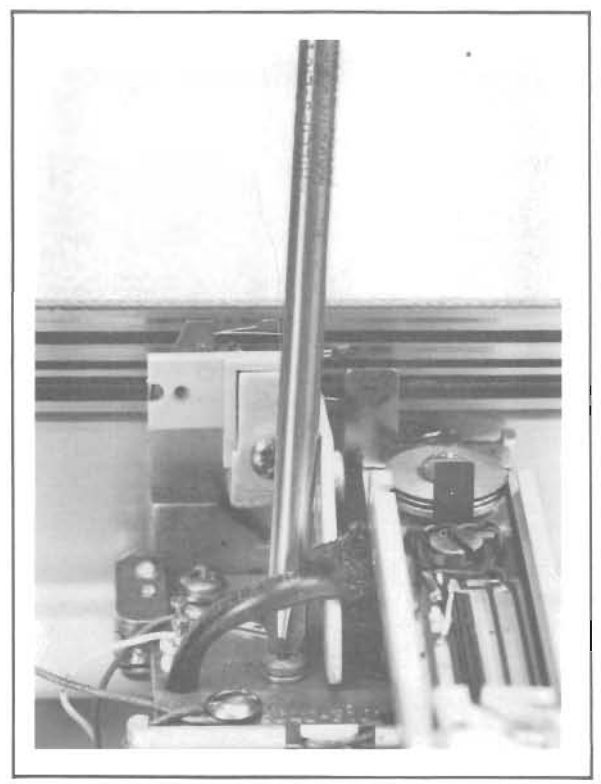


Figure 26. Y-Axis Motor Clamp Screw

Figure 27. X-Axis Track Bearing Adjustment

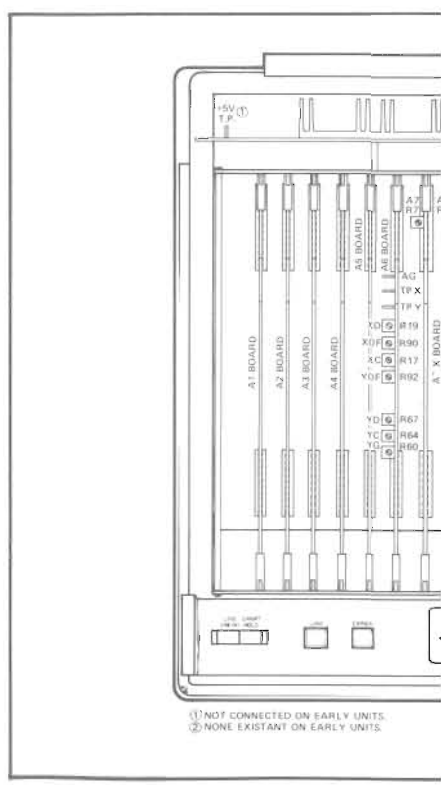


Figure 28. Cir

APPENDIX B
EXERCISER PROGRAM

STEP	KEY
0	CLEAR
1	5
2	ENTER EXP
3	3
4	X → ( )
5	b
6	FMT
7	↑
8	ENTER EXP
9	3
10	↑
11	9
12	9
13	9
14	9
15	X → ( )
16	a
17	FMT
18	↓
19	CLEAR X
20	↑
21	b
22	FMT
23	↓
24	↑
25	2
26	÷
27	CONTINUE
28	a
29	FMT
30	↓
31	CLEAR X
32	↑
33	b
34	FMT
35	↓
36	7
37	5

STEP	KEY
38	0
39	0
40	↑
41	a
42	FMT
43	↓
44	CLEAR X
45	↑
46	b
47	FMT
48	↓
49	a
50	↑
51	8
52	3
53	3
54	1
55	FMT
56	↓
57	CLEAR X
58	↑
59	b
60	FMT
61	↓
62	a
63	↑
64	5
65	6
66	6
67	7
68	FMT
69	↓
70	CLEAR X
71	↑
72	b
73	FMT
74	↓
75	a

APPENDIX B
EXERCISER PROGRAM

STEP	KEY
76	↑
77	4
78	3
79	3
80	3
81	FMT
82	↓
83	CLEAR X
84	↑
85	b
86	FMT
87	↓
88	a
89	↑
90	1
91	6
92	6
93	8
94	FMT
95	↓
96	CLEAR X
97	↑
98	b
99	FMT
100	↓
101	7
102	5
103	0
104	0
105	↑
106	CLEAR X
107	FMT
108	↓
109	↑
110	b
111	FMT
112	↓
113	b

STEP	KEY
114	↑
115	2
116	÷
117	CLEAR X
118	FMT
119	↓
120	X ⇄ Y
121	b
122	FMT
123	↓
124	ENTER EXP
125	3
126	↑
127	CLEAR X
128	FMT
129	↓
130	↑
131	b
132	FMT
133	↓
134	CLEAR X
135	↑
136	FMT
137	↑
138	a
139	↑
140	FMT
141	↓
142	CLEAR X
143	↑
144	FMT
145	↓
146	5
147	0
148	0
149	↑
150	CLEAR X
151	FMT

APPENDIX B
EXERCISER PROGRAM

STEP	KEY
152	↑
153	a
154	FMT
155	↓
156	b
157	↑
158	CLEAR X
159	FMT
160	↑
161	a
162	FMT
163	↓
164	9
165	5
166	0
167	0
168	↑
169	CLEAR X
170	FMT
171	↑
172	a
173	FMT
174	↓
175	6
176	6
177	7
178	↑
179	a
180	X ⇄ Y
181	FMT
182	↑
183	X ⇄ Y
184	CLEAR X
185	X ⇄ Y
186	FMT
187	↓
188	X ⇄ Y
189	CLEAR X

STEP	KEY
190	X ⇄ Y
191	FMT
192	↓
193	b
194	FMT
195	↑
196	X ⇄ Y
197	a
198	X ⇄ Y
199	FMT
200	↓
201	9
202	3
203	3
204	4
205	FMT
206	↑
207	X ⇄ Y
208	CLEAR X
209	X ⇄ Y
210	FMT
211	↓
212	CLEAR
213	b
214	↑
215	a
216	FMT
217	↑
218	FMT
219	↓
220	a
221	↑
222	6
223	6
224	7
225	+
226	Y → ( )
227	a

APPENDIX B
EXERCISER PROGRAM

STEP	KEY	STEP	KEY
228	ENTER EXP	266	+
229	4	267	Y → ( )
230	X<Y	268	b
231	0	269	ENTER EXP
232	2	270	4
233	4	271	IF X = Y
234	2	272	0
235	GO TO	273	2
236	2	274	8
237	1	275	5
238	3	276	GO TO
239	STOP	277	2
240	CONTINUE	278	5
241	CONTINUE	279	5
242	CLEAR	280	STOP
243	9	281	CONTINUE
244	9	282	CONTINUE
245	9	283	CONTINUE
246	9	284	CONTINUE
247	FMT	285	CLEAR
248	↑	286	9
249	FMT	287	9
250	d	288	9
251	ENTER EXP	289	9
252	3	290	↑
253	CONTINUE	291	CLEAR X
254	CONTINUE	292	FMT
255	b	293	↑
256	↑	294	FMT
257	a	295	↓
258	FMT	296	CONTINUE
259	↑	297	CONTINUE
260	FMT	298	CONTINUE
261	↓	299	CONTINUE
262	b	300	CONTINUE
263	↑	301	CONTINUE
264	ENTER EXP	302	CONTINUE
265	3	303	CONTINUE

APPENDIX B
EXERCISER PROGRAM

STEP	KEY	STEP	KEY
304	CLEAR	331	9
305	9	332	9
306	9	333	9
307	9	334	IF X < Y
308	9	335	0
309	X → ( )	336	3
310	b	337	4
311	↑	338	5
312	CLEAR X	339	GO TO
313	FMT	340	0
314	↑	341	3
315	b	342	1
316	↑	343	5
317	a	344	STOP
318	–	345	5
319	FMT	346	0
320	↓	347	0
321	a	348	0
322	↑	349	↑
323	1	350	1
324	1	351	0
325	1	352	0
326	1	353	0
327	+	354	FMT
328	Y → ( )	355	↑
329	a	356	END
330	9		

APPENDIX C
TEST PROGRAM

STEP	KEY
0	LABEL
1	1
2	CLEAR
3	FMT
4	↑
5	ENTER EXP
6	3
7	↑
8	FMT
9	↑
10	GO TO
11	2
12	LABEL
13	2
14	7
15	6
16	0
17	0
18	↑
19	FMT
20	UP
21	8
22	6
23	0
24	0
25	↑
26	FMT
27	↑
28	GO TO
29	1
30	4
31	LABEL
32	3
33	CLEAR
34	FMT
35	↑
36	ENTER EXP
37	3
38	↑
39	2
40	0
41	0
42	FMT
43	↑
44	GO TO
45	3
46	3
47	LABEL
48	4
49	CLEAR
50	FMT
51	↑
52	2
53	0
54	0
55	↑
56	ENTER EXP
57	3
58	FMT
59	↑
60	GO TO
61	4
62	9
63	LABEL
64	5
65	CLEAR
66	FMT
67	↑
68	X → ( )
69	0
70	X → ( )
71	1
72	↑
73	5
74	ENTER EXP
75	3

APPENDIX C
TEST PROGRAM

STEP	KEY	STEP	KEY
76	X → ( )	114	8
77	2	115	4
78	↑	116	LABEL
79	5	117	6
80	0	118	CLEAR
81	0	119	X → ( )
82	X → ( )	120	1
83	3	121	↑
84	X ← ( )	122	5
85	1	123	1
86	↑	124	0
87	X ← ( )	125	0
88	0	126	X → ( )
89	FMT	127	0
90	↓	128	FMT
91	X ← ( )	129	↑
92	3	130	5
93	↑	131	ENTER EXP
94	X ← ( )	132	3
95	2	133	X → ( )
96	FMT	134	3
97	↓	135	↑
98	X ← ( )	136	5
99	1	137	6
100	↑	138	0
101	X ← ( )	139	0
102	0	140	X → ( )
103	FMT	141	2
104	↓	142	X ← ( )
105	ENTER EXP	143	1
106	2	144	↑
107	X → ( )	145	X ← ( )
108	+	146	0
109	1	147	FMT
110	X → ( )	148	↓
111	+	149	X ← ( )
112	3	150	3
113	GO TO	151	↑

APPENDIX C
TEST PROGRAM

STEP	KEY	STEP	KEY
152	X ← ( )	190	3
153	2	191	X → ( )
154	FMT	192	2
155	↓	193	+
156	X ← ( )	194	X → ( )
157	1	195	3
158	↑	196	↑
159	X ← ( )	197	ENTER EXP
160	0	198	2
161	FMT	199	X → ( )
162	↓	200	4
163	ENTER EXP	201	X←( )
164	2	202	1
165	X → ( )	203	↑
166	+	204	X←( )
167	0	205	0
168	X → ( )	206	FMT
169	+	207	↑
170	2	208	X←( )
171	GO TO	209	1
172	1	210	↑
173	4	211	X←( )
174	2	212	0
175	LABEL	213	FMT
176	7	214	↓
177	CLEAR	215	X←( )
178	X → ( )	216	3
179	0	217	↑
180	↑	218	X←( )
181	5	219	2
182	1	220	FMT
183	0	221	↓
184	0	222	X←( )
185	X → ( )	223	1
186	1	224	↑
187	↑	225	X←( )
188	4	226	0
189	ENTER EXP	227	FMT

APPENDIX C
TEST PROGRAM

STEP	KEY	STEP	KEY
228	↑	235	+
229	X ← ( )	236	2
230	4	237	GO TO
231	X → ( )	238	2
232	+	239	0
233	0	240	8
234	X → ( )	241	END

APPENDIX D
MNEMONICS GLOSSARY

MNEMONIC	MEANING
4BW	Four Bit Word
5UF	5 Volts Unfiltered
8BW	Eight Bit Word
A	A Buss (Input to Arithmetic Unit)
AC	High Voltage AC to Chart Hold
AST	Clock (Astable)
B	B Buss (Input to Arithmetic Unit)
B15	Port 15 of B Buss
C	Output C Register
C14	Clear F14 Flop
CCC	Clear Cycle Counter
CCF	Clear Control Flops
CDE	Code (BCD or Binary Command Line)
CHD	Chart Hold
CLC	Clear Last Pen Command
CLP	Clamp (Status Line and Servo Clamp)
CMO	Command Multiplexer Output
CRY	Carry (Arithmetic Unit)
CSR	Clear Shift Registers
CTL	Control (Transfer Line)
DMO	Data Multiplexer Output
DXS	Delta X Sign (Command Line)
DYS	Delta Y Sign (Command Line)
F	Output F Register
F1-5	Temporary Storage Flops
F1Ø-14	Cycle Counter Flops
FLD	Format Light Driver
FLG	Flag (Transfer Line)
FLS	Format Lamp Supply
FMT	Format (Status Line)
IØ-16	Input Data Lines
ISC	Increment State Counter
LS	Limit Switch
LSC	Load State Counter
LSP	Last Sum Positive
LWL	Lower Left (Front Panel Switch)
MDE	Mode (Delta or Absolute Command Line)
MVR	Maneuver (Position or Pen Command Line)

APPENDIX D
MNEMONICS GLOSSARY

MNEMONIC	MEANING
PØ-15	System Strobe Pulses Generated Each Machine Cycle
PDN	Pen Down (Front Panel Switch)
PEN	Pen (Status Line)
PLS	Power Lamp Supply
PNC	Pen Command (Command Line)
PNH	Pen Driver - High Side
PNL	Pen Driver - Low Side
PSC	Preset Clamp
PUP	Pen Up (Front Panel Switch)
QFR	Qualifier
QMO	Qualifier Multiplexer Output
RØØ-9	ROM Outputs
RDY	Ready (Status Line)
S15	Port 15 Control Flop Decoder
SBY	Standby (Status Line)
SFT	Shift (Memory Registers)
SHD	Shift DAC's
SKP	Skip
SPH	Sample Hold
SSY	Servo Standby
SUM	Sum (Arithmetic)
SW	Shard Hold Disabling Switch
SYC	Syncronization (Command Line)
T	Table
UPR	Upper Right (Front Panel Switch)
VEL	Velocity
WØ-3	Word Select
XØ	X Dac Output
X1	Output X1 Register
XC	X Compensation Adjustment Pot
XD	X Deadband Adjustment Pot
XDI	X Dac Input
XOD	X Output Drive
XOF	X Offset Adjustment Pot
X OUTPUT	X Driver Output
XSP	X Scaling Pot
XSW	ArmX Slidewire
XSW-	Bottom X Slidewire

APPENDIX D
MNEMONICS GLOSSARY

MNEMONIC	MEANING
XZP	X Zero Pot
YØ	Y Dac Output
Y1	Output Y1 Register
YC	Y Compensation Adjustment Pot
YD	Y Deadband Adjustment Pot
YDI	Y Dac Input
YG	Y Gain Adjustment Pot
YOD	Y Output Drive
YOF	Y Offset Adjustment Pot
Y OUTPUT	Y Driver Output
YSP	Y Scaling Pot
YSW	Arm - Y Slidewire
YSW+	Top - Y Slidewire
YSW-	Bottom - Y Slidewire
YZP	Y Zero Pot

APPENDIX E
LOGIC CIRCUIT

This Appendix contains the Logic Circuit Diagram plus its associated Timing Diagram. For detailed circuit diagrams, refer to Appendix F.

