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Canoga Park, Calif.

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LIST OF ILLUSTRATIONS

100850 POWER SUPPLY

1.0 GENERAL DESCRIPTION

1.1 Mechanical - The Model 100850 Power Supply is constructed as a self-contained unit and is designed to fit Bay 1 of a Standard 100775 Module Case. Figure 1.1a shows the overall mechanical details, the size being 6-3/4" x 7" by 6" high. Input and output connections are made via terminal blocks TB1 through TB3.

The components which are more likely to require replacement are contained on a separate assembly (100849 shown in Figure 1.2), which plugs into the main body of the power supply. This modular construction allows easier trouble shooting and maintenance.

The power supply is retained in the module case by means of 4 screws as shown in Figure 1.1a.

Cooling air is circulated by the fan located in the back of the 100775 module drawer.

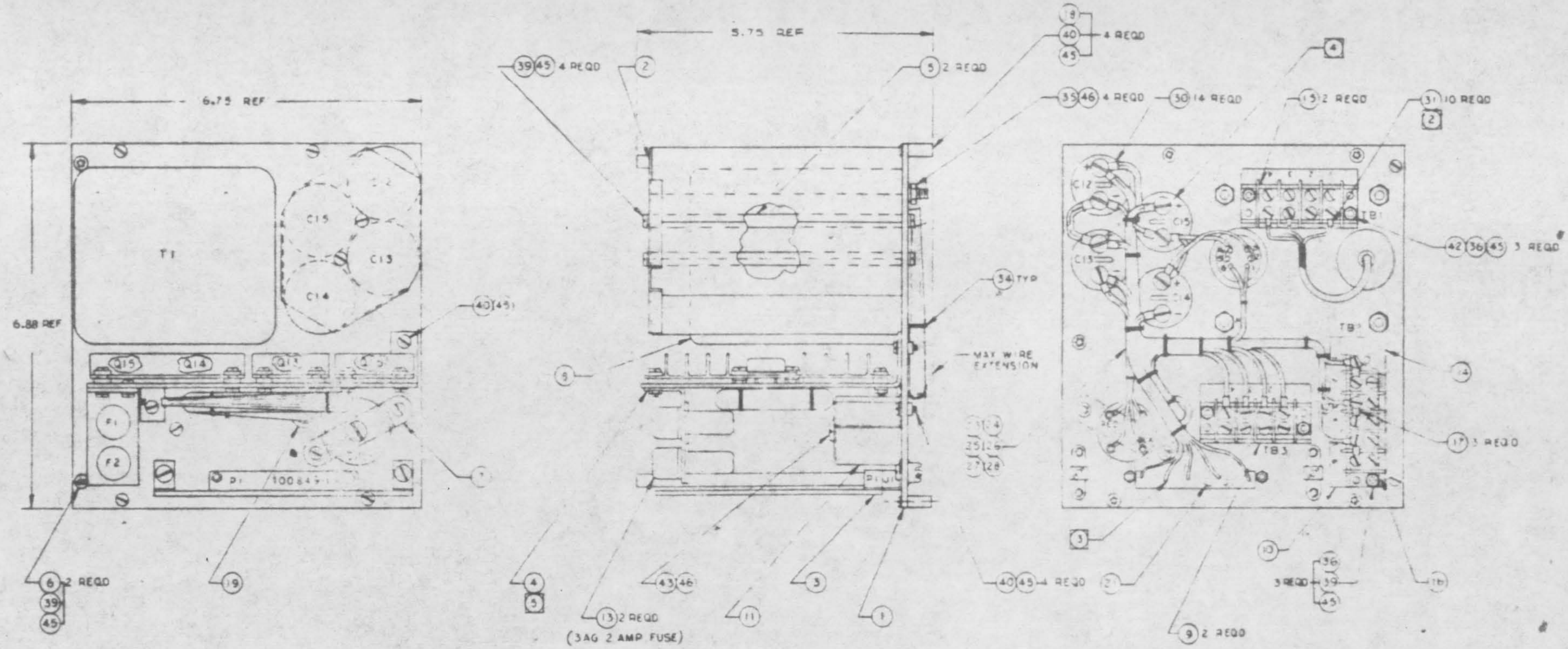
1.2 Electrical - The outputs of the power supply are such that it will normally power all Redcor standard modules that can be contained in a 100775 Module Case. The nominal output regulated DC voltages are plus and minus 12.5 volts and the maximum loading that can be placed on each output is 2 amperes. In addition to the static voltages, a power multivibrator operating at 6 Kc/s is provided to supply a dynamic source

