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COLLINS

instruction book

Collins Radio Company

COLLINS RADIO CO.
DALLAS, TEXAS 75207

54Z-1
AM Frequency Monitor

BROADCAST EQUIPMENT GUARANTEE

The equipment described herein is sold under the following guarantee:

a. Except as set forth in paragraph b. of this section, Collins agrees with Buyer to repair or replace, without charge, any properly maintained equipment, parts or accessories which are defective as to design, materials, or workmanship and which are returned in accordance with Collins instructions by Buyer to Collins factory, transportation prepaid, provided:
   1. Notice of a claimed defect in the design, materials or workmanship of the equipment manufactured by Collins is given by Buyer to Collins within five (5) years from date of delivery, with exception of rotating machinery such as blowers, motors, and fans whereby notice must be given by Buyer to Collins within two (2) years from date of delivery.
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20V-3	26U-2	81M	172G-2	216C-2	313T-4	642A-2	820F-1	830D-1	830F-2A
26J-1	42E-7	144A-1	212H-1	313T-1	356H-1	786M-1	A830-2	830E-1	830H-1A
26U-1	42E-8	172G-1	212Z-1	313T-3	564A-1	820E-1	830B-1	830F-1	830N-1A

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c. Collins further guarantees that any radio transmitter described herein will deliver full radio frequency power output at the antenna lead when connected to a suitable load, but such guarantee shall not be construed as a guarantee of any definite coverage or range of said apparatus.

d. The guarantee of this section is void if:
   1. The equipment malfunctions or becomes defective as a result of alterations or repairs by others than Collins or its authorized service center, or
   2. The equipment is exposed to environmental conditions more severe than specified by Collins in equipment manuals.

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g. The guarantees of this section and limitations thereon will also accrue to the benefit of any purchaser of Buyer's F.C.C. license, provided:
   1. Notice of the sale of the F.C.C. license is given by Buyer to Collins in writing within thirty (30) days after the consummation of said sale; and
   2. No greater rights are granted to the purchaser of Buyer's F.C.C. license than are granted herein to Buyer.

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ADDRESS:

Collins Radio Company
Customer Returned Goods, 412-023
1225 North Alma Road
Richardson, Texas 75080

INFORMATION NEEDED:

(A) Type number, name and serial number of equipment
(B) Date of delivery of equipment
(C) Date placed in service
(D) Number of hours of service
(E) Nature of trouble
(F) Cause of trouble if known
(G) Part number (9 or 10 digit number) and name of part thought to be causing trouble
(H) Item or symbol number of same obtained from parts list or schematic
(I) Collins number (and name) of unit subassemblies involved in trouble
(J) Remarks

How to Order Replacement Parts When ordering replacement parts, you should direct your order as indicated below and furnish the following information insofar as applicable. To enable us to give you better replacement service, please be sure to give us complete information.

ADDRESS:

Collins Radio Company
Service Parts, 412-024
1225 North Alma Road
Richardson, Texas 75080

INFORMATION NEEDED:

(A) Quantity required
(B) Collins part number (9 or 10 digit number) and description
(C) Item or symbol number obtained from parts list or schematic
(D) Collins type number, name and serial number of principal equipment
(E) Unit subassembly number (where applicable)

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COLLINS

instruction book

54Z-1
AM Frequency Monitor

Collins Radio Company | Dallas, Texas

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glossary

AND:	A coincidence circuit that provides a prescribed output when all of several possible input conditions are met.
FLIP-FLOP:	A bistable multivibrator.
GATE:	A circuit operating as a switch to pass or block a signal.
NAND:	An AND circuit that provides phase inversion.
NOR:	An OR circuit that provides phase inversion.
OR:	A circuit that provides a prescribed output with one or more of several possible input signals.
TOGGLE:	Change of state. Reverse the outputs of a flip-flop.
TRUTH TABLE:	Shows output conditions of a logic element for all combinations of input conditions.

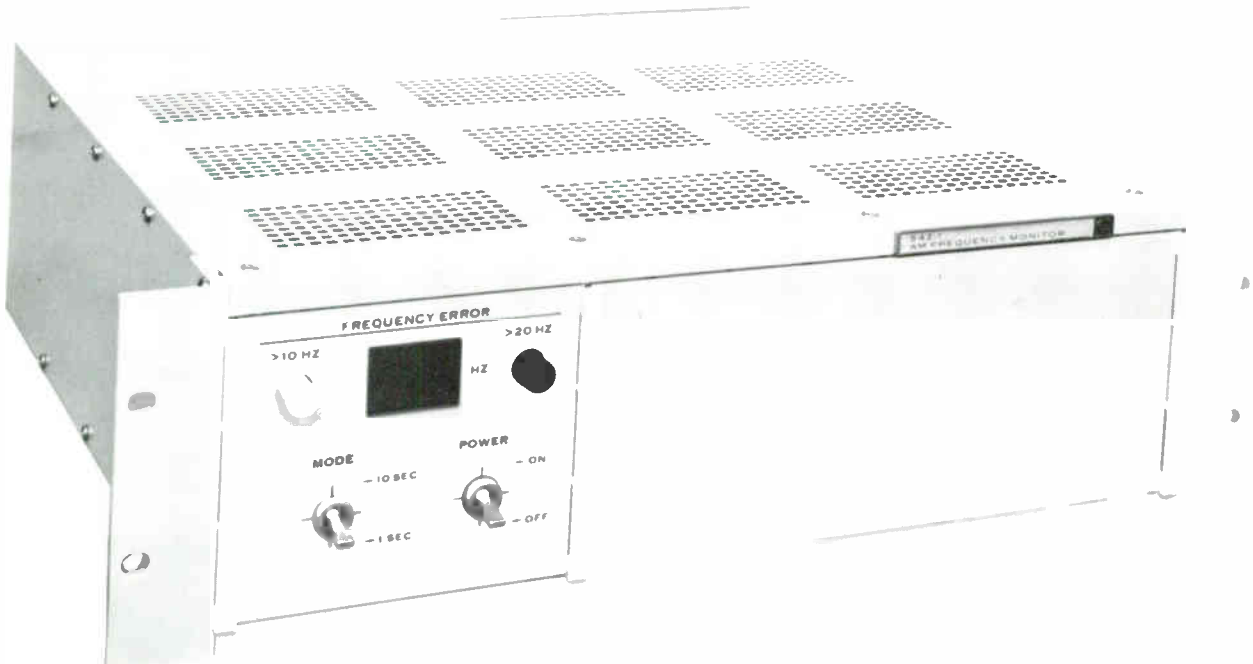


Figure 1-1. 54Z-1 AM Frequency Monitor.

section 1
general description

1.1 PURPOSE OF INSTRUCTION BOOK

This instruction book contains information for the installation, adjustment, operation, and maintenance of the 54Z-1 AM Frequency Monitor.

1.2 PURPOSE OF EQUIPMENT

The 54Z-1 AM Frequency Monitor (figure 1-1) is a solid-state digital counter for remote, unattended monitoring of AM broadcast transmitter carrier frequency drift. Frequency error is displayed up to ±20 Hz in 1-Hz increments and local alarm indicators for errors greater than 10 Hz and 20 Hz are provided on the front panel. In addition, the frequency error in digital form, polarity of error, and contact closures for operation of remote indicators, alarms, or interlocks (to initiate transmitter shutdown) are provided on the monitor rear panel.

1.3 PHYSICAL DESCRIPTION

The monitor is assembled in a metal case 5-1/4 inches high, 19 inches wide, 14 inches deep, and weighs approximately 20 pounds. The monitor is of modular construction consisting of six fiberglass etched circuit cards and a control and indicator module (with a power supply) that are removable from the front. The monitor contains a shield to prevent rf interference and emission. The rf input, 1-MHz output (to check frequency standard operation), and remote readout connections are located on the rear panel.

1.4 FUNCTIONAL DESCRIPTION

The frequency monitor determines frequency error by converting the transmitter carrier to a pulse train and using the pulse train to clock a binary counter from a preset number to zero during a precise 1- or 10-second time period. During the 1-second readout time, the count in the binary counter is read, decoded, and applied to the monitor display and, if applicable, the alarm circuits. The frequency error display is updated at the end of each count period and is displayed during the next sample period.

See figure 1-2. During monitor installation and setup, a binary number corresponding to the transmitter carrier frequency is physically wired on the preset card. The preset card provides the binary counter with the binary number to start counting from. The 1- or 10-second sample time, 1-second off-time, and 6 timing pulses (P1 through P6) are derived by dividing the 3-MHz oscillator output. The rf transmitter carrier, containing from 0- to 90-percent amplitude modulation, is applied to the rf circuit where it is amplified and clipped to form a pulse train corresponding to the carrier frequency. The pulse train is applied to the count gate matrix but is not passed until the 1- or 10-second SAMPLE signal from the divider network is applied to the count gate matrix. Prior to a count period the binary counter is set at P1 time and preset to the transmitter frequency at P2 time. The decade counter is cleared at P1 time to ensure that the decade counter starts from 0 and not an ambiguous number left from the previous count period. During a 10-second sample time the rf pulse train is applied to the decade counter where it is divided by 10 and applied through the binary counter gate to the binary counter. The pulses, applied to the binary counter, cause the binary counter to count backwards from the transmitter carrier frequency towards zero. During the 1-second off-time (after the count period) the number in the binary counter is analyzed by the detector and storage circuits. The count remaining in the decade counter is examined by the round-off circuit and if it is five or higher, adds another pulse to the binary counter, decreasing the count by one. If the binary counter counted more transmitter carrier frequency pulses than the assigned frequency, the detector and storage circuits add a pulse to the binary counter to again decrease the frequency count by one. This pulse is added because the binary counter transition through zero requires an extra pulse from the rf input pulse train. The detector and storage circuits apply the count from the binary counter to the code converter and the alarm and inhibit circuits, and apply the polarity sign to the display circuits. The code converter decodes the binary input and applies a decimal equivalent to the display circuits, and the digital signals to the rear terminal connectors, and the optional digital-to-analog converter. The inhibit circuit prevents the first greater-than-20-Hz error from energizing the greater-than-20-Hz alarm relay. A TRANSIENT INHIBIT PULSE applied to the inhibit circuit also prevents the greater-than-20-Hz alarm circuit from operating if a momentary power loss or fluctuation interrupts the frequency count. If the transmitter rf carrier is lost or turned off, a SIGNAL PRESENCE signal inhibits both alarm circuits. The greater-than-10-Hz alarm is not inhibited for the first error count and the first error of 10-Hz or greater energizes the alarm.

Operation in the 1-second sample mode is similar to the 10-second mode with the following differences. The counting period is 1 second. The rf pulse train, applied to the count gate matrix, bypasses the decade counter and is applied directly to the binary counter gate and then to the binary counter. The round-off circuit is not used in the 1-second mode which reduces the accuracy of the counter.

1.5 CUSTOMER OPTIONS

The following equipment options to tailor the monitor to customer requirements and provide checkout are available.

a. Preset 1 Card (CPN 770-7893-001). This card is supplied in monitor CPN 758-5605-002 and is used to set only the transmitter carrier frequency into the binary counter.
b. Preset 2 Card (CPN 770-7899-001). This card, supplied in monitor CPN 758-5605-003, is used to set the transmitter carrier frequency into the binary counter and provides digital-to-analog conversion for a remote analog frequency meter.
c. 82U-1 Remote Analog Meter Panel (CPN 777-1390-001). The analog meter is a frequency meter mounted on a standard 19-inch rack panel and provides visual remote frequency indications when using a monitor with Preset 2 Card installed.
d. 782B-1 Self-Check Card (CPN 777-1439-001). The self-check card is prewired to 1 MHz and contains a switch wired to preset errors of -16, -8, -0, +8, and +16 into the binary counter. This card provides a functional check by comparing the preset error to the monitor 1-MHz reference output.
e. Extender Card (CPN 781-5248-001). The extender card provides access to monitor circuit card components for checkout.

1.6 TECHNICAL CHARACTERISTICS

Frequency Range:
540 to 1600 kHz

Minimum Channel Spacing:
1 kHz

Input Voltage Level:
Unmodulated Carrier
2- to 20-volts peak

Amplitude Modulation
0 to 90%

Input Impedance:
50 ± 5 ohms

Frequency Standard:
Stability
0.5 part per 10^6 from -25° to 55°C

Aging
1 part per 10^6 per year

Error Display:
-20 to +20 Hz. Inhibited above ±20 Hz

Alarm Presentation:
Visual alarm and contact closure when error exceeds ±10 Hz.
Visual alarm and contact closure, inhibited from transient activation, when error exceeds ± 20 Hz for two consecutive sample times.

Accuracy of Readout:
10-Second Sample
±1 Hz

1-Second Sample
±2 Hz

Resolution of Readout:
1 Hz

Ambient Temperature Range:
-25° to 55°C

Ambient Humidity Range:
Up to 95%

Altitude Range:
Up to 10,000 feet

Shock and Vibration Conditions:
Normal handling and shipping

Power Source:
117 vac ±10%, single phase, 50/60 Hz

Type of Service:
Continuous

Alarm Relay Contact Rating:
At 24 vdc - 2 amperes resistive,
1 ampere inductive

At 115 vrms - 1 ampere resistive,
0.5 ampere inductive

External Readout Signal Characteristics:
Typically 3 ma at 1 vdc

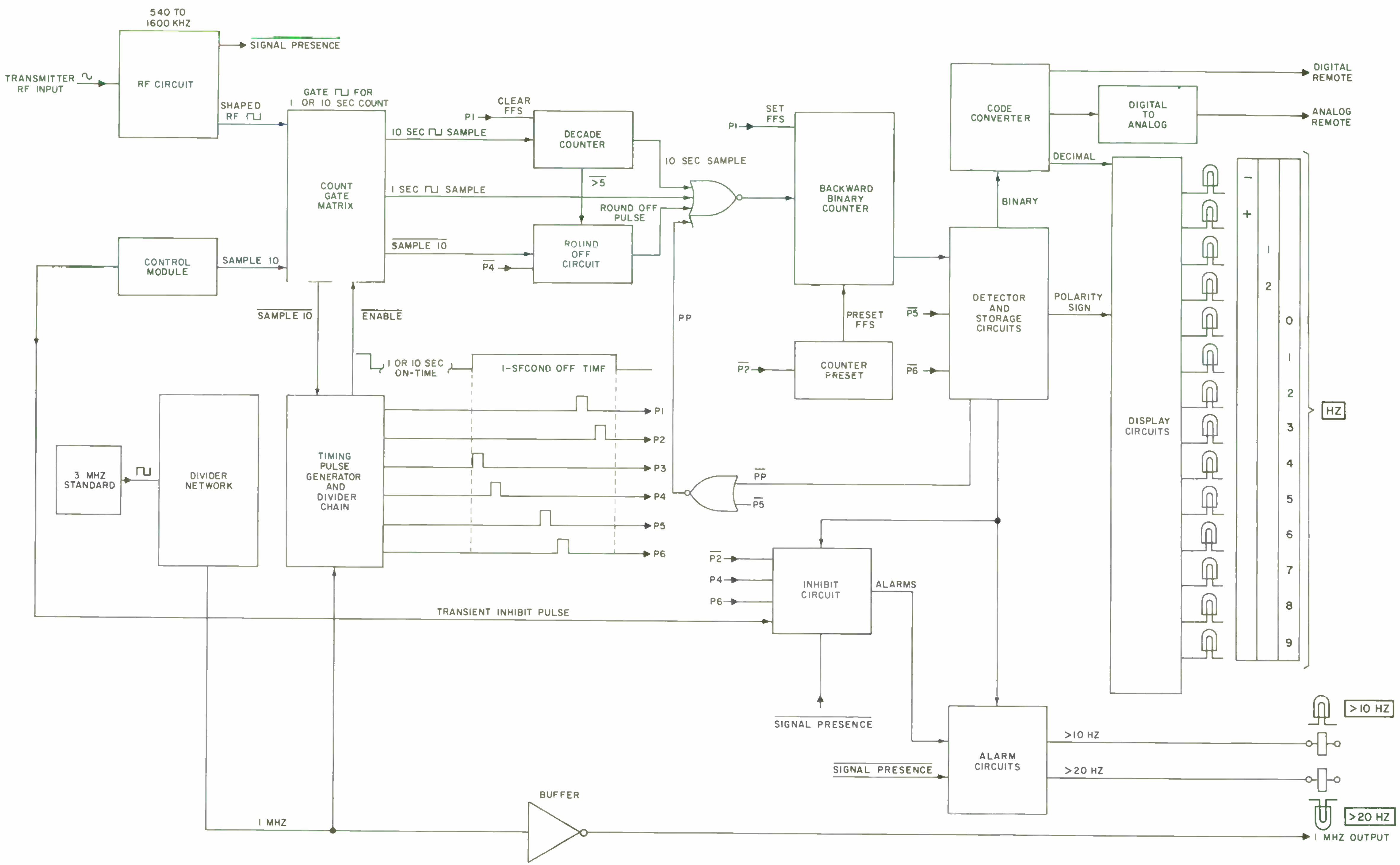


Figure 1-2. Functional Block Diagram.

section 2
installation and adjustment

2.1 UNPACKING AND INSPECTING THE EQUIPMENT

Remove all packing material and carefully lift the unit from the package. Check the equipment against the packing slips. Visually inspect the units for damaged or missing components. Check for proper operation of controls. Any claims for damage should be filed promptly with the transportation agency. If such claims are to be filed, all packing material must be retained.

2.2 INSTALLATION

2.2.1 Mounting

Position the monitor in a standard 19-inch rack or cabinet and secure.

2.2.2 Connections

Prior to connecting monitor primary power and external inputs and outputs, set POWER switch to OFF.

2.2.3 Alarm and Digital Readout Connections

Connect the desired digital readouts and alarms to the terminal block on back of monitor (figure 2-1) as listed in table 2-1. Refer to paragraph 1.7 for alarm relay contact rating and external readout characteristics.

2.2.4 Remote Analog Meter Connection

If the remote analog frequency meter readout option was purchased, verify that the monitor contains a Preset 2 Card (CPN 770-7899-001) in slot A6. Loop resistance of the connecting line to the remote meter must not exceed 15K. Connect the remote meter pin 1 to monitor terminal 19 and pin 2 to monitor terminal 20. Remove shorting spring from meter terminals. Retain shorting spring for future use. Replace shorting spring on meter terminals before disconnection from the monitor. To calibrate meter, refer to paragraph 2.2.7.

2.2.5 RF Cable and Primary Power Connection

Connect the monitor power cord to a 115-vac, 50/60-Hz source.

Note

The monitor will not operate properly if the rf input is not within the following limits.

Obtain the rf transmitter output signal from a point in the AM transmitter where the amplitude modulation is less than 90 percent and the signal level of the unmodulated carrier is between 2 and 20 volts peak. Connect a 50-ohm coaxial cable between the monitor rf input connector and the transmitter.

2.2.6 Preset Card Wiring

The monitor contains one of two types of preset cards in slot A6. Regardless of the type of preset card in the monitor, the card must be wired to correspond to the broadcast transmitter frequency that it will monitor. To wire a preset card, two 15-inch lengths of pliable number 24 bus wire are required. The jumper wires are connected to the terminals by two or three tight wraps around each terminal. The column on the extreme left of table 2-2 lists transmitter frequency and the 18 columns progressing to the right correspond to preset card terminals 1 through 18. Connect a jumper wire to preset card pin 19 and each terminal represented by a 0 in table 2-2, columns 1 through 18. Connect a jumper wire to preset card GRD terminal and each terminal represented by a 1 in table 2-2, columns 1 through 18.

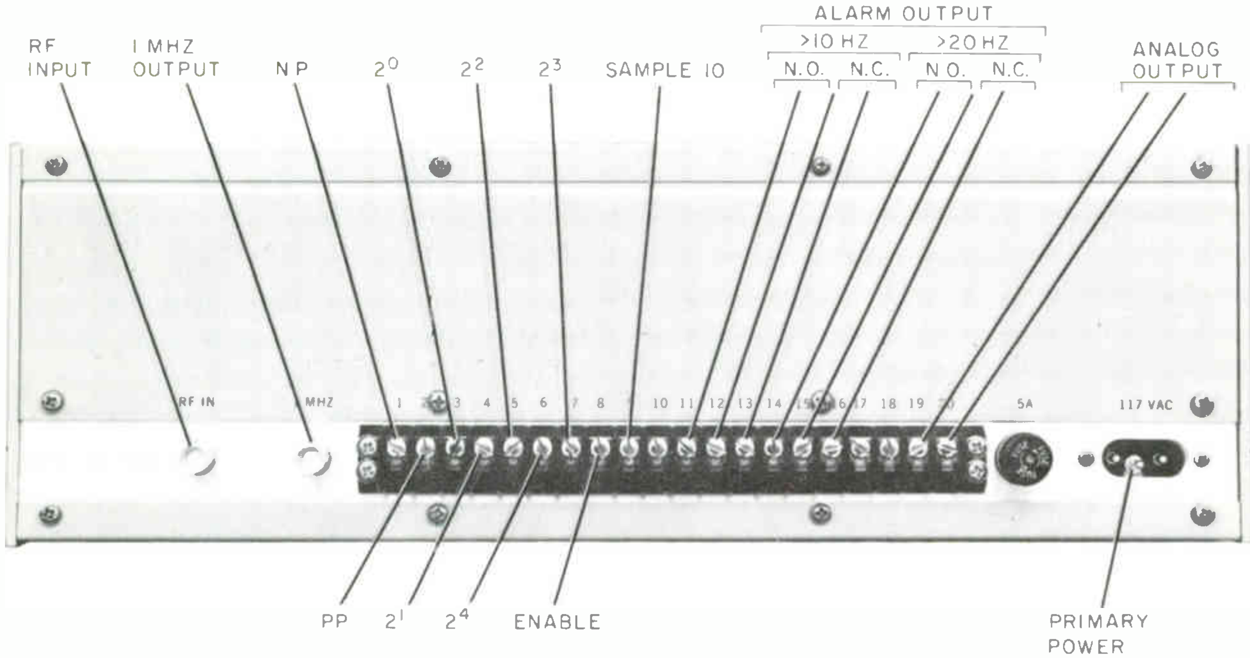


Figure 2-1. Rear Panel Connections.

Table 2-1. Alarm and Digital Readout Connections.

SIGNAL NOMENCLATURE	TERMINAL NO.
Alarms	
>10-Hz Contact Closure (greater than 10 Hz)	
Normally closed contacts	12 and 13
Normally open contacts	11 and 12
>20-Hz Contact Closure (greater than 20 Hz)	
Normally closed contacts	15 and 16
Normally open contacts	14 and 15
Readout Signals	
NEGATIVE POLARITY (negative frequency error)	1
POSITIVE POLARITY (positive frequency error)	2
2^0 (binary 1)	3
2^1 (binary 2)	4
2^2 (binary 4)	5
2^3 (binary 8)	7
2^4 (binary 16)	6
ENABLE (10 second or 1 second)	8
SAMPLE 10 (from MODE switch)	9

2.2.7 Remote Analog Meter Calibration

If the remote analog meter was purchased and the meter is connected, calibrate meter as follows:

a. Remove logic 2 and logic 4 cards from locations A4 and A8.
b. Place preset 2 card on extender card in location A6.
c. Using jumper wire, connect collector of Q9 to GRD terminal on preset 2 card.
d. Set POWER switch to ON.
e. Using adjustment located on remote meter panel, adjust meter reading to +18 or -18. The polarity depends on the signal stored in A1A5A53 when the logic 2 card is removed.
f. Set POWER switch to OFF.
g. Remove jumper wire from Q9 and GRD terminal on preset 2 card.
h. Remove extender card and place preset 2 card back in card cage.

2.2.8 Installation Checks

Note

The following procedure does not check calibration of the monitor frequency standard. Refer to calibration procedure for oscillator adjustment.

If a self-check card has been purchased, check monitor operation after installation using the following procedure.

a. Remove preset card from location A6, insert self-check card in location A6 and remove rf card from location A1.
b. Connect jumper wire from logic 1, test point 1 to logic 2, test point 5.
c. Set POWER switch to ON and set MODE switch to 1 SEC.
d. Rotate self-check card frequency error switch through each of the five positions and observe error display indications of -16, -8, -0, +8, and +16.
e. Set MODE switch to 10 SEC and repeat step d.

Table 2-2. Preset Card Wiring Table.

FREQUENCY (kHz)	PRESET CARD TERMINAL NUMBERS																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
540	0	0	1	1	0	1	0	1	1	1	1	0	0	0	0	0	1	0
550	0	1	1	1	0	0	0	1	0	0	1	1	0	0	0	0	1	0
560	0	0	0	0	1	1	1	0	1	0	0	0	1	0	0	0	1	0
570	0	1	0	0	1	0	1	0	0	1	1	0	1	0	0	0	1	0
580	0	0	1	0	1	1	0	0	1	1	0	1	1	0	0	0	1	0
590	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0
600	0	0	0	1	1	1	1	1	1	0	0	1	0	1	0	0	1	0
610	0	1	0	1	1	0	1	1	1	0	0	1	0	1	0	0	1	0
620	0	0	1	1	1	1	0	1	0	1	1	1	0	1	0	0	1	0
630	0	1	1	1	1	0	0	1	1	1	0	0	1	1	0	0	1	0
640	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	1	0
650	0	1	0	0	0	1	1	0	1	0	1	1	1	1	0	0	1	0
660	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0
670	0	1	1	0	0	1	0	0	1	1	1	0	0	0	1	0	1	0
680	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	0	1	0
690	0	1	0	1	0	1	1	1	0	0	0	0	1	0	1	0	1	0

Table 2-2. Preset Card Wiring Table (Cont).