APPENDIX E
LOGIC CIRCUIT

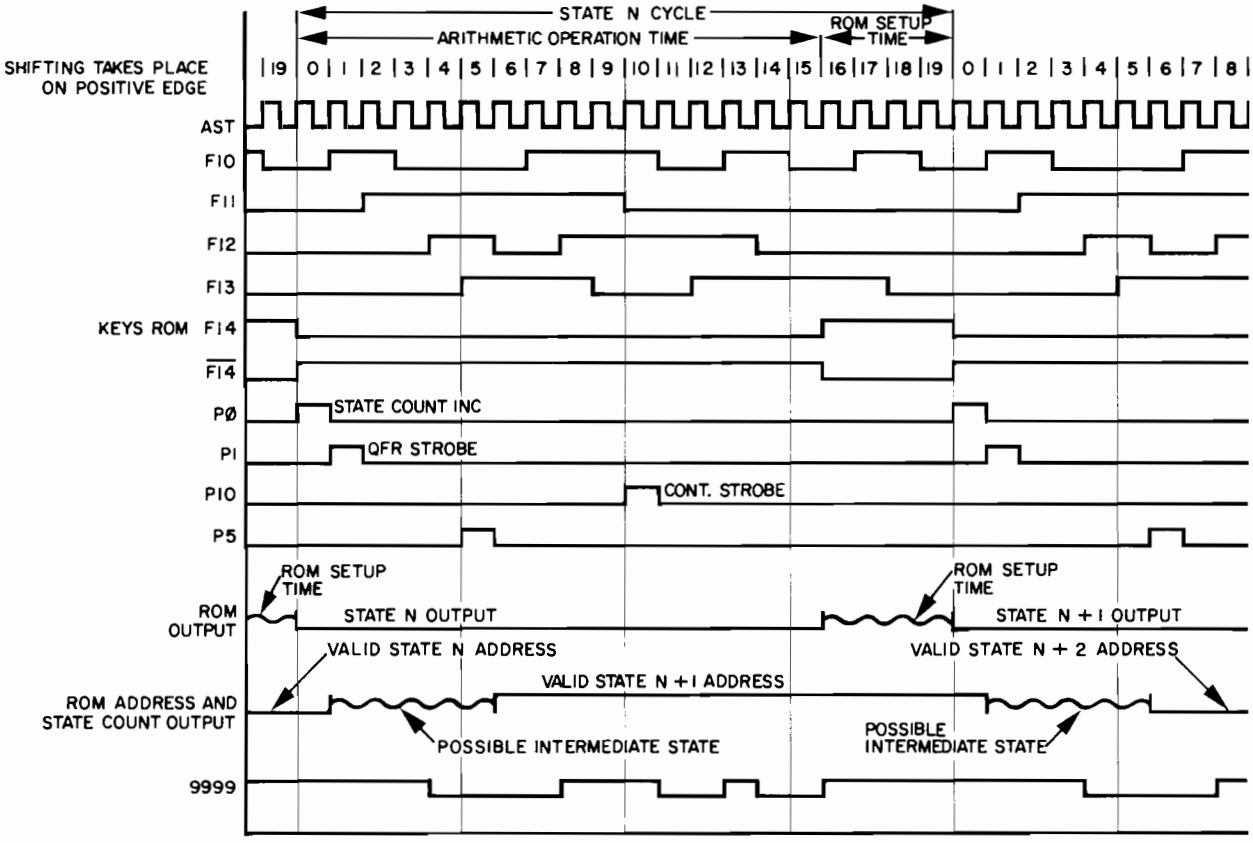


Figure 34. Timing Diagram

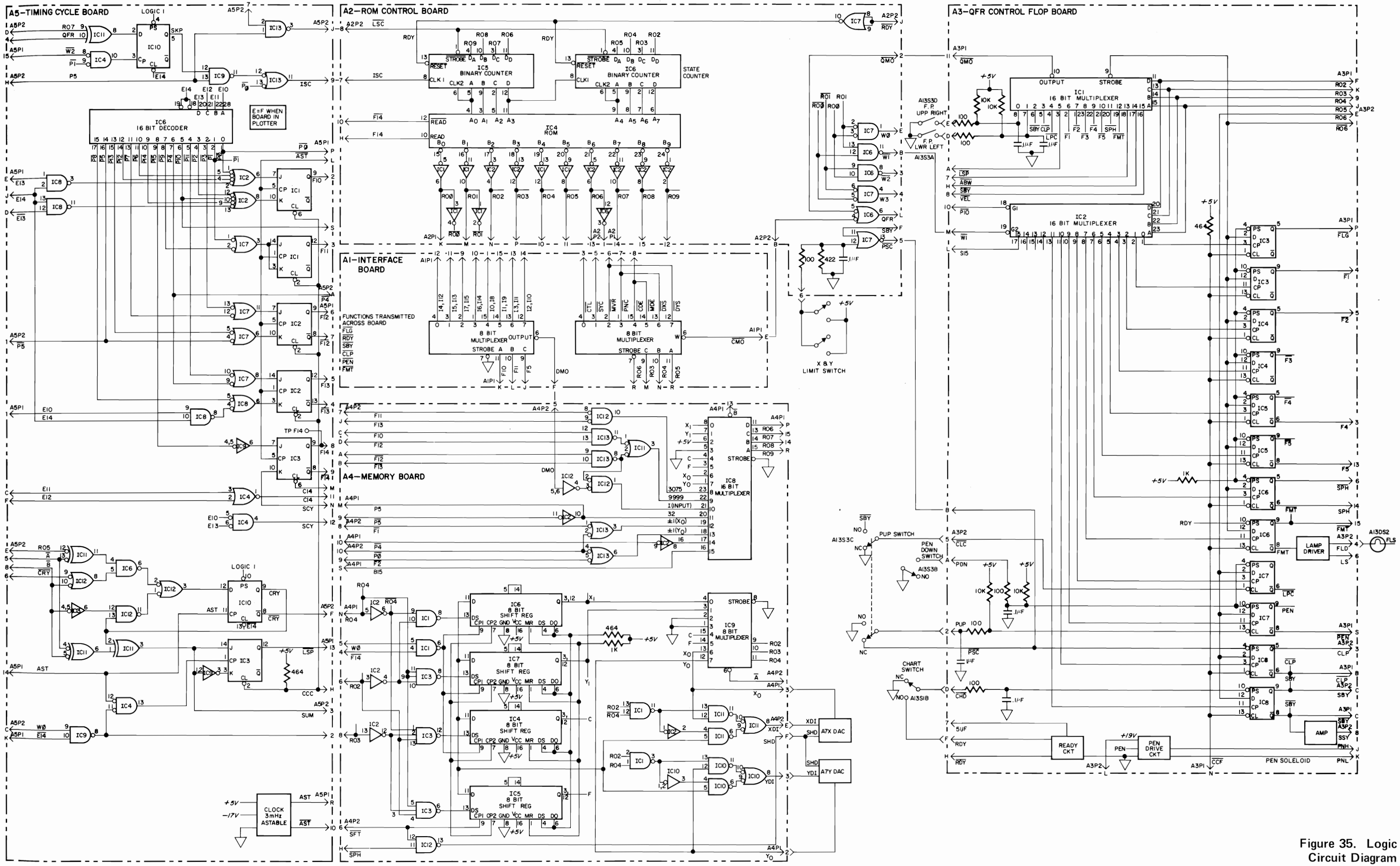


Figure 35. Logic Circuit Diagram

APPENDIX F
SCHEMATICS AND ELECTRICAL PARTS LIST

This Appendix contains Schematics and Electrical Parts Lists. For Mechanical Parts and Miscellaneous Parts information, refer to Chapter four.