1.2 (continued)

of power. The characteristic waveform of this multivibrator is trapezoidal and is described in Figure 1.5 and the maximum loading that can be placed on this output is 500mA. (NOTE: The power supplied by the multi-supply should be subtracted from the plus and minus voltage supplies as this power is derived from the same regulator circuit.) Individual specifications are listed in paragraph 1.3. The major components of the power supply are: Power transformer with primary and secondary box electrostatic shields, rectifier assembly, filter capacitors, plug-in regulator card and heat sinks containing the power transistors.

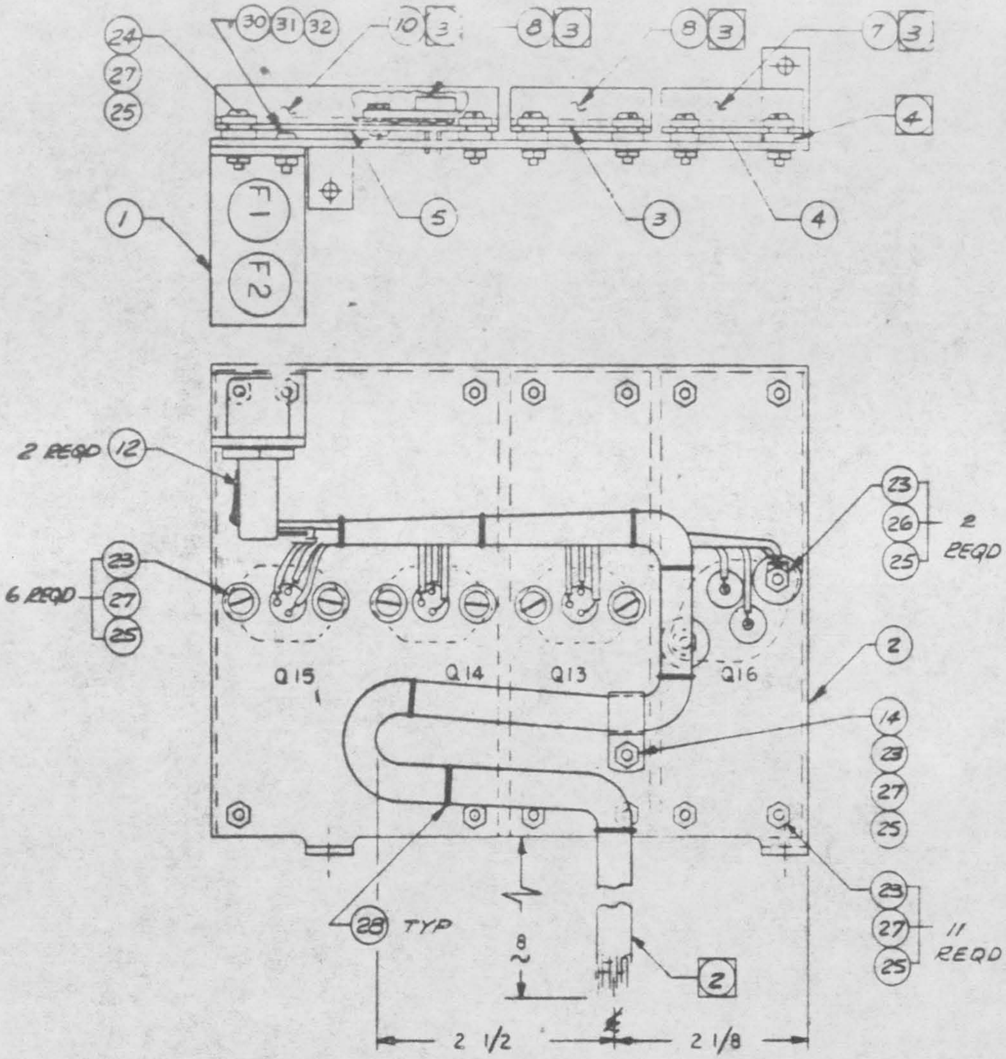
The plug-in card 100849 contains the reference zener, regulator amplifiers and multivibrator circuitry such that should any malfunction occur, the major assemblies can be isolated for individual testing.