FREQUENCY (kHz)	PRESET CARD TERMINAL NUMBERS																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
700	0	0	1	1	0	0	1	1	1	0	1	0	1	0	1	0	1	0
710	0	1	1	1	0	1	0	1	0	1	0	1	1	0	1	0	1	0
720	0	0	0	0	1	0	0	1	1	1	1	1	1	0	1	0	1	0
730	0	1	0	0	1	1	1	0	0	0	1	0	0	1	1	0	1	0
740	0	0	1	0	1	0	1	0	1	0	0	1	0	1	1	0	1	0
750	0	1	1	0	1	1	0	0	0	1	1	1	0	1	1	0	1	0
760	0	0	0	1	1	0	0	0	1	1	0	0	1	1	1	0	1	0
770	0	1	0	1	1	1	1	1	1	1	1	0	1	1	1	0	1	0
780	0	0	1	1	1	0	1	1	0	0	1	1	1	1	1	0	1	0
790	0	1	1	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0
800	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1	1	0
810	0	1	0	0	0	0	0	1	1	1	0	1	0	0	0	1	1	0
820	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	1	1	0
830	0	1	1	0	0	0	1	0	1	0	1	0	1	0	0	1	1	0
840	0	0	0	1	0	1	0	0	0	1	0	1	1	0	0	1	1	0
850	0	1	0	1	0	0	0	0	1	1	1	1	1	0	0	1	1	0
860	0	0	1	1	0	1	1	1	1	1	0	0	0	1	0	1	1	0
870	0	1	1	1	0	0	1	1	0	0	0	1	0	1	0	1	1	0
880	0	0	0	0	1	1	0	1	1	0	1	1	0	1	0	1	1	0
890	0	1	0	0	1	0	0	1	0	1	0	0	1	1	0	1	1	0
900	0	0	1	0	1	1	1	0	1	1	1	0	1	1	0	1	1	0
910	0	1	1	0	1	0	1	0	0	0	1	1	1	1	0	1	1	0
920	0	0	0	1	1	1	0	0	1	0	0	0	0	0	1	1	1	0
930	0	1	0	1	1	0	0	0	0	1	1	0	0	0	1	1	1	0
940	0	0	1	1	1	1	1	1	0	1	0	1	0	0	1	1	1	0
950	0	1	1	1	1	0	1	1	1	1	1	1	0	0	1	1	1	0
960	0	0	0	0	0	0	1	1	0	0	1	0	1	0	1	1	1	0
970	0	1	0	0	0	1	0	1	1	0	0	1	1	0	1	1	1	0
980	0	0	1	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0
990	0	1	1	0	0	1	1	0	1	1	0	0	0	1	1	1	1	0
1000	0	0	0	1	0	0	1	0	0	0	0	1	0	1	1	1	1	0
1010	0	1	0	1	0	1	0	0	1	0	1	1	0	1	1	1	1	0

Table 2-2. Preset Card Wiring Table (Cont).

FREQUENCY (kHz)	PRESET CARD TERMINAL NUMBERS																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1020	0	0	1	1	0	0	0	0	0	1	0	0	1	1	1	1	1	0
1030	0	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0
1040	0	0	0	0	1	0	1	1	1	1	0	1	1	1	1	1	1	0
1050	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1
1060	0	0	1	0	1	0	0	1	1	0	1	0	0	0	0	0	0	1
1070	0	1	1	0	1	1	1	0	0	1	0	1	0	0	0	0	0	1
1080	0	0	0	1	1	0	1	0	1	1	1	1	0	0	0	0	0	1
1090	0	1	0	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1
1100	0	0	1	1	1	0	0	0	1	0	0	1	1	0	0	0	0	1
1110	0	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0	0	1
1120	0	0	0	0	0	1	1	1	0	1	0	0	0	1	0	0	0	1
1130	0	1	0	0	0	0	1	1	1	1	1	0	0	1	0	0	0	1
1140	0	0	1	0	0	1	0	1	0	0	1	1	0	1	0	0	0	1
1150	0	1	1	0	0	0	0	1	1	0	0	0	1	1	0	0	0	1
1160	0	0	0	1	0	1	1	0	0	1	1	0	1	1	0	0	0	1
1170	0	1	0	1	0	0	1	0	1	1	0	1	1	1	0	0	0	1
1180	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1
1190	0	1	1	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1
1200	0	0	0	0	1	1	1	1	1	0	0	1	0	0	1	0	0	1
1210	0	1	0	0	1	0	1	1	0	1	1	1	0	0	1	0	0	1
1220	0	0	1	0	1	1	0	1	1	1	0	0	1	0	1	0	0	1
1230	0	1	1	0	1	0	0	1	0	0	0	1	1	0	1	0	0	1
1240	0	0	0	1	1	1	1	0	1	0	1	1	1	0	1	0	0	1
1250	0	1	0	1	1	0	1	0	0	1	0	0	0	1	1	0	0	1
1260	0	0	1	1	1	1	0	0	1	1	1	0	0	1	1	0	0	1
1270	0	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	1
1280	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	1
1290	0	1	0	0	0	1	1	1	1	0	1	0	1	1	1	0	0	1
1300	0	0	1	0	0	0	1	1	0	1	0	1	1	1	1	0	0	1
1310	0	1	1	0	0	1	0	1	1	1	1	1	1	1	1	0	0	1
1320	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	1
1330	0	1	0	1	0	1	1	0	1	0	0	1	0	0	0	1	0	1

Table 2-2. Preset Card Wiring Table (Cont).

FREQUENCY (kHz)	PRESET CARD TERMINAL NUMBERS																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1340	0	0	1	1	0	0	1	0	0	1	1	1	0	0	0	1	0	1
1350	0	1	1	1	0	1	0	0	1	1	0	0	1	0	0	1	0	1
1360	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	0	1
1370	0	1	0	0	1	1	1	1	0	0	1	1	1	0	0	1	0	1
1380	0	0	1	0	1	0	1	1	1	0	0	0	0	1	0	1	0	1
1390	0	1	1	0	1	1	0	1	0	1	1	0	0	1	0	1	0	1
1400	0	0	0	1	1	0	0	1	1	1	0	1	0	1	0	1	0	1
1410	0	1	0	1	1	1	1	0	0	0	0	0	1	1	0	1	0	1
1420	0	0	1	1	1	0	1	0	1	0	1	0	1	1	0	1	0	1
1430	0	1	1	1	1	1	0	0	0	1	0	1	1	1	0	1	0	1
1440	0	0	0	0	0	1	0	0	1	1	1	1	1	1	0	1	0	1
1450	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	1
1460	0	0	1	0	0	1	1	1	0	0	0	1	0	0	1	1	0	1
1470	0	1	1	0	0	0	1	1	1	0	1	1	0	0	1	1	0	1
1480	0	0	0	1	0	1	0	1	0	1	0	0	1	0	1	1	0	1
1490	0	1	0	1	0	0	0	1	1	1	1	0	1	0	1	1	0	1
1500	0	0	1	1	0	1	1	0	0	0	1	1	1	0	1	1	0	1
1510	0	1	1	1	0	0	1	0	1	0	0	0	0	1	1	1	0	1
1520	0	0	0	0	1	1	0	0	0	1	1	0	0	1	1	1	0	1
1530	0	1	0	0	1	0	0	0	1	1	0	1	0	1	1	1	0	1
1540	0	0	1	0	1	1	1	1	1	1	1	1	0	1	1	1	0	1
1550	0	1	1	0	1	0	1	1	0	0	1	0	1	1	1	1	0	1
1560	0	0	0	1	1	1	0	1	1	0	0	1	1	1	1	1	0	1
1570	0	1	0	1	1	0	0	1	0	1	1	1	1	1	1	1	0	1
1580	0	0	1	1	1	1	1	0	1	1	0	0	0	0	0	0	1	1
1590	0	1	1	1	1	0	1	0	0	0	0	1	0	0	0	0	1	1
1600	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1	1

3.1 PANEL CONTROLS AND INDICATORS

This section locates, illustrates, and describes the function of each front panel control (figure 3-1 and table 3-1).

3.2 OPERATING INSTRUCTIONS

To operate monitor, set POWER switch to ON. There is no delay or warmup time required; however, disregard the first one or two error displays to allow the counting circuits to stabilize. Set MODE switch to 10 SEC. This is the normal mode of operation for the monitor and provides the greatest accuracy. The frequency error readout is updated every 11 seconds. The 1 SEC mode of operation, with a 2-second update time, is usually used when adjusting transmitter frequency. When switching monitor mode of operation, disregard the first one or two error displays to allow the counting circuits to stabilize. The greater-than-20-Hz alarm is protected from transient activation when switching monitor mode of operation or when turning power on.

3.3 TRANSMITTER FREQUENCY ADJUSTMENT

If the transmitter frequency drifts, it may be adjusted as follows:

a. Set MODE switch to 1 SEC.
b. Observe display and adjust transmitter frequency until display indicates -0-Hz frequency error.
c. Set MODE switch to 10 SEC.
d. If required, adjust transmitter frequency until display indicates -0-Hz frequency error.

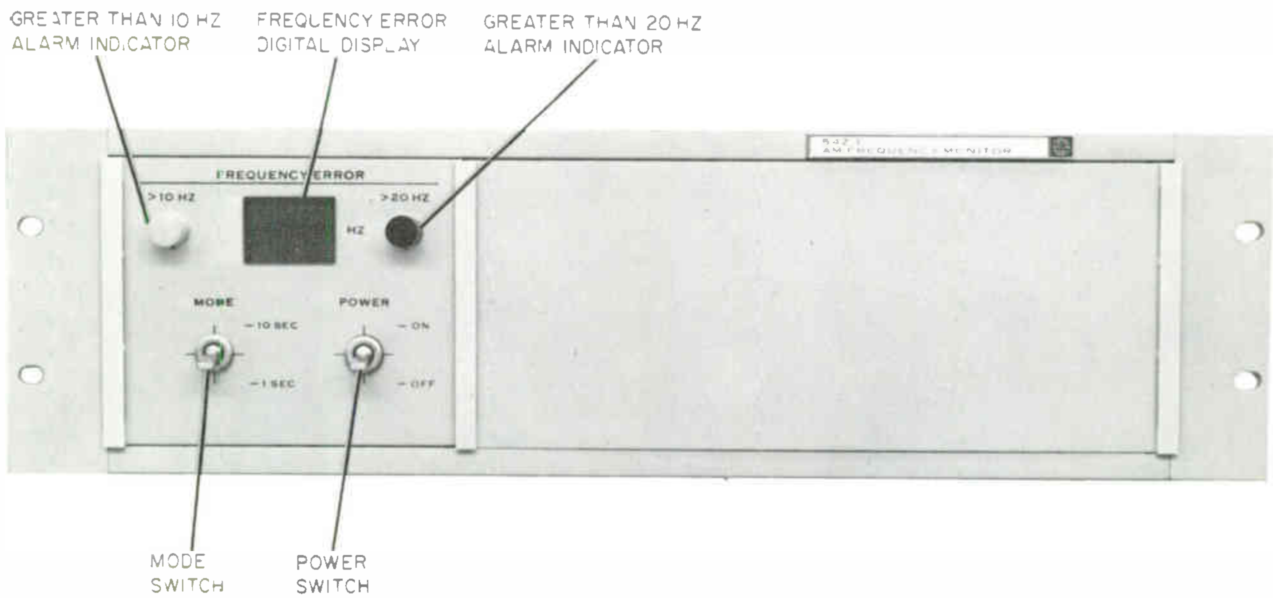


Figure 3-1. Panel Controls and Indicators.

Table 3-1. Controls and Indicators.

NAME	PANEL MARKING	FUNCTION
Power switch	POWER ON/OFF	Turns monitor on and off
Mode switch	MODE	
	1 SEC	Selects 1-second sample time
	10 SEC	Selects 10-second sample time
Frequency-error-greater-than-10-Hz indicator lamp	FREQUENCY ERROR > 10 HZ	Indicates frequency error of more than ±10 Hz.
Frequency-error-greater-than-20-Hz indicator lamp	FREQUENCY ERROR > 20 HZ	Indicates frequency error of more than ±20 Hz.
Frequency-error readout screen	FREQUENCY ERROR HZ	Displays frequency error from 0 to ±20 Hz.

section 4
principles of operation

4.1 GENERAL

The 54Z-1 Frequency Monitor uses integrated circuits to perform the digital counting, decoding, readout and gate functions.

It uses positive logic; that is, a logic 1 is always more positive than a logic 0. The logic states are represented by the following voltages:

Logic 1: nominally 1.0 volts
Logic 0: nominally 0.3 volt

4.2 INTEGRATED CIRCUITS

The following paragraphs present a general description of the integrated circuits used in the frequency monitor.

4.2.1 Fairchild JK Flip-Flop

The Fairchild Micrologic 923 flip-flops are used as storage elements, counters, and dividers. Refer to figure 4-1 for schematic diagram, logic symbol and truth table. The JK flip-flops differ from ordinary flip-flops in that no ambiguous output state can result from simultaneous logic-1 inputs. There are only two output conditions: pin 7 is logic 1 while pin 5 is logic 0, and pin 7 is logic 0 while pin 5 is logic 1. The flip-flop changes state on the negative transition of a clock pulse at pin 2 or a logic 1 applied at pin 6. Simultaneous logic 0 signals on the SET (pin 1) and CLEAR (pin 3) inputs allow the output at pins 5 and 7 to toggle (reverse) when the clock pulse is applied. With logic 1 inputs on the SET and CLEAR pins, the output at pins 5 and 7 will not change with the clock input. A logic 1 on pin 1 and logic 0 on pin 3 changes the output at pin 7 to logic 1 and at pin 5 to logic 0 at the next clock pulse. A logic 0 on pin 1 and logic 1 on pin 3 changes the output at pin 7 to logic 0 and at pin 5 to logic 1 at the next clock pulse. A logic 1 applied to pin 6 presets the output at pin 7 to logic 0, regardless of the clock input or the logic levels on pins 1 and 3.

4.2.2 Dual 2-Input NOR Gate

The Fairchild Micrologic 914 is a dual 2-input NOR gate. When any one or more inputs to a NOR gate are logic 1, the output is a logic 0. Refer to figure 4-2 for schematic, logic symbols, and truth tables. Each NOR gate may be used separately as a 2-input gate or the output pins 6 and 7 may be tied together to form a 4-input gate. In the gate function operation, assume a logic-1 input at pin 2 and a square-wave input at pin 1. The output at pin 7 remains at a logic 0 due to the logic-1 input at pin 2 blocking the square-wave input at pin 1. When the input at pin 2 changes to logic 0, the square wave at pin 1 is passed by the gate. Any input pins not used are tied to ground (logic 0). The dual 2-input gate is also used as a set-reset flip-flop by external crosscoupling; that is, pin 6 to pin 2 and pin 7 to pin 3 and the control pulses are applied to pins 1 and 5.

4.2.3 Buffer Element

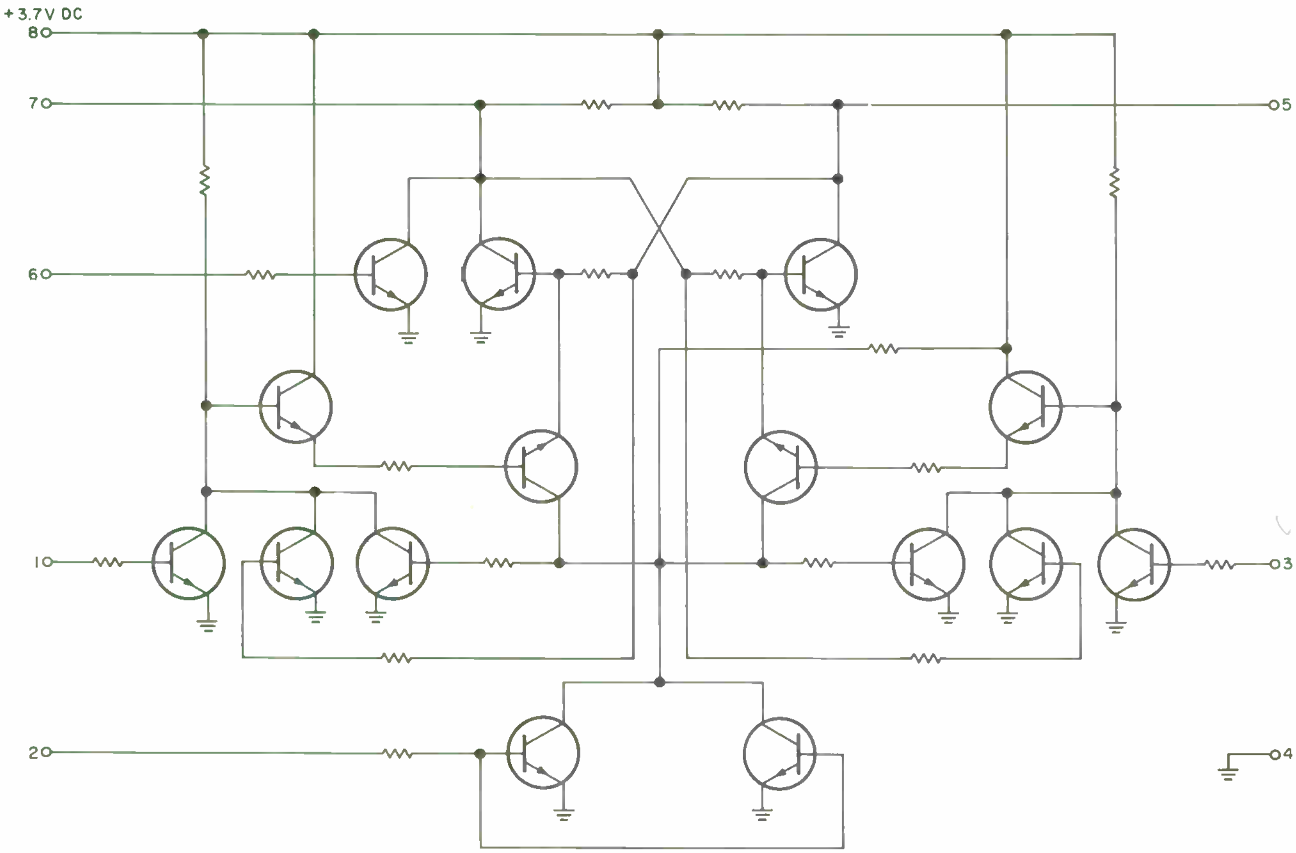
The Fairchild Micrologic 900 Buffer is an inverting driver capable of supplying 16 ma at 0.9 vdc. Refer to figure 4-2 for schematic, logic symbol, and truth table. The buffer is used as a line driver to increase fanout, as a buffer to provide isolation, or as an inverting amplifier. Fanout refers to the number of integrated circuits that a device can drive. A logic 1 at pin 3 produces a logic-0 output at pin 5. A logic 0 at pin 3 produces a logic-1 output at pin 5.

4.3 MONITOR PRINCIPLES OF OPERATION

The following paragraphs are keyed to the functional diagram in figure 7-1. The signals in figure 7-1 with a bar across the top are logic 0, when they are present, and signals without a bar are logic 1, when they are present.

4.3.1 Frequency Divider Network

The 3-MHz crystal oscillator output applied to the shaper is formed into a square wave and applied to a divide-by-3 flip-flop network (figure 7-1)



TRUTH TABLE

SET PIN 1	CLEAR PIN 3	OUTPUT PIN 7
1	1	X^n
1	0	1
0	1	0
0	0	$\overline{X^n}$

X IS THE OUTPUT STATE AT TIME n

1 = HIGH
0 = LOW

LOGIC SYMBOL

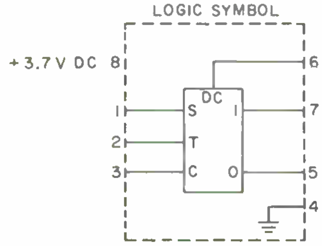


Figure 4-1. Fairchild 923 JK Flip-Flop Schematic.

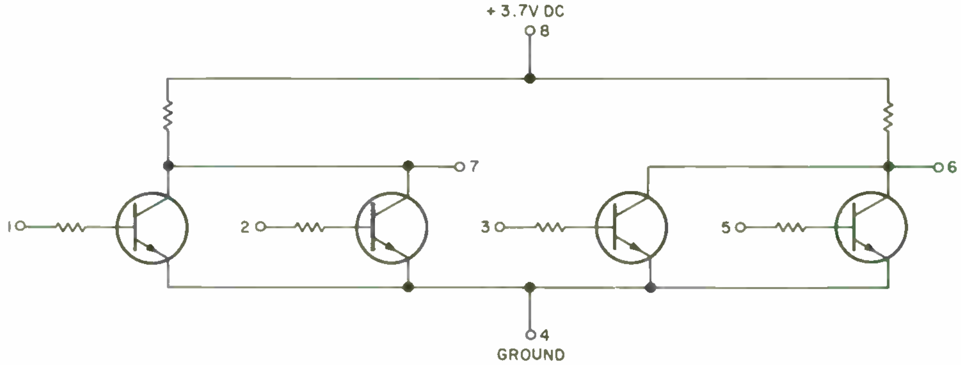
that produces two 1-MHz outputs. One output from the divide-by-3 network is fed to a buffer and then to an rf connector on the rear panel. The other 1-MHz output is applied to a divide-by-4 flip-flop network. The resulting 250-kHz signal is divided twice by 25 to obtain first a 10-kHz signal and then a 400-Hz signal. The 400-Hz signal is applied to a divide-by-50 flip-flop network to obtain an 8-Hz signal that is applied to a divide-by-8 network. The divide-by-8 network provides 4-, 2-, and 1-Hz output signals to the timing pulse generator logic. The 1-Hz signal is also applied to a divide-by-2-or-11 network that provides a 1- or 10-second sample time with a 1-second readout time.

4.3.2 Timing Pulse Generator

The 8-, 4-, 2-, and 1-Hz signals, derived from the divider network (figure 7-1), are used to establish the 1-second and 10-second sample, readout, and timing pulses required for the sampling and processing operation.

One output of the 1-Hz signal is divided by 2 or 11, depending on MODE switch position, to produce a sample time of 1 or 10 seconds respectively with a 1-second off-time for sample count processing and display updating. The sample signal is sent to a count gate matrix to control the rf input sample time.

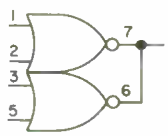
FAIRCHILD MICROLOGIC 914 DUAL TWO INPUT NOR GATE



TRUTH TABLE
PINS 6 AND 7 CONNECTED

INPUT PINS				OUTPUT PINS
1	2	3	5	6 OR 7
1	1	1	1	0
1	1	1	0	0
1	1	0	1	0
1	1	0	0	0
1	0	1	1	0
1	0	1	0	0
1	0	0	1	0
1	0	0	0	0
0	1	1	1	0
0	1	1	0	0
0	1	0	1	0
0	1	0	0	0
0	0	1	1	0
0	0	1	0	0
0	0	0	1	0
0	0	0	0	1

LOGIC SYMBOL



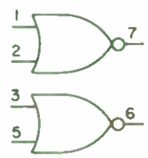
1= HIGH
0= LOW

TRUTH TABLE
PINS 6 AND 7
NOT CONNECTED

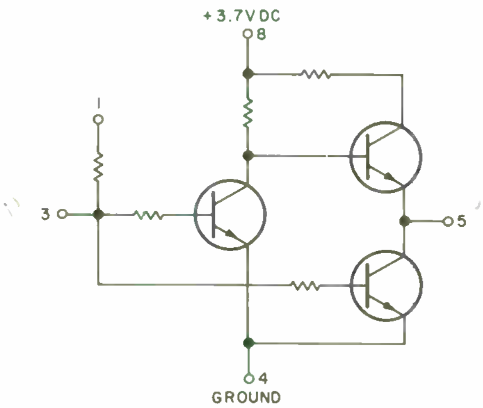
INPUT PINS		OUTPUT PINS
1	2	7
0	0	1
1	0	0
1	1	0
0	1	0

INPUT PINS		OUTPUT PINS
3	5	6
0	0	1
1	0	0
1	1	0
0	1	0

LOGIC SYMBOL



FAIRCHILD MICROLOGIC 900 BUFFER



TRUTH TABLE

INPUT PIN 3	OUTPUT PIN 5
0	1
1	0

1 = HIGH
0 = LOW

LOGIC SYMBOL

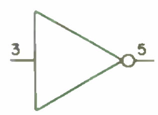


Figure 4-2. Fairchild 914 Dual 2-Input Gate and 900 Buffer Schematic.

A second 1-Hz signal, from the divide-by-8 network, is combined with 4-, 2-, and 1-Hz signals to generate timing pulses that perform sequential operations during the 1-second off-time (figure 5-2). These pulses, spaced over the 1-second off-time, are 80 ms in duration with 45 ms between pulses. The pulses are identified as P1, (P1), $\overline{P2}$, P3, P4, $\overline{P4}$, $\overline{P5}$, P6, and $\overline{P6}$ and are discussed in the following paragraphs as they are used.