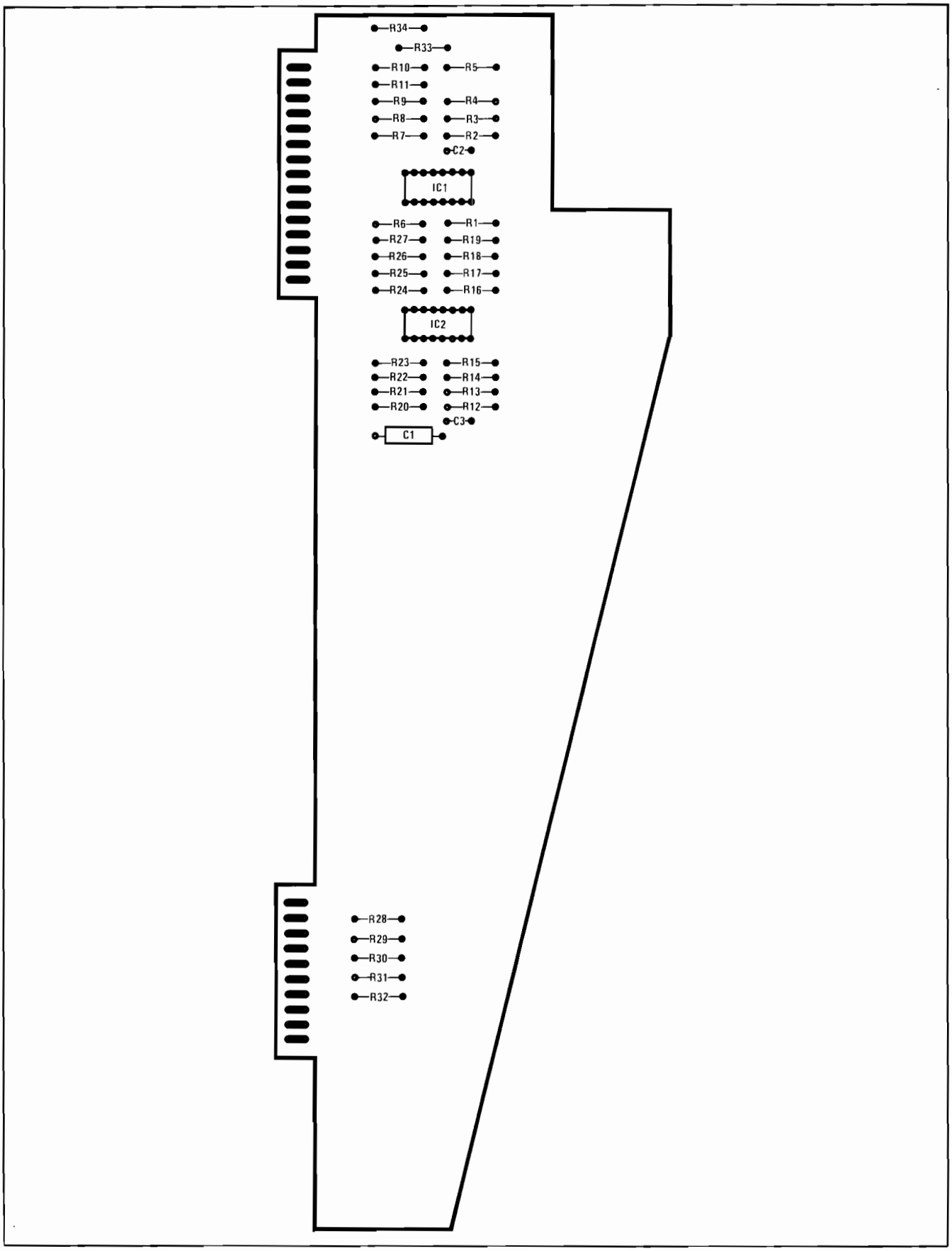


Figure 36. Interface Board

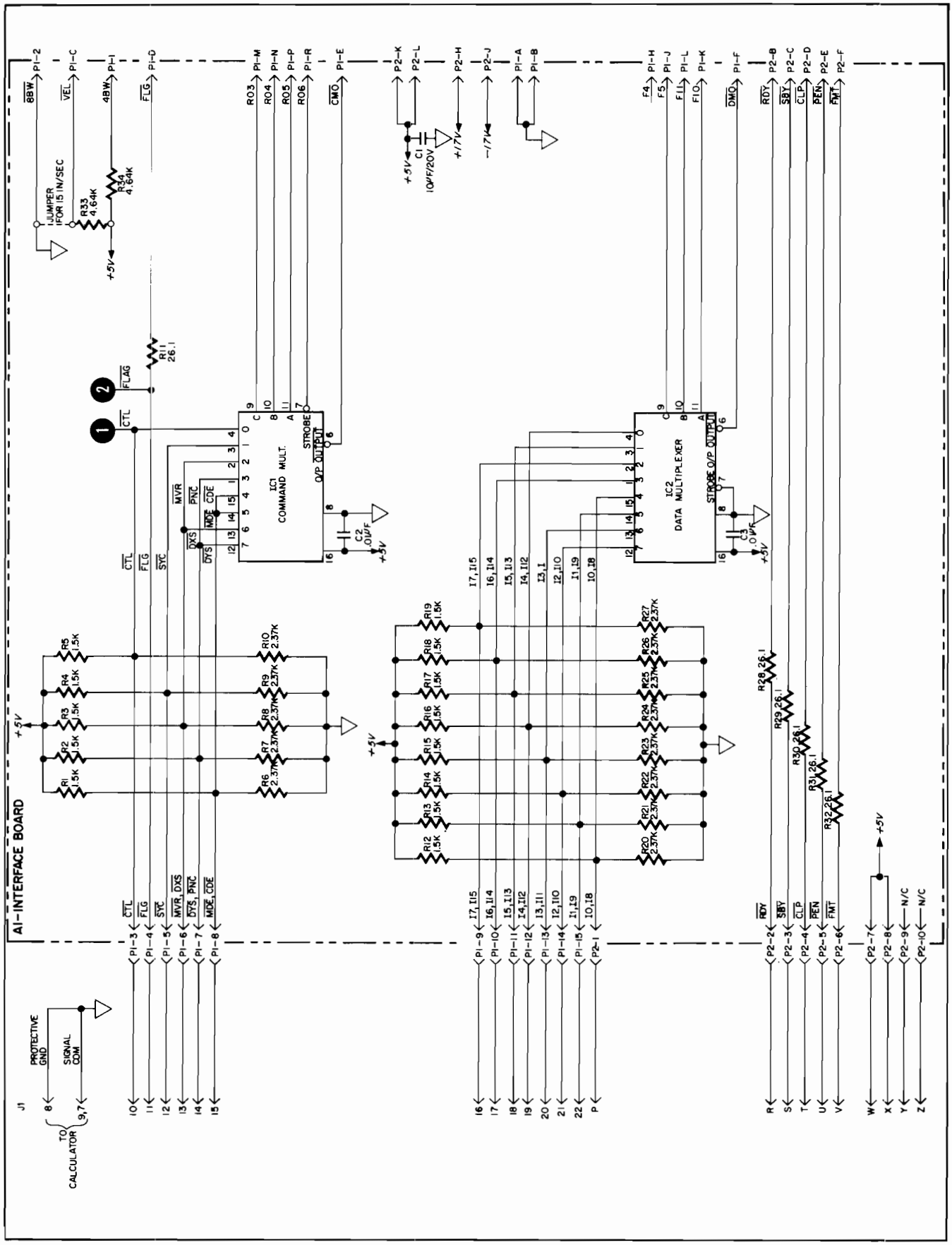


Figure 37. Interface Schematic

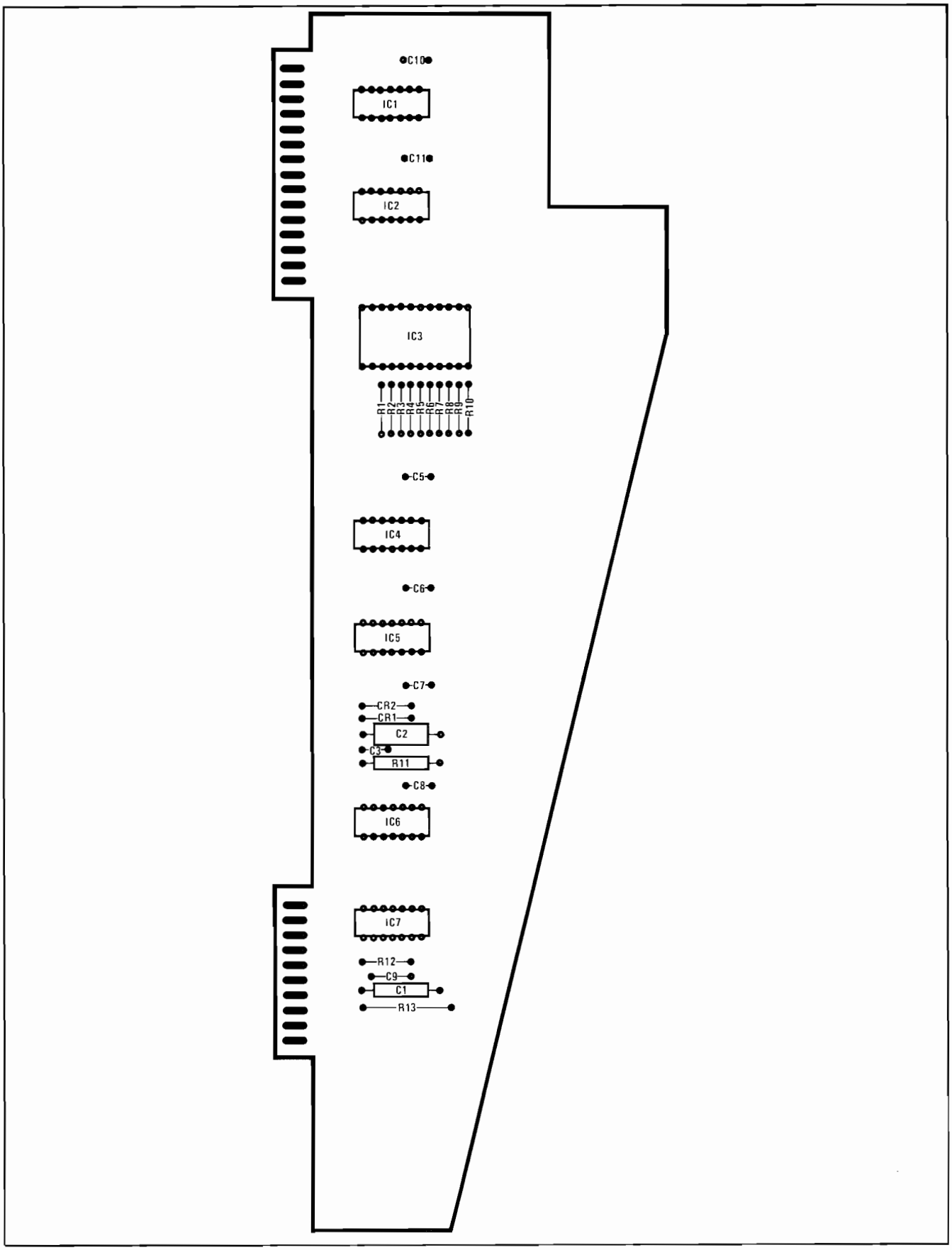


Figure 38. ROM Control Board

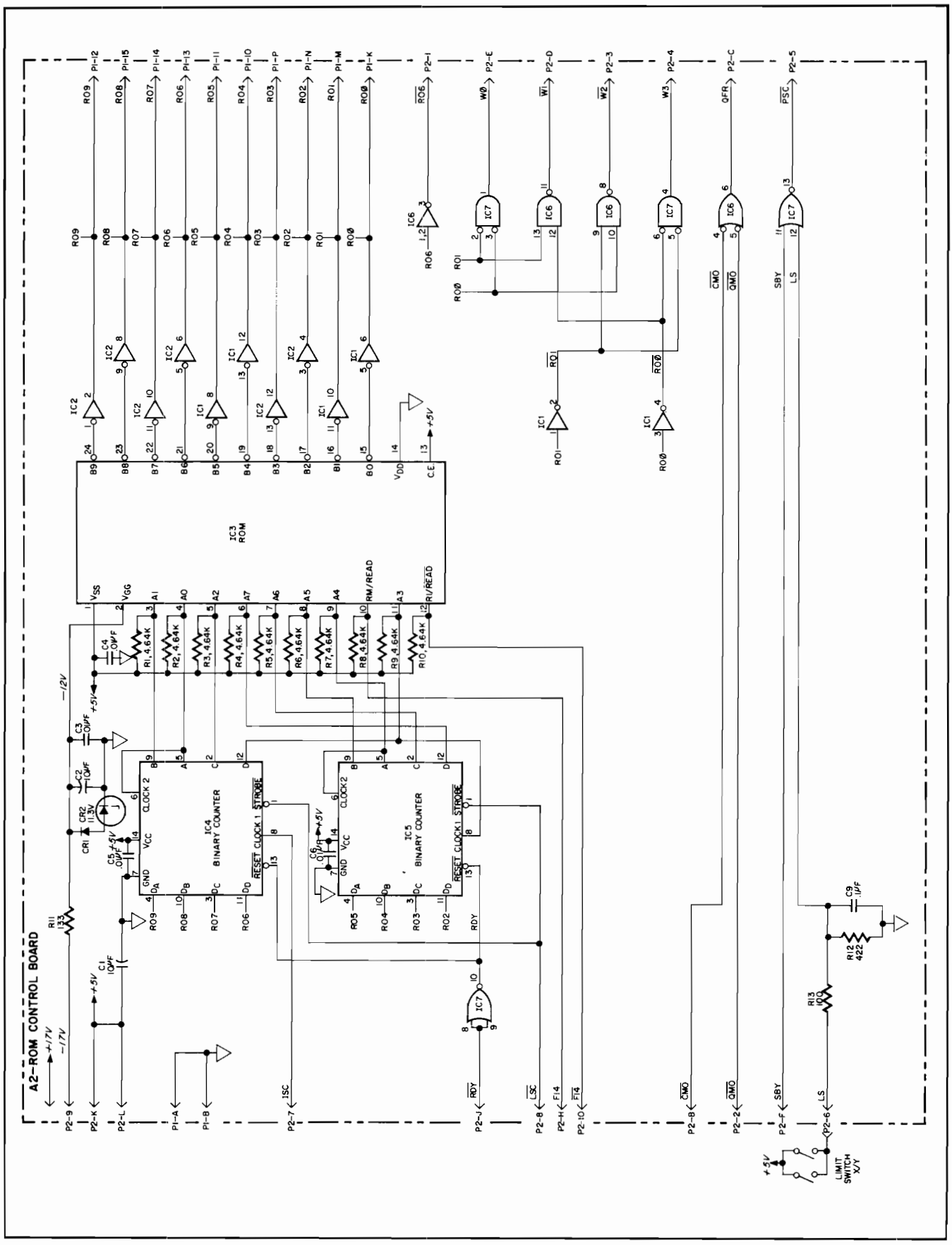


Figure 39. ROM Control Schematic

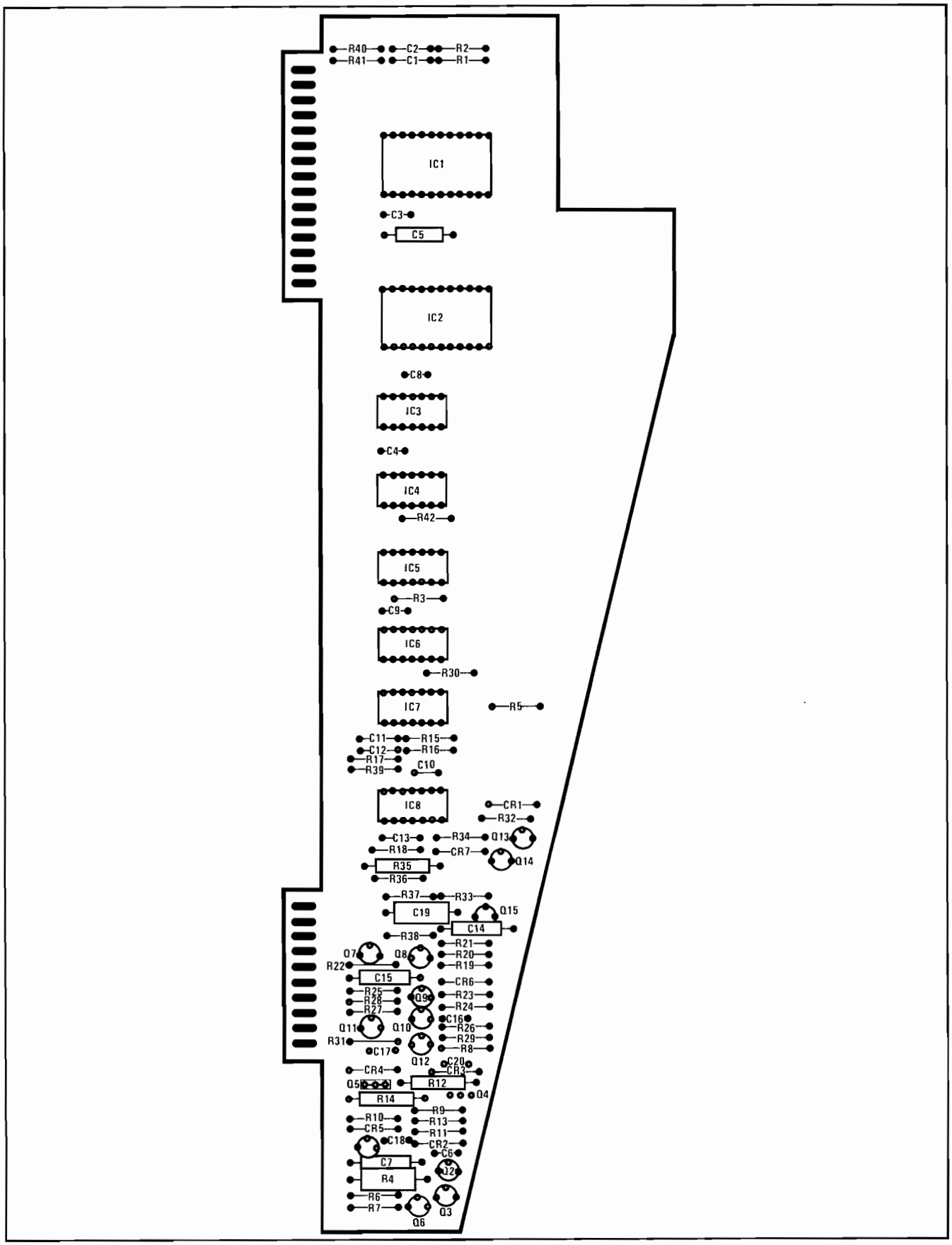


Figure 40. Control Flop Board

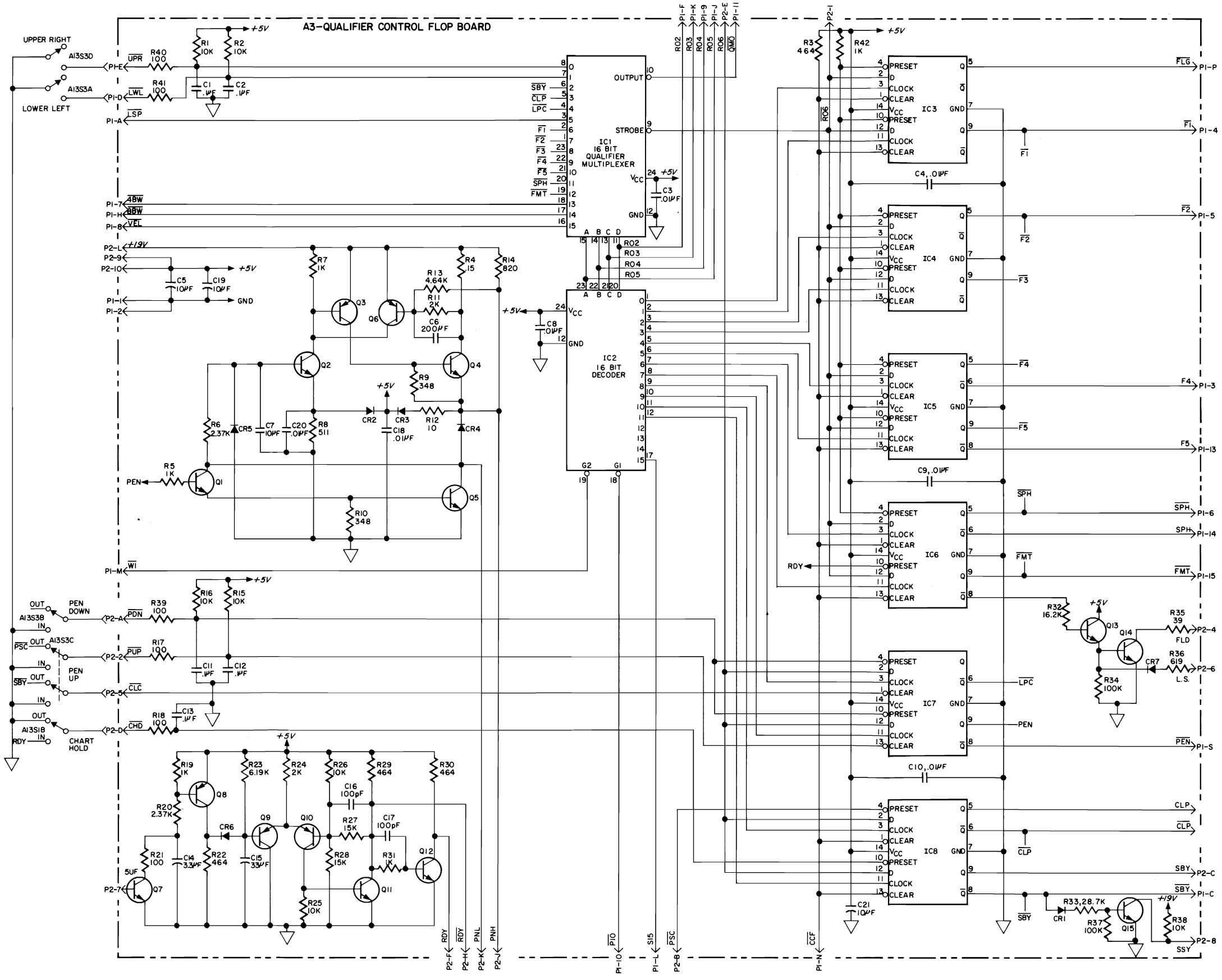


Figure 41.
Control Flop Schematic

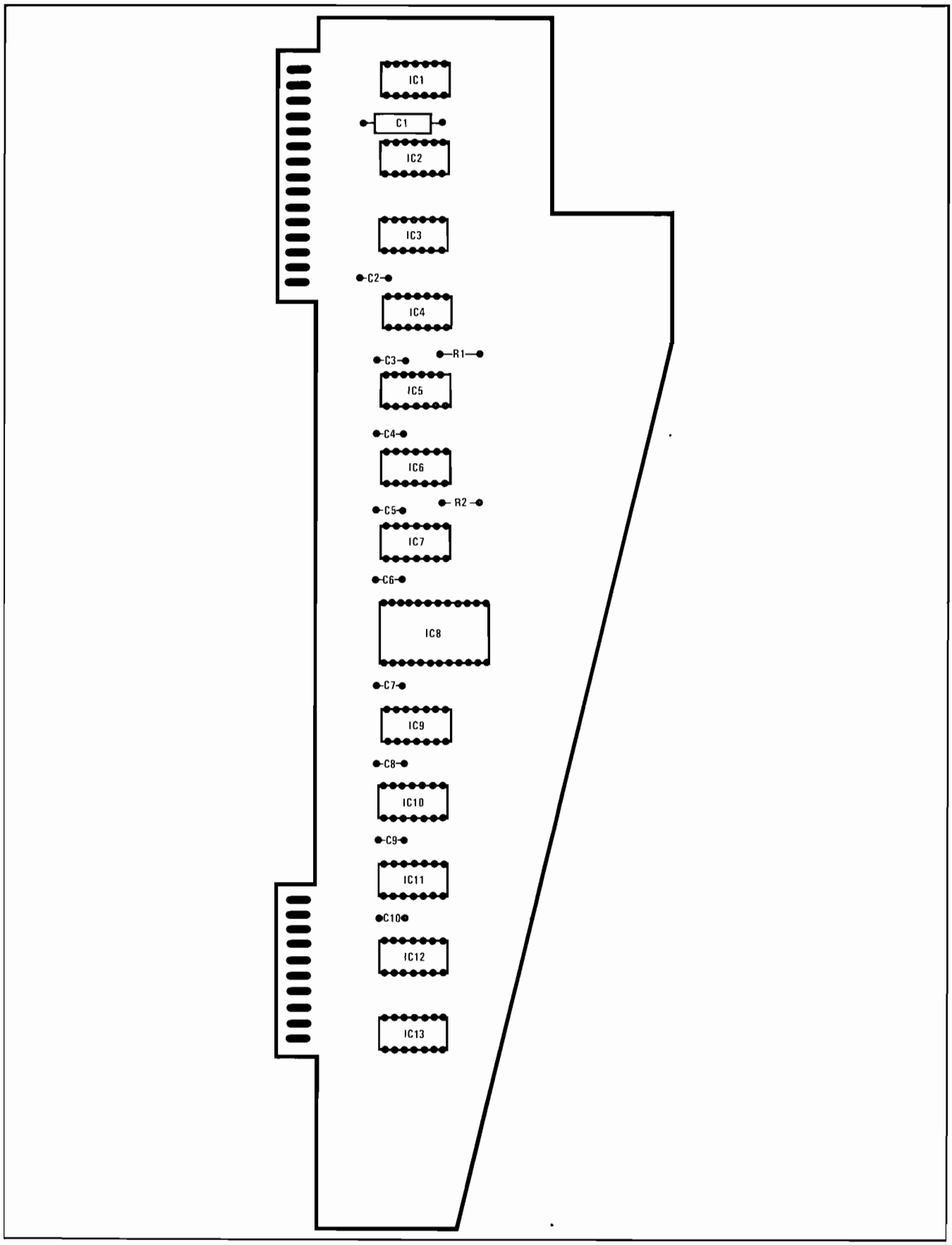


Figure 42. Memory Board

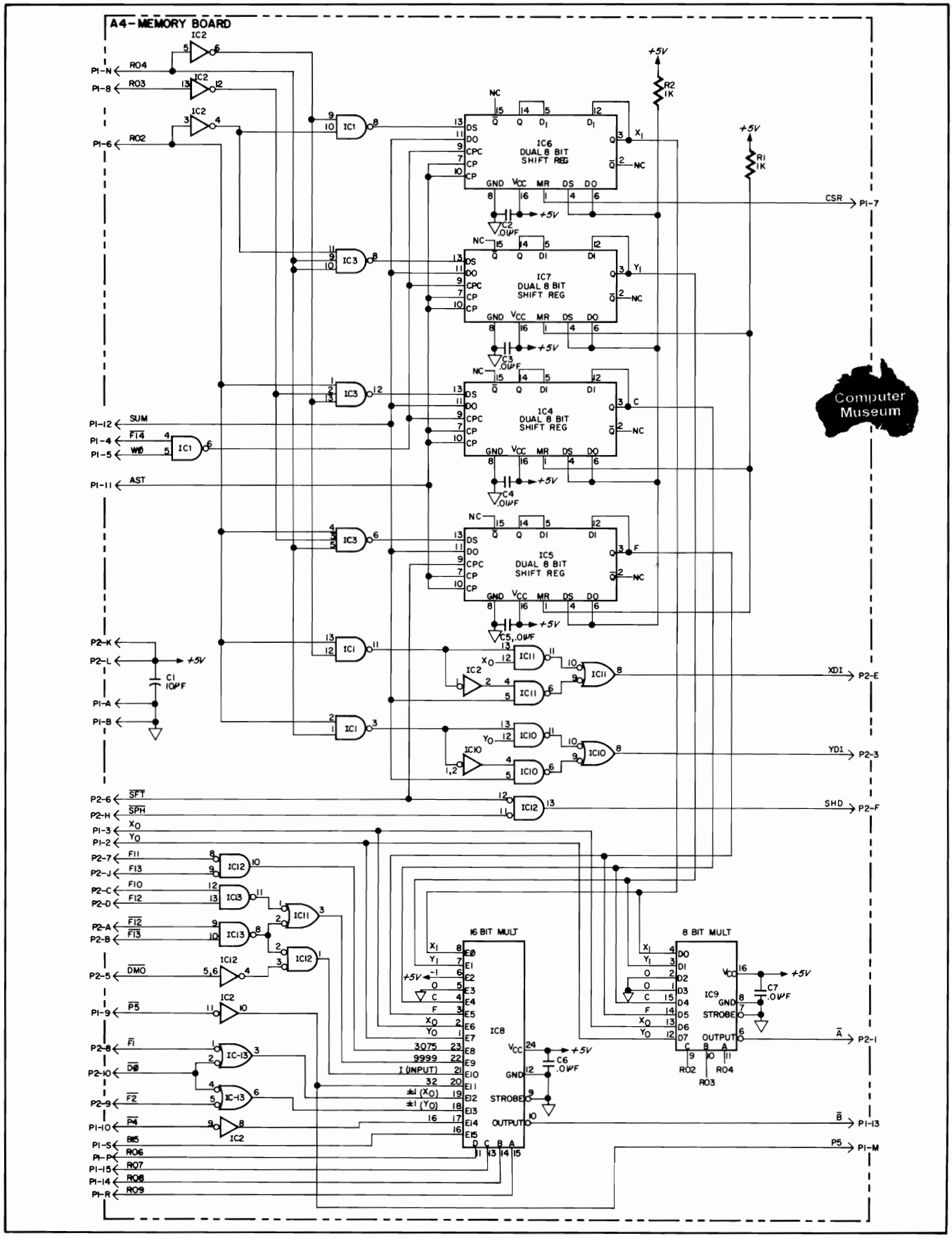


Figure 43. Memory Schematic

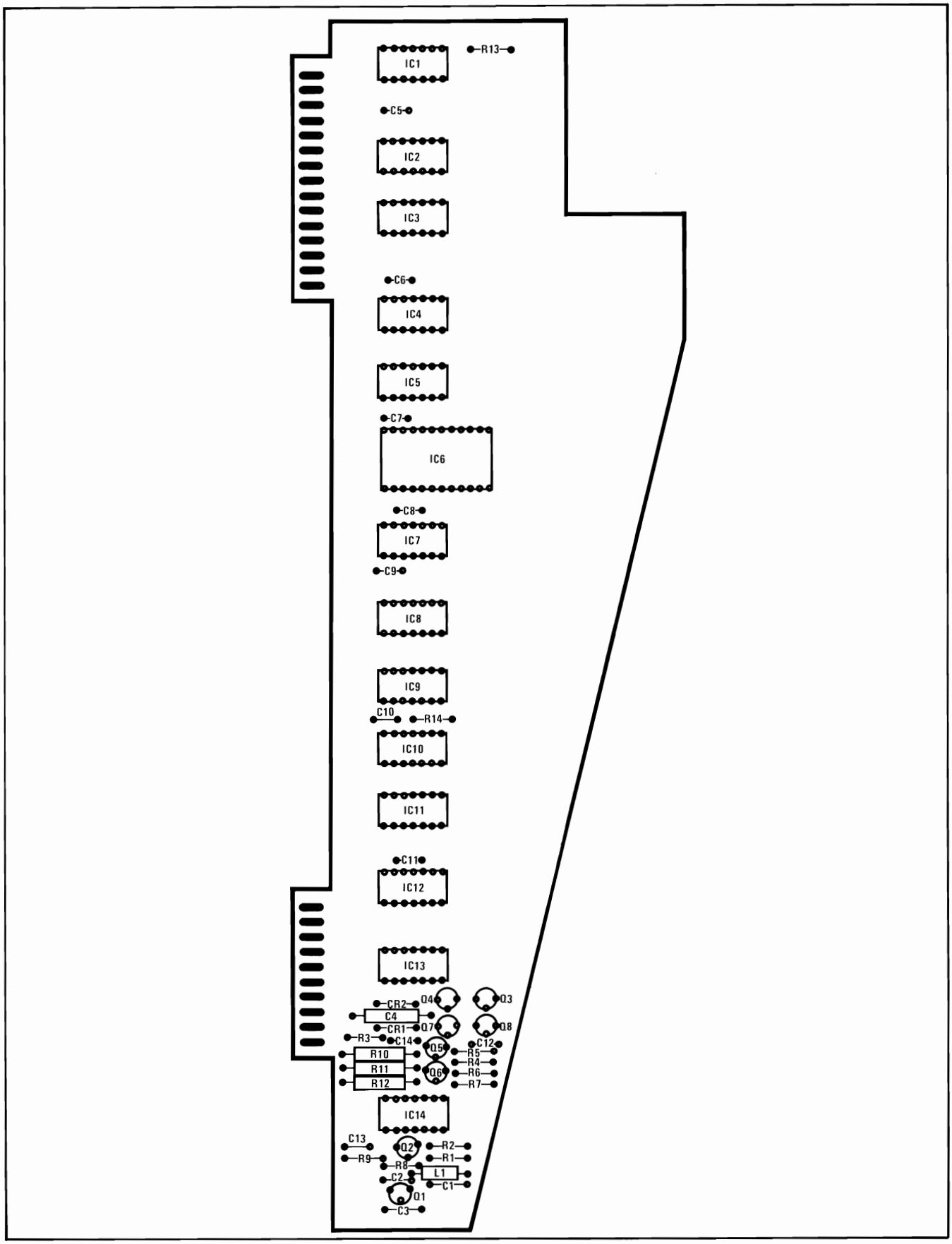


Figure 44. Time Cycle Board

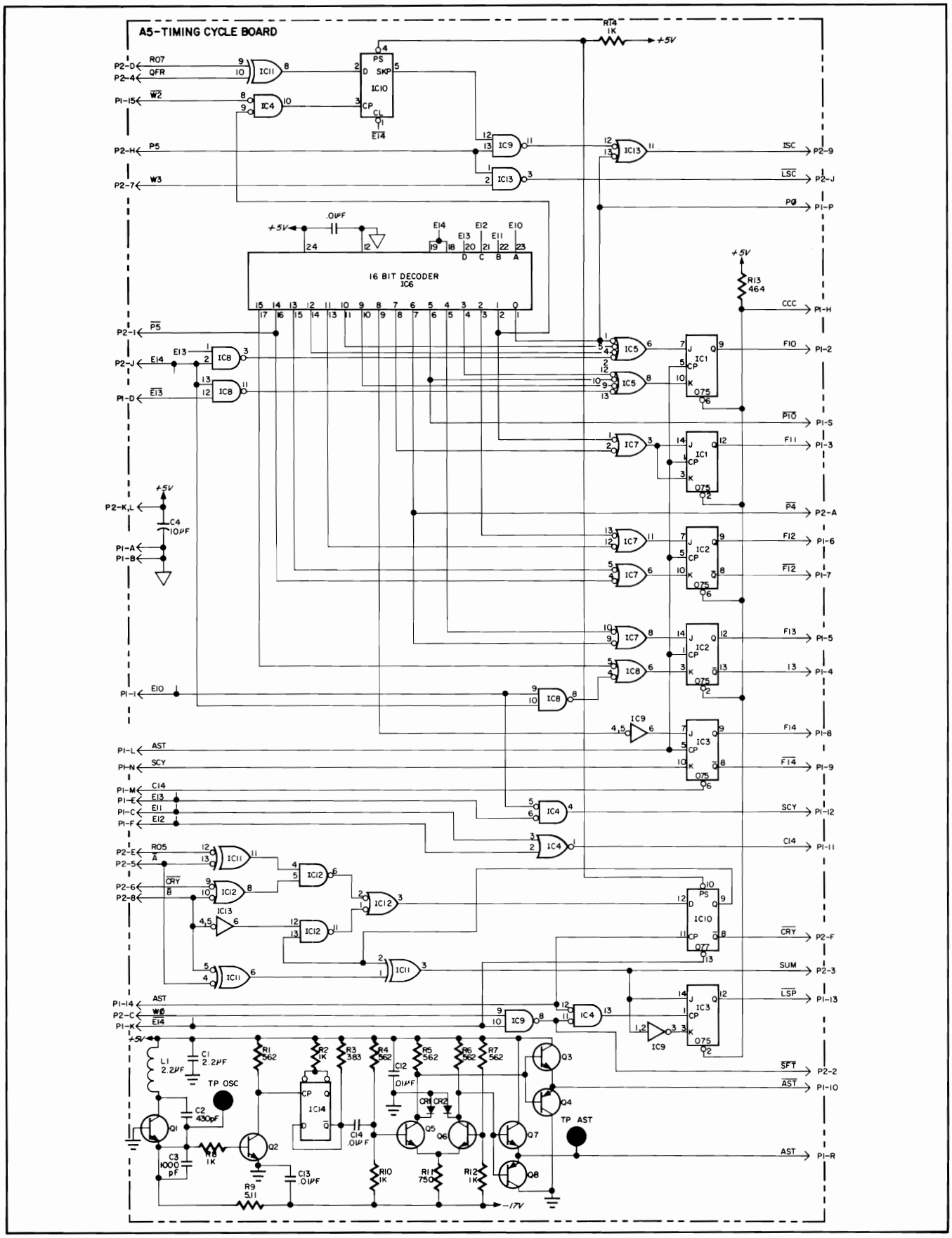


Figure 45. Time Cycle Schematic

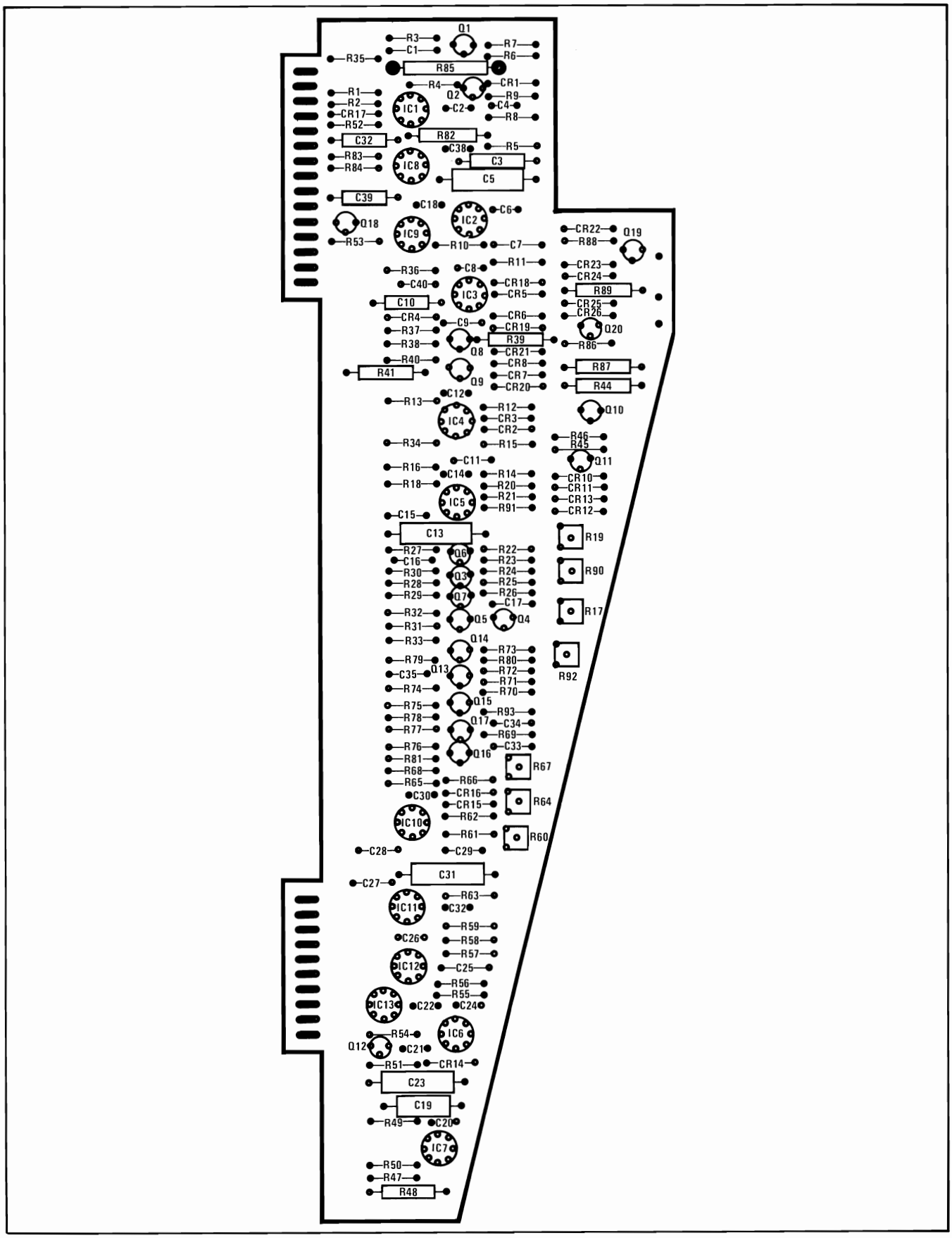


Figure 46. Servo Board

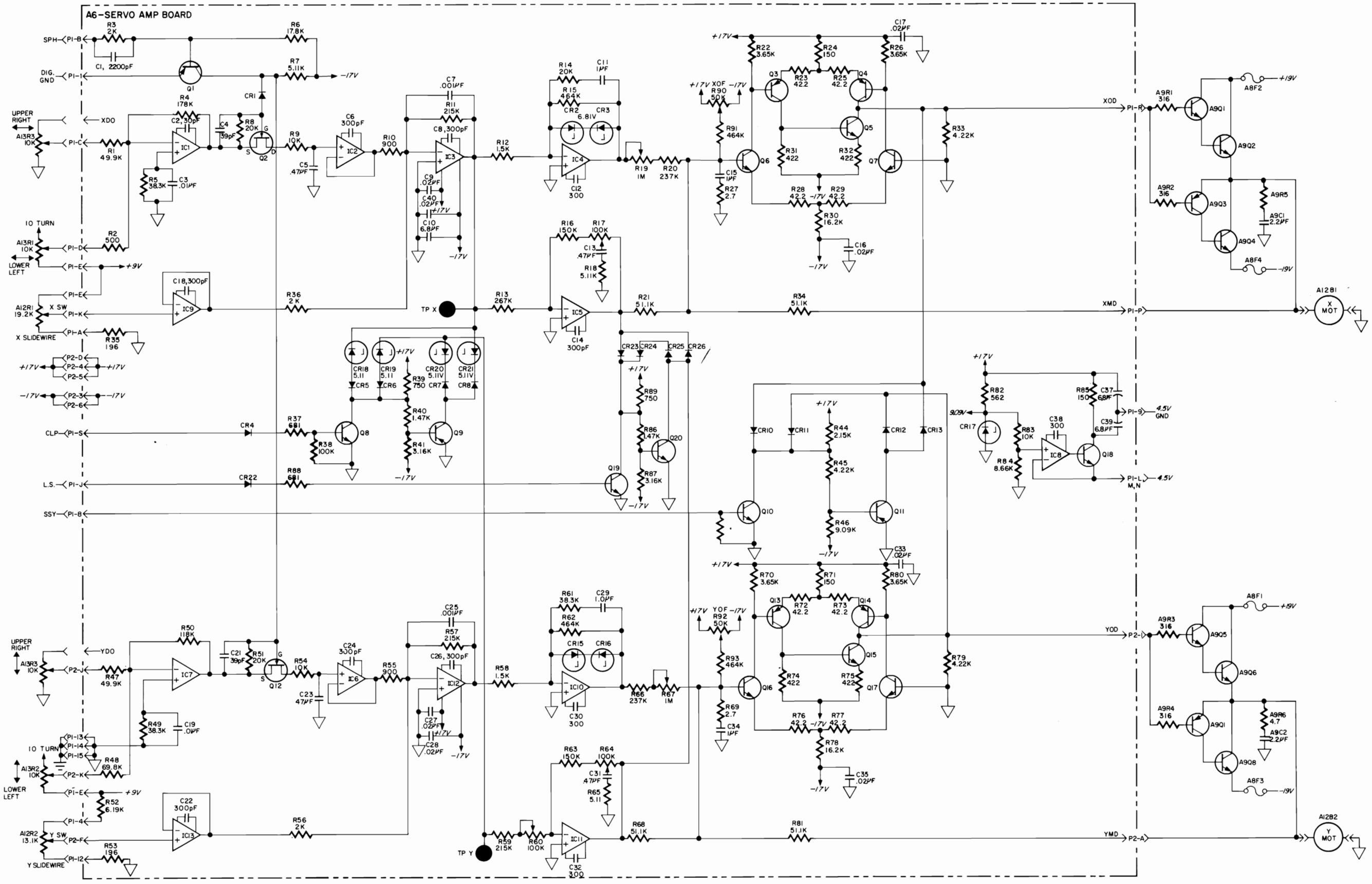


Figure 47.
Servo Schematic

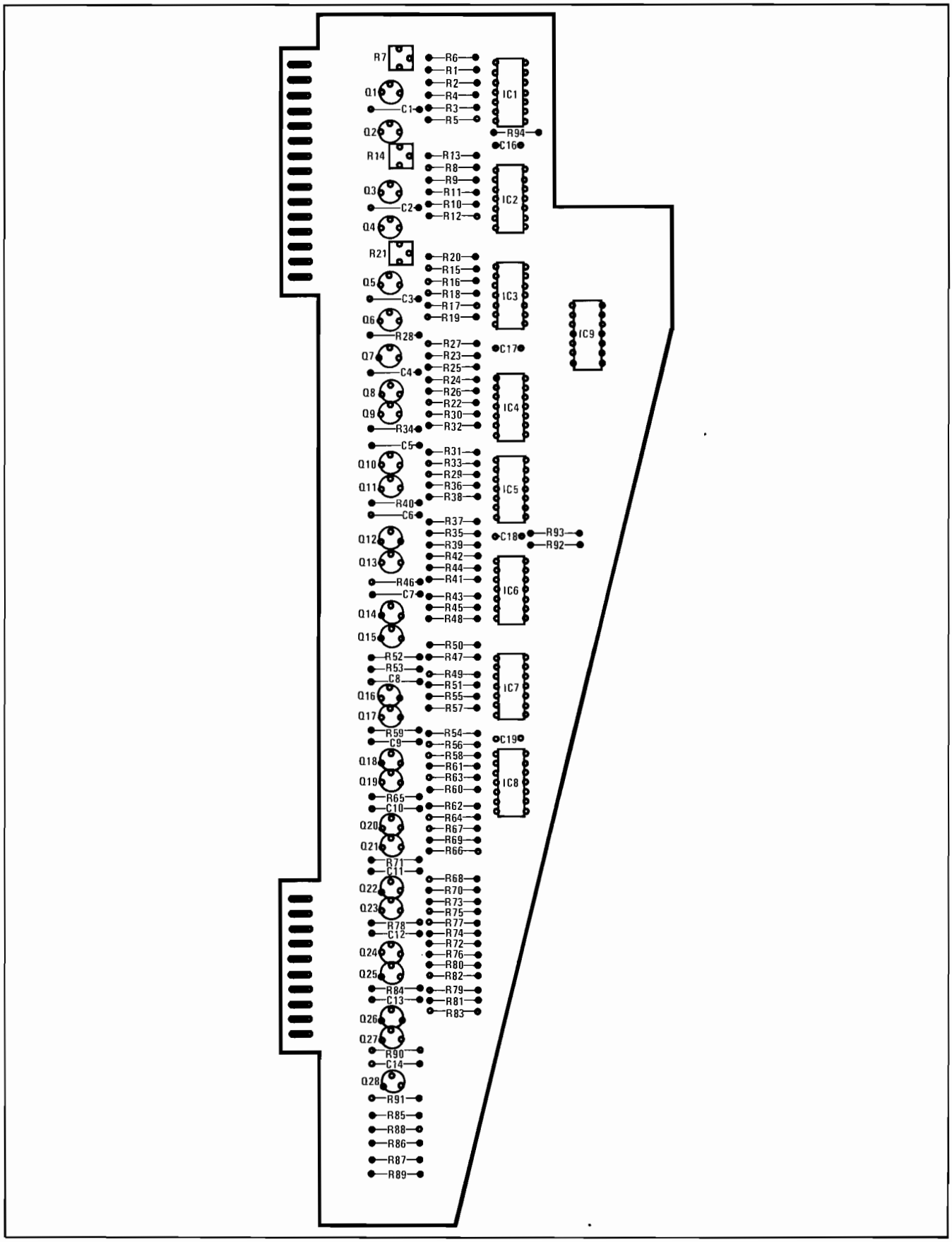


Figure 48. DAC Board

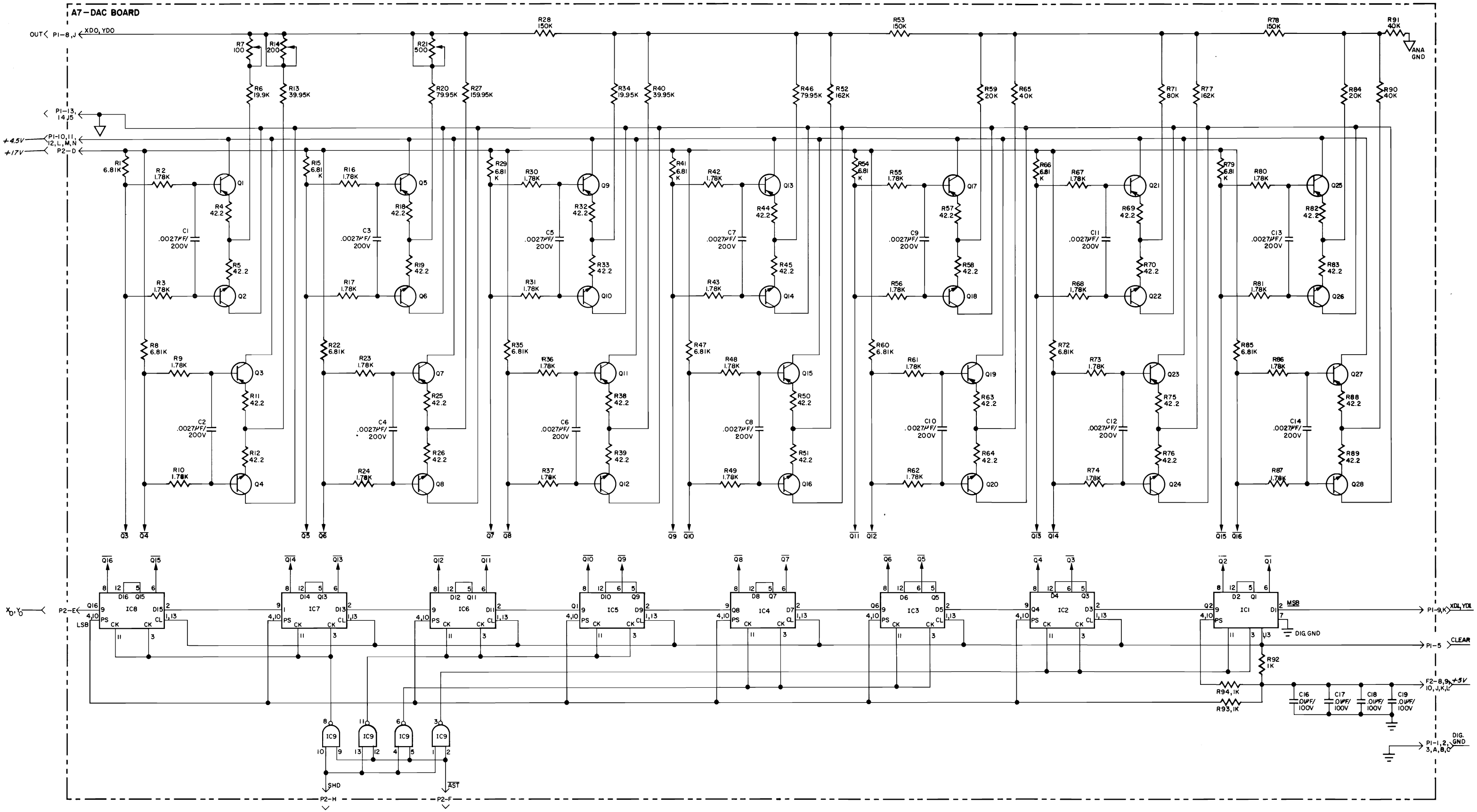


Figure 49.
DAC Schematic

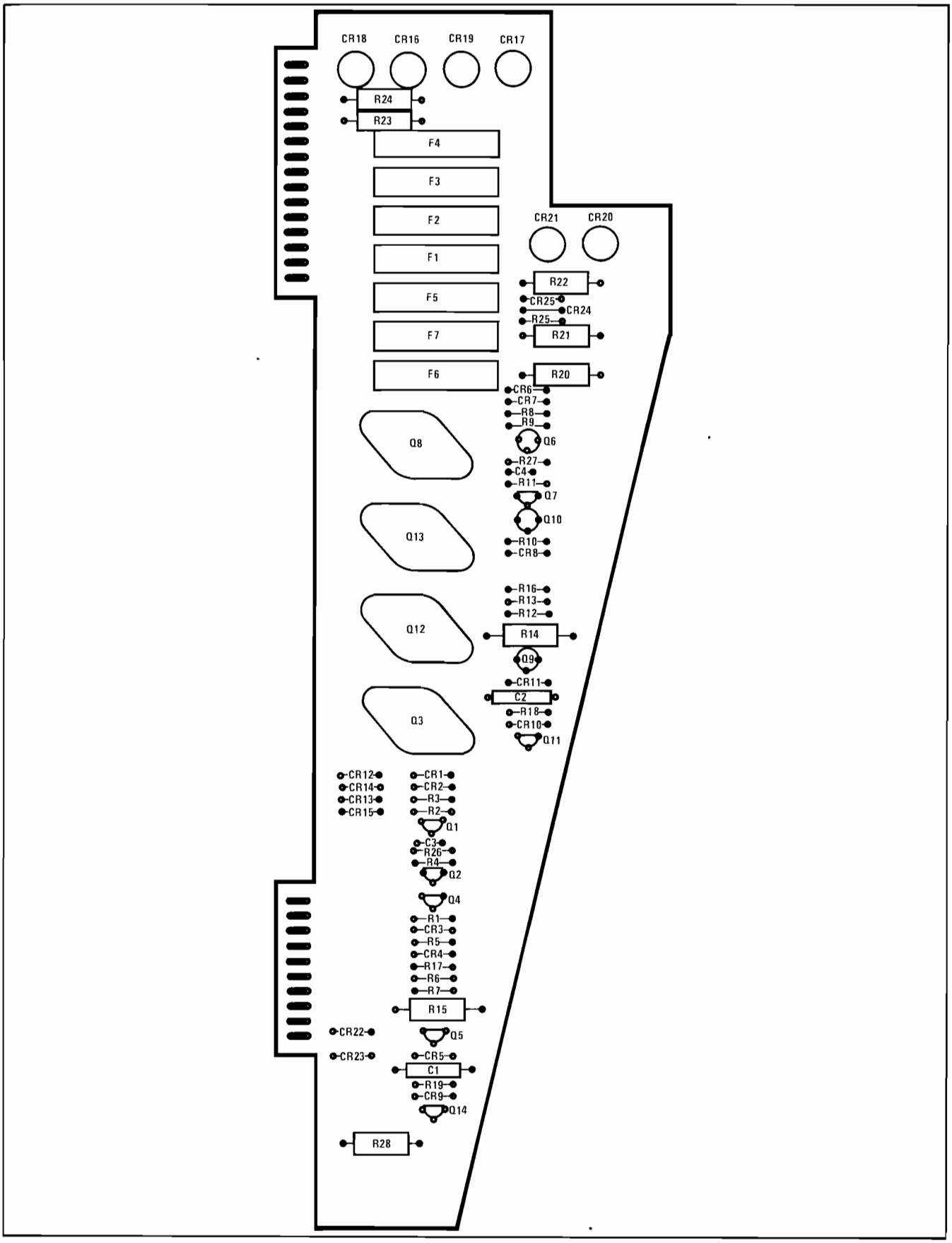


Figure 50. Rectifier Board

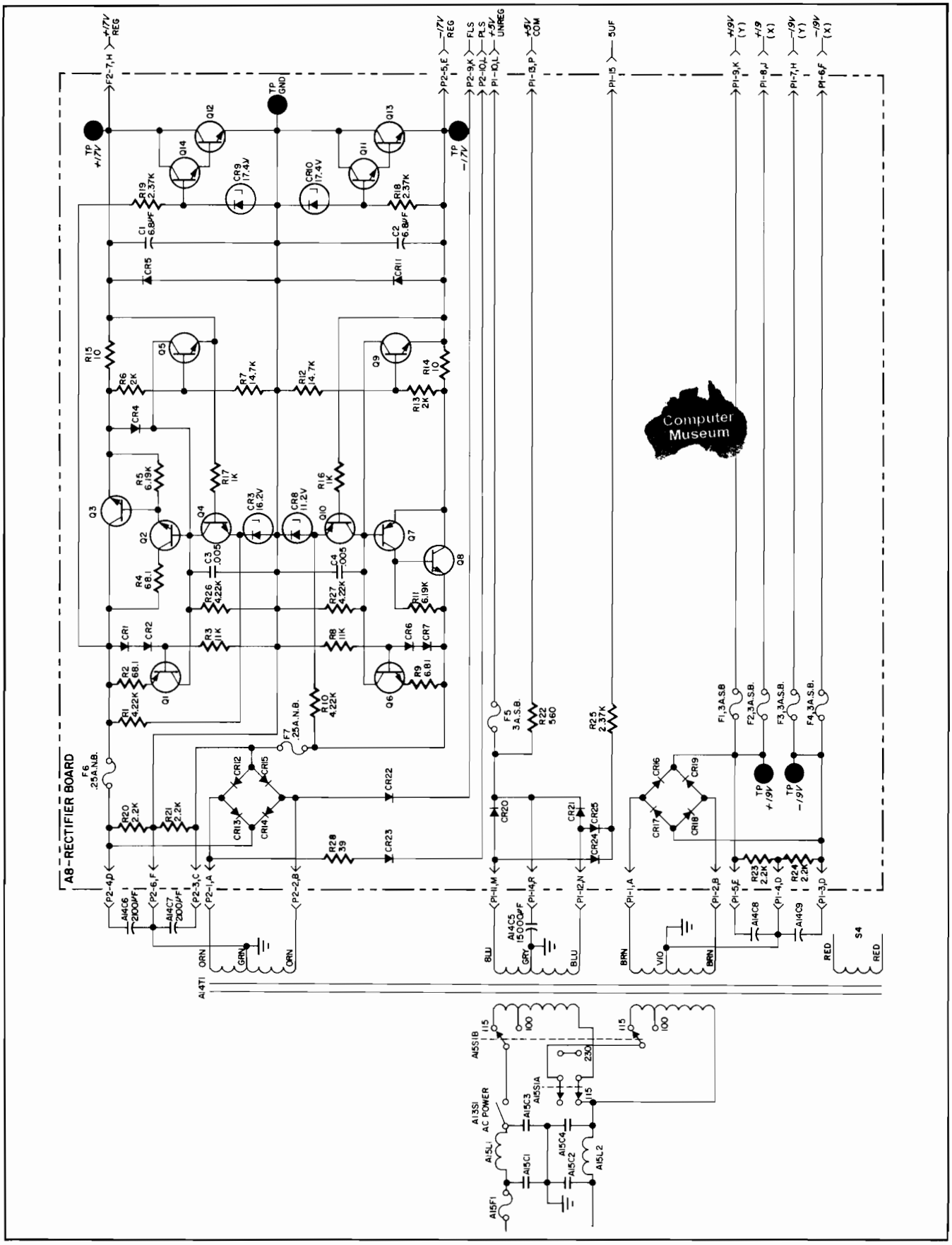


Figure 51. Rectifier Schematic

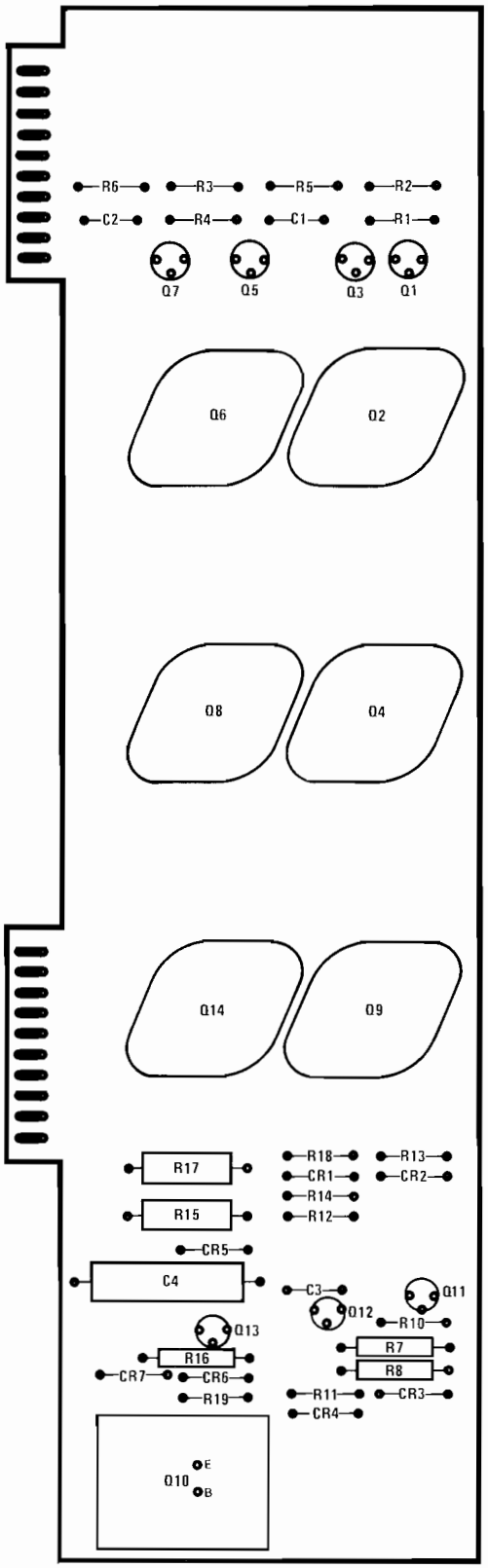


Figure 52. Power Driver Board

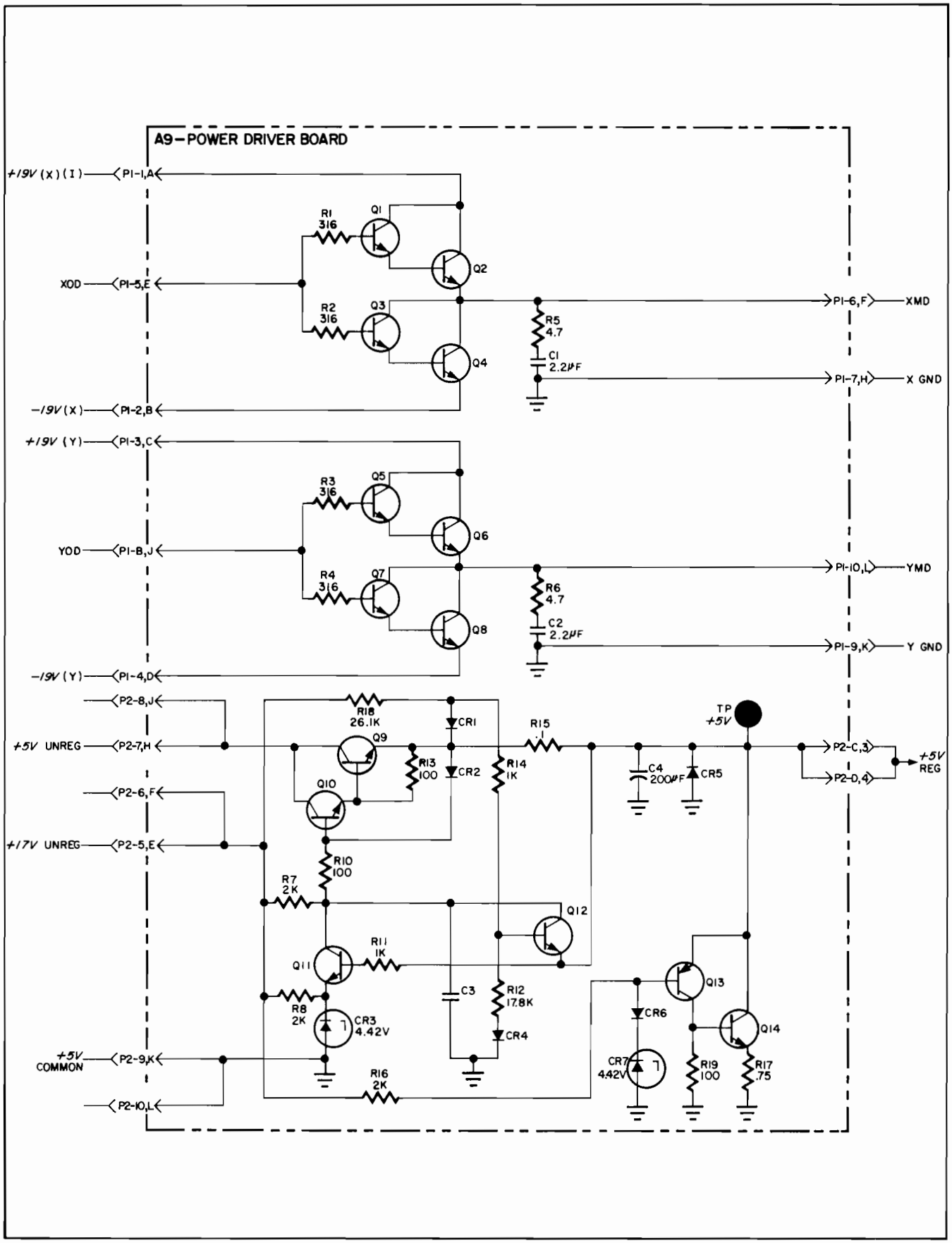


Figure 53. Power Driver Schematic

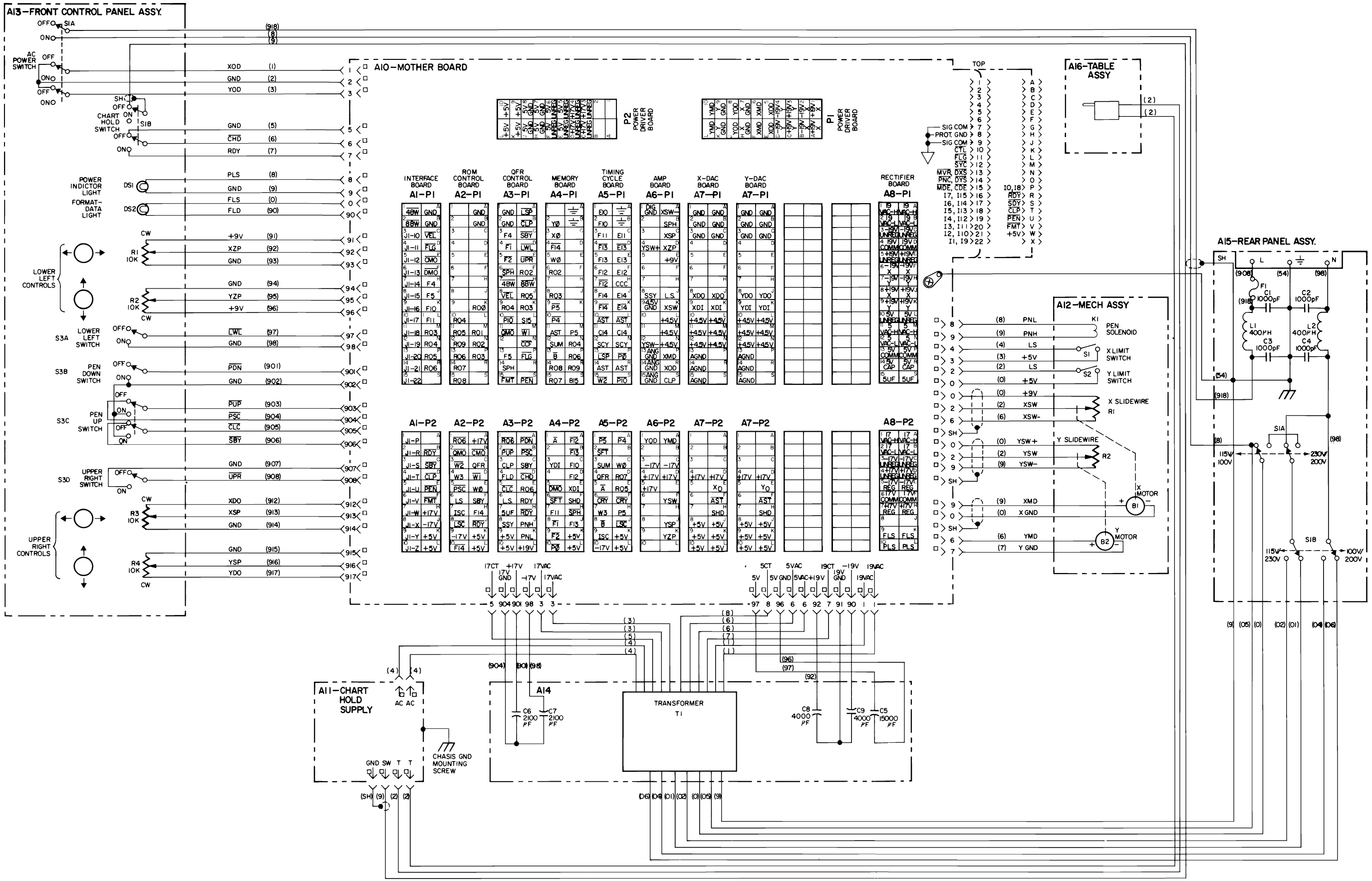


Figure 54.
Mother Board Schematic

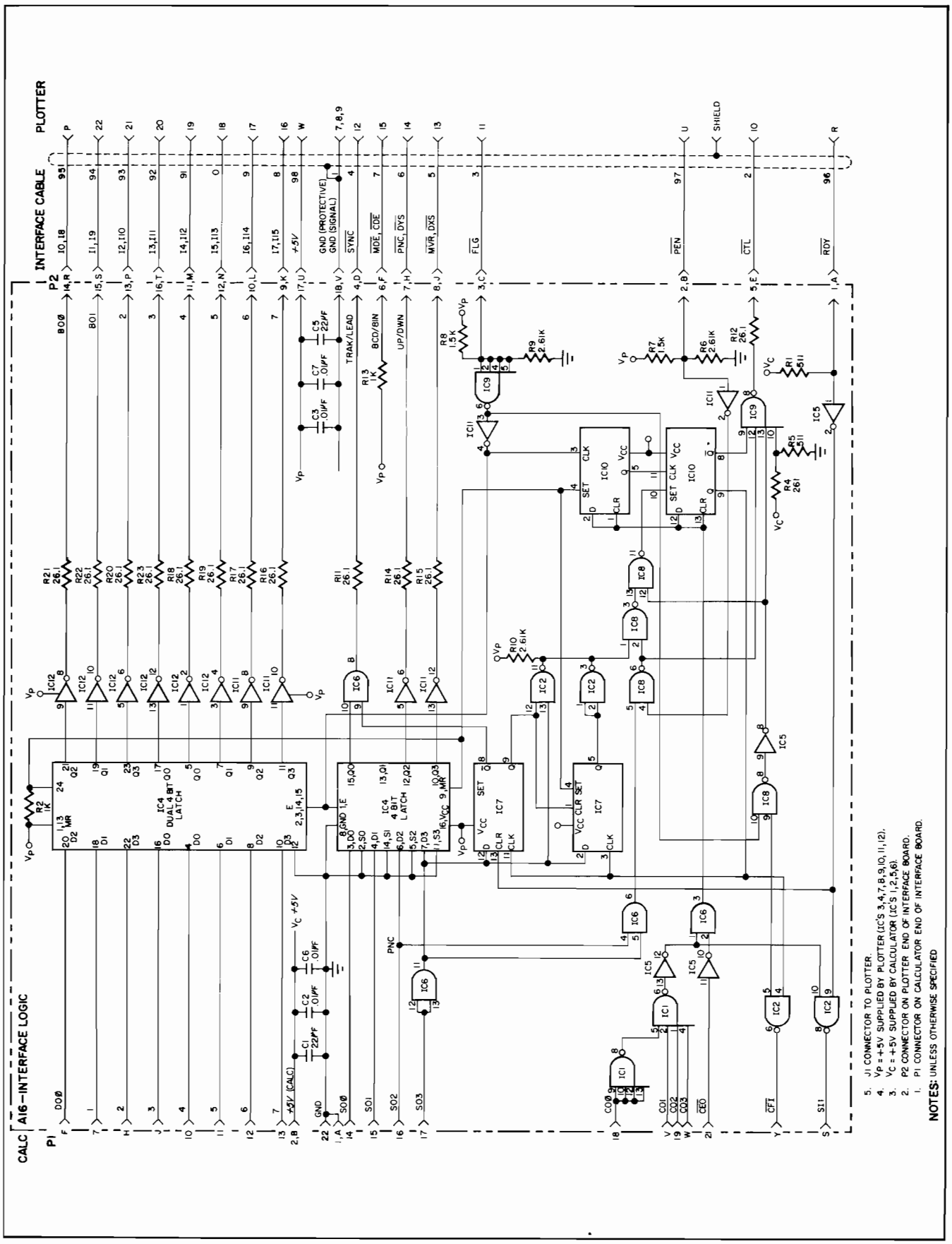


Figure 55. Interface Logic Schematic

Table 7. Electrical Parts List

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	09862-60010	1	INTERFACE BOARD	28480	09862-60010
A1C1	0180-0374	9	C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A1C2	0150-0093	45	C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A1C3	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A1C3	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A11C1	1820-0622	3	IC:TTL 8-INPT MULTIPLEXER W/ENABLE	01295	SN74151N
A11C2	1820-0622		IC:TTL 8-INPT MULTIPLEXER W/ENABLE	01295	SN74151N
A1R1	0757-0427	17	R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R2	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R3	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R4	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R5	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R6	0698-3150	18	R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R7	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R8	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R9	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R10	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R11	