DC fuses after the rectifier assembly are provided and are contained on a clip board accessible from the top of the module drawer, see Figure 1.1a.



5 DRESS CABLE BUNDLE TO RETAIN FORM SPECIFIED ON REDCOR #100950. POSITION BUNDLE AS INDICATED.
4 ORIENT CAPACITORS ONLY AS SHOWN.
3 DRESS WIRES BELOW LEVEL OF J1 PINS.
2 USE THESE ITEMS ONLY ON TERMINAL STRIPS.
1. REF: WIRING DIAG. 100834, SCHEMATIC NO. 100852, PL100850.

Figure 1.1a



100850				
WIRE LIST				
WIRE NO	ITEM NO	COL	FROM	TO
1	17	BLU	F1-A	C14-NEG
2	17	BLU	F1-B	Q16-C
3	20	BLU	Q16-C	J1-X
4	20	BLU	Q16-B	J1-Q
5	17	BLU	Q16-E	C13-NEG
6	16	RED	F2-A	C15-POS
7	16	RED	F2-B	Q13-C
8	19	RED	Q13-C	J1-U
9	19	RED	Q13-B	J1-V
10	16	RED	Q13-E	C12-POS
11				
12				
13				
14				
15	21	WHT	Q14-E	J1-R
16	21	WHT	Q14-B	J1-D
17	21	WHT	Q15-E	J1-M
18	21	WHT	Q15-B	J1-P
19	18	BLK	Q14-C	Q15-C
20	18	BLK	Q14-C	J1-K

100946				
WIRE LIST				
WIRE NO	ITEM NO	COL	FROM	TO
1	17	BLU	F1-A	C14-NEG
2	17	BLU	F1-B	Q16-C
3	20	BLU	Q16-C	J1-X
4	20	BLU	Q16-B	J1-J
5	17	BLU	Q16-E	C12-NEG
6	16	RED	F2-A	C13-POS
7	16	RED	F2-B	Q13-C
8	19	RED	Q13-C	J1-U
9	19	RED	Q13-B	J1-V
10	16	RED	Q13-E	TB2-6
11				
12				
13				
14				
15	22	WHT	Q14-E	J1-R
16	21	WHT	Q14-B	J1-D
17	22	WHT	Q15-E	J1-M
18	21	WHT	Q15-B	J1-P
19	18	BLK	Q14-C	Q15-C
20	18	BLK	Q14-C	J1-K