4.3.3 RF Circuit

The rf input (figure 7-7) from the transmitter is limited by diodes CR1 and CR2 and applied to transistor Q1. The output signal from Q1 is limited by diodes CR3 and CR4 and then applied to transistors Q2, Q3, and Q4 where it is further amplified, limited, and shaped to form a square wave.

A signal presence circuit, consisting of transistors Q5, Q6, Q7 and diodes CR5 and CR6, provides a low-level dc when the rf input is applied to the monitor. The rf input is amplified by transistors Q5 and Q6 and applied to the voltage doubler formed by diodes CR5, CR6, and capacitors C8 and C10. The positive voltage on the base of transistor Q7 causes Q7 to conduct, providing a low-level dc output. Loss of the rf input shuts off transistor Q7 and inhibits the alarm and display circuits by providing a logic-1 output. The signal presence circuit prevents the monitor from causing an alarm when there is no rf input.

4.3.4 Count Gate Matrix

The count gate matrix (figure 7-1) directs the shaped rf input through the 1-second or 10-second gates as selected by the MODE switch position.

The MODE switch 10 SEC position applies a logic 1 to the count gate matrix that disables the 1-second gate A1A4A2. The logic 1 applied to A1A4A1 causes a logic-0 output that enables the round-off circuit and the decade counter output gate A1A4A13 and causes the divide-by-2-or-11 circuit to supply an 11-second period (containing a logic-0 sample time of 10 seconds and a logic-1 read time of 1 second) to the count gate matrix rf gates A1A4A3, A2, and A7. The decade counter output gate A1A4A13 is disabled during the readout time by set-reset flip-flop A1A4A8.

The MODE switch 1 SEC position applies a logic 0 to the count gate matrix that enables the 1-second gate A1A4A2. The logic 0 applied to A1A4A1 causes a logic-1 output that disables the round-off circuit and the decade counter output gate A1A4A13 and causes the divide-by-2-or-11 circuit to supply a 2-second period (containing a logic-0 sample time for 1 second and a logic-1 read time for 1 second) to the count gate matrix rf gates A1A4A3, A2, and A7.

4.3.5 Decade Counter

The decade counter (figure 7-1) is a ring counter that produces 1 output pulse for every 10 input pulses. The decade counter receives the rf pulse train from the count gate matrix and applies the divided-by-10 output from pin 7 of A1A4A25 to the output gate A1A4A13. Sampling the input pulses for 10 seconds and dividing by 10 permits frequency count round-off that reduces count gate ambiguity. At the end of the sample period, the decade counter output is inhibited by a P3 pulse. During the readout time the count remaining in the decade counter is examined by the round-off circuit and if it is five or more, another count is added to the binary counter. The count of five or more is logic 0 at A1A4A25 pin 5. The decade counter is cleared (logic 0 at pin 7, and logic 1 at pin 5) prior to each sample period by a logic 1 on pins 6 at P1 time.

4.3.6 Round-Off Circuit

The round-off circuit (figure 7-1) rounds off the frequency count to the nearest whole cycle when the monitor is operating in the 10-second sample mode. The round-off circuit is enabled by a logic 0 from A1A4A1 and a logic 0 (five or greater count) from the decade counter A1A4A25 pin 5. With the two ENABLE signals present during readout time, a logic 0, from the timing pulse generator, at P4 time adds one count to the binary counter. The round-off circuit is disabled when the MODE switch is set to the 1 SEC position by a logic 1 from the A1A4A1.

4.3.7 Binary Counter Gate

The binary counter gate (figure 7-1) is a 4-input NOR gate that supplies the binary counter with all count pulses. The four inputs are: 1- or 10-second rf count pulses, the round-off pulse, and the positive polarity pulse. To add a count to the binary counter, a logic-1 pulse is applied to the input which provides a logic-0 output pulse to the binary counter.

4.3.8 Binary Counter Preset

To count from 1,600 kHz, 21 flip-flops are required and 18 flip-flops are wired for preset (figure 7-1). The 3 lowest order flip-flops A1A2A1, A2, and A3 are always set to zero at P1 time by a logic 1 and are not wired to the preset card A1A6. The preset card is wired (by the customer) to the binary equivalent of the transmitter frequency that it will monitor. Preset occurs at P2 time when a logic 0 is applied to the preset card buffer which in turn applies a logic 1 to all the binary counter flip-flops connected to A1A6 terminal 19.

4.3.9 Binary Counter

The binary counter (figure 7-1) counts backwards from a binary number, representing the transmitter frequency, during a precise time period. Prior to a sample period, the binary counter flip-flops are set at P1 time by a logic-1 pulse and preset at P2 time to the binary number representing the transmitter frequency. During a sample period, each pulse from the binary counter gate decreases the number in the binary counter by one. At the end of a sample period, all flip-flops will be set to zero if the transmitter frequency is correct. A negative error results if the counter does not reach zero and a positive error results if the counter passes zero. The error count and polarity of error are then examined by the detector and storage circuits.

4.3.10 Detector and Storage Circuits

The detector and storage circuits (figure 7-1) analyze the states of all 21 flip-flops in the binary counter to determine polarity and magnitude of frequency error and to store the information for display during the next sample period.

The polarity detector consists of two 16-input NOR circuits with the outputs applied to polarity storage flip-flops A1A5A52 and 53 and the greater-than-10 and greater-than-20 error detectors. Pins 5 of the last 16 flip-flops in the binary counter are connected to one 16-input NOR gate. Pins 7 are connected to the other 16-input NOR gate. When there is a negative frequency error, the 16 flip-flop outputs from all pins 5 are logic 1 and the outputs at all pins 7 are logic 0. For a negative frequency error the following conditions exist: a logic-0 input to A1A5A52 pin 3 and a logic-1 input to A52 pin 1, a logic-1 input to A1A5A53 pin 3 and a logic-0 input to A53 pin 1.

At P6 time, flip-flops A52 and A53 are updated by a P6 pulse. This provides a logic 1 from A1A5A54 pin 7 to transistor A1A9A2Q9, lighting the negative error display lamp and a logic 0 from A1A5A51 pin 6 to transistor A1A9A2Q4, inhibiting the positive-error display lamp. When there is a positive frequency error, the outputs of the binary counter flip-flops are reversed (pins 5 logic 0 and pins 7 logic 1), the storage circuit outputs are reversed, the positive-error lamp lights, and the negative-error lamp is inhibited.

If the logic levels on pin 5 in the last 16 binary counter flip-flops are not the same, the frequency error is 32 Hz or greater and the outputs of both 16-input NOR gates are logic 0. The logic-0 outputs are inverted to logic 1 through A1A5A26 and are applied to the greater-than-10 and 20-Hz error detectors A1A5A31 and A36. The error detectors provide a logic 1 from A1A5A41 to the greater-than-10 and 20-Hz alarm storage flip-flops A1A8A9 and A10.

The error signals for display from the first five binary counter flip-flops are applied to the display storage circuit. The error signals are also examined by NOR gates A1A4A16, 17, 18, and 19, which are part of the greater-than-10-and 20-Hz error detectors. The display error signals are loaded directly into the storage flip-flops by a logic 0 applied to the storage circuit NOR gates at P5 time. The output signals from the storage flip-flops are partially combined, buffered, and applied to the binary to decimal decode circuit.

For all positive errors, an additional pulse is added to the binary counter. This pulse is required because the counter transition through zero requires an extra pulse from the rf input pulse train. The pulse is added by clocking the binary counter at P5 time with logic-0 signals $\overline{P5}$ and $\overline{PP}$ and storing the new number in the storage flip-flops during P5 time. The stored binary number, for positive frequency errors, is inverted for proper decoding in the code converter. This is accomplished by toggling the display storage flip-flops at P6 time with logic-0 signals $\overline{P6}$ and $\overline{PP}$.

4.3.11 Decode Circuit

The decode circuit (figure 7-1) receives binary error signals from the storage circuits, decodes the signals, and lights the decimal equivalent lamp.

Assume logic 0 on A1A8 input pins 5, 10, 12, and 14 and logic 1 on A1A8 input pins 1, 2, 3, 4, 15, and 18. The four logic-0 signals on pins 5, 10, 12, and 14 only enable 4-input gate A1A8A36. The resulting logic-1 output of A1A8A36 is inverted twice by A38. The logic-1 output from A1A8A38 pin 6 enables transistor A1A9A2Q7 that lights the 5 (units) lamp.

4.3.12 External Readout Signals

The external readout signals (figure 7-1) are digital and, as an option, analog. The binary digital signals are obtained directly from the storage circuits on A1A4 pins 9, 24, 26, 27, and 33 and applied to A1A10 logic for conditioning. The digital readout signals are: sample 10, enable, 2^0, 2^1, 2^2, 2^3, 2^4, positive polarity, and negative polarity.

The analog output is derived by applying the digital signals to the analog output converter. The analog output signal is determined by the transistor that is enabled and the current flow through the collector resistor. If more than one transistor is enabled, the collector currents are added, resulting in a larger analog meter indication. The polarity of error is controlled by a negative-polarity-stored ($\overline{NPS}$) signal that is logic 0 when frequency error is negative. When the frequency error is positive, the NPS signal changes to a logic-1 enabling transistor A1A6Q2 which energizes relay A1A6K1. This changes the analog meter movement to indicate a positive error signal. The analog output is inhibited during display update time by a logic-1 signal to transistor A1A6Q3 that cuts off transistor Q1. If the error is greater than 20 Hz, the GREATER-THAN-20-Hz ALARM signal enables transistor A1A6Q10 which disables transistor Q1 and pegs the remote meter.

4.3.13 Alarm Circuits

The alarm circuits (figure 7-1) receive the greater-than-10-and-20-Hz error signals (refer to paragraph 4.3.10) from the greater-than-10-and-20-Hz error detectors and stores them in storage flip-flops A1A8A9 and A10 at P6 time. A logic 0 from flip-flop A1A5A9 pin 5 and a logic 0 SIGNAL PRESENCE signal from the rf circuit produce a logic 1 from A1A8A14 pin 6 that enables transistor A1A9A2 Q25 which energizes relay A1A9A2K1. Relay A1A9A2K1 contacts 6 and 7 light the greater-than-10-Hz alarm indicator, and contacts 9 and 10 close the greater-than-10-Hz external/remote alarm circuit. A logic 1 from flip-flop A1A8A9 pin 5 inhibits the greater-than-10-Hz alarm relay by providing a logic 0 from A1A8A14 pin 6.

LAMP INHIBIT during display update is provided by a logic-1 signal at P4 time to A1A8A15 pin 3 that sets the output of A1A8A15 pin 7 to logic 1. This produces a logic 1 from A1A8A34 pin 5 that inhibits all readout signals. The set-reset flip-flop A1A8A15 is reset by a logic 1 at P6 time applied to A1A8A15 pin 2. The output at A1A8A15 pin 7 changes to logic 0 and provides a logic 0 at A1A8A34 pin 5 that enables all readout gates.

With an error of less than 20 Hz, the output of flip-flop A1A8A10 pin 5 is a logic 1 that inhibits the GREATER-THAN-20-Hz ALARM signal from A1A8A14 pin 7, presets flip flops A1A8A29 and A30 pins 5 through A1A8A19 and A24 to logic 1, and provides a logic 1 through A1A8A20 and A24 to pin 2 of flip-flop A1A8A29. With the first error count greater than 20 Hz, the output at pin 5 of flip-flop A1A8A10 changes at P6 time to logic 0. This enables one input of A1A8A14, removes the logic-1 preset at pins 6 of flip-flops A1A8A29 and A30 and applies logic 0 to A1A8A20 pin 1. A logic 0 at P2 time applied to A1A8A20 pin 2 clocks flip-flop A1A8A29. With the second greater-than-20-Hz count, the output of flip-flop A1A8A10 pin 5 remains logic 0 and the logic-0 P2 pulse clocks flip-flop A1A8A29 which then clocks flip-flop A1A8A30. With the third greater-than-20-Hz count, the output of flip-flop A1A8A10 pin 5 remains logic 0 and the logic-0 P2 pulse clocks flip-flop A1A8A29. This provides two logic-0 outputs from flip-flops A1A8A29 and A30 to A25 pins 3 and 5. The logic-1 output from A1A8A20 pin 6 disables the flip-flop input gate A1A8A20 and provides a logic-1 output (greater than 20 alarm) from A1A8A14 pin 7 that enables transistor A1A9A2 Q24 which energizes relay A1A942 K2. Relay A1A9A2K2 contacts light the greater-than-20-Hz alarm indicator and close the greater-than-20-Hz external/remote alarm circuit.

If a logic-1 SIGNAL PRESENCE and/or a TRANSIENT INHIBIT signal is applied to A1A8A19, the inhibit flip-flops preset to the zero state and remain in this state until the signal is removed. The greater-than-20-Hz logic-1 signal from A1A8A10 pin 7 provides a LAMP INHIBIT signal that inhibits the display circuits for errors over 20 Hz.

4.3.14 Power Supply

The power supply (figure 7-8) provides regulated and filtered 3.7 vdc and 20 vdc for monitor transistor circuits and unregulated 5.5 vdc for indicator and alarm display circuits.

The 20-vdc power supply is a full-wave rectifier consisting of diodes CR10 and 11 and capacitor C7. The voltage output is regulated at 20 vdc by VR12. The 5.5-vdc power supply is a full-wave rectifier, consisting of diodes CR8 and CR9 and capacitor C6.

The 3.7-vdc power supply is a full-wave rectifier with a series regulator. The rectifier consists of diodes CR6 and CR7 and capacitors C4 and C5. The series regulator consists of transistors Q3 and Q4 that are controlled by transistors Q1 and Q2. If the series regulator fails, VR2 limits the voltage to 5.1 volts to protect the integrated circuits.

4.3.15 Self-Check Card

The self-check card (figure 7-9) checks the monitor counting circuits by presetting an error count in the binary counter and counting a 1-MHz reference signal. At P2 time the self-check card presets the binary counter to 999,984; 999,992; 1,000,000; 1,000,008; or 1,000,016, depending on the error switch position. The 1-MHz reference, jumpered between logic 1 card A1A2 TP1 and logic 2 card A1A4 TP5, clocks the binary counter. When the monitor is operating properly, the resulting error readouts will be -16, -8, -0, +8, or +16 HZ, depending on the error switch position.

section 5
maintenance

5.1 PREVENTIVE MAINTENANCE

There is no preventive maintenance required for the monitor.

5.2 CORRECTIVE MAINTENANCE

Monitor corrective maintenance is limited to calibration and lamp replacement unless a circuit card fails. Refer to paragraph 5.4 for monitor calibration data. Refer to paragraph 5.5 for indicator lamp replacement data. Refer to paragraph 5.6 for general trouble analysis procedures.

Caution

The monitor POWER switch must be set to OFF prior to removing or installing any circuit card or components.

5.3 SPARE PARTS

Spare parts may be ordered from the following address:

Collins Radio Company
Service Parts, 412-024
1225 North Alma Road
Richardson, Texas 75080

5.4 CALIBRATION

Adjust the 3-MHz oscillator standard as follows:

a. Tune a communication receiver to WWV test frequency of 5, 10, 15, or 20 MHz.
b. Connect a coaxial cable to the monitor 1-MHz output jack A2P2.
c. Position the coaxial cable close to the communication receiver antenna terminal.
d. Observe S-meter on receiver or listen for the beat note caused by the difference in frequency between the harmonic of the 1-MHz monitor standard and the WWV carrier frequency. For example, if the 1-MHz monitor standard frequency is 0.2 Hz high and the 10-MHz WWV carrier is tuned in, the beat note is 0.2 times 10 or 2 Hz. If the 20-MHz WWV carrier is tuned in, the beat note is 0.2 times 20 or 4 Hz.
e. Adjust the monitor 3-MHz oscillator until the 1-MHz standard beat note is less then 1/2 Hz. This adjusts the monitor to within 0.1-Hz error when using the 5-MHz WWV carrier reference. The 1-MHz standard frequency can be adjusted closer when using the higher WWV carrier frequencies.

5.5 INDICATOR LAMP REPLACEMENT

5.5.1 Alarm Indicator Lamp Replacement

Remove alarm indicator cover and replace lamp.

5.5.2 Readout Assembly Lamp Replacement

The lamps are mounted on two removable readout modules that are housed in the readout assembly. When the readout assembly (figure 5-1) in the control module is viewed from the back, the units indicators are in the left-hand readout module and the tens, positive, and negative indicators are in the right-hand readout module. Each readout module is numbered with lamp and terminal designations. Determine which readout module to remove and which lamp to replace from table 5-1 before starting the replacement procedure. Replace indicator lamps as follows:

a. Remove two screws from readout module and carefully pull it straight back from readout assembly.
b. Replace lamp.
c. Replace readout module.

5.6 TROUBLE ANALYSIS

Circuit malfunctions can be isolated to a circuit card by using an oscilloscope and circuit card test points. Indicator lamp failures can be isolated by lamp substitution. Use the functional diagram, figure 7-1, as an aid in localizing faults. Test points are accessible with the cards plugged into the monitor. The card extender provides access to components on individual cards.

Table 5-1. Lamp Number to Character Display Conversion Chart.

UNIT INDICATORS		TENS, POSITIVE, AND NEGATIVE INDICATORS	
LEFT READOUT MODULE		RIGHT READOUT MODULE	
LAMP NO. TERMINAL	CHARACTER DISPLAY	LAMP NO. TERMINAL	CHARACTER DISPLAY
2	1	5	+
3	2	6	-
4	3	7	1
5	4	8	2
6	5		
7	6		
8	7		
9	8		
10	9		
11	0		

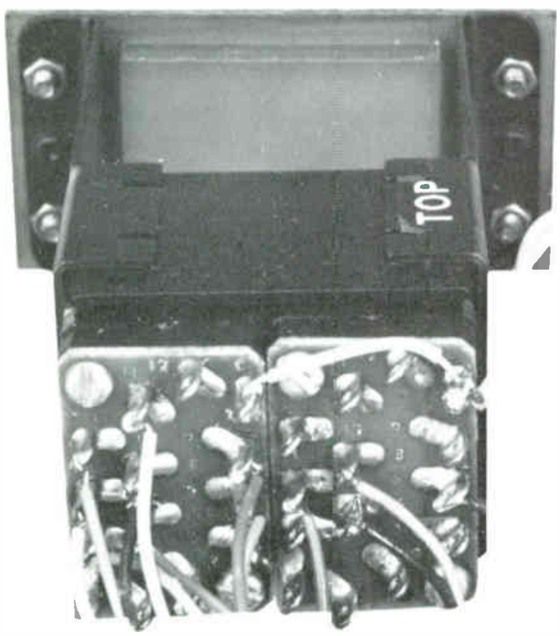


Figure 5-1. Readout Assembly, Rear View.

Circuit card test-point indications are listed in table 5-2. The signals are either logic 1 or logic 0. The amplitude of a logic 1 is typically 1 vdc and the amplitude of a logic 0 is 0.3 vdc. These voltages are typical and will vary, but a logic 1 should never be below 0.85 vdc or a logic 0 be above 0.45 vdc. If the specified indication is not obtained at a test point, refer to the schematics in section 7 to isolate the malfunction. Some indications in table 5-2 will be a different frequency for each monitor; however, the relationship given in the table will remain constant. To obtain total time between P time pulses, add 1-second or 10-second sample time as indicated by the MODE switch position. The amplitudes of waveforms in table 5-2 and figure 5-2 are logic 1 or logic 0.

The following paragraphs present possible malfunction indications and general procedures to follow for malfunction isolation. If required, detailed troubleshooting is performed using an oscilloscope, extender card, and referring to the detailed schematics in section 7.

Caution

When making repairs on the circuit cards, do not use a soldering iron rated at more than 40 watts. Do not jar or strike the card to remove excess solder.

5.6.1 Error Display and Warning Indicators Not Lighted

a. Check rf cable input at rear of monitor for rf input. (Refer to paragraph 2.2.5 for parameters.)
b. Check 1/2-A fuse at rear of monitor.
c. Check 5-A fuse in control module.
d. Check SHAPED RF and $\overline{\text{SIGNAL PRESENCE}}$ signals logic 2 card A1A4 (table 5-2).
e. Check power supply voltages (figure 7-8).

Table 5-2. Test Point Indications.

CIRCUIT CARD	TEST POINT	INDICATION
RF Card	TP1	Square wave equal to rf carrier frequency
A1A1	TP2	Ground
Logic 1	TP1	1-MHz square wave
A1A2	TP2	8-Hz square wave
	TP3	$\overline{\text{P6}}$ timing pulse (figure 5-2)
	TP4	$\overline{\text{ENABLE}}$ (figure 5-2)
	TP5	1-Hz square wave
	TP6	Ground
Logic 2	TP1	P3 timing pulse (figure 5-2)
A1A4	TP2	540,000 to 1,600,000 pulses in 1 second or 10 seconds, depending on MODE selector switch position
	TP3	$\overline{\text{P5}}$ timing pulse (figure 5-2)
	TP4	$\overline{\text{SAMPLE 10}}$ (figure 5-2)
	TP5	SHAPED RF-540 to 1600 kHz, depending upon transmitter frequency
	TP6	Ground
Logic 3	TP1	540,000 to 1,600,000 pulses (1- or 10-second time span) divided by 8
A1A5		
	TP2	P1 timing pulse (figure 5-2)
	TP3	Logic 1 when positive polarity is stored
	TP4	Logic 1 when negative polarity is stored
	TP5	(P1) timing pulse (fig. 5-2); occurs at the same time as P1
	TP6	Ground
Logic 4	TP1	> ±10 STORED; logic 1 when error is greater than 10 Hz
A1A8	TP2	> ±20 STORED; logic 0 when error is greater than 20 Hz
	TP3	$\overline{\text{P6}}$ timing pulse (figure 5-2)
	TP4	$\overline{\text{SIGNAL PRESENCE}}$; logic 0 when rf signal is present
	TP5	Not used
	TP6	Ground

5.6.2 *Greater Than 20-Hz Alarm Lighted and Greater Than 10-Hz Alarm Not Lighted*

a. Check greater-than-10-Hz indicator lamp.
b. Check greater-than-10-Hz contact closure at terminals on rear of monitor.
c. Check greater-than-10-Hz stored signal on logic 4 card A1A8 (table 5-2).

5.6.3 *Greater Than 20-Hz Alarm Lighted With Some Error Display*

Check lamp inhibit circuit on logic 4 card A1A8 (figure 7-6).

5.6.4 *Greater Than 10-Hz Alarm Lighted With Error Display of 10 Hz or Less*

a. Check logic levels in decoding circuit on logic 4 card A1A8 (figure 7-6).
b. Check lamp in tens-digit circuit.

5.6.5 *Error Display With No Polarity Indication*

a. Check polarity signal on logic 4 card A1A8 (figure 7-6).
b. Check polarity lamps in control module.

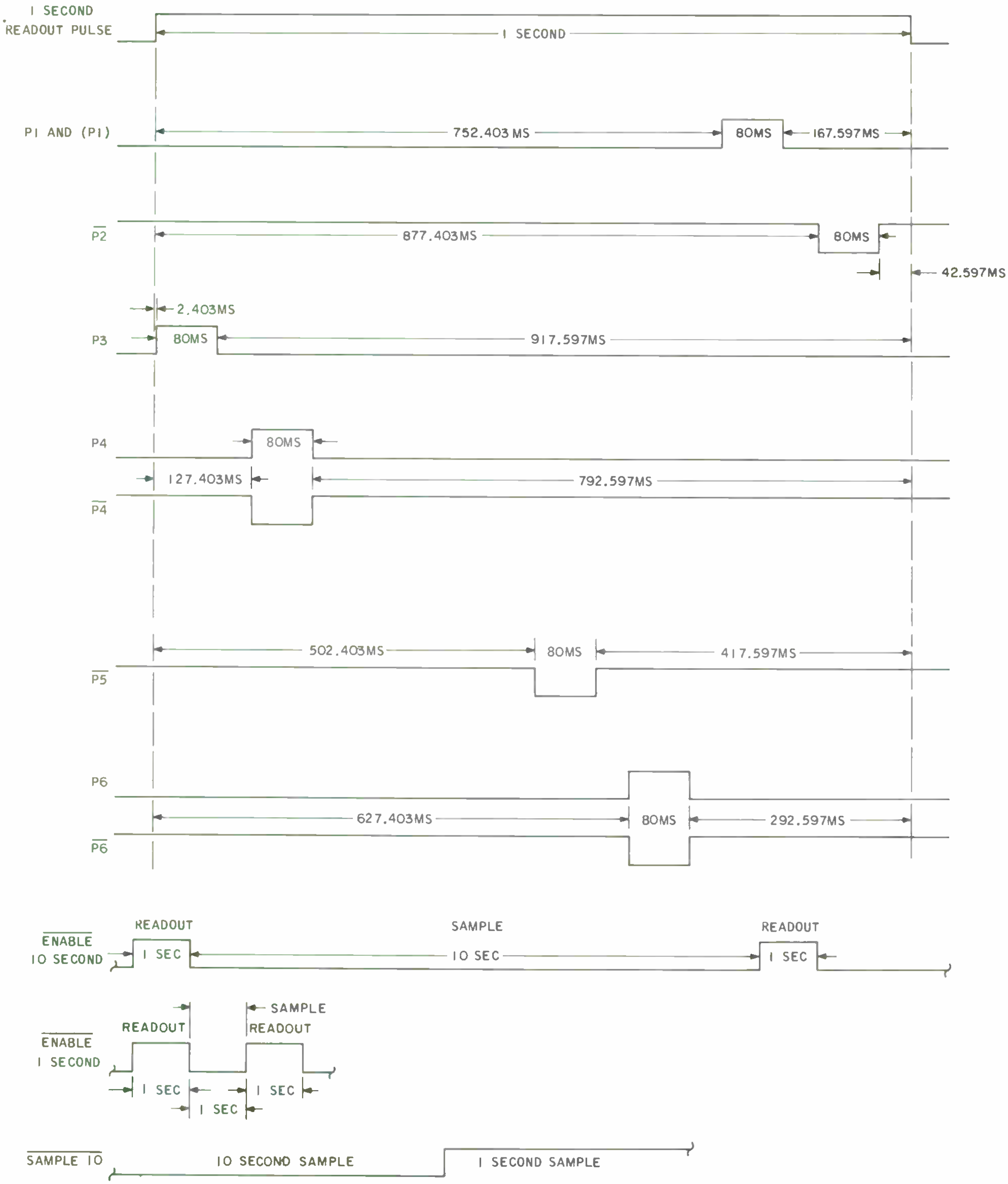


Figure 5-2. Control and Timing Pulse Waveforms.

section 6
parts list

6.1 GENERAL

This section contains a list of all replaceable electrical, electronic, and critical mechanical parts for the 54Z-1 AM Frequency Monitor (758-5605-XXX).