0698-3432	18	R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A1R12	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R13	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R14	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R15	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R16	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R17	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R18	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R19	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A1R20	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R21	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R22	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R23	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R24	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R25	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R26	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R27	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R28	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A1R29	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A1R30	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A1R31	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A1R32	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A1R33	0698-3155	13	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A1R34	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2	09862-60020	1	ROM CONTROL BOARD	28480	09862-60020
A2C1	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A2C2	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X902082-DYS
A2C3	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A2C4	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A2C5	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A2C6	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A2C7	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A2C8	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A2C9	0150-0121	6	C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50B1S-CML
A2CR1	1901-0040	20	DIODE:SILICON 30MA 30WV	07263	FDG1088
A2CR2	1902-0695	1	DIODE:ZENER 11.3V 2%	28480	1902-0695
A2IC1	1820-0174	6	IC:TTL HEX INVERTER	01295	SN7404N
A2IC2	1820-0174		IC:TTL HEX INVERTER	01295	SN7404N
A2IC3	1818-0001	1	ROM	28480	1818-0001
A2IC4	1820-0765	2	IC:TTL 4-BIT BINARY COUNTER	01295	SN74197N
A2IC5	1820-0765		IC:TTL 4-BIT BINARY COUNTER	01295	SN74197N
A2IC6	1820-0054	12	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A2IC7	1820-0328	3	IC:TTL QUAD 2-INPT NOR GATE	04713	SN7402N