4 TEFLON BUSHINGS SUPPLIED WITH HEAT SINKS, ITEMS 4 & 5.

3 DO NOT USE MICA WASHERS

2 TAG WIRES WITH DESTINATIONS (TO) FROM WIRE LIST. FORM BUNDLE AS INDICATED.

1 REF: PL100950, SCHE: 100852, 10095

NOTE: UNLESS OTHERWISE SPECIFIED

Figure 1.1b

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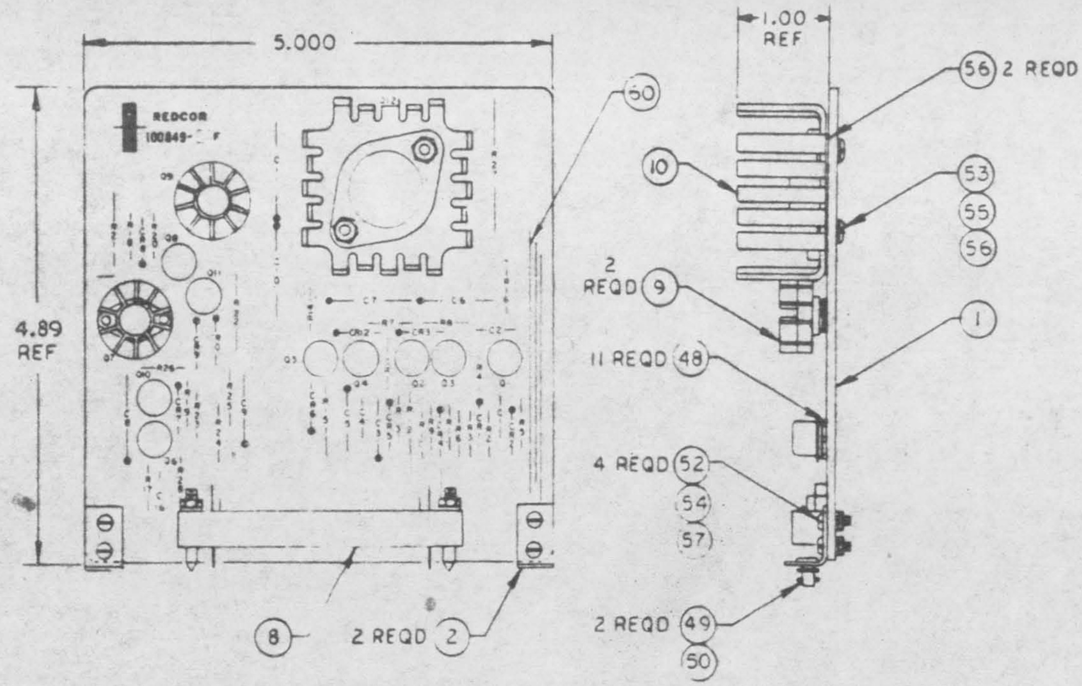

TABULATION	
DASH NO.	DESCRIPTION
-1	OMIT C10, C11, Q12 & R27. ITEMS 10, 53 55, 56 & 58.
-2	OMIT C9.

1. REF: SCHEMATIC NO. 100852, 100956, 101011. P. L. NO. 100849.

NOTE: UNLESS OTHERWISE SPECIFIED

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Figure 1.2

1.3 Detailed Specifications

Output Voltages:	+12.5 volts -12.5 volts
Output Loading:	2 amps
Output Ripple (120 cps):	
No load	4mV peak/peak
Full load	15mV peak/peak
Regulation:	
No load/full load	100mV
Line Regulation:	
105/125V AC	±100mV
Multivibrator	
Voltage	±12.0 volts
Frequency	6Kc/s ±2Kc/s
Loading	500mA
Input Power:	115V AC 50-400cps

1.4 Detailed Circuit Description

1.5 Rectifier Assembly - The circuit operation of the power supply may be best understood by referencing Figures 1.3 and 1.4.

Figure 1.4 shows the power transformer T1 bridge rectifier assembly CR11 and capacitors C14 and C15. These components operate in a conventional rectifier capacitor manner to produce DC voltages of +19 ±1 volts at the red end of C15 and -19 ±1 volts at the blue end of C14 with the ground being the commoned positive and negative terminals of C14 and C15 respectively.

1.5 (continued)

F1 and F2 provide fuse protection of the components described above from any excessive loads which are incurred by the regulator and output current loads.