The manufacturers' codes appearing in the Mfr Code column of the parts list are listed in numerical order at the end of the parts list. The code list provides the manufacturer's name and address as shown in the Federal Supply Code for Manufacturers' Handbook H4-1. Manufacturers not listed in Handbook H4-1 are assigned a 5-letter code and appear first in the code list.

6.2 LIST OF EQUIPMENT

	Page
54Z-1 AM Frequency Monitor	6-2
AMRF Card	6-4
Logic 1 Card	6-7
Logic 2 Card	6-10
Logic 3 Card	6-13
Preset 1 Card	6-15
Preset 2 Card	6-17
Logic 4 Card	6-19
AM Control Module	6-21
Lampdriver Board	6-23
Backplane Board With Connector Assembly	6-27
Optional Equipment	6-30
782B-1 Self-Check Card	6-32

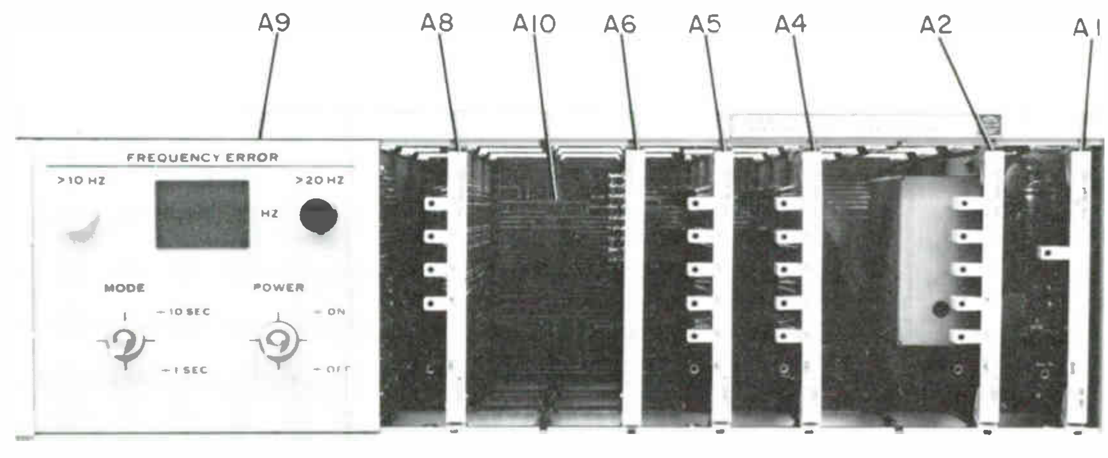


Figure 6-1. 54Z-1 AM Frequency Monitor.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	AM FREQUENCY MONITOR 542-1			758-5605-001
	AM FREQUENCY MONITOR 542-1			758-5605-002
	AM FREQUENCY MONITOR 542-1			758-5605-003
A1	AMRF CARD SEE BREAKDOWN ON PAGE 6-4			770-7864-001
A2	LOGIC 1 CARD SEE BREAKDOWN ON PAGE 6-7			781-5225-001
A3	NOT USED			
A4	LOGIC 2 CARD SEE BREAKDOWN ON PAGE 6-10			770-7779-001
A5	LOGIC 3 CARD SEE BREAKDOWN ON PAGE 6-13			770-7823-001
A6	PRESET 1 CARD -USED ON 758-5605-C02 ONLY- SEE BREAKDOWN ON PAGE 6-15			770-7893-001
	PRESET 2 CARD -USED ON 758-5605-C03 ONLY- SEE BREAKDOWN ON PAGE 6-17			770-7899-001
A7	NOT USED			
A8	LOGIC 4 CARD SEE BREAKDOWN ON PAGE 6-19			770-7858-001
A9	AM CONTROL MODULE SEE BREAKDOWN ON PAGE 6-21			776-1917-001
A10	BACKPLANE BOARD WITH CONNECTOR ASSEMBLY SEE BREAKDOWN ON PAGE 6-27			776-1841-001

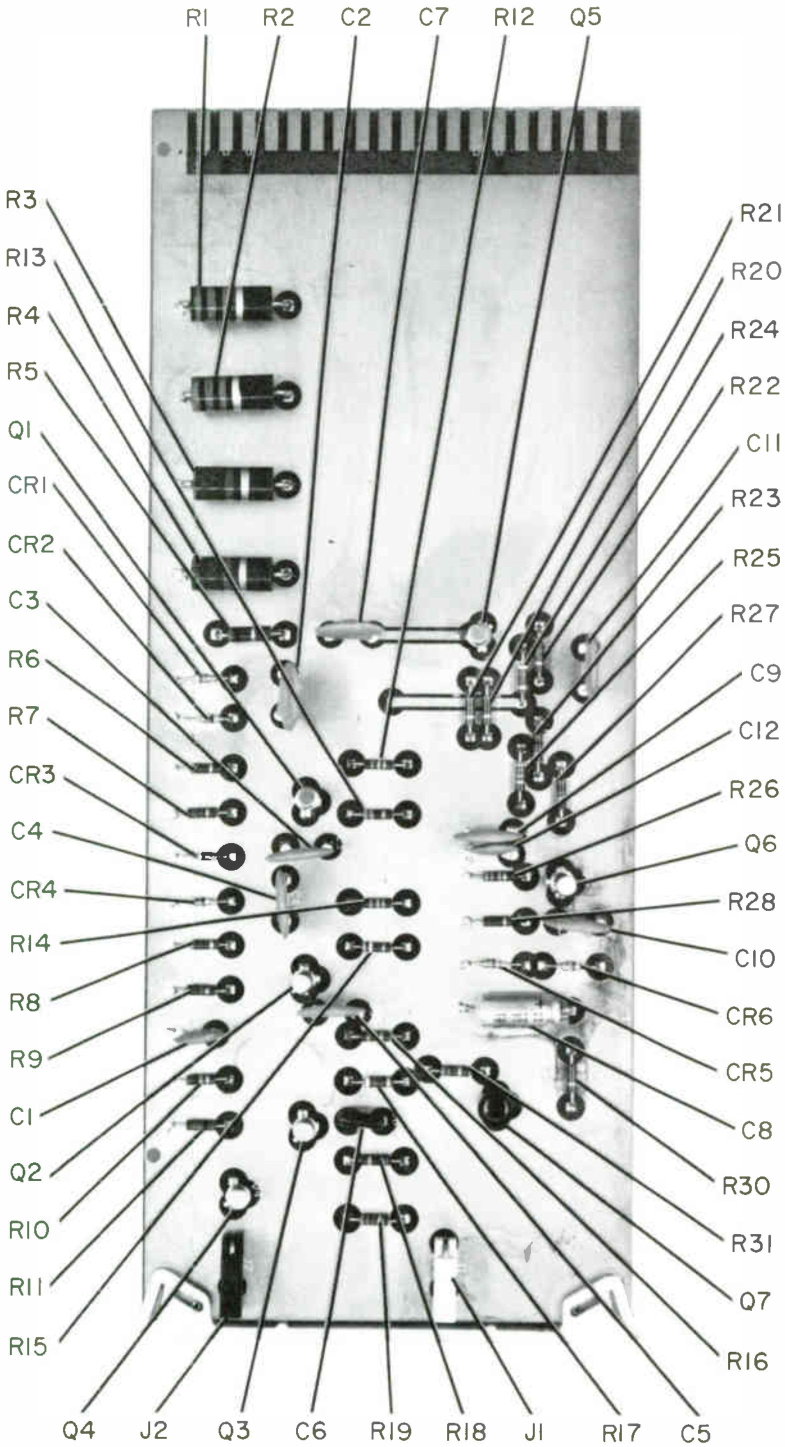


Figure 6-2. AMRF Card.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	AMRF CARD A1			770-7864-001
C1	CAPACITOR, FXD, CERAMIC 0.02 UF, PLUS 80% MINUS 20%, 100 VDCW	855-502X5V0203Z	72982	913-3678-000
C2	CAPACITOR, FXD, CERAMIC 0.05 UF, PLUS 80% MINUS 20%, 100 VDCW	845-014X5V0503Z	72982	913-3679-000
C3	SAME AS C2			
C4	SAME AS C2			
C5	SAME AS C2			
C6	CAPACITOR, FXD, MICA 33 UF, 5% TOL, 500 VDCW	CM05E330J03	81349	912-2780-000
C7	SAME AS C2			
C8	CAPACITOR, FXD, ELECTROLYTIC 10 UF, PLUS 100% MINUS 10%, 25 VDCW	D28776	56289	183-1163-000
C9	SAME AS C2			
C10	SAME AS C2			
C11	SAME AS C2			
CR1	SEMICONDUCTOR DEVICE, DIODE	1N914	07688	353-2906-000
CR2 THROUGH CR6	SAME AS CR1			
J1	JACK, TIP BLACK	4877-125-0	17117	360-0434-010
J2	JACK, TIP WHITE	4877-125-9	17117	360-0434-100
Q1	TRANSISTOR	2N708	07688	352-0322-010
Q2 THROUGH Q6	SAME AS Q1			
Q7	TRANSISTOR	2N3567	07688	352-0629-010
R1	RESISTOR, FXD, COMPOSITION 180 OHMS, 10% TOL, 2 WATTS	RC42GF181K	81349	745-5621-000
R2	SAME AS R1			
R3	RESISTOR, FXD, COMPOSITION 220 OHMS, 10% TOL, 2 WATTS	RC42GF221K	81349	745-5624-000
R4	SAME AS R3			
R5	RESISTOR, FXD, COMPOSITION 1K OHMS, 10% TOL, 1/2 WATT	RC20GF102K	81349	745-1352-000
R6	RESISTOR, FXD, COMPOSITION 8200 OHMS, 10% TOL, 1/4 WATT	RC07GF822K	81349	745-0782-000
R7	RESISTOR, FXD, COMPOSITION 560 OHMS, 10% TOL, 1/4 WATT	RC07GF561K	81349	745-0740-000
R8	SAME AS R6			
R9	SAME AS R7			
R10	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 1/4 WATT	RC07GF103K	81349	745-0785-000
R11	RESISTOR, FXD, COMPOSITION 100 OHMS, 10% TOL, 1/4 WATT	RC07GF101K	81349	745-0713-000
R12	RESISTOR, FXD, COMPOSITION 56K OHMS, 10% TOL, 1/4 WATT	RC07GF563K	81349	745-0812-000
R13	RESISTOR, FXD, COMPOSITION 3300 OHMS, 10% TOL, 1/4 WATT	RC07GF332K	81349	745-0767-000
R14	SAME AS R12			
R15	RESISTOR, FXD, COMPOSITION 3900 OHMS, 10% TOL, 1/4 WATT	RC07GF392K	81349	745-0770-000
R16	SAME AS R12			
R17	RESISTOR, FXD, COMPOSITION 4700 OHMS, 10% TOL, 1/4 WATT	RC07GF472K	81349	745-0773-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R18	RESISTOR, FXD, COMPOSITION 18K OHMS, 10% TOL, 1/4 WATT	RC07GF183K	81349	745-0794-000
R19	RESISTOR, FXD, COMPOSITION 680 OHMS, 10% TOL, 1/4 WATT	RC07GF681K	81349	745-0743-000
R20	RESISTOR, FXD, COMPOSITION 82K OHMS, 10% TOL, 1/4 WATT	RC07GF823K	81349	745-0818-000
R21	SAME AS R6			
R22	RESISTOR, FXD, COMPOSITION 180 OHMS, 10% TOL, 1/4 WATT	RC07GF181K	81349	745-0722-000
R23	SAME AS R11			
R24	SAME AS R17			
R25	RESISTOR, FXD, COMPOSITION 47K OHMS, 10% TOL, 1/4 WATT	RC07GF473K	81349	745-0809-000
R26	RESISTOR, FXD, COMPOSITION 33K OHMS, 10% TOL, 1/4 WATT	RC07GF333K	81349	745-0803-000
R27	RESISTOR, FXD, COMPOSITION 120 OHMS, 10% TOL, 1/4 WATT	RC07GF121K	81349	745-0716-000
R28	RESISTOR, FXD, COMPOSITION 2200 OHMS, 10% TOL, 1/4 WATT	RC07GF222K	81349	745-0761-000
R29	NOT USED			
R30	RESISTOR, FXD, COMPOSITION 220 OHMS, 10% TOL, 1/4 WATT	RC07GF221K	81349	745-0725-000
R31	SAME AS R19			

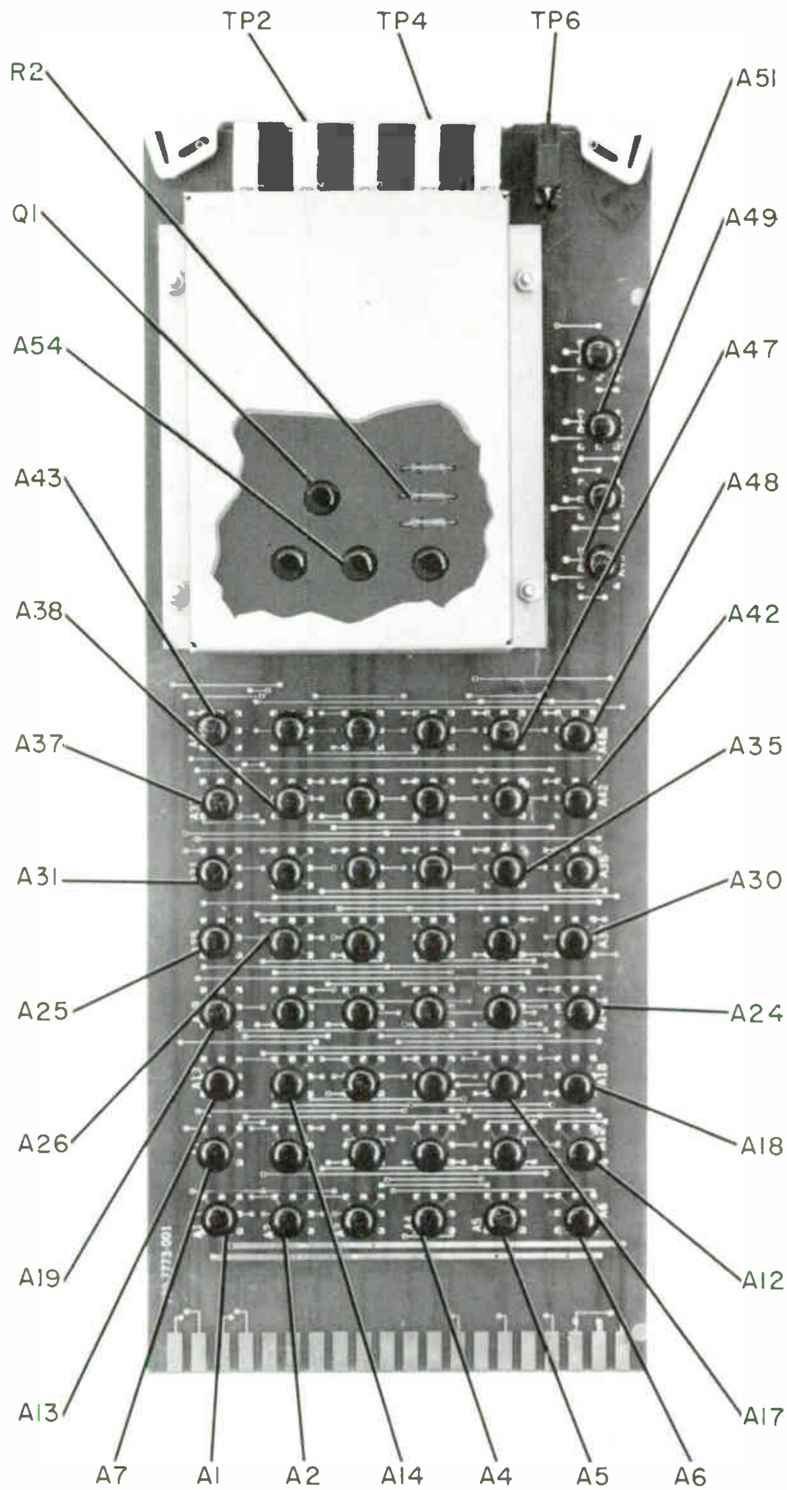


Figure 6-3. Logic 1 Card (Sheet 1 of 2).

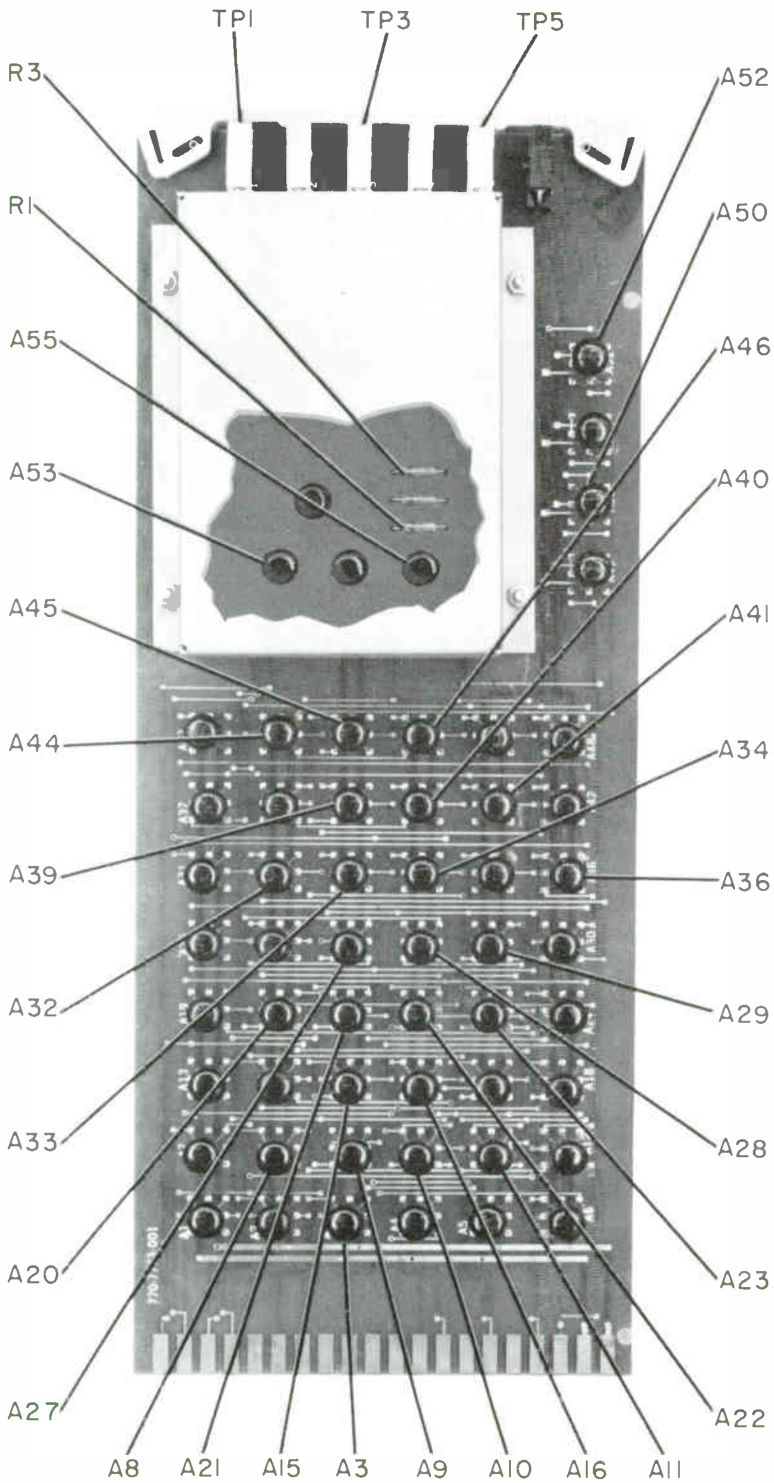


Figure 6-3. Logic 1 Card (Sheet 2 of 2).

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	LOGIC 1 CARD A2			781-5225-001
A1	INTEGRATED CIRCUIT	SL3977	07263	351-7121-010
A2	SAME AS A1			
A3	SAME AS A1			
A4	INTEGRATED CIRCUIT	SL3978	07263	351-7121-020
A5	INTEGRATED CIRCUIT	SL3979	07263	351-7121-030
A6	SAME AS A5			
A7	SAME AS A5			
A8	SAME AS A5			
A9 THROUGH A12	SAME AS A4			
A13	SAME AS A5			
A14	SAME AS A4			
A15 THROUGH A18	SAME AS A1			
A19 THROUGH A23	SAME AS A4			
A24	SAME AS A1			
A25	SAME AS A1			
A26	SAME AS A1			
A27 THROUGH A30	SAME AS A4			
A31 THROUGH A36	SAME AS A1			
A37	SAME AS A4			
A38	SAME AS A4			
A39 THROUGH A43	SAME AS A1			
A44	SAME AS A4			
A45 THROUGH A49	SAME AS A1			
A50	SAME AS A4			
A51	SAME AS A1			
A52	SAME AS A1			
A53	SAME AS A5			
A54	SAME AS A1			
A55	SAME AS A1			
Q1	TRANSISTOR	2N3567	07688	352-0629-010
R1	RESISTOR, FXD, COMPOSITION 680 OHMS, 10% TOL, 1/4 WATT	RC07GF681K	81349	745-0743-000
R2	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 1/4 WATT	RC07GF103K	81349	745-0785-000
R3	RESISTOR, FXD, COMPOSITION 2200 OHMS, 10% TOL, 1/4 WATT	RC07GF222K	81349	745-0761-000
TP1	JACK, TIP WHITE	4877-125-9	17117	360-0494-100
TP2 THROUGH TP5	SAME AS TP1			
TP6	JACK, TIP BLACK	4877-125-0	17117	360-0434-010

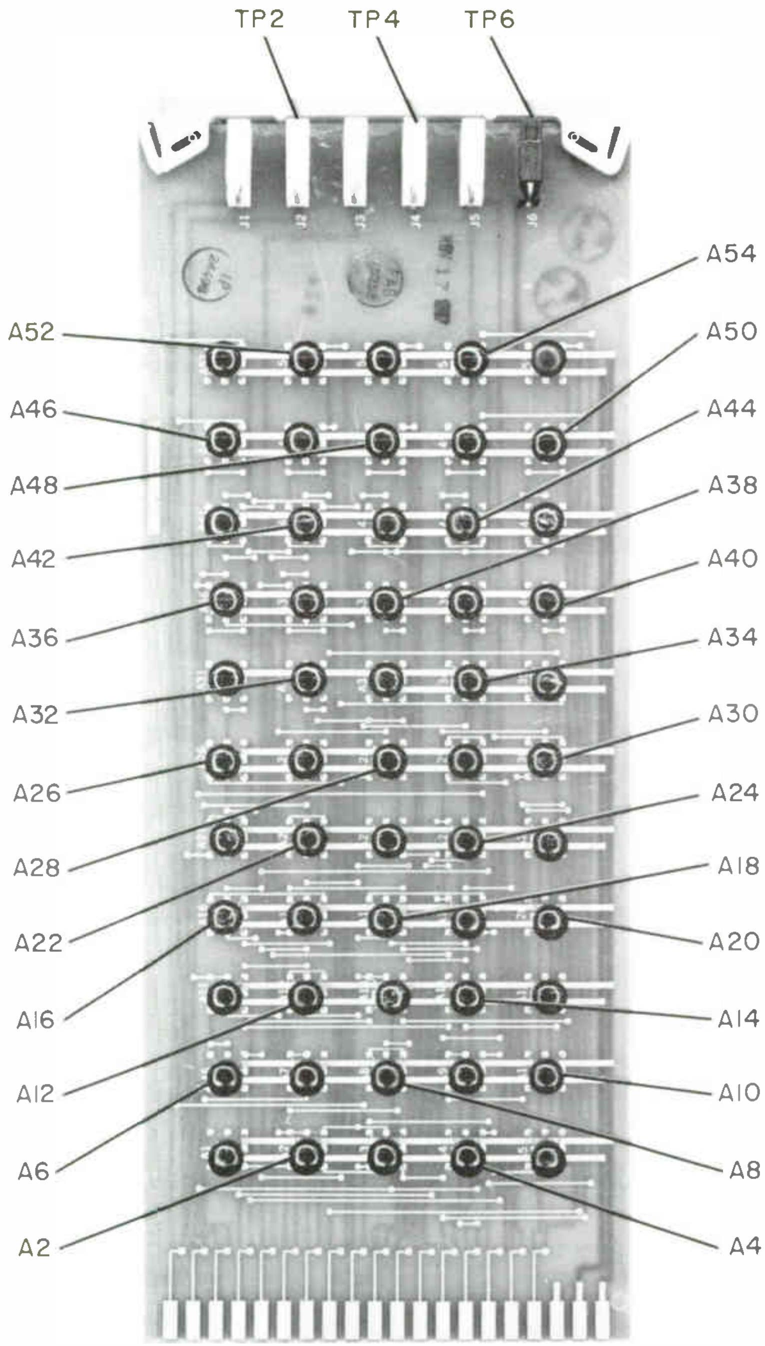


Figure 6-4. Logic 2 Card (Sheet 1 of 2).