A2R1	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R2	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R3	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R4	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R5	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R6	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R7	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R8	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R9	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R10	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A2R11	0698-3399	1	R:FXD MET FLM 133 OHM 1% 1/2W	28480	0698-3399
A2R12	0698-3447	5	R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A2R13	0757-0401	10	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3	09862-60030	1	CONTROL FLOP BOARD	28480	09862-60030

Table 7. Electrical Parts List (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3C1	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A3C2	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A3C3	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3C4	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3C5	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A3C6	0160-3449	1	C:FXD CER 2000 PF 10% 250VDCW	56289	C067B251F202KS25-CDH
A3C7	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A3C8	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3C9	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3C10	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3C11	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A3C12	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A3C13	0150-0121		C:FXD CER 0.1 UF +80-20% 50VDCW	56289	5C50BIS-CML
A3C14	0180-0161	1	C:FXD ELECT 3.3 UF 20% 35VDCW	56289	150D335X0035B2-DYS
A3C15	0180-0229	1	C:FXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A3C16	0160-2204	2	C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A3C17	0160-2204		C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A3C18	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3C19	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A3C20	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A3C21	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A3CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR3	1901-0158	13	DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A3CR4	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A3CR5	1902-0554	1	DIODE BREAKDOWN:10V 1W	28480	1902-0554
A3CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A3IC1	1820-0640	2	IC:TTL DATA SELECTOR/MULTIPLEXER	01295	SN74150N