Fuse protection of the transformer primary is supplied by the fuse at the rear of the standard 100775 rack.

1.6 Regulator Circuitry - The series regulator transistors Q13, Q16 and output filter capacitors of Figure 1.4, C12 and C13 operate in conjunction with the components of Figure 1.3. The voltage source to which the regulator is referenced is the zener diode CR9. Transistors Q10, Q7 and Q6 provide successive voltage and current amplification of signals such by controlling the base of the series regulator transistor Q16 (Figure 1.4), the coarse DC voltage at its collector is regulated to -12.5 volts at its emitter, the sensing feedback being provided by pin Y of P1 (Figure 1.3) from the output at C13. In a similar manner, transistors Q8, Q9 and Q11 are amplifier stages which provide control signals to the base of the series regulator transistor Q13 and output capacitor C12. This voltage is +12.5 volts and the reference of this amplifier is the equal and opposite voltage of the -12.5 supply via resistors R23, R24 and R25. In this manner the plus and minus 12.5 volts output may be made to track.

1.7 Multivibrator and Power Driver - Transistors Q1, Q2 and Q3 (Figure 1.3) are connected to operate as an astable multivibrator with components R5, R6, C1 and C2 controlling the respective off-times of their associated transistors. CR1 and CR3 provide a means of preventing the simultaneous saturation of Q1 and Q3, respectively, to ensure starting of the multivibrator. Diodes CR2 and CR4 provide disconnect operation of the timing circuits.