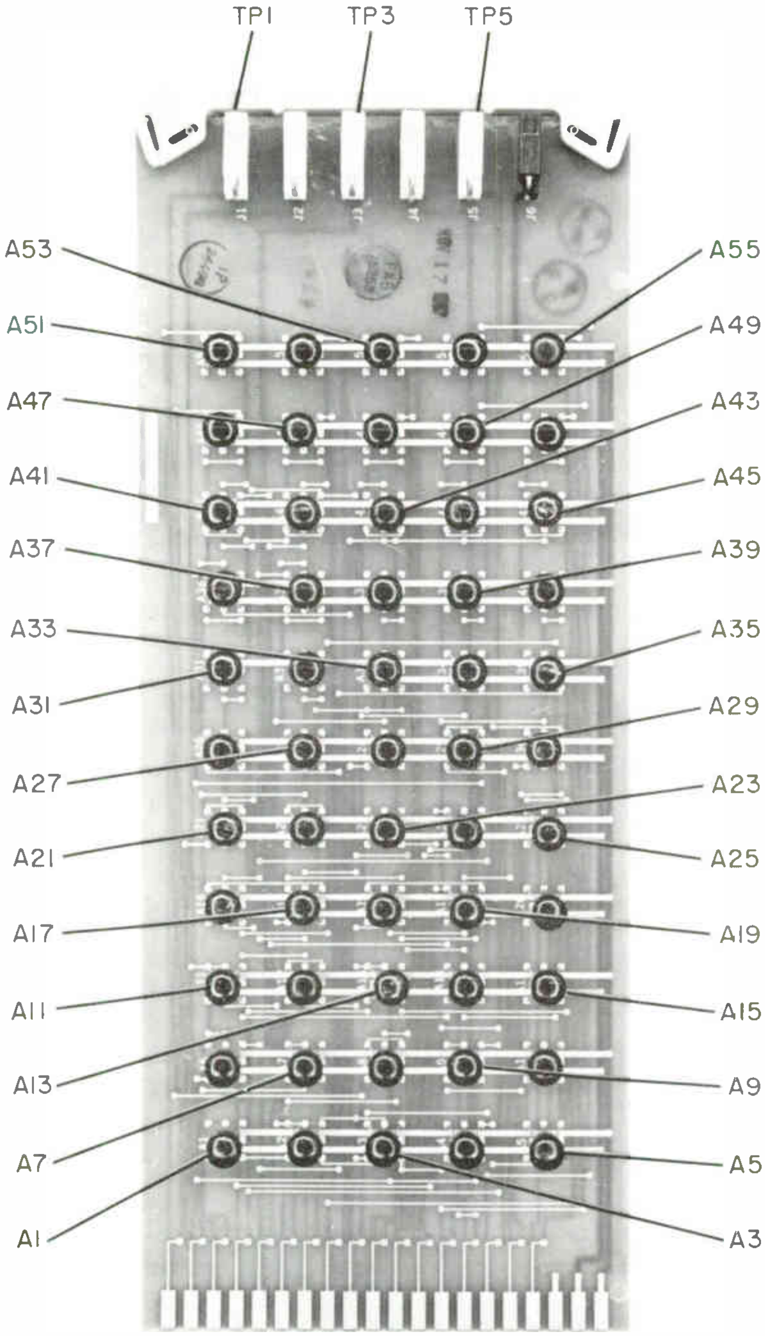


Figure 6-4. Logic 2 Card (Sheet 2 of 2).

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	LOGIC 2 CARD A4			770-7779-001
A1	INTEGRATED CIRCUIT	SL3979	07263	351-7121-030
A2	INTEGRATED CIRCUIT	SL3979	07263	351-7121-020
A3	SAME AS A2			
A4	SAME AS A1			
A5	INTEGRATED CIRCUIT	SL3977	07263	351-7121-010
A6 THROUGH A9	SAME AS A2			
A10	SAME AS A5			
A11 THROUGH A14	SAME AS A2			
A15	SAME AS A5			
A16 THROUGH A19	SAME AS A2			
A20	SAME AS A5			
A21	SAME AS A2			
A22	SAME AS A2			
A23	SAME AS A1			
A24	SAME AS A2			
A25	SAME AS A5			
A26 THROUGH A30	SAME AS A2			
A31	SAME AS A1			
A32	SAME AS A1			
A33	SAME AS A2			
A34	SAME AS A2			
A35	SAME AS A2			
A36	SAME AS A5			
A37	SAME AS A5			
A38	SAME AS A1			
A39	SAME AS A1			
A40	SAME AS A1			
A41	SAME AS A2			
A42	SAME AS A2			
A43	SAME AS A5			
A44	SAME AS A5			
A45	SAME AS A5			
A46 THROUGH A55	SAME AS A1			
TP1	JACK, TIP WHITE	4877-125-9	17117	360-0434-100
TP2 THROUGH TP5	SAME AS TP1			
TP6	JACK, TIP BLACK	4877-125-0	17117	360-0434-010

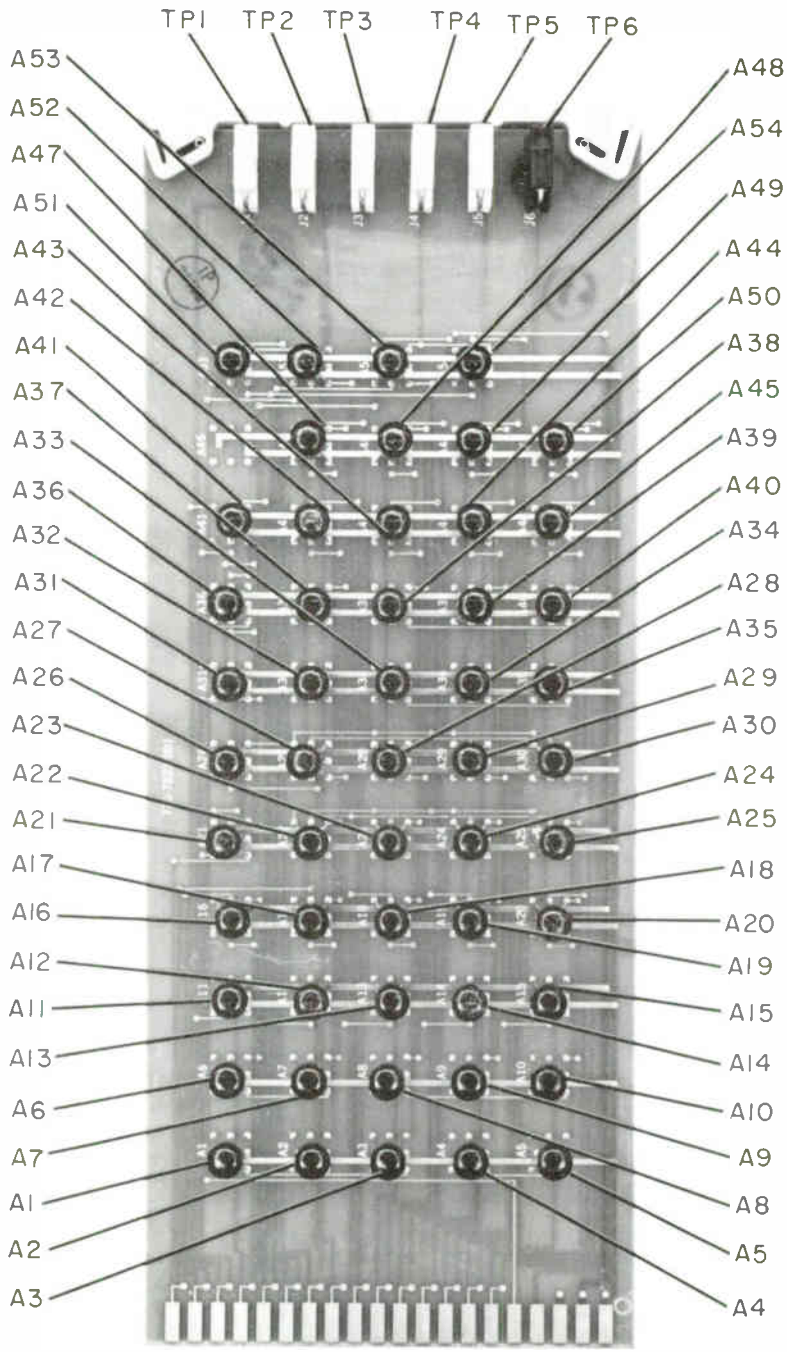


Figure 6-5. Logic 3 Card.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	LOGIC 3 CARD A5			770-7823-001
A1	INTEGRATED CIRCUIT	SL3979	07263	351-7121-030
A2 THROUGH A10	SAME AS A1			
A11	INTEGRATED CIRCUIT	SL3977	07263	351-7121-010
A12 THROUGH A20	SAME AS A11			
A21	INTEGRATED CIRCUIT	SL3978	07263	351-7121-020
A22 THROUGH A31	SAME AS A21			
A32 THROUGH A35	SAME AS A1			
A36	SAME AS A21			
A37 THROUGH A40	SAME AS A1			
A41	SAME AS A21			
A42 THROUGH A45	SAME AS A11			
A46	NOT USED			
A47 THROUGH A50	SAME AS A11			
A51	SAME AS A21			
A52	SAME AS A11			
A53	SAME AS A11			
A54	SAME AS A21			
TP1	JACK, TIP WHITE	4877-125-9	17117	360-0434-100
TP2 THROUGH TP5	SAME AS TP1			
TP6	JACK, TIP BLACK	4877-125-9	17117	360-0434-010

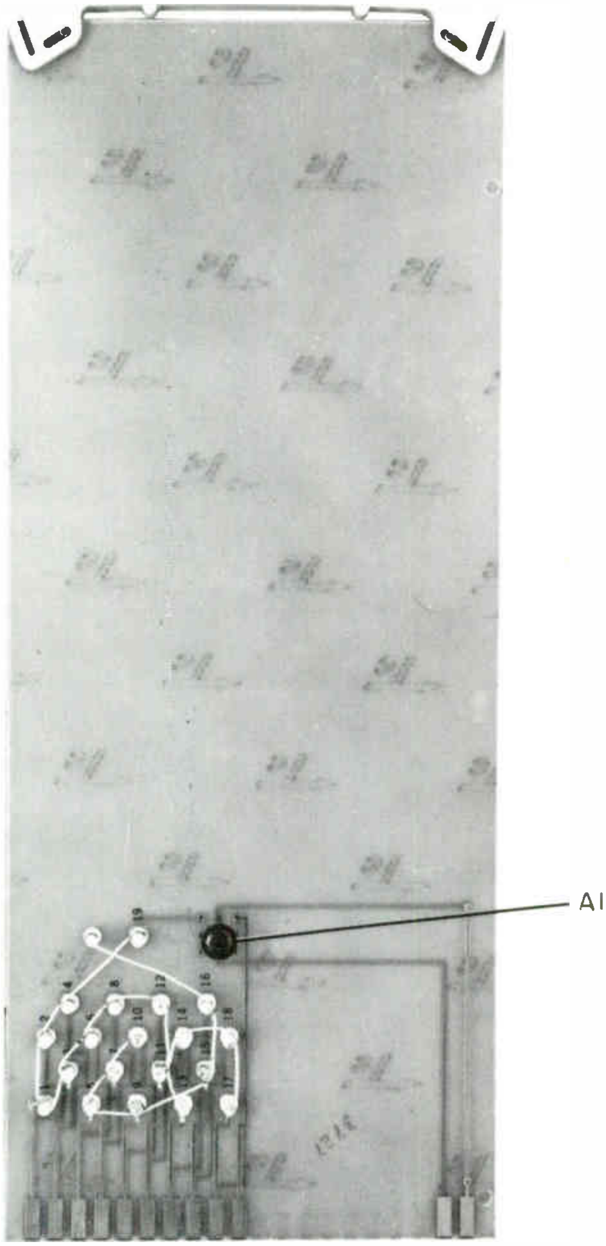


Figure 6-6. Preset 1 Card.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	PRESET 1 CARD A6			770-7893-001
A1	INTEGRATED CIRCUIT	SL3979	07263	351-7121-010

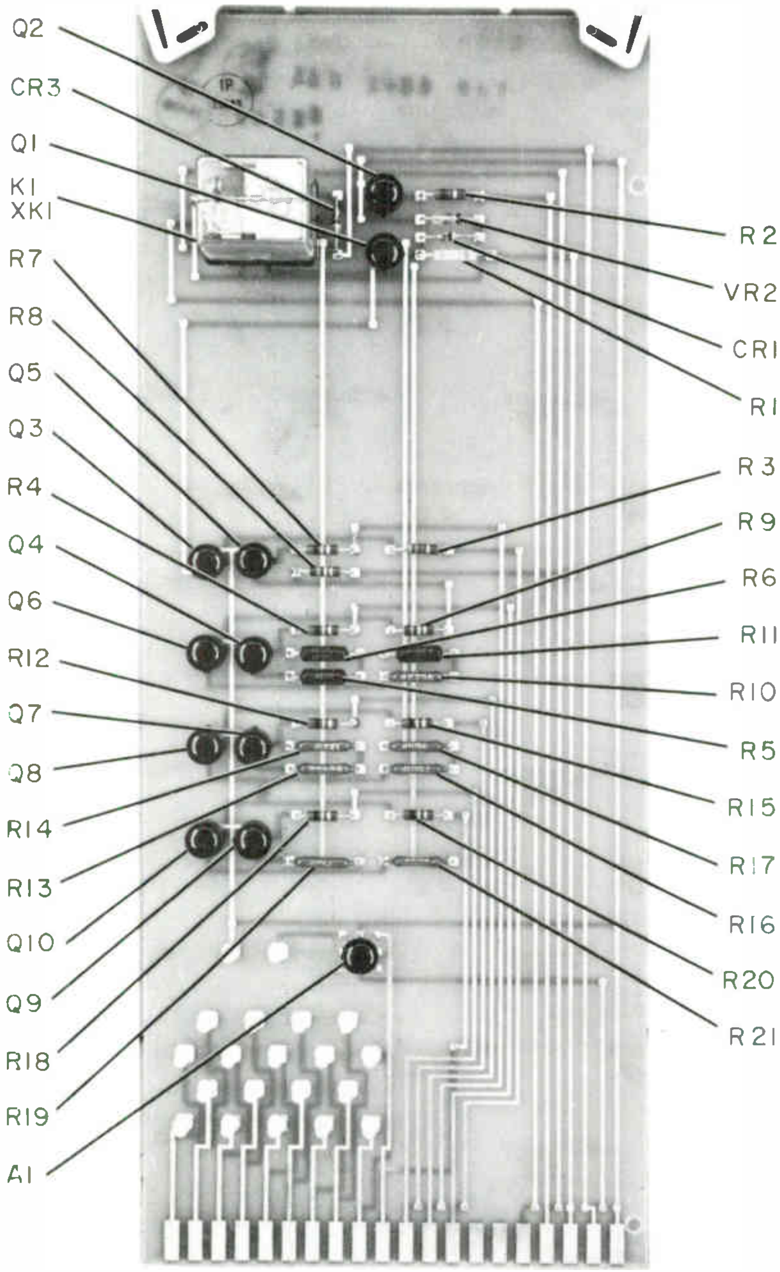


Figure 6-7. Preset 2 Card.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	PRESET 2 CARD			770-7899-001
A1	INTEGRATED CIRCUIT	SL3979	07263	351-7121-030
CR1	SEMICONDUCTOR DEVICE, DIODE	1N914	07688	353-2906-000
CR2	NOT USED			
CR3	SAME AS CR1			
K1	RELAY, ARMATURE 2C CONTACT ARRANGEMENT	T154-2C6VDC52-DHMS	70309	970-2227-000
Q1	TRANSISTOR	2N3567	07688	352-0629-010
Q2 THROUGH Q10	SAME AS Q1			
R1	RESISTOR, FXD, COMPOSITION 1200 OHMS, 10% TOL, 1/4 WATT	RC07GF122K	81349	745-0752-000
R2	RESISTOR, FXD, COMPOSITION 100 OHMS, 10% TOL, 1/4 WATT	RC07GF101K	81349	745-0713-000
R3	RESISTOR, FXD, COMPOSITION 330 OHMS, 10% TOL, 1/4 WATT	RC07GF331K	81349	745-0731-000
R4	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 1/4 WATT	RC07GF103K	81349	745-0785-000
R5	RESISTOR, FXD, FILM 110K OHMS, 1% TOL, 1/4 WATT	RN60D1103F	81349	705-6694-000
R6	RESISTOR, FXD, FILM 10K OHMS, 1% TOL, 1/4 WATT	RN60D1002F	81349	705-6644-000
R7	SAME AS R4			
R8	RESISTOR, FXD, COMPOSITION 56K OHMS, 10% TOL, 1/4 WATT	RC07GF563K	81349	745-0812-000
R9	SAME AS R8			
R10	RESISTOR, FXD, FILM 56.2K OHMS, 1% TOL, 1/4 WATT	RN60D5622F	81349	705-6680-000
R11	RESISTOR, FXD, FILM 3830 OHMS, 1% TOL, 1/4 WATT	RN60D3831F	81349	705-6624-000
R12	SAME AS R4			
R13	RESISTOR, FXD, FILM 28.7K OHMS, 1% TOL, 1/4 WATT	RN60D2872F	81349	705-6666-000
R14	RESISTOR, FXD, FILM 1330 OHMS, 1% TOL, 1/4 WATT	RN60D1331F	81349	705-6602-000
R15	SAME AS R4			
R16	RESISTOR, FXD, FILM 7500 OHMS , 1% TOL, 1/4 WATT	RN60D7501F	81349	705-6638-000
R17	SAME AS R16			
R18	SAME AS R4			
R19	SAME AS R16			
R20	SAME AS R4			
R21	RESISTOR, FXD, FILM 14.7K OHMS, 1% TOL, 1/4 WATT	RN60D1472F	81349	705-6652-000
VR1	NOT USED			
VR2	SEMICONDUCTOR DEVICE, DIODE	1N748	07688	353-2703-000
XK1	SOCKET, RELAY 10 CONTACTS	30055-1	02288	220-1475-001

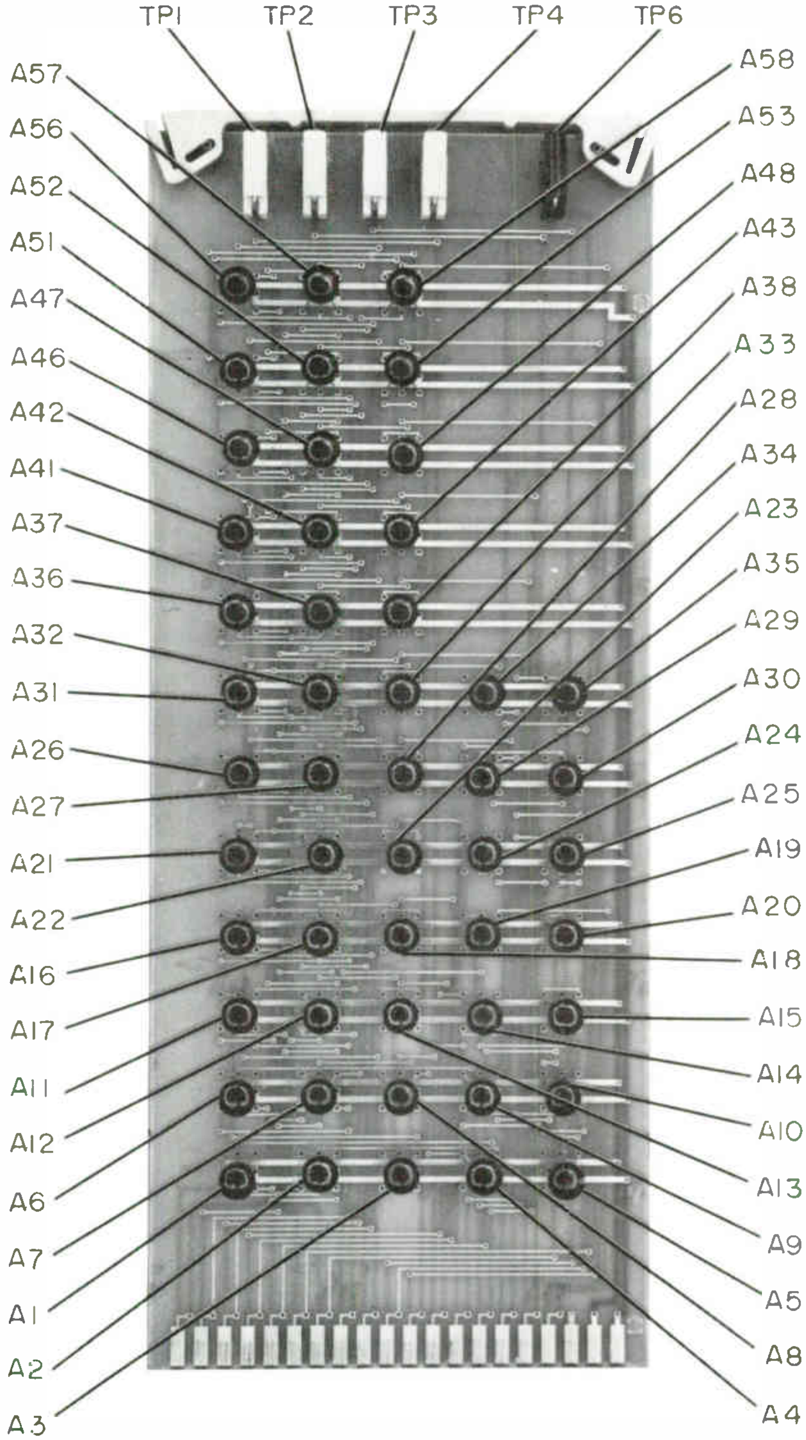


Figure 6-8. Logic 4 Card.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	LOGIC 4 CARD A8			770-7858-001
A1	INTEGRATED CIRCUIT	SL3978	07263	351-7121-020
A2 THROUGH A8	SAME AS A1			
A9	INTEGRATED CIRCUIT	SL3977	07263	351-7121-010
A10	SAME AS A9			
A11 THROUGH A28	SAME AS A1			
A29	SAME AS A9			
A30	SAME AS A9			
A31	SAME AS A1			
A32	SAME AS A1			
A33	SAME AS A1			
A34	INTEGRATED CIRCUIT	SL3979	07263	351-7121-030
A35 THROUGH A38	SAME AS A1			
A39	NOT USED			
A40	NOT USED			
A41	SAME AS A1			
A42	SAME AS A1			
A43	SAME AS A1			
A44	NOT USED			
A45	NOT USED			
A46	SAME AS A1			
A47	SAME AS A1			
A48	SAME AS A1			
A49	NOT USED			
A50	NOT USED			
A51	SAME AS A1			
A52	SAME AS A1			
A53	SAME AS A1			
A54	NOT USED			
A55	NOT USED			
A56	SAME AS A1			
A57	SAME AS A1			
A58	SAME AS A1			
TP1	JACK, TIP WHITE	4877-125-9	17117	360-0434-100
TP2	SAME AS TP1			
TP3	SAME AS TP1			
TP4	SAME AS TP1			
TP5	NOT USED			
TP6	JACK, TIP BLACK	4877-125-0	17117	360-0434-010