A3IC2	1820-0495	2	IC:TTL 1 OF 16 DECODER	01295	SN74154N
A3IC3	1820-0077	18	IC:TTL DUAL D F/F	01295	SN7474N
A3IC4	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A3IC5	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A3IC6	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A3IC7	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A3IC8	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A3Q1	1854-0071	23	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q3	1853-0020	20	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q4	1854-0300	2	TSTR:SI NPN	28480	1854-0300
A3Q5	1854-0300		TSTR:SI NPN	28480	1854-0300
A3Q6	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q8	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q9	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q10	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q11	1854-0094	4	TSTR:SI NPN	80131	2N3646
A3Q12	1854-0094		TSTR:SI NPN	80131	2N3646
A3Q13	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q14	1854-0039	4	TSTR:SI NPN	80131	2N3053
A3Q15	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3R1	0757-0442	9	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R2	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R3	0698-0082	5	R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A3R4	0812-0045	1	R:FXD WW 0.15 OHM 5% 3W	28480	0812-0045
A3R5	0757-0280	20	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R6	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A3R7	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R8	0757-0416	3	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A3R9	0698-3445	2	R:FXD MET FLM 348 OHM 1% 1/8W	28480	0698-3445
A3R10	0698-3445		R:FXD MET FLM 348 OHM 1% 1/8W	28480	0698-3445
A3R11	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R12	0698-0093	1	R:FXD MET OX 10 OHM 5% 1W	28480	0698-0093
A3R13	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A3R14	0761-0059	1	R:FXD MET OX 820 OHM 5% 1W	28480	0761-0059
A3R15	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R16	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R17	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R18	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R19	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R20	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A3R21	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R22	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A3R23	0757-0290	3	R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A3R24	0757-0283	4	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283