The output of the multivibrator is taken via R10, to the junction of C3, C4 and C5. The waveform appearing at R10 and the junction of CR3 and CR4 is a 12.5 square wave which drives through C3 and Q4. The emitter of which drives the base of Q14 (Figure 1.4); Q14 is thus driven in and out of saturation successively. In an identical manner transistor Q5 and Q15 provide to the complementary output. The common collectors of Q14 and Q15 will then provide an output swing from +12.0 to -12.0 repetitively at 180μSec intervals. The rise and fall time of the successive transitions between +12.0 volts to -12.0 volts and vice versa, is controlled by C4.

C6 and C7 and R16 provide a means of returning a balanced waveform with respect to power ground. R12 and R15 provide a means to limit currents through the output transistors Q14 and Q15.

Power for operating the circuitry is derived from the ±12.5 regulated power supplies.

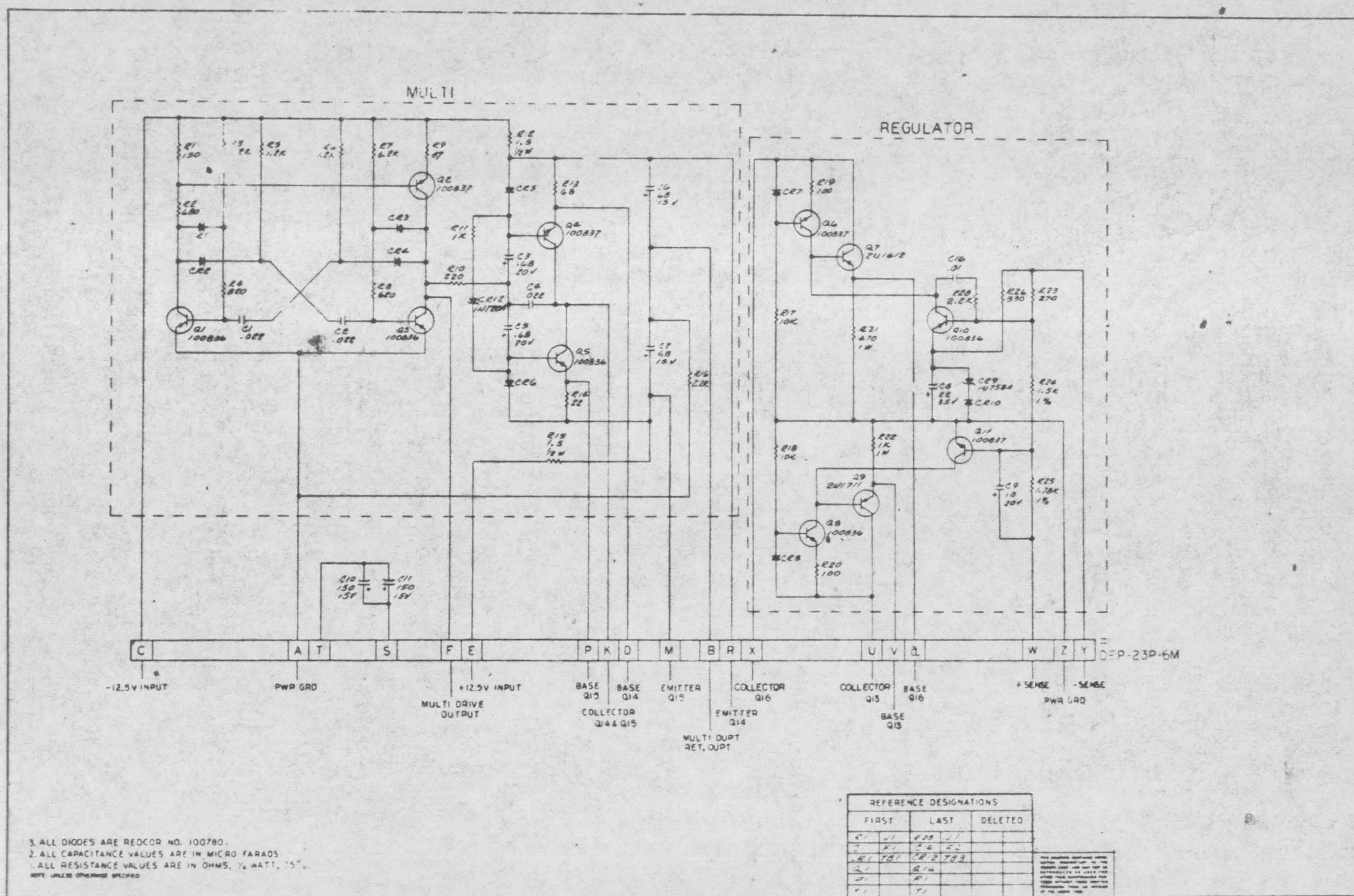

MULTI
REGULATOR
C
A
T
S
F
E
P
K
D
M
B
R
X
U
V
a
W
Z
Y
DEP-23P-6M
-12.5V INPUT
PWR GRD
MULTI DRIVE OUTPUT
+12.5V INPUT
BASE Q15
COLLECTOR Q14 & Q15
BASE Q14
EMITTER Q15
MULTI OUPT RET. OUPT
EMITTER Q14
COLLECTOR Q16
COLLECTOR Q13
BASE Q13
BASE Q16
+SENSE
PWR GRD
-SENSE
REFERENCE DESIGNATIONS
FIRST
LAST
DELETED
3. ALL DIODES ARE REDCOR NO. 100780.
2. ALL CAPACITANCE VALUES ARE IN MICRO FARADS
1. ALL RESISTANCE VALUES ARE IN OHMS, ¼ WATT, ±5%.
NOTE: UNLESS OTHERWISE SPECIFIED