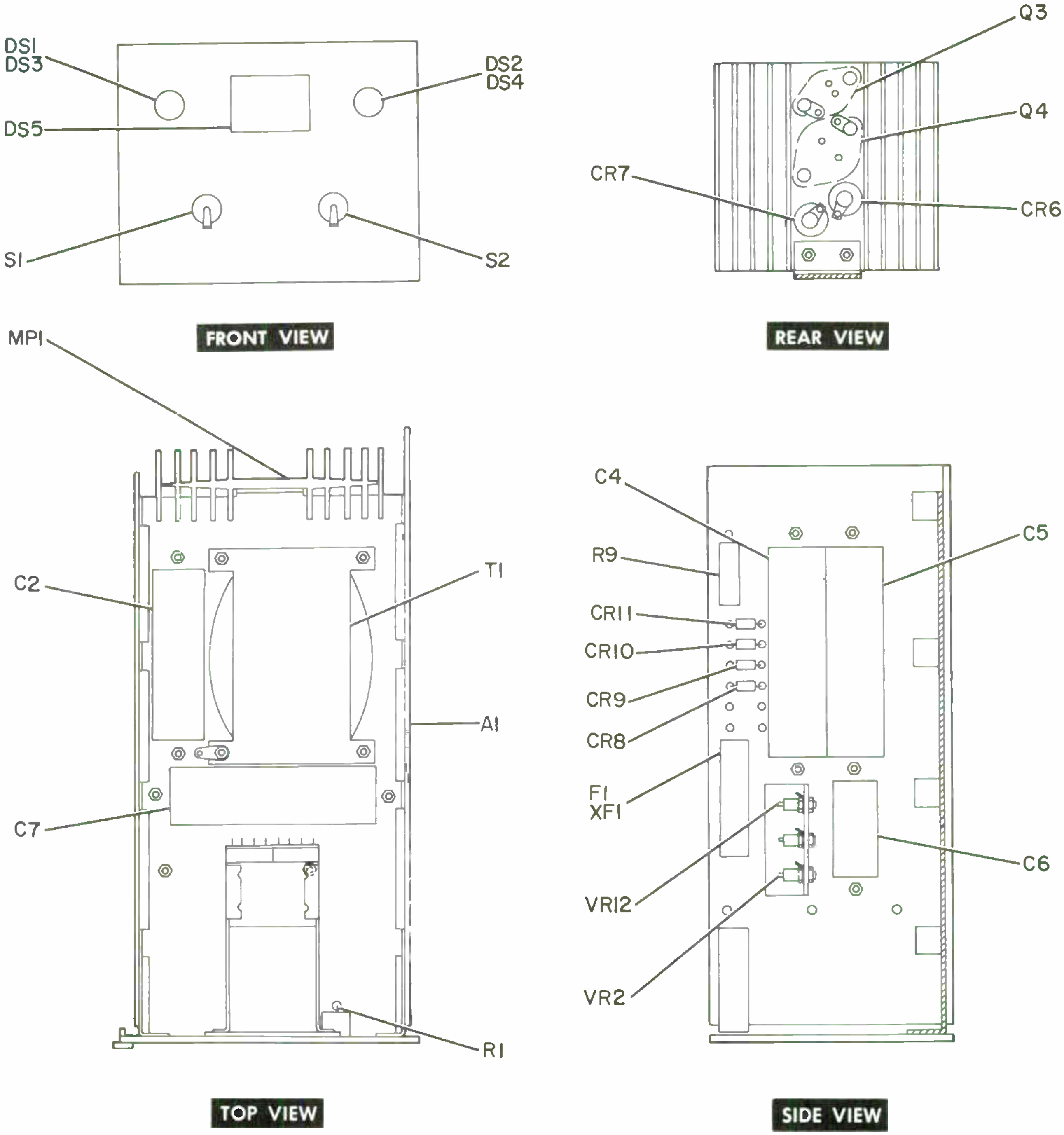


Figure 6-9. AM Control Module.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	AM CONTROL MODULE A9			776-1917-001
A1	LAMP DRIVER BOARD SEE BREAKDOWN ON PAGE 6-23			774-7116-001
C1	NOT USED			
C2	CAPACITOR, FXD, ELECTROLYTIC 2K UF, PLUS 100% MINUS 10%, 6 VDCW			183-1311-000
C3	NOT USED			
C4	CAPACITOR, FXD, ELECTROLYTIC 2900 UF, PLUS 75% MINUS 10%, 10 VDCW	601D298G010FT4	56289	183-1282-160
C5	SAME AS C4			
C6	CAPACITOR, FXD, ELECTROLYTIC 500 UF, PLUS 100% MINUS 10%, 12 VDCW	D33645	56289	183-1785-000
C7	CAPACITOR, FXD, ELECTROLYTIC 2300 UF, PLUS 75% MINUS 10%, 40 VDCW	601D238G040JT4	56289	183-1282-050
CR1 THROUGH CR5	NOT USED			
CR6	SEMICONDUCTOR DEVICE, DIODE	1N1200	07688	353-1721-000
CR7	SAME AS CR6			
CR8	SEMICONDUCTOR DEVICE, DIODE	2A100	13327	353-6453-010
CR9	SAME AS CR8			
CR10	SAME AS CR8			
CR11	SAME AS CR8			
DS1	LIGHT, INDICATOR AMBER	183-9730-1473	72619	262-2559-000
DS2	LIGHT, INDICATOR RED	183-9730-1471	72619	262-2557-000
DS3	LAMP, INCANDESCENT 0.2 AMPS, 6 VOLTS	MS25237-328	96906	262-0023-000
DS4	SAME AS DS3			
DS5	INDICATOR, DIGITAL DISPLAY 115 MA, 5 VOLTS	600329A	00303	262-2244-020
F1	FUSE, CARTRIDGE 5 AMPS	MTH250-5	71400	264-0726-000
MP1	HEATSINK			776-1852-001
Q1	NOT USED			
Q2	NOT USED			
Q3	TRANSISTOR	2N3767	07688	352-0689-020
Q4	TRANSISTOR	2N3055	07688	352-0583-010
R1	RESISTOR, FXD, COMPOSITION 56K OHMS, 10% TOL, 1/4 WATT	RC07GF563K	81349	745-0812-000
R2 THROUGH R8	NOT USED			
R9	RESISTOR, FXD, WIRE WOUND 62 OHMS, 5% TOL, 6.5 WATTS	RW67V620H	81349	747-5495-000
S1	SWITCH, TOGGLE SPDT CONTACT ARRANGEMENT	83052C	95691	266-5330-000
S2	SWITCH, TOGGLE SPST CONTACT ARRANGEMENT	83050CA	95691	266-5329-000
T1	TRANSFORMER, POWER STEP DOWN, OPEN FRAME	950-1697-200	83003	662-0324-010
VR1	NOT USED			
VR2	SEMICONDUCTOR DEVICE, DIODE	1N3996A	07688	353-6232-000
VR3 THROUGH VR11	NOT USED			
VR12	SEMICONDUCTOR DEVICE, DIODE	1N2984B	07688	353-1365-000
XF1	FUSEHOLDER 20 AMPS	3938	71400	265-1037-000

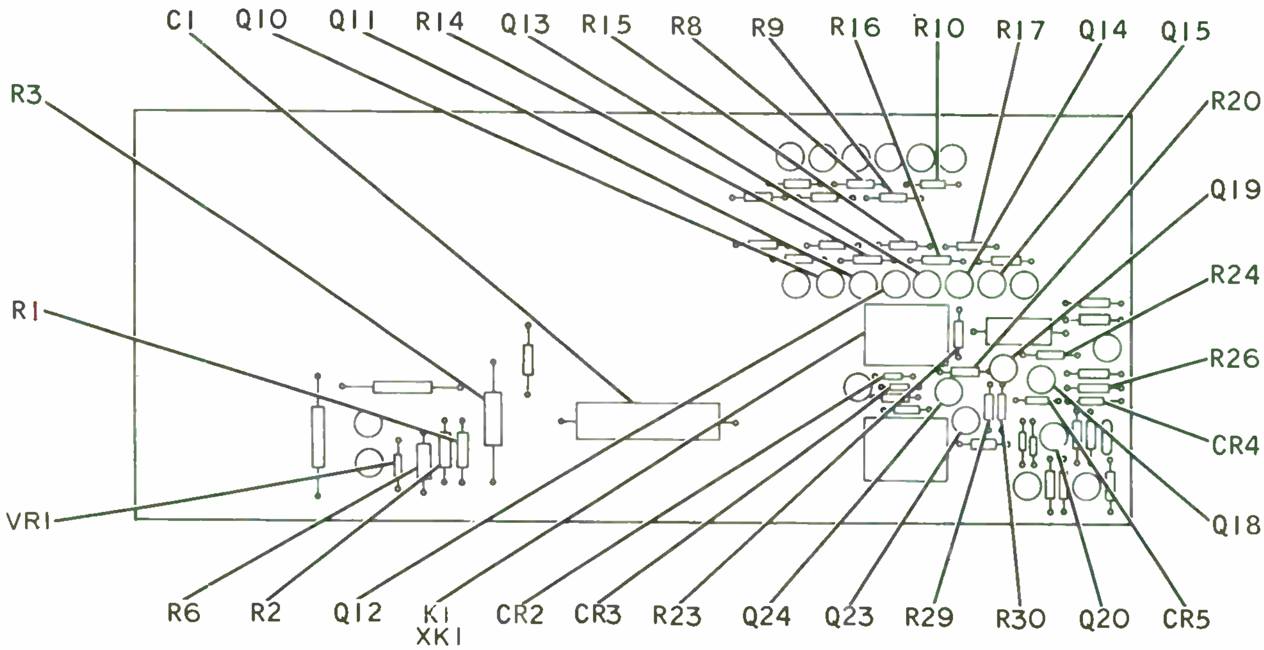


Figure 6-10. Lampdriver Board (Sheet 1 of 2).

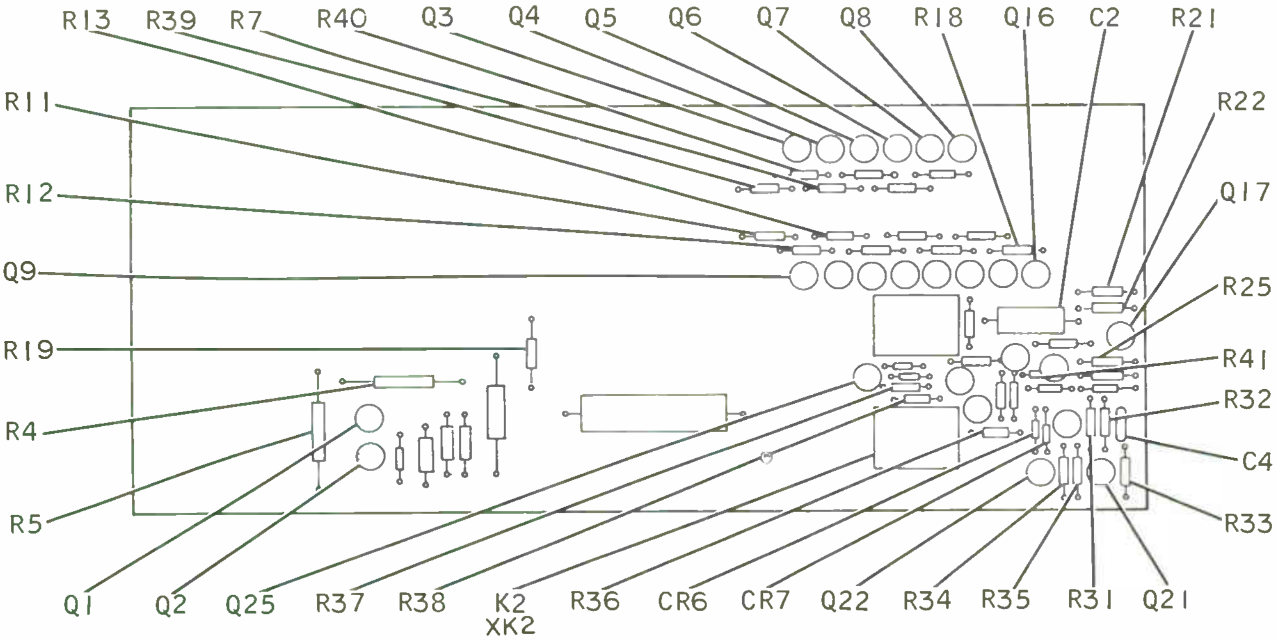


Figure 6-10. Lampdriver Board (Sheet 2 of 2).

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	LAMPDRIVER BOARD A9A1			774-7116-001
C1	CAPACITOR, FXD, ELECTROLYTIC 300 UF, PLUS 75% MINUS 10%, 6 VDCW	30D36266	56289	183-1189-000
C2	CAPACITOR, FXD, ELECTROLYTIC 40 UF, PLUS 20% MINUS 15%, 30 VDCW	109D406C2030F2	56289	184-7781-000
C3	CAPACITOR, FXD, CERAMIC 0.33 UF, 20% TOL, 25 VDCW	5C7A	56289	913-3806-000
C4	SAME AS C3			
CR1	NOT USED			
CR2	SEMICONDUCTOR DEVICE, DIODE	1N914	07688	353-2906-000
CR3 THROUGH CR7	SAME AS CR2			
K1	RELAY, ARMATURE 2C CONTACT ARRANGEMENT	TP154CC6	70309	970-2451-230
K2	SAME AS K1			
Q1	TRANSISTOR	2N3569	07688	352-0629-030
Q2	SAME AS Q1			
Q3	TRANSISTOR	2N3567	07688	352-0629-010
Q4	SAME AS Q1			
Q5 THROUGH Q8	SAME AS Q3			
Q9	SAME AS Q1			
Q10 THROUGH Q25	SAME AS Q3			
R1	RESISTOR, FXD, COMPOSITION 2200 OHMS, 10% TOL, 1/2 WATT	RC20GF222K	81349	745-1366-000
R2	SAME AS R1			
R3	RESISTOR, FXD, COMPOSITION 680 OHMS 10% TOL, 1 WATT	RC32GF681K	81349	745-3345-000
R4	RESISTOR, FXD, FILM 536 OHMS, 1% TOL, 1/2 WATT	RN65D5360F	81349	705-7083-000
R5	RESISTOR, FXD, FILM 1470 OHMS, 1% TOL, 1/2 WATT	RN65D1471F	81349	705-7104-000
R6	RESISTOR, FXD, COMPOSITION 330 OHMS, 10% TOL, 1/2 WATT	RC20GF331K	81349	745-1331-000
R7	RESISTOR, FXD, COMPOSITION 220 OHMS, 10% TOL, 1/4 WATT	RC07GF221K	81349	745-0725-000
R8 THROUGH R18	SAME AS R7			
R19	RESISTOR, FXD, COMPOSITION 680 OHMS, 10% TOL, 1/4 WATT	RC07GF681K	81349	745-0743-000
R20	SAME AS R19			
R21	SAME AS R19			
R22	RESISTOR, FXD, COMPOSITION 1K OHMS, 10% TOL, 1/4 WATT	RC07GF102K	81349	745-0749-000
R23	SAME AS R19			
R24	SAME AS R22			
R25	SAME AS R19			
R26	RESISTOR, FXD, COMPOSITION 3900 OHMS, 10% TOL, 1/4 WATT	RC07GF392K	81349	745-0770-000
R27	NOT USED			
R28	NOT USED			
R29	SAME AS R19			
R30	SAME AS R26			
R31	SAME AS R19			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R32	SAME AS R26			
R33	RESISTOR, FXD, COMPOSITION 500 OHMS, 10% TOL, 1/4 WATT	RC07GF561K	81349	745-0740-000
R34	RESISTOR, FXD, COMPOSITION 2200 OHMS, 10% TOL, 1/4 WATT	RC07GF222K	81349	745-0761-000
R35	SAME AS R33			
R36	SAME AS R22			
R37 THROUGH R40	SAME AS R7			
R41	SAME AS R26			
VR1	SEMICONDUCTOR DEVICE, DIODE	1N751A	07688	353-2710-000
XK1	SOCKET, RELAY 10 CONTACTS	3055-1	02288	220-1475-000
XK2	SAME AS XK1			

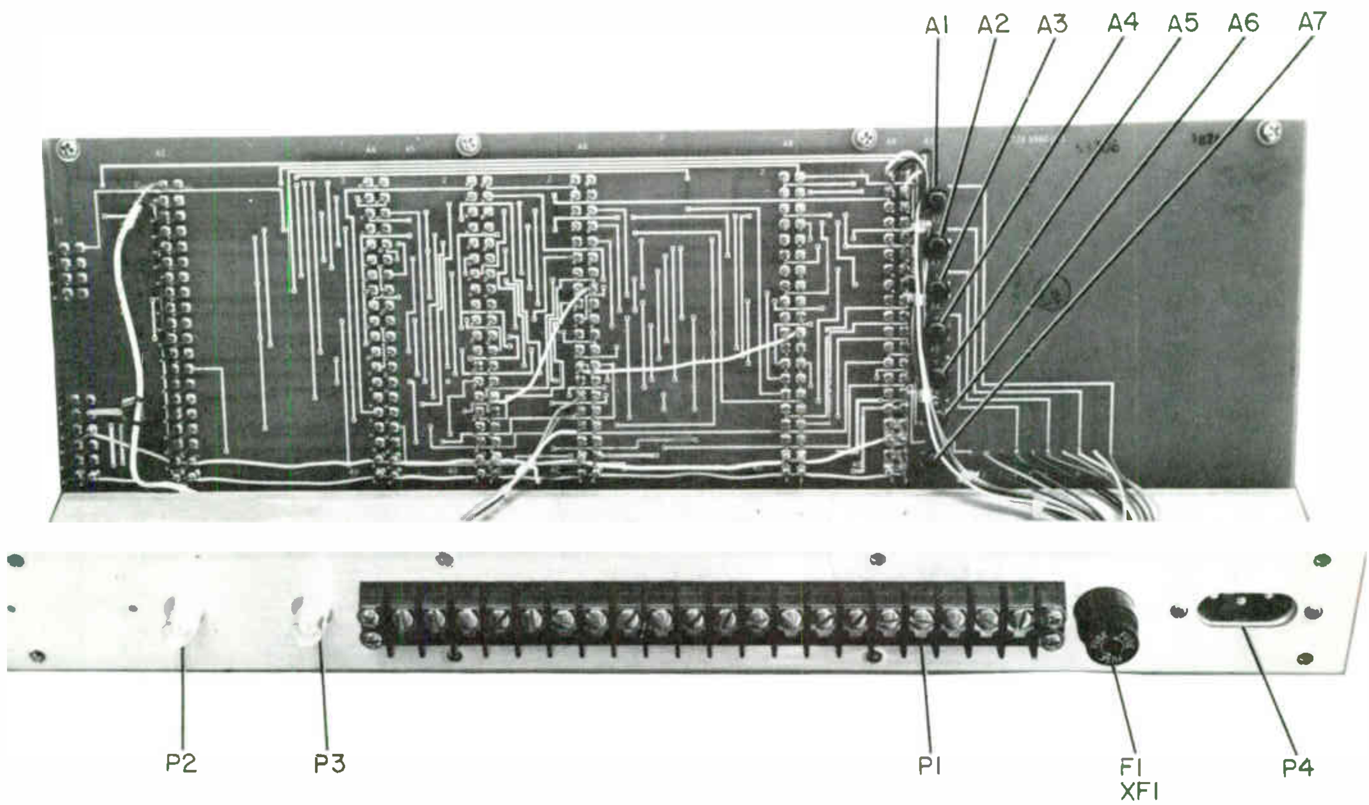


Figure 6-11. Backplane Board With Connector Assembly.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	BACKPLANE BOARD WITH CONNECTOR ASSEMBLY A10			776-1841-001
A1	INTEGRATED CIRCUIT	SL3978	07263	351-7121-020
A2 THROUGH A7	SAME AS A1			
F1	FUSE, CARTRIDGE 1/2 AMP	F02B250V1AS	81349	264-4260-000
P1	BOARD, TERMINAL 20 TERMINALS	607A3000-20	75382	367-1852-200
P2	CONNECTOR, ELECTRICAL 1 CONTACT	UGG25BU	80058	357-9670-000
P3	SAME AS P2			
P4	CONNECTOR, ELECTRICAL 3 CONTACTS	1065-1	87930	368-0207-010
XF1	FUSEHOLDER 30 AMPS	HKPH	71400	265-1171-000

ILLUSTRATION NOT AVAILABLE

(To be supplied at later date)

Figure 6-12. Optional Equipment.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	OPTIONAL EQUIPMENT			
A1	782B-1 SELF-CHECK CARD			777-1439-001
	SEE BREAKDOWN ON PAGE 6-32			
A2	EXTENDER CARD			
A3	NOT USED			781-1488-001
A4	82U-1 REMOTE READOUT METER			777-1390-001
	-USED WITH 758-5605-003			
	ONLY-			
	NO PARTS LIST AVAILABLE			
	AT THIS TIME			

ILLUSTRATION NOT AVAILABLE

(To be supplied at later date)

Figure 6-13. 782B-1 Self-Check Card.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	782B-1 SELF-CHECK CARD A1			777-1439-001
A1	INTEGRATED CIRCUIT	SL3979	07263	351-7121-030
S1	SWITCH, ROTARY 2 SECTIONS, 4 POLES, 5 POSITIONS	237966K2	76854	259-2204-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	MANUFACTURERS CODES			
CODE	MANUFACTURER			
00303	SHELLEY ASSOCIATES INC EL SEGUNDO, CALIFORNIA			
02288	ALLIED CONTROL CO, INC PLANTSVILLE, CONNECTICUT			
07263	FAIRCHILD CAMERA AND INSTRUMENT CORPORATION, SEMICONDUCTOR DIVISION MOUNTIAN VIEW, CALIFORNIA			
07688	JOINT ELECTRON DEVICE ENGINEERING COUNCIL WASHINGTON D C			
12615	U S TERMINALS INC CINCINATTI, OHIO			
13327	SOLITRON DEVICES INC TAPPAN, NEW YORK			
17117	ELECTRONIC MOULDING CORP PAWTUCKET, RHODE ISLAND			
56289	SPRAGUE ELECTRIC CO NORTH ADAMS, MASSACHUSETTS			
70309	ALLIED CONTROL CO, INC NEW YORK, NEW YORK			
71400	BUSSMAN MFG. DIVISION OF MC GRAW-EDISON CO ST LOUIS, MISSOURI			
72619	DIALIGHT CORP BROOKLYN, NEW YORK			
72982	ERIE TECHNOLOGICAL PRODUCTS INC ERIE, PENNSYLVANIA			
75382	KULKA ELECTRIC CORP MT VERNON, NEW YORK			
76854	OAK MANUFACTURING CO CRYSTAL LAKE, ILLINOIS			
80058	JOINT ELECTRONIC TYPE DESIGNATION SYSTEM			
81349	MILITARY SPECIFICATIONS			
83003	VARO INC GARLAND, TEXAS			
87930	TOWER MANUFACTURING CORP PROVIDENCE, RHODE ISLAND			
95691	ARROW-HART AND HEGEMAN ELECTRIC CO LOS ANGELES, CALIFORNIA			
96906	MILITARY SPECIFICATIONS			

section 7
illustrations

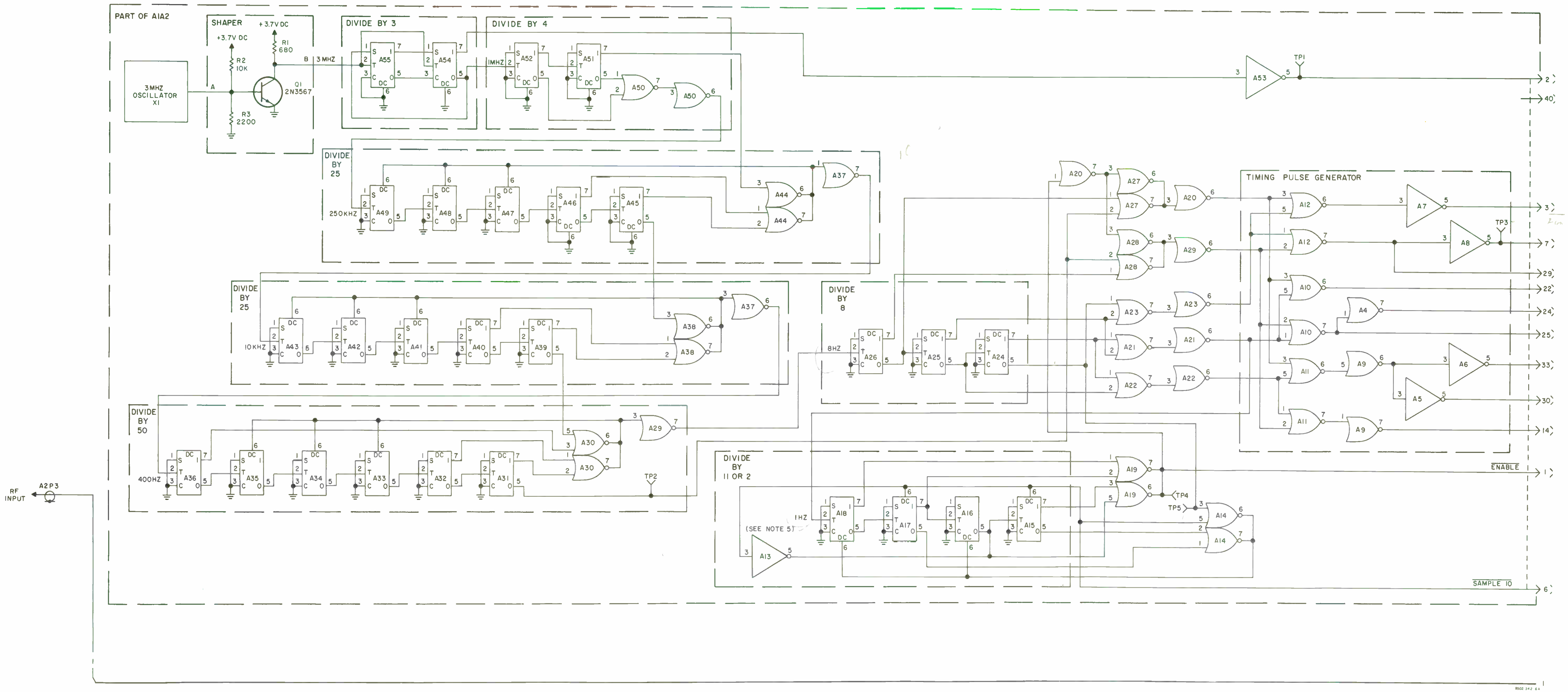


Figure 7-1. Functional Diagram (Sheet 1 of 6).