Table 7. Electrical Parts List (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3R25	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R26	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R27	0757-0446	2	R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A3R28	0757-0446		R:FXD MET FLM 15.0K OHM 1% 1/8W	28480	0757-0446
A3R29	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A3R30	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A3R31	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R32	0757-0447	3	R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A3R33	0698-3449	1	R:FXD MET FLM 28.7K OHM 1% 1/8W	28480	0698-3449
A3R34	0757-0465	3	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R35	0698-3696	2	R:FXD MET OX 39 OHM 5% 1W	28480	0698-3696
A3R36	0757-0418	1	R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A3R37	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R38	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R39	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R40	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R41	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R42	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4	09862-60040	1	MEMORY BOARD	28480	09862-60040
A4C1	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A4C2	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A4C3	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A4C4	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A4C5	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A4C6	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A4C7	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A4C8	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A4C9	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A4C10	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A4IC1	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A4IC2	1820-0174		IC:TTL HEX INVERTER	01295	SN7404N
A4IC3	1820-0068	1	IC:TTL TRIPLE 3-INPUT POS NAND GATE	12040	SN7410N
A4IC4	1820-0741	4	IC:TTL DUAL 8-BIT SHIFT REGISTER	28480	1820-0741
A4IC5	1820-0741		IC:TTL DUAL 8-BIT SHIFT REGISTER	28480	1820-0741
A4IC6	1820-0741		IC:TTL DUAL 8-BIT SHIFT REGISTER	28480	1820-0741
A4IC7	1820-0741		IC:TTL DUAL 8-BIT SHIFT REGISTER	28480	1820-0741
A4IC8	1820-0640		IC:TTL DATA SELECTOR/MULTIPLEXER	01295	SN74150N
A4IC9	1820-0622		IC:TTL 8-INPT MULTIPLEXER W/ENABLE	01295	SN74151N
A4IC10	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A4IC11	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A4IC12	1820-0328		IC:TTL QUAD 2-INPT NOR GATE	04713	SN7402N
A4IC13	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A4R1	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R2	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A5	09862-60050	1	TIMING CYCLE BOARD	28480	09862-60050
A5C2	0160-0939	1	C: FXD MICA 430 PF 5% 300 VDCW	28480	0160-0939
A5C3	0160-2218	1	C:FXD MICA 1000 PF 5%	28480	0160-2218
A5C4	0180-0374		C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X9020B2-DYS
A5C5	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5C6	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5C7	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5C8	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5C9	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5C10	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5C11	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5C12	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5C13	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5C14	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A5CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A5IC1	1820-0075	3	IC:TTL DUAL J-K MASTER SLAVE F/F	01295	SN7473N
A5IC2	1820-0075		IC:TTL DUAL J-K MASTER SLAVE F/F	01295	SN7473N
A5IC3	1820-0075		IC:TTL DUAL J-K MASTER SLAVE F/F	01295	SN7473N
A5IC4	1820-0328		IC:TTL QUAD 2-INPT NOR GATE	04713	SN7402N
A5IC5	1820-0069	2	IC:TTL DUAL 4-INPT POS NAND GATE	01295	SN7420N
A5IC6	1820-0495		IC:TTL 1 OF 16 DECODER	01295	SN74154N
A5IC7	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A5IC8	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A5IC9	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A5IC10	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A5IC11	1820-0282	1	IC:TTL QUAD 2-INPT EXCL. OR GATE	01295	SN7486N
A5IC12	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A5IC13	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A5IC14	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A5L1	9100-3333	1	COIL/CHOKE 2.2 UH 5%	82142	TYPE 19-4411-12J

Table 7. Electrical Parts List (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5Q1	1854-0094		TSTR:SI NPN	80131	2N3646
A5Q2	1854-0094		TSTR:SI NPN	80131	2N3646
A5Q3	1854-0092	4	TSTR:SI NPN	80131	2N3563
A5Q4	1853-0015	2	TSTR:SI PNP	80131	2N3640
A5Q5	1854-0092		TSTR:SI NPN	80131	2N3563
A5Q6	1854-0092		TSTR:SI NPN	80131	2N3563
A5Q7	1854-0092		TSTR:SI NPN	80131	2N3563
A5Q8	1853-0015		TSTR:SI PNP	80131	2N3640
A5R1	0757-0417	5	R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A5R2	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A5R3	0698-3446	1	R:FXD MET FLM 383 OHM 1% 1/8W	28480	0698-3446
A5R4	0757-0417		R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A5R5	0757-0417		R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A5R6	0757-0417		R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A5R7	0757-0417		R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A5R8	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A5R9	0757-0438	4	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5R10	0757-0159	2	R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A5R11	0757-0817	3	R:FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817
A5R12	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A5R13	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A5R14	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6	09862-60070	1	SERVO BOARD	28480	09862-60070
A6C1	0160-0154	1	C:FXD MICA MY 0.0022 UF 10% 200VDCW	56289	192P22292-PTS
A6C2	0160-2199	2	C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A6C3	0160-0161	2	C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6C4	0140-0190	5	C:FXD MICA 39 PF 5%	72136	RDM15E390J3C
A6C5	0160-2110	4	C:FXD MY 0.47 UF 20% 200VDCW	14752	2108IC474
A6C6	0160-2207	11	C:FXD MICA 300 PF 5%	28480	0160-2207
A6C7	0160-0153	2	C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A6C8	0160-2207		C:FXD MICA 300 PF 5%	28480	0160-2207
A6C9	0160-2146	8	C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A6C10	0180-0116	5	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X903582-DYS
A6C11	0160-0127	4	C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A6C12	0160-2207		C:FXD MICA 300 PF 5%	28480	0160-2207
A6C13	0160-2110		C:FXD MY 0.47 UF 20% 200VDCW	14752	2108IC474
A6C14	0160-2207		C:FXD MICA 300 PF 5%	28480	0160-2207
A6C15	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A6C16	0160-2146		C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A6C17	0160-2146		C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A6C18	0160-2207		C:FXD MICA 300 PF 5%	28480	0160-2207
A6C19	0160-0161		C:FXD MY 0.01 UF 10% 200VDCW	56289	192P10392-PTS
A6C20	0160-2199		C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A6C21	0140-0190		C:FXD MICA 39 PF 5%	72136	RDM15E390J3C
A6C22	0160-2207		C:FXD MICA 300 PF 5%	28480	0160-2207
A6C23	0160-2110		C:FXD MY 0.47 UF 20% 200VDCW	14752	2108IC474
A6C24	0160-2207		C:FXD MICA 300 PF 5%	28480	0160-2207
A6C25	0160-0153		C:FXD MY 0.001 UF 10% 200VDCW	56289	192P10292-PTS
A6C26	0160-2207		C:FXD MICA 300 PF 5%	28480	0160-2207
A6C27	0160-2146		C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A6C28	0160-2146		C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A6C29	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A6C30	0160-2207		C:FXD MICA 300 PF 5%	28480	0160-2207
A6C31	0160-2110		C:FXD MY 0.47 UF 20% 200VDCW	14752	2108IC474
A6C32	0160-2207		C:FXD MICA 300 PF 5%	28480	0160-2207
A6C33	0160-2146		C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A6C34	0160-0127		C:FXD CER 1.0 UF 20% 25VDCW	56289	5C13CS-CML
A6C35	0160-2146		C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A6C37	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X903582-DYS
A6C38	0160-2207		C:FXD MICA 300 PF 5%	28480	0160-2207
A6C39	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X903582-DYS
A6C40	0160-2146		C:FXD CER 0.02 UF +80-20% 100VDCW	91418	TA
A6CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR2	1902-0048	4	DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A6CR3	1902-0048		DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A6CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR5	1901-0450	12	DIODE:SILICON	28480	1901-0450
A6CR6	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR7	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR8	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR10	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR11	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR12	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR13	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR14	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088

Table 7. Electrical Parts List (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6CR15	1902-0048		DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A6CR16	1902-0048		DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A6CR17	1902-3150	1	DIODE BREAKDOWN:9.09V 2%	28480	1902-3150
A6CR18	1902-0041	4	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A6CR19	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A6CR20	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A6CR21	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A6CR22	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A6CR23	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR24	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR25	1901-0450		DIODE:SILICON	28480	1901-0450
A6CR26	1901-0450		DIODE:SILICON	28480	1901-0450
A6IC1	1820-0223	13	INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6IC2	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6IC3	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6IC4	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6IC5	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6IC6	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6IC7	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6IC8	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6IC9	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6IC10	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6IC11	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6IC12	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6IC13	1820-0223		INTEGRATED CIRCUIT:OPERATIONAL AMPL.	28480	1820-0223
A6Q1	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A6Q2	1855-0062	2	TSTR:SI FET 30V	01295	2N1595
A6Q3	1853-0098	4	TSTR:SI PNP	80131	2N5086
A6Q4	1853-0098		TSTR:SI PNP	80131	2N5086
A6Q5	1854-0087	8	TSTR:SI NPN	80131	2N3417
A6Q6	1854-0087		TSTR:SI NPN	80131	2N3417
A6Q7	1854-0087		TSTR:SI NPN	80131	2N3417
A6Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q9	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A6Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q11	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A6Q12	1855-0062		TSTR:SI FET 30V	01295	2N1595
A6Q13	1853-0098		TSTR:SI PNP	80131	2N5086
A6Q14	1853-0098		TSTR:SI PNP	80131	2N5086
A6Q15	1854-0087		TSTR:SI NPN	80131	2N3417
A6Q16	1854-0087		TSTR:SI NPN	80131	2N3417
A6Q17	1854-0087		TSTR:SI NPN	80131	2N3417
A6Q18	1854-0039		TSTR:SI NPN	80131	2N3053
A6Q19	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q20	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A6R1	0698-7652	2	R:FXD FLM 49.9K OHM 1.0% 1/8W	28480	0698-7652
A6R2	0698-6349	1	R:FXD FLM 500K OHM 1.0% 1/8W	28480	0698-6349
A6R3	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A6R4	0698-8077	1	R:FXD FLM 178K OHM 1.0% 1/8W	28480	0698-8077
A6R5	0698-3161	3	R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A6R6	0698-3136	2	R:FXD MET FLM 17.8K OHM 1% 2/8W	19701	MF4C T-0
A6R7	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A6R8	0757-0449	5	R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A6R9	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A6R10	0698-6335	2	R:FXD FLM 900 OHM 1% 1/8W	28480	0698-6335
A6R11	0698-3454	3	R:FXD MET FLM 215K OHM 1% 1/8W	28480	0698-3454
A6R12	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A6R13	0698-4531	1	R:FXD FLM 267K OHM 1% 1/8W	28480	0698-4531
A6R14	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A6R15	0698-3260	4	R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A6R16	0757-0469	4	R:FXD FLM 150K OHM 1% 1/8W	28480	0757-0469
A6R17	2100-2516	3	R:VAR CERMET 100K OHM 10% LIN 1/2W	28480	2100-2516
A6R18	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A6R19	2100-2692	2	R:VAR CERMET 1 MEGOHM 20% TYPE V 1/2W	28480	2100-2692
A6R20	0698-3266	2	R:FXD MET FLM 237K OHM 1% 1/8W	28480	0698-3266
A6R21	0757-0458	4	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A6R22	0757-0434	4	R:FXD MET FLM 3.65K OHM 1% 1/8W	28480	0757-0434
A6R23	0757-0316	36	R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A6R24	0757-0284	2	R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A6R25	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A6R26	0757-0434		R:FXD MET FLM 3.65K OHM 1% 1/8W	28480	0757-0434
A6R27	0683-0275	2	R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A6R28	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A6R29	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A6R30	0757-0447		R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447

Table 7. Electrical Parts List (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6R31	0698-3447		R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A6R32	0698-3447		R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A6R33	0698-3154	7	R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A6R34	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A6R35	0698-3440	2	R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A6R36	0698-6330	2	R:FXD FLM 2K OHM 1% 1/8W	28480	0698-6330
A6R37	0757-0419	2	R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A6R38	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A6R39	0757-0817		R:FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817
A6R40	0757-1094	2	R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A6R41	0698-3410	2	R:FXD MET FLM 3.16K OHM 1% 1/2W	28480	0698-3410
A6R44	0698-3408	1	R:FXD MET FLM 2.15K OHM 1% 1/2W	28480	0698-3408
A6R45	0698-3154		R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A6R46	0757-0288	1	R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A6R47	0698-7652		R:FXD FLM 49.9K OHM 1.0% 1/8W	28480	0698-7652
A6R48	0698-8078	1	R:FXD FLM 698K OHM 1.0% 1/2W	28480	0698-8078
A6R49	0698-3161		R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A6R50	0698-8074	1	R:FXD FLM 118K OHM 1.0% 1/8W	28480	0698-8074
A6R51	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A6R52	0698-8075	1	R:FXD FLM 6.19K OHM 1.0% 1/8W	28480	0698-8075
A6R53	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A6R54	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A6R55	0698-6335		R:FXD FLM 900 OHM 1% 1/8W	28480	0698-6335
A6R56	0698-6330		R:FXD FLM 2K OHM 1% 1/8W	28480	0698-6330
A6R57	0698-3454		R:FXD MET FLM 215K OHM 1% 1/8W	28480	0698-3454
A6R58	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A6R59	0698-3454		R:FXD MET FLM 215K OHM 1% 1/8W	28480	0698-3454
A6R60	2100-2516		R:VAR CERMET 100K OHM 10% LIN 1/2W	28480	2100-2516
A6R61	0698-3161		R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A6R62	0698-3260		R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A6R63	0757-0469		R:FXD FLM 150K OHM 1% 1/8W	28480	0757-0469
A6R64	2100-2516		R:VAR CERMET 100K OHM 10% LIN 1/2W	28480	2100-2516
A6R65	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A6R66	0698-3266		R:FXD MET FLM 237K OHM 1% 1/8W	28480	0698-3266
A6R67	2100-2692		R:VAR CERMET 1 MEGOHM 20% TYPE V 1/2W	28480	2100-2692
A6R68	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A6R69	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A6R70	0757-0434		R:FXD MET FLM 3.65K OHM 1% 1/8W	28480	0757-0434
A6R71	0757-0284		R:FXD MET FLM 150 OHM 1% 1/8W	28480	0757-0284
A6R72	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A6R73	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A6R74	0698-3447		R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A6R75	0698-3447		R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A6R76	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A6R77	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A6R78	0757-0447		R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A6R79	0698-3154		R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A6R80	0757-0434		R:FXD MET FLM 3.65K OHM 1% 1/8W	28480	0757-0434
A6R81	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A6R82	0757-0815	1	R:FXD MET FLM 562 OHM 1% 1/2W	28480	0757-0815
A6R83	0698-3274	1	R:FXD MET FLM 10K OHM 1% 1/8W	28480	0698-3274
A6R84	0698-8076	1	R:FXD FLM 8.66K OHM 1.0% 1/8W	28480	0698-8076
A6R85	0811-1217	1	R:FXD WW 150 OHM 5% 5W	28480	0811-1217
A6R86	0757-1094		R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A6R87	0698-3410		R:FXD MET FLM 3.16K OHM 1% 1/2W	28480	0698-3410
A6R88	0757-0419		R:FXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A6R89	0757-0817		R:FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817
A6R90	2100-2517	2	R:VAR FLM 50K OHM 10% LIN 1/2W	28480	2100-2517
A6R91	0698-3260		R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A6R92	2100-2517		R:VAR FLM 50K OHM 10% LIN 1/2W	28480	2100-2517
A6R93	0698-3260		R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A7	09862-60060	1	DAC BOARD	28480	09862-60060
A7C1	0160-0300	14	C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C2	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C3	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C4	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C5	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C6	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C7	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C8	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C9	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C10	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C11	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C12	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C13	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS

Table 7. Electrical Parts List (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7C14	0160-0300		C:FXD MY 0.0027 UF 200VDCW	56289	192P27292-PTS
A7C15			NOT ASSIGNED		
A7C16	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A7C17	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A7C18	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A7C19	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A7IC1	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A7IC2	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A7IC3	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A7IC4	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A7IC5	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A7IC6	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A7IC7	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A7IC8	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A7IC9	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A7Q1	1853-0319	4	TSTR:SI PNP	28480	1853-0319
A7Q2	1854-0538	4	TSTR:SI NPN	28480	1854-0538
A7Q3	1853-0319		TSTR:SI PNP	28480	1853-0319
A7Q4	1854-0538		TSTR:SI NPN	28480	1854-0538
A7Q5	1853-0319		TSTR:SI PNP	28480	1853-0319
A7Q6	1854-0538		TSTR:SI NPN	28480	1854-0538
A7Q7	1853-0319		TSTR:SI PNP	28480	1853-0319
A7Q8	1854-0538		TSTR:SI NPN	28480	1854-0538
A7Q9	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q11	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q12	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q13	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q14	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q15	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q16	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q17	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q18	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q19	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q20	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q21	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q22	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q23	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q24	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q25	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q26	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q27	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A7Q28	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7R1	0757-0439	14	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R2	0757-0278	28	R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R3	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R4	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R5	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R6	0811-2742	1	R:FXD WW 19.9K OHM 0.1% 1/16W	28480	0811-2742
A7R7	2100-2632	1	R:VAR FLM 100 OHM 10% LIN 1/2W	28480	2100-2632
A7R8	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R9	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R10	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R11	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R12	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R13	0811-3099	1	R:FXD WW 39.95K OHM 0.01% 1/32W	28480	0811-3099
A7R15	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R16	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R17	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R18	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R19	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R20	0811-3100	1	R:FXD WW 79.95K OHM 0.01% 1/32W	28480	0811-3100
A7R22	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R23	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R24	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R25	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R26	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R27	0811-3098	1	R:FXD WW 159.95K OHM 0.01% 1/32W	28480	0811-3098
A7R28	0811-3097	1	R:FXD WW 150K OHM 0.01% 1/32W	28480	0811-3097
A7R29	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R30	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R31	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R32	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R33	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R34	0811-3096	1	R:FXD WW 19.95K OHM 0.05% 1/32W	28480	0811-3096

Table 7. Electrical Parts List (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7R35	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R36	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R37	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R38	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R39	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R40	0811-2744	1	R:FXD WW 39.95K OHM 0.05% 1/32W	28480	0811-2744
A7R41	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R42	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R43	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R44	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R45	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R46	0811-2747	1	R:FXD WW 79.95K OHM 0.1% 1/16W	28480	0811-2747
A7R47	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R48	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R49	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R50	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R51	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R52	0757-0470	2	R:FXD MET FLM 162K OHM 1% 1/8W	28480	0757-0470
A7R53	0757-0469		R:FXD FLM 150K OHM 1% 1/8W	28480	0757-0469
A7R54	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R55	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R56	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R57	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R58	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R59	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A7R60	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R61	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R62	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R63	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R64	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R65	0698-4008	3	R:FXD MET FLM 40K OHM 1% 1/8W	28480	0698-4008
A7R66	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R67	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R68	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R69	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R70	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R71	0698-3201	1	R:FXD FLM 80.0K OHM 1% 1/8W	28480	0698-3201
A7R72	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R73	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R74	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R75	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R76	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R77	0757-0470		R:FXD MET FLM 162K OHM 1% 1/8W	28480	0757-0470
A7R78	0757-0469		R:FXD FLM 150K OHM 1% 1/8W	28480	0757-0469
A7R79	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R80	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R81	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R82	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R83	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R84	0757-0449		R:FXD FLM 20K OHM 1% 1/8W	28480	0757-0449
A7R85	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A7R86	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R87	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A7R88	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R89	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A7R90	0698-4008		R:FXD MET FLM 40K OHM 1% 1/8W	28480	0698-4008
A7R91	0698-4008		R:FXD MET FLM 40K OHM 1% 1/8W	28480	0698-4008
A7R92	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A7R93	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A7R94	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A8	09862-60080	1	RECTIFIER BOARD	28480	09862-60080
A8C1	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A8C2	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A8C3	0160-2145	2	C:FXD CER 5000 PF +80-20% 100VDCW	91418	TA
A8C4	0160-2145		C:FXD CER 5000 PF +80-20% 100VDCW	91418	TA
A8CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A8CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A8CR3	1902-0184	2	DIODE BREAKDOWN:SILICON 16.2V 5%	28480	1902-0184
A8CR4	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A8CR5	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A8CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A8CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A8CR8	1902-0184		DIODE BREAKDOWN:SILICON 16.2V 5%	28480	1902-0184
A8CR9	1902-3223	2	DIODE BREAKDOWN:17.4V 2% 400MW	28480	1902-3223
A8CR10	1902-3223		DIODE BREAKDOWN:17.4V 2% 400MW	28480	1902-3223

Table 7. Electrical Parts List (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8CR11	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A8CR12	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A8CR13	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A8CR14	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A8CR15	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A8CR16	1901-0200	6	DIODE:SILICON 100 PIV 3A	02735	1N4998
A8CR17	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A8CR18	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A8CR19	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A8CR20	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A8CR21	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A8CR22	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A8CR23	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A8CR24	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A8CR25	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A8F1	2110-0029	5	FUSE:CARTRIDGE 3 AMP 125V SLOW BLOW	75915	313003
A8F2	2110-0029		FUSE:CARTRIDGE 3 AMP 125V SLOW BLOW	75915	313003
A8F3	2110-0029		FUSE:CARTRIDGE 3 AMP 125V SLOW BLOW	75915	313003
A8F4	2110-0029		FUSE:CARTRIDGE 3 AMP 125V SLOW BLOW	75915	313003
A8F5	2110-0029		FUSE:CARTRIDGE 3 AMP 125V SLOW BLOW	75915	313003
A8F6	2110-0004	2	FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
A8F7	2110-0004		FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
A8Q1	1853-0036	4	TSTR:SI PNP	80131	2N3906
A8Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q3	1854-0441	5	TSTR:SI NPN	80131	2N3054
A8Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q7	1853-0036		TSTR:SI PNP	80131	2N3906
A8Q8	1854-0441		TSTR:SI NPN	80131	2N3054
A8Q9	1853-0036		TSTR:SI PNP	80131	2N3906
A8Q10	1853-0036		TSTR:SI PNP	80131	2N3906
A8Q11	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q12	1854-0441		TSTR:SI NPN	80131	2N3054
A8Q13	1854-0441		TSTR:SI NPN	80131	2N3054
A8Q14	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A8R1	0698-3154		R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A8R2	0757-0397	3	R:FXD MET FLM 68.1 OHM 1% 1/8W	28480	0757-0397
A8R3	0757-0443	2	R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A8R4	0757-0397		R:FXD MET FLM 68.1 OHM 1% 1/8W	28480	0757-0397
A8R5	0757-0290		R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A8R6	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A8R7	0698-3156	2	R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A8R8	0757-0443		R:FXD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A8R9	0757-0397		R:FXD MET FLM 68.1 OHM 1% 1/8W	28480	0757-0397
A8R10	0698-3154		R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A8R11	0757-0290		R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A8R12	0698-3156		R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A8R13	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A8R14	0698-3601	2	R:FXD MET OX 10 OHM 5% 2W	28480	0698-3601
A8R15	0698-3601		R:FXD MET OX 10 OHM 5% 2W	28480	0698-3601
A8R16	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A8R17	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A8R18	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A8R19	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A8R20	0761-0005	4	R:FXD MET OX 2200 OHM 5% 1a	28480	0761-0005
A8R21	0761-0005		R:FXD MET OX 2200 OHM 5% 1a	28480	0761-0005
A8R22	0761-0057	1	R:FXD MET OX 560 OHM 5% 1W	28480	0761-0057
A8R23	0761-0005		R:FXD MET OX 2200 OHM 5% 1a	28480	0761-0005
A8R24	0761-0005		R:FXD MET OX 2200 OHM 5% 1a	28480	0761-0005
A8R25	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A8R26	0698-3154		R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A8R27	0698-3154		R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A8R28	0698-3696		R:FXD MET OX 39 OHM 5% 1W	28480	0698-3696
A9	09862-60090	1	POWER DRIVER BOARD	28480	09862-60090
A9C1	0160-0128	2	C:FXD CER 2.2 UF 20% 25VDCW	56289	5C152C2S-CML
A9C2	0160-0128		C:FXD CER 2.2 UF 20% 25VDCW	56289	5C152C2S-CML
A9C3	0150-0096	1	C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TA
A9C4	0180-0104	1	C:FXD ELECT 200 UF +75-10% 15VDCW	56289	300207G015DF4-DSM
A9CR1	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A9CR2	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A9CR3	1902-3077	2	DIODE BREAKDOWN:4.42V 2%	28480	1902-3077
A9CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A9CR5	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A9CR6	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088

Table 7. Electrical Parts List (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9CR7	1902-3077		DIODE BREAKDOWN:4.42V 2%	28480	1902-3077
A9Q1	1854-0039		TSTR:SI NPN	80131	2N3053
A9Q2	1854-0530	6	TSTR:SI NPN	80131	2N3055
A9Q3	1853-0012	3	TSTR:SI PNP	80131	2N2904A
A9Q4	1854-0530		TSTR:SI NPN	80131	2N3055
A9Q5	1854-0039		TSTR:SI NPN	80131	2N3053
A9Q6	1854-0530		TSTR:SI NPN	80131	2N3055
A9Q7	1853-0012		TSTR:SI PNP	80131	2N2904A
A9Q8	1854-0530		TSTR:SI NPN	80131	2N3055
A9Q9	1854-0530		TSTR:SI NPN	80131	2N3055
A9Q10	1854-0441		TSTR:SI NPN	80131	2N3054
A9Q11	1854-0087		TSTR:SI NPN	80131	2N3417
A9Q12	1854-0087		TSTR:SI NPN	80131	2N3417
A9Q13	1853-0012		TSTR:SI PNP	80131	2N2904A
A9Q14	1854-0530		TSTR:SI NPN	80131	2N3055
A9R1	0698-3444	4	R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A9R2	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A9R3	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A9R4	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A9R5	0683-0475	2	R:FXD COMP 4.7 OHM 5% 1/4W	01121	CB 47G5
A9R6	0683-0475		R:FXD COMP 4.7 OHM 5% 1/4W	01121	CB 47G5
A9R7	0757-0824	3	R:FXD MET FLM 2000 OHM 1% 1/2W	28480	0757-0824
A9R8	0757-0824		R:FXD MET FLM 2000 OHM 1% 1/2W	28480	0757-0824
A9R10	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A9R11	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A9R12	0698-3136		R:FXD MET FLM 17.8K OHM 1% 2/8W	19701	MF4C T-0
A9R13	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A9R14	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A9R15	0811-1827	1	R:FXD WW 0.1 OHM 10% 3W	28480	0811-1827
A9R16	0757-0824		R:FXD MET FLM 2000 OHM 1% 1/2W	28480	0757-0824
A9R17	0811-1849	1	R:FXD WW 0.75 OHM 10% 5W	28480	0811-1849
A9R18	0698-3159	1	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A9R19	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A10			NOT ASSIGNED		
A11			NOT ASSIGNED		
A12			NOT ASSIGNED		
A13DS1	2140-0336	2	LAMP:INCANDESCENT 12V 100 MA	28480	2140-0336
A13DS2	2140-0336		LAMP:INCANDESCENT 12V 100 MA	28480	2140-0336
A13R1	2100-2682	4	R:VAR WW 10K OHM 10% LIN 2W	28480	2100-2682
A13R2	2100-2682		R:VAR WW 10K OHM 10% LIN 2W	28480	2100-2682
A13R3	2100-2682		R:VAR WW 10K OHM 10% LIN 2W	28480	2100-2682
A13R4	2100-2682		R:VAR WW 10K OHM 10% LIN 2W	28480	2100-2682
A13S1	3101-1643	1	SWITCH	28480	3101-1643
A13S3	3101-1644	1	SWITCH:PUSHBUTTON 2PDT 4 STATIONS	28480	3101-1644
A14C5	0180-2421	1	C:FXD AL ELECT 15000 UF +75-10% 20VDCW	56289	32D153G020BC6B
A14C6	0180-2420	2	C:FXD AL ELECT 2100 UF +75-10% 40VDCW	56289	320212G040AB6B
A14C7	0180-2420		C:FXD AL ELECT 2100 UF +75-10% 40VDCW	56289	320212G040AB6B
A14C8	0180-2197	2	C:FXD ELECT 4000 UF +75-10% 30VDCW	28480	0180-2197
A14C9	0180-2197		C:FXD ELECT 4000 UF +75-10% 30VDCW	28480	0180-2197
A14T1	09862-60180	1	TRANSFORMER	28480	09862-60180
A15C1	0160-0195	4	C:FXD CER 1000 PF 20% 250WVAC	56289	19C251A1-CDH
A15C2	0160-0195		C:FXD CER 1000 PF 20% 250WVAC	56289	19C251A1-CDH
A15C3	0160-0195		C:FXD CER 1000 PF 20% 250WVAC	56289	19C251A1-CDH
A15C4	0160-0195		C:FXD CER 1000 PF 20% 250WVAC	56289	19C251A1-CDH
A15L1	9100-1344	2	COIL	28480	9100-1344
A15L2	9100-1344		COIL	28480	9100-1344
A15S1	3101-1609	1	SWITCH:SLIDE 2-OPDT	82389	11E-1036
A16	09862-60130	1	INTERFACE LOGIC BOARD	28480	09862-60130
A16C1	0180-0228	2	C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A16C2	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A16C3	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A16C4	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A16C5	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A16C6	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A16C7	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A16C8	0150-0093		C:FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K800011
A16IC1	1820-0069		IC:TTL DUAL 4-INPT POS NAND GATE	01295	SN7420N
A16IC2	1820-0269	1	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7403N
A16IC3	1820-0701	1	IC:TTL LOW POWER QUAD LATCH	07263	U7893L1459X
A16IC4	1820-0614	1	IC:TTL DUAL 4-BIT LATCH(LOW POWER)	07263	U6N93L0859
A16IC5	1820-0174		IC:TTL HEX INVERTER	01295	SN7404N
A16IC6	1820-0511	1	IC:TTL QUAD 2-INPT AND GATE	01295	SN7408N
A16IC7	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A16IC8	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A16IC9	1820-0537	1	IC:TTL DUAL 4-INPT NAND GATE	28480	1820-0537

Table 7. Electrical Parts List (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16IC10	1820-0077		IC:TTL DUAL D F/F	01295	SN7474N
A16IC11	1820-0174		IC:TTL HEX INVERTER	01295	SN7404N
A16IC12	1820-0174		IC:TTL HEX INVERTER	01295	SN7404N
A16R1	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A16R2	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A16R3	0698-0085	4	R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A16R4	0698-3132	1	R:FXD FLM 261 OHM 1% 1/8W	28480	0698-3132
A16R5	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A16R6	0698-0085		R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A16R7	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A16R8	0757-0427		R:FXD MET FLM 1.5K OHM 1% 1/8W	28480	0757-0427
A16R9	0698-0085		R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A16R10	0698-0085		R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A16R11	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A16R12	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A16R13	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A16R14	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A16R15	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A16R16	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A16R17	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A16R18	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A16R19	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A16R20	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A16R21	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A16R22	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A16R23	0698-3432		R:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432

Table 8. Code List of Manufacturers

Mfr. No.	Manufacturer Name	Address	Zip Code
01121	Allen Bradley Company	Milwaukee, Wis.	53204
01295	Texas Instruments Inc. Semiconductor Components Div.	Dallas, Tex.	75231
02735	RCA Solid State and Receiving Tube Division	Somerville, N. J.	08876
04713	Motorola Semiconductor Products, Inc.	Phoenix, Arizona	85008
07263	Fairchild Camera and Inst. Corp. Semiconductor Div.	Mountain View, Calif.	94040
12040	National Semiconductor Corp	Danbury, Conn.	06810
14752	Electro-Cube Inc.	San Gabriel, Calif.	91176
19701	Electra/Midland Corp.	Mineral Wells, Tex.	76067
28480	Hewlett-Packard Company	Palo Alto, Calif.	94304
56289	Sprague Electric Co.	N. Adams, Mass.	01247
71400	Bussman Mfg. Division McGraw-Edison Co.	St. Louis, Mo.	63017
72136	Electro Motive Mfg. Co. Inc.	Willimantic, Conn.	06226
72982	Erie Technological Prod. Inc.	Erie, Pa.	16512
75915	Littlefuse, Inc.	Des Plaines, Ill.	60016
80131	Electronic Industries Association	Washington, D. C.	20006
82142	Airco Speer Elect. Comp.	Du Bois, Pa.	15801
82389	Switchcraft, Inc.	Chicago, Ill.	60630
91418	Radio Materials Co.	Chicago, Ill.	60646