Figure 1.3

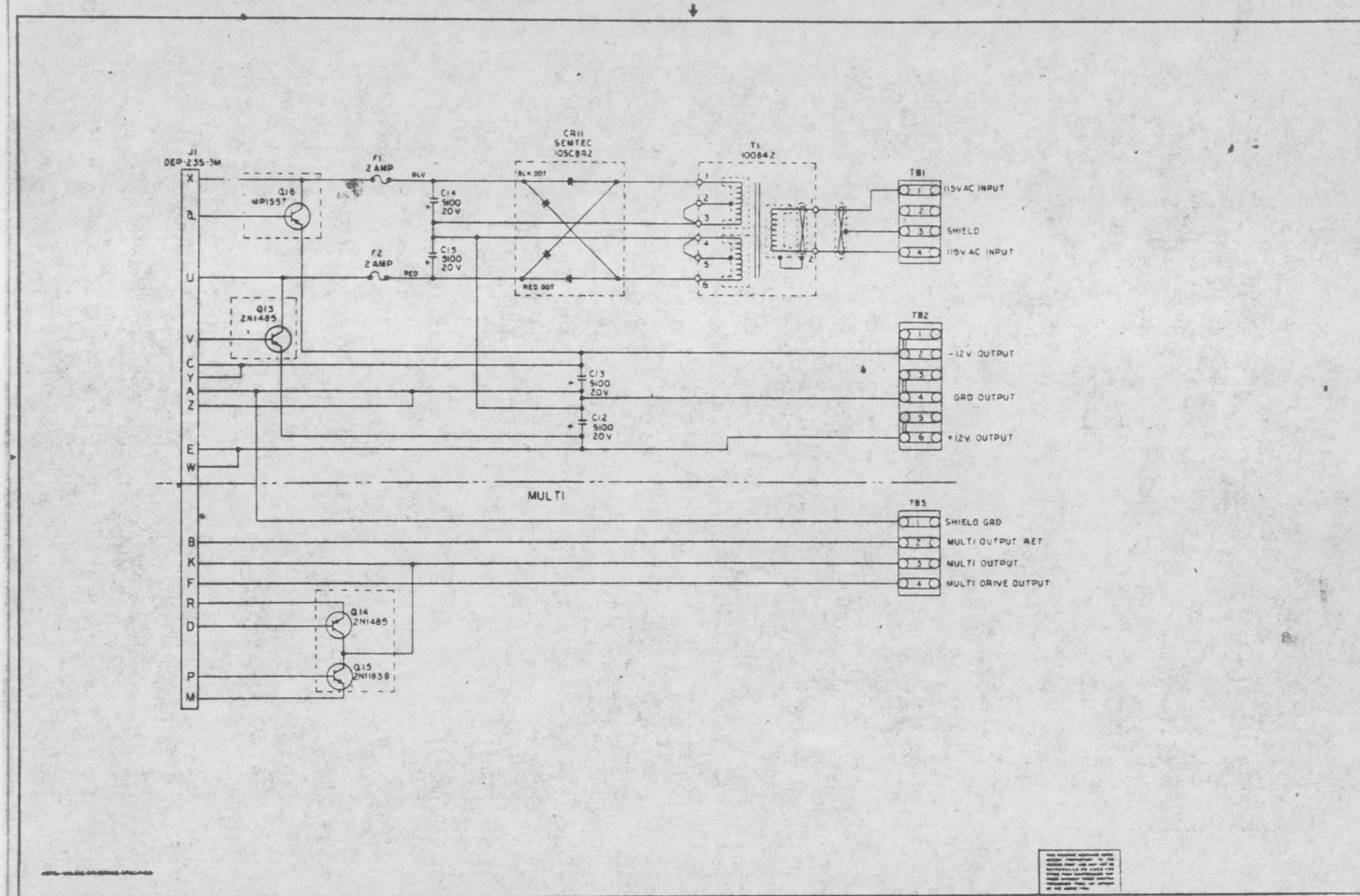

J1
DEP-23S-3M
X
a
U
V
C
Y
A
Z
E
W
B
K
F
R
D
P
M
Q16
MP1557
Q13
2N1485
Q14
2N1485
Q15
2N11838
F1
2 AMP
F2
2 AMP
BLU
RED
C14
5100
20 V
C15
5100
20 V
C13
5100
20 V
C12
5100
20 V
CR11
SEMTEC
10SCBR2
BLK DOT
RED DOT
T1
10084Z
TB1
115VAC INPUT
SHIELD
115V AC INPUT
TB2
-12V OUTPUT
GRD OUTPUT
+12V OUTPUT
MULTI
TB3
SHIELD GRD
MULTI OUTPUT RET
MULTI OUTPUT
MULTI DRIVE OUTPUT

Figure 1.4

1.8 Maintenance - In case of complete malfunction first check the 100775 chassis fuse. 115 AC should be measured at pins 1 and 4 of TB1. (Figure 1.1a).

The transformer secondary voltages appearing at pins 1 and 3 and 4 and 6 should be 18 ±2V RMS. After rectification, the voltage at C14 blue wire and C15 red wire should be ±19 ±2V DC, the ripple at no load being less than 100mV. At full load the ripple should be 2V at 120 cps maximum. Any deviation from these voltages may require replacement of T1, CR11, C14 or C15.

If malfunction of the power supply is still in evidence but with the preceding check points measuring correctly, the fault may be in the regulator assembly or the multidriver circuits. Malfunctions in the multidriver circuits can cause excessive loading, causing F1 and F2 to burn out. Remove R12 and R15 (Figure 1.3) to troubleshoot the regulator circuit. When proper operation is restored, check waveform of the astable multivibrator output described in 1.7, if Q1, Q2, and Q3 are operating properly, replace R12 and R15. Any difficulty will be isolated to the multidriver section.