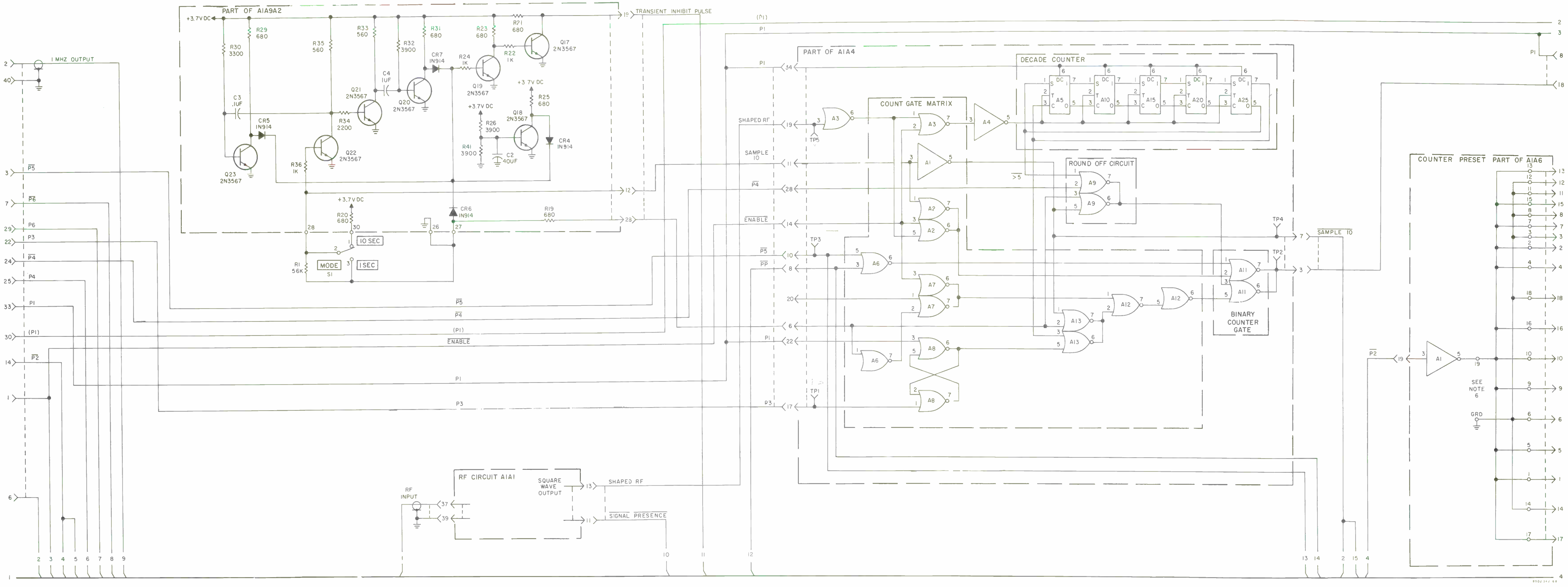


Figure 7-1. Functional Diagram (Sheet 2 of 6).

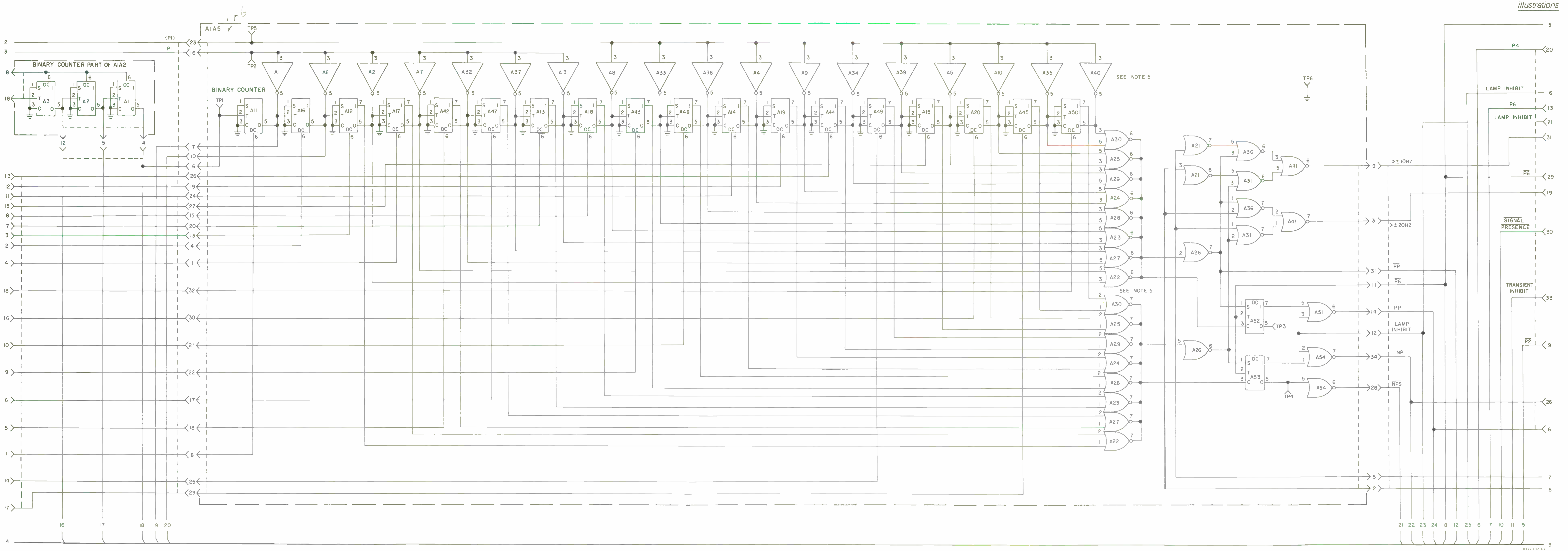


Figure 7-1. Functional Diagram (Sheet 3 of 6).

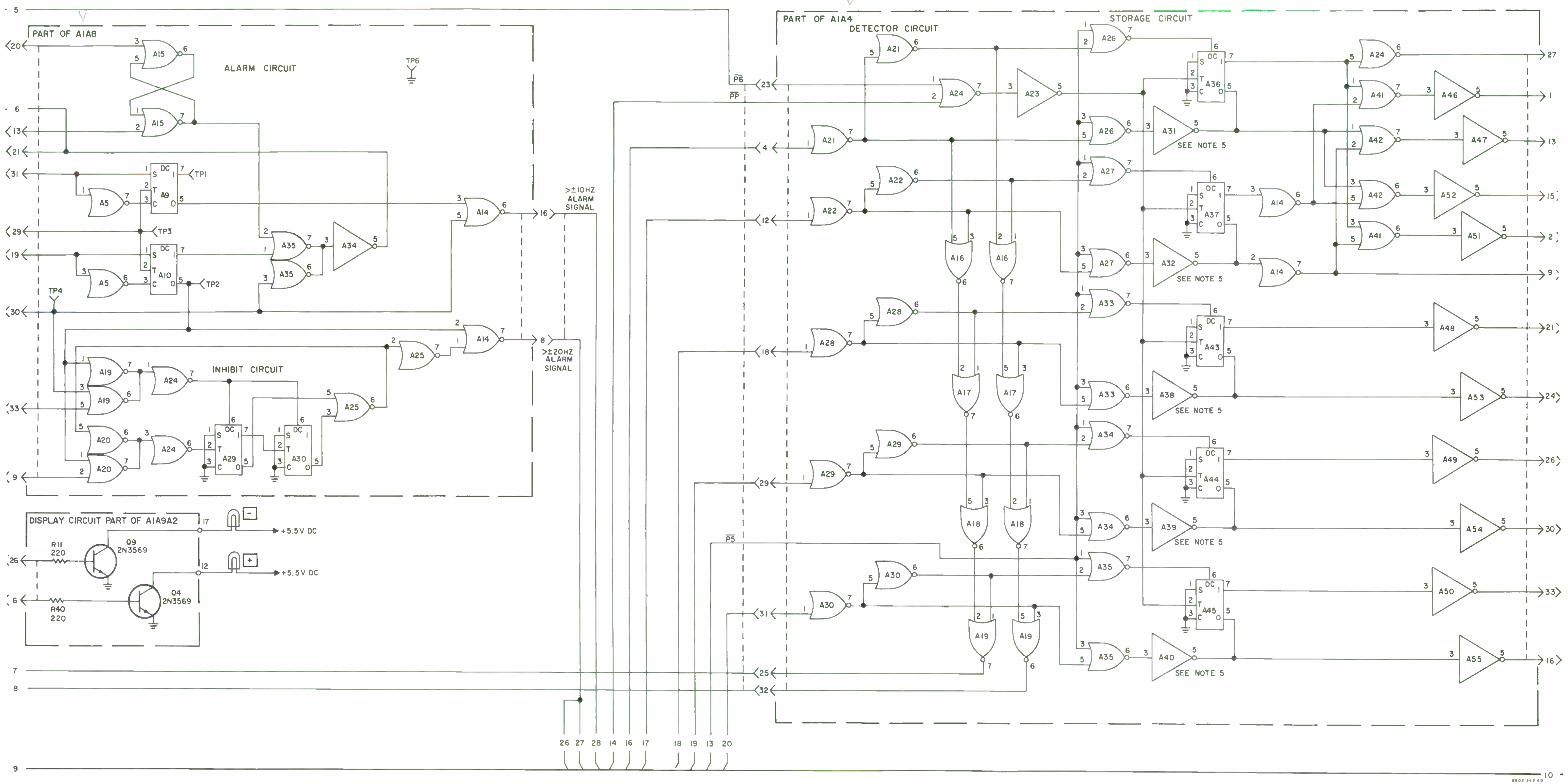


Figure 7-1. Functional Diagram (Sheet 4 of 6).

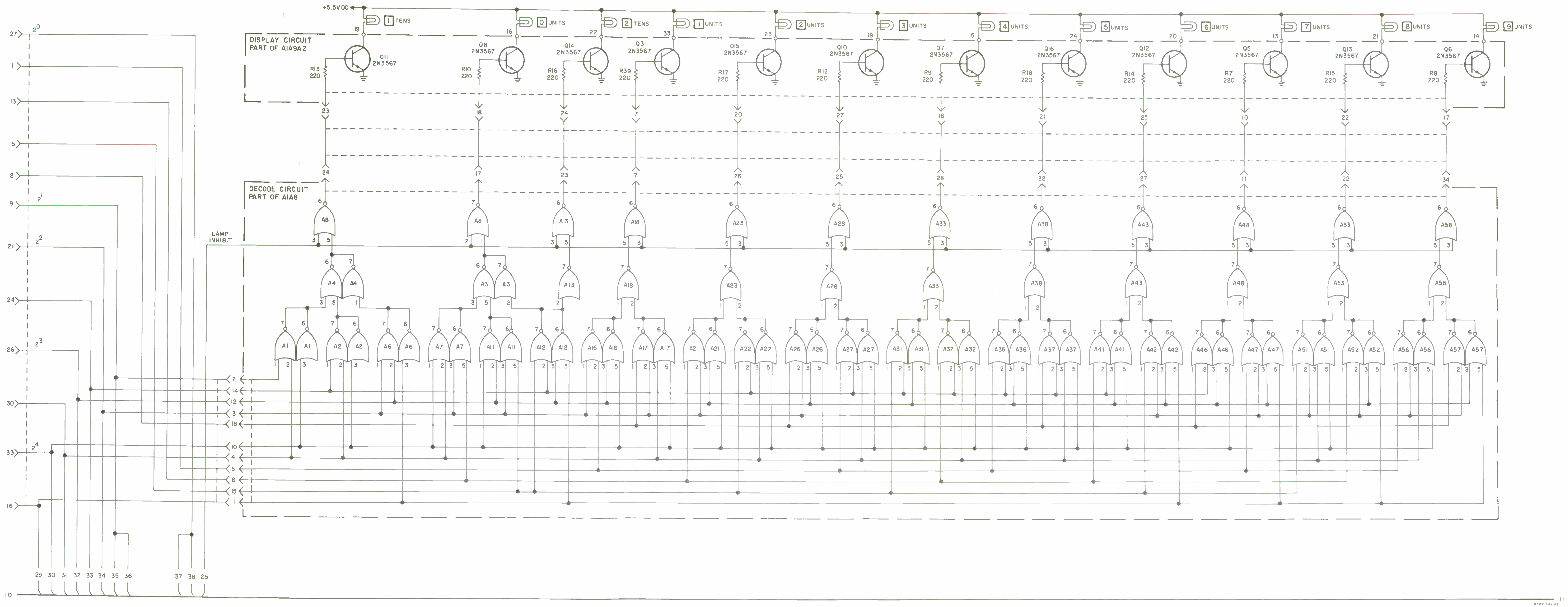


Figure 7-1. Functional Diagram (Sheet 5 of 6).

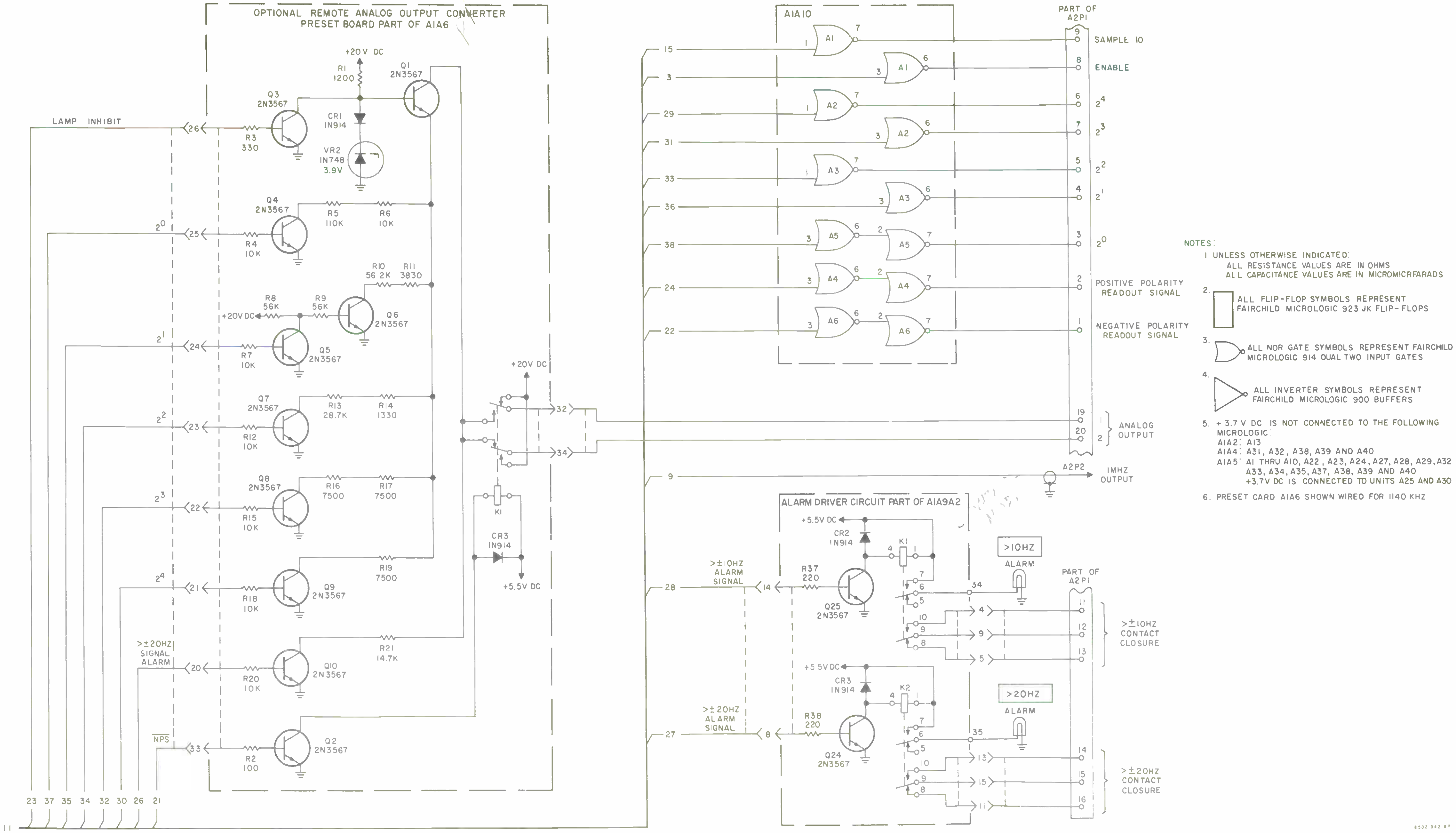
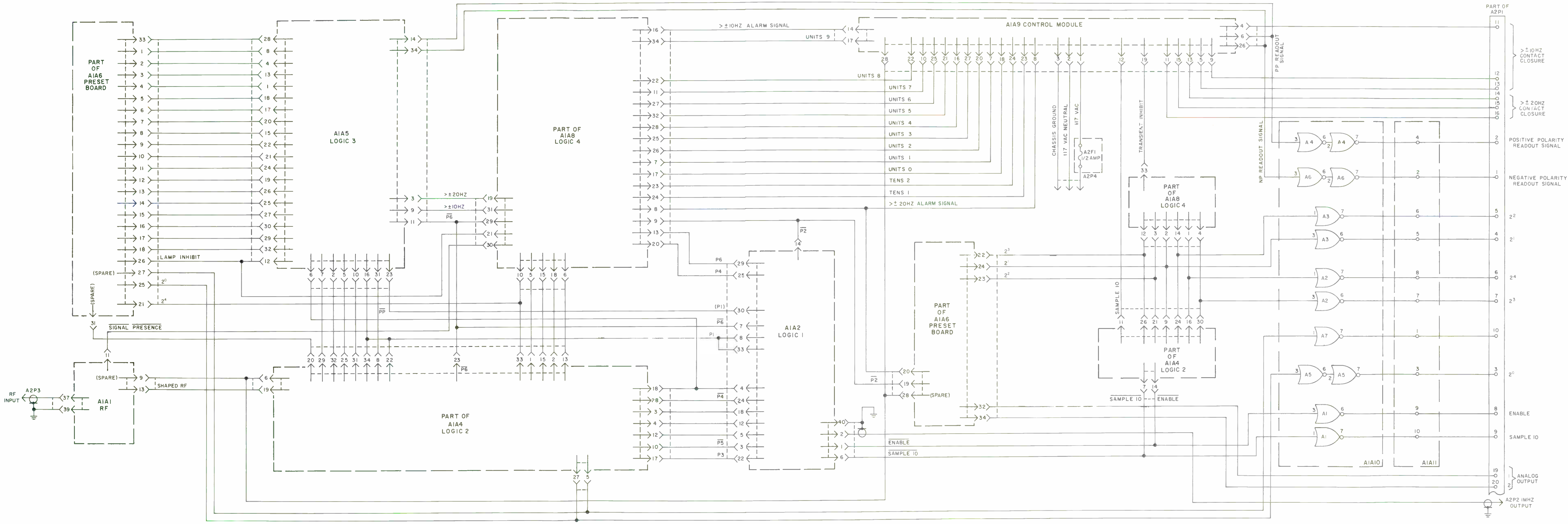


Figure 7-1. Functional Diagram (Sheet 6 of 6).



POWER WIRING		
FROM	TO	FUNCTION
A1A9-39	A1A10A1-4	GRD
A1A9-39	A1A10A2-4	GRD
A1A9-39	A1A10A3-4	GRD
A1A9-39	A1A10A4-4	GRD
A1A9-39	A1A10A5-4	GRD
A1A9-39	A1A10A6-4	GRD
A1A9-39	A1A10A7-4	GRD
A1A9-39	A1A9-40	GRD
A1A9-40	A1A8-39	GRD
A1A8-39	A1A8-40	GRD
A1A8-40	A1A6-39	GRD
A1A6-39	A1A6-40	GRD
A1A6-40	A1A5-39	GRD
A1A5-39	A1A5-40	GRD
A1A5-40	A1A4-39	GRD
A1A4-39	A1A4-40	GRD
A1A4-40	A1A2-39	GRD
A1A2-39	A1A2-40	GRD
A1A2-40	A1A1-39	GRD
A1A1-39	A1A1-40	GRD
A1A9-33	A1A10A1-8	+3.7V DC
A1A9-33	A1A10A2-8	+3.7V DC
A1A9-33	A1A10A3-8	+3.7V DC
A1A9-33	A1A10A4-8	+3.7V DC
A1A9-33	A1A10A5-8	+3.7V DC
A1A9-33	A1A10A6-8	+3.7V DC
A1A9-33	A1A10A7-8	+3.7V DC
A1A9-35	A1A9-36	+3.7V DC
A1A9-36	A1A8-37	+3.7V DC
A1A8-37	A1A8-38	+3.7V DC
A1A8-38	A1A6-38	+3.7V DC
A1A6-38	A1A5-37	+3.7V DC
A1A5-37	A1A5-38	+3.7V DC
A1A5-38	A1A4-37	+3.7V DC
A1A4-37	A1A4-38	+3.7V DC
A1A4-38	A1A2-37	+3.7V DC
A1A2-37	A1A2-38	+3.7V DC
A1A2-38	A1A1-33	+3.7V DC
A1A9-30	A1A6-35	+20V DC
A1A6-35	A1A6-36	+20V DC
A1A6-36	A1A2-35	+20V DC
A1A2-35	A1A2-36	+20V DC
A1A2-36	A1A1-35	+20V DC
A1A9-29	A1A6-37	+5.5V DC
A1A9-32	A1A9-31	+5.1V DC
A1A9-31	A1A1-31	+5.1V DC

Figure 7-2. Interconnecting Wiring Diagram.

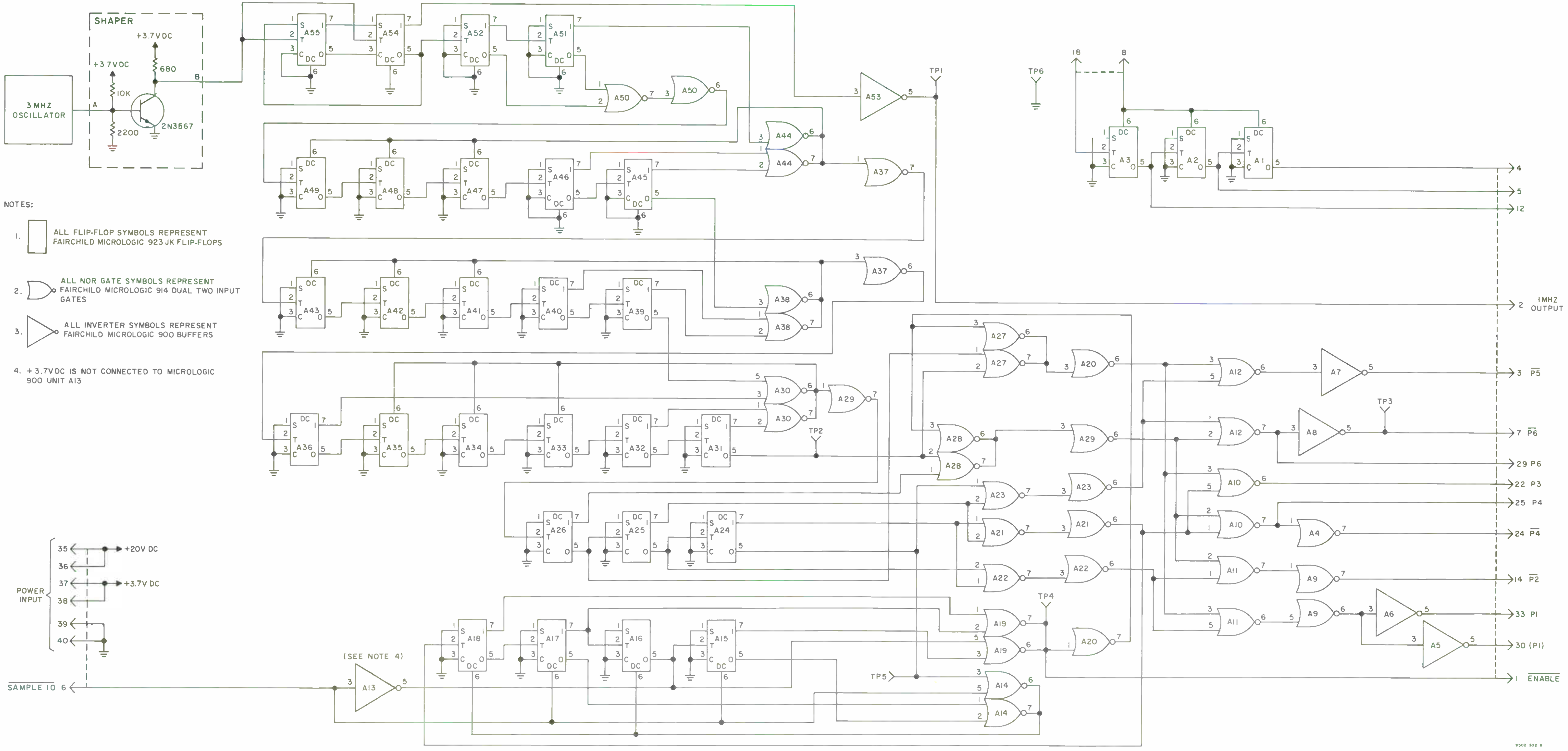


Figure 7-3. Logic 1 Card A1A2 Schematic.

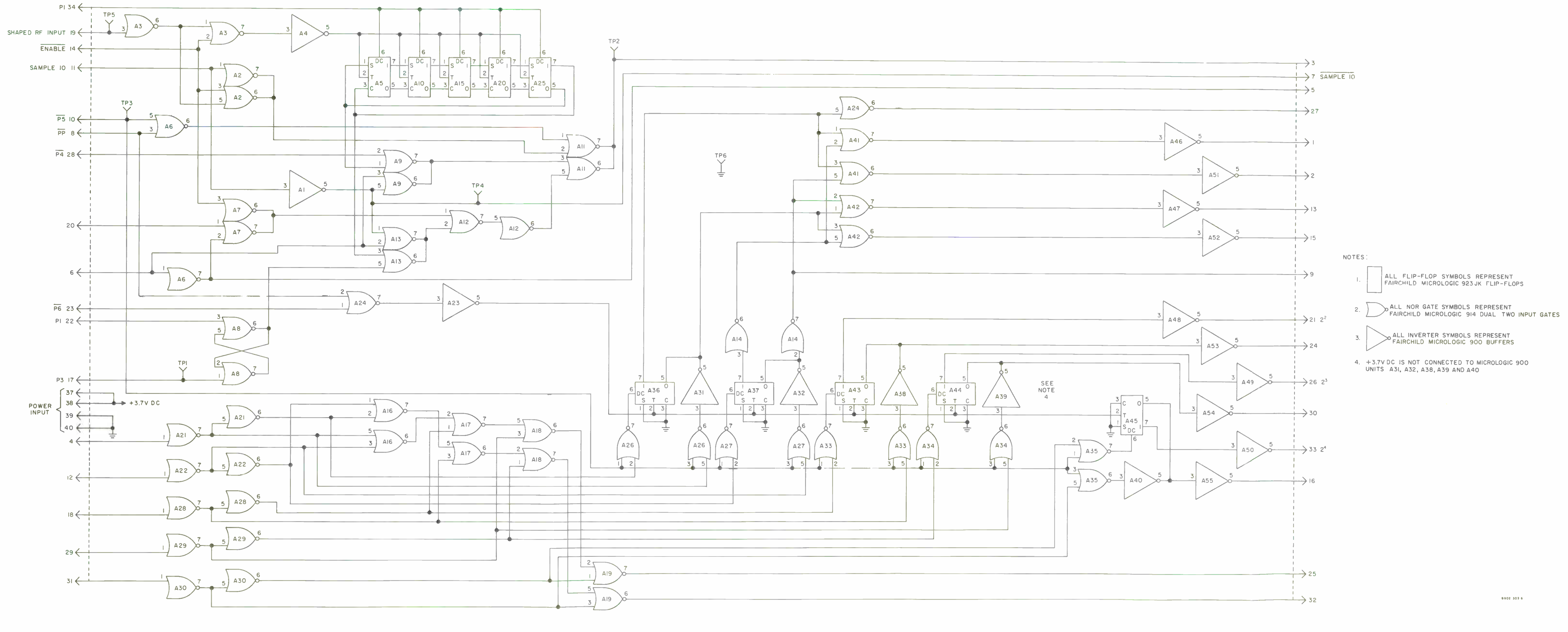


Figure 7-4. Logic 2 Card A1A4 Schematic.

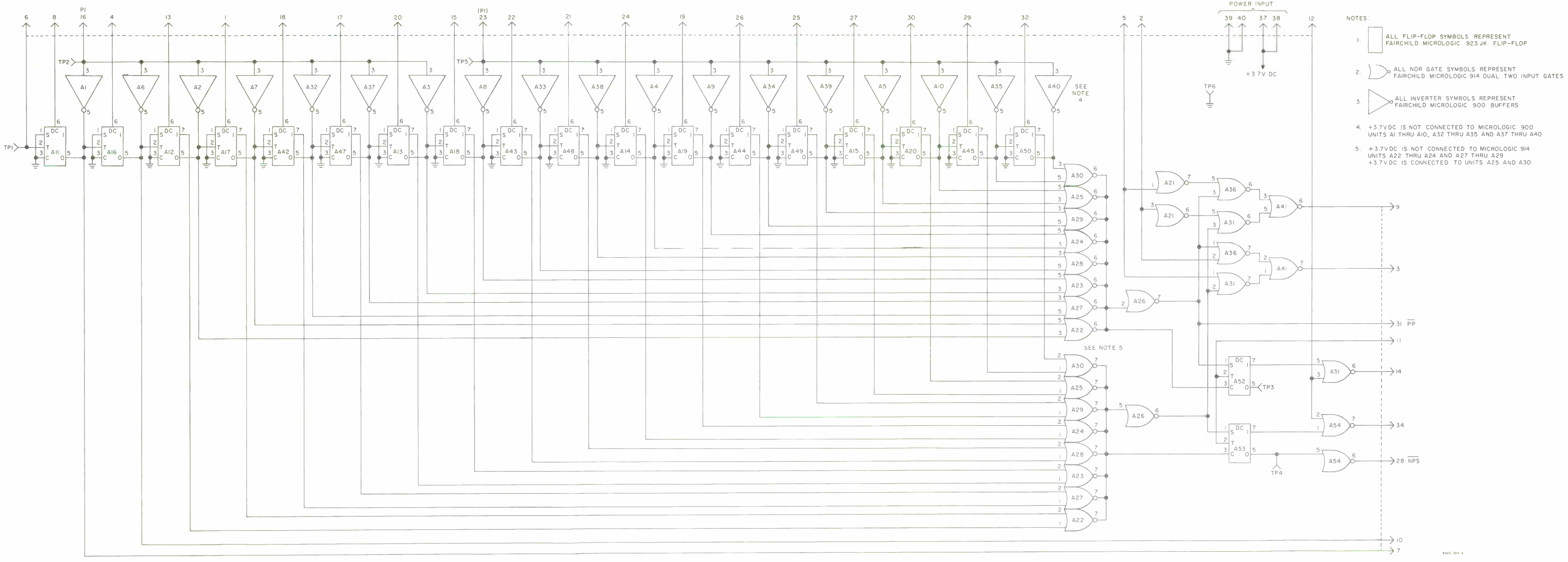


Figure 7-5. Logic 3 Card A1A5 Schematic.

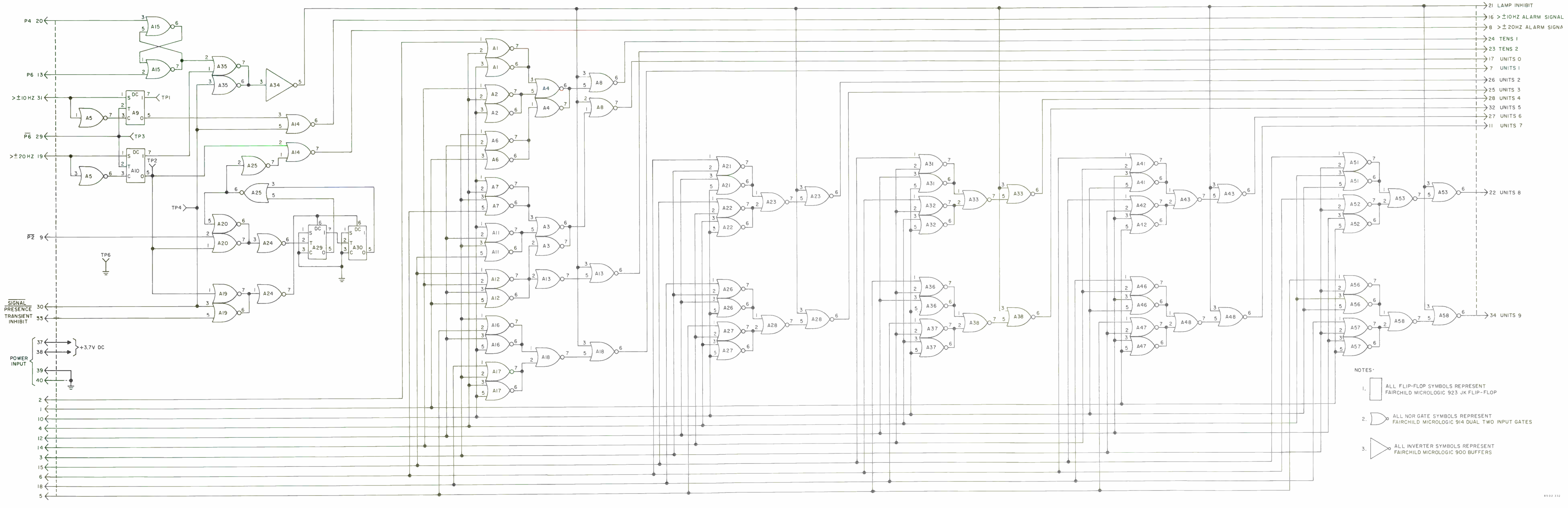


Figure 7-6. Logic 4 Card A1A8 Schematic.

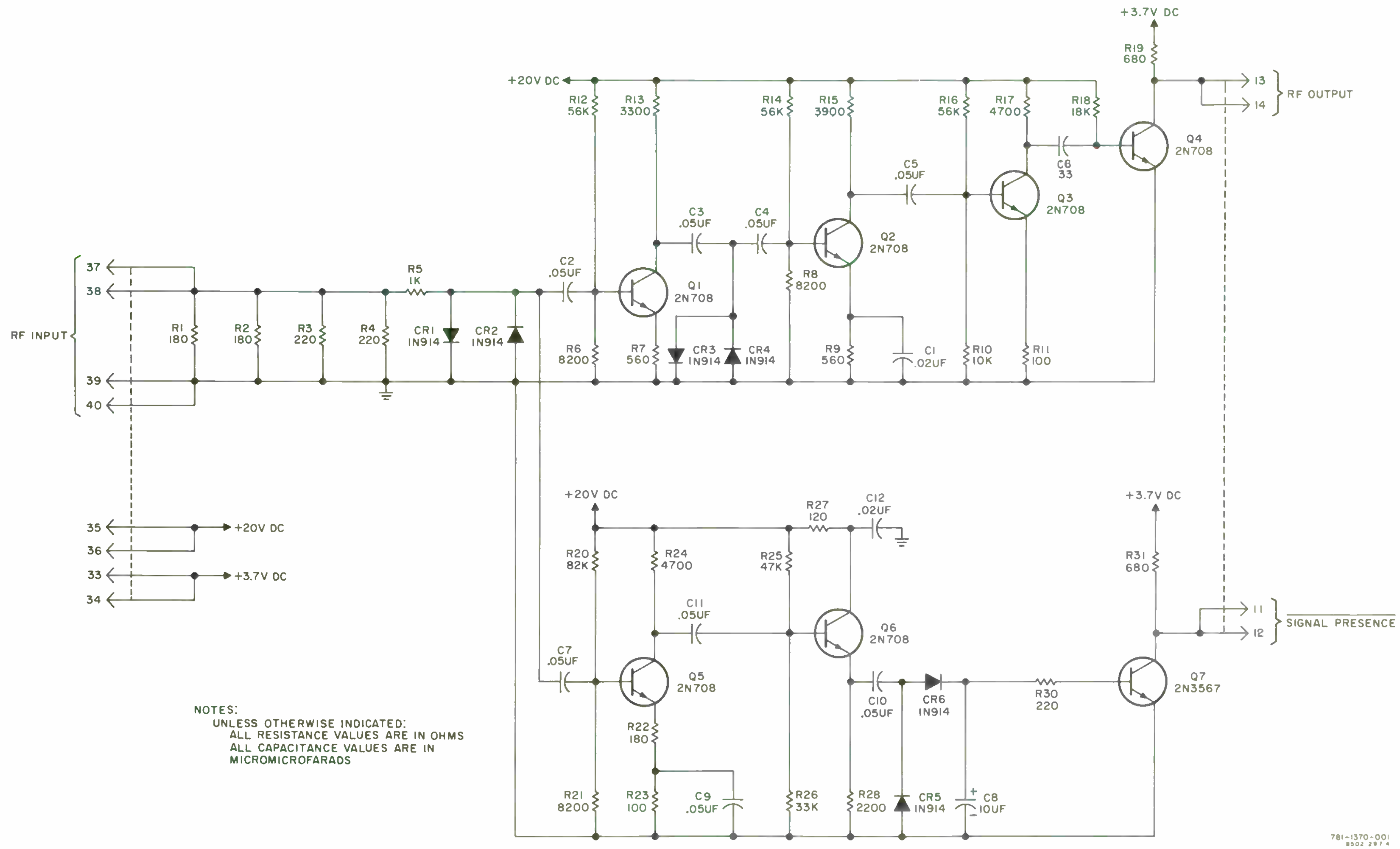


Figure 7-7. RF Card A1A1 Schematic.

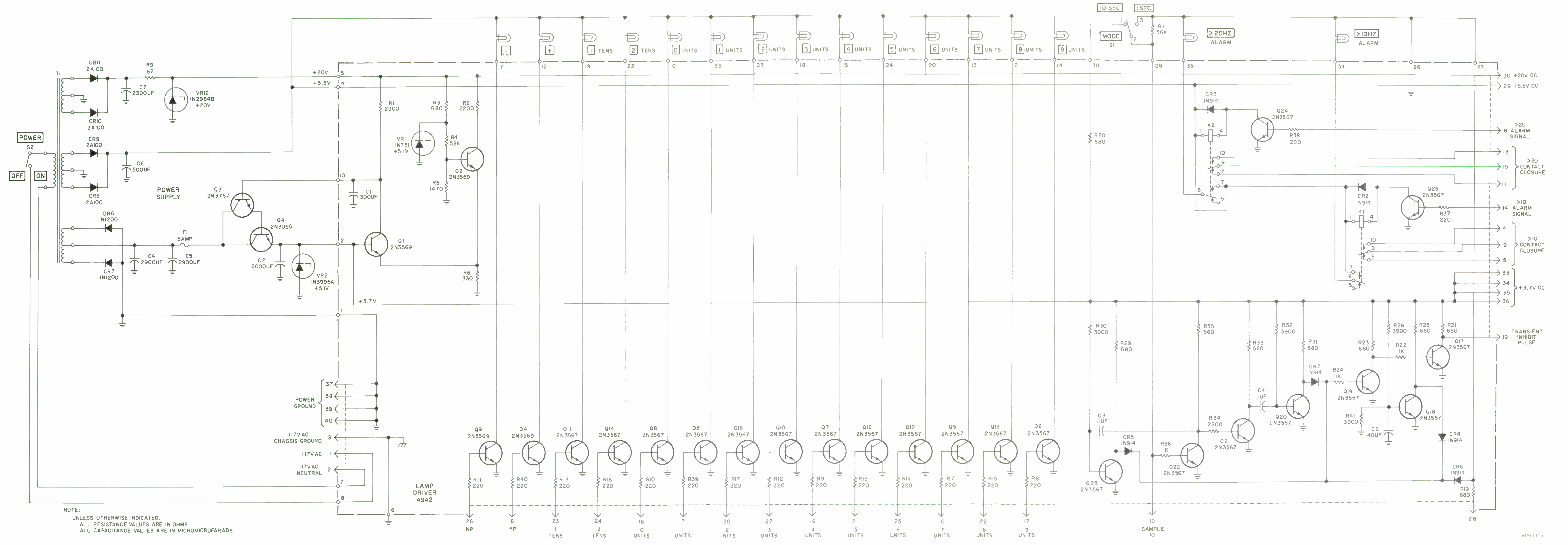


Figure 7-8. Control Module Schematic.

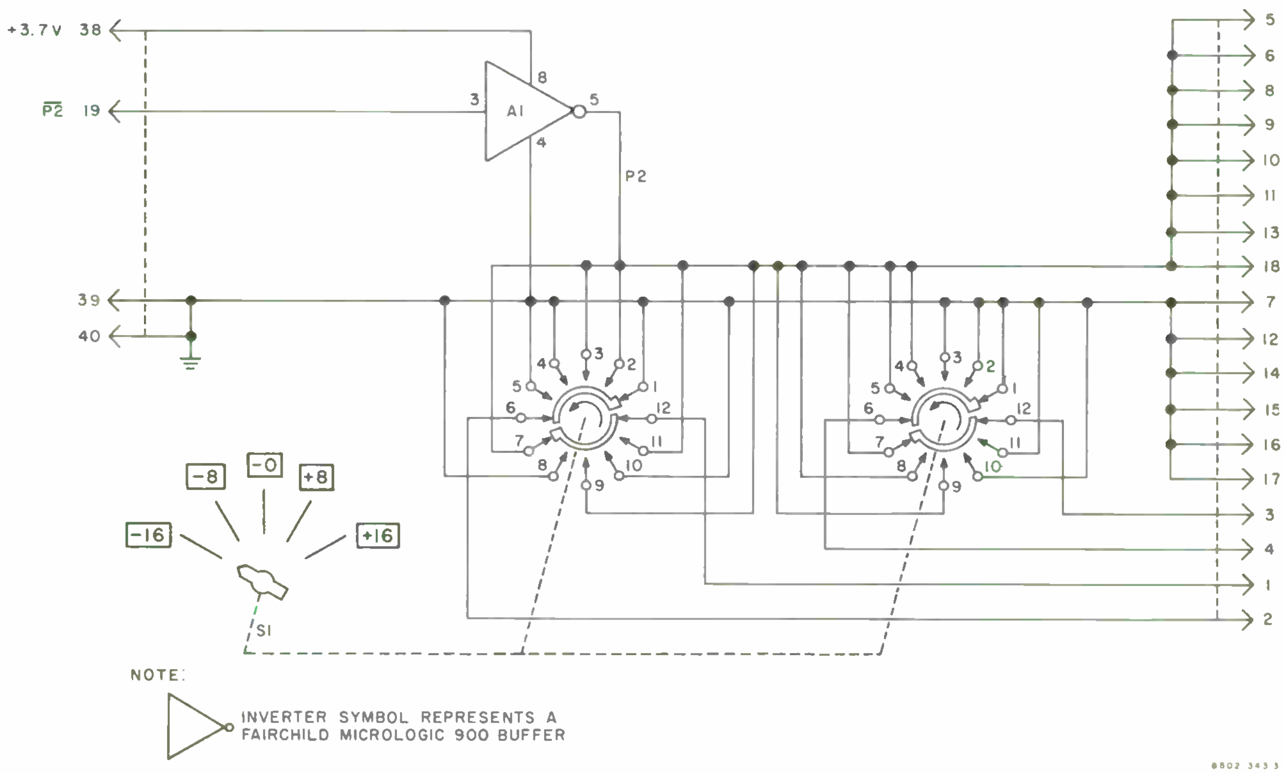


Figure 7-9. Self-Check Card Schematic.

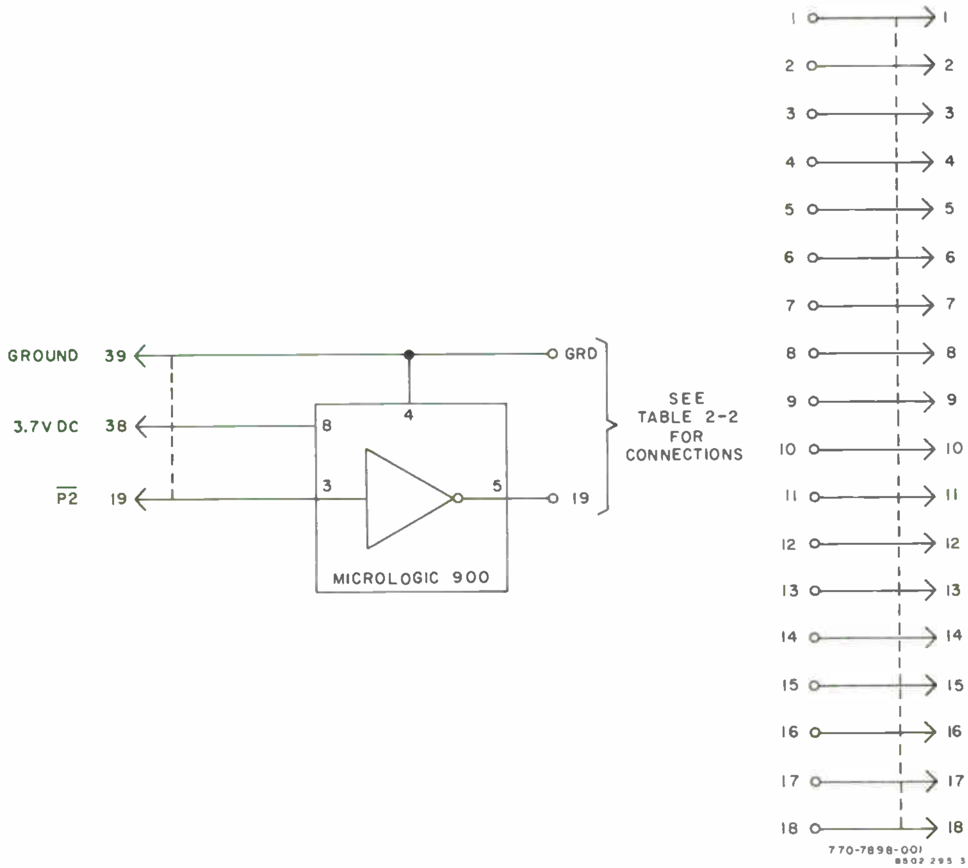


Figure 7-10. Preset 1 Card A1A6 Schematic.

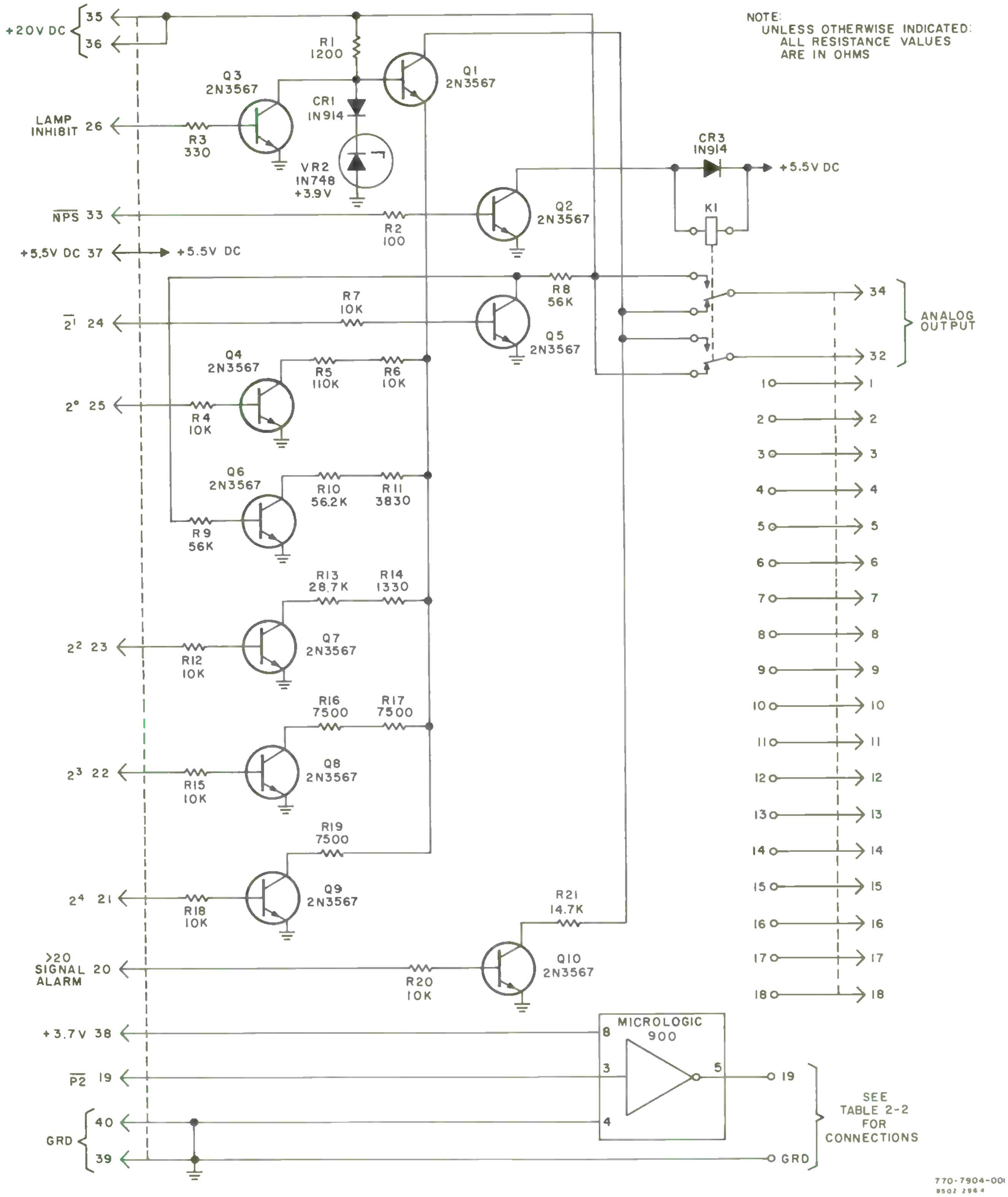


Figure 7-11. Preset 2 Card A1A6 Schematic.

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