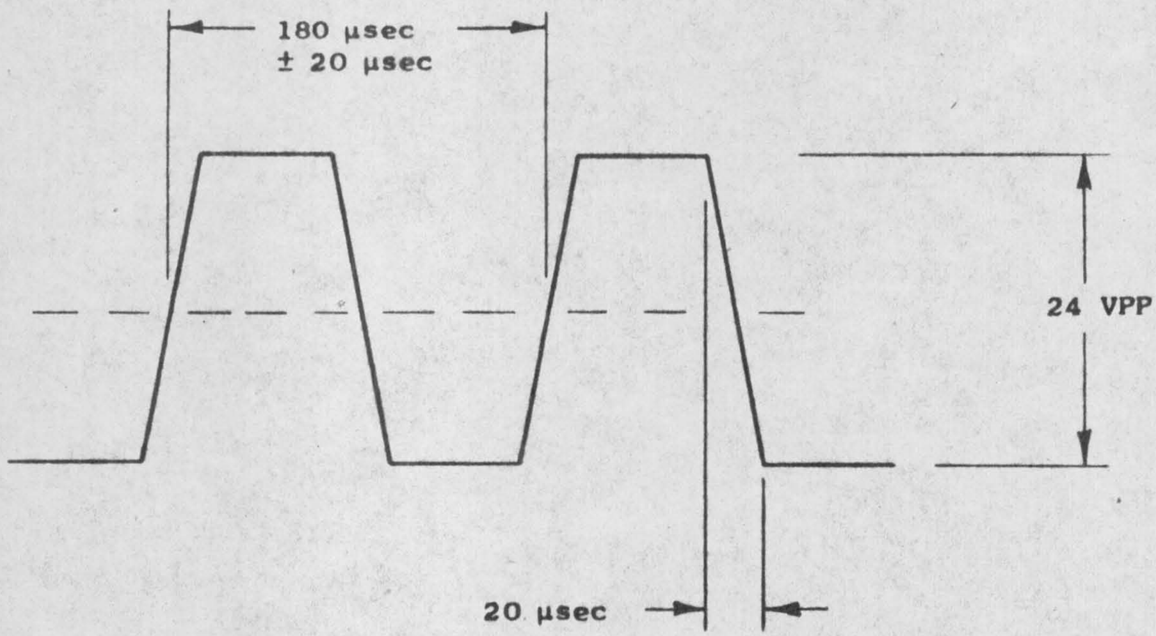
1.9 Regulator Card - The reference voltage on the regulator card is CR9 and is measured at the junction of CR9 and the emitter of Q10. This voltage is nominally -10 volts. Conventional circuit checking technique may be utilized to find further component failures.

1.9 (continued)

NOTE: It is important to note that the two supplies are referenced together, such failure of the -12.5 volts will also cause failure of the +12.5. The reverse is not true however, as it is possible to have -12.5V and not +12.5 volts.

1.10 Multidriver Assembly - The output from the astable multivibrator can be observed at the junction of R10 and the common collectors of Q3 and Q2. At this point a 0 to -12 volts square wave should appear with a rise and fall time of less than 5µSecs, and a repetition rate of 180µSec ±20µSecs. Replace Q1, Q2 or Q3 as necessary. Transistors Q4, Q5, Q14 and Q15 may be checked by conventional techniques to find any component failures.

Figure 1.5 Multivibrator Power Waveform



A D D E N D U M

MODEL 100850 PARTS LIST

Replace R11 (3.3K, 1/4W, ±5% - Part No. RC07GF332J) with a 1K OHM, 1/4W, ±5% Allen Bradley Resistor, Part No. RC07GF102J, in series with a 1N720A Hughes Zener Diode, Reference Designation CR12. The cathode of the Zener Diode shall be connected to the base of Q5.

PARTS LIST - 100850 POWER SUPPLY

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor,Mylar, .022 MF	Goodall	Type 602,Style2	
C2	Same as C1			
C3	Capacitor, Tantalum, .68MF, 20V	Texas Inst.	SCM684F$_2$P035K4	
C4	Same as C1			
C5	Same as C3			
C6	Capacitor, Electrolytic, 68MF, 15V	Texas Inst.	SCM686GP015K4	
C7	Same as C6			
C8	Capacitor, Tantalum, 22 MF, 35V	Texas Inst.	SCM226GP035K4	
C9	Capacitor, Tantalum, 10MF, 20V	Texas Inst.	SCM106BP020K4	
C10	Capacitor, Tantalum, 150MF, 15V	Texas Inst.	SCM157HP015K4	*
C11	Same as C10			*
C12	Capacitor, 5100 MFD,20 WV	Gen. Inst.	CQMS-602	
C13	Same as C12			
C14	Same as C12			
C15	Same as C12			
C16	Capacitor, Disc., .01 MF, 25V	Sprague	40C387	
CR1	Diode, Silicon	Redcor	100780-1	
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Same as CR1			
CR9	Diode, Zener	Hughes	1N758A	
CR10	Same as CR1			
CR11	Diode Quad,#10-32 Mtg.	Semtech	SA-908	

* Use on 100849-1

PARTS LIST - 100850 POWER SUPPLY

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
F1	Fuse, 3 AG	Littlefuse	312002	
F2	Same as F1			
Q1	Transistor, PNP	Redcor	100836	
Q2	Transistor, NPN	Redcor	100837	
Q3	Same as Q1			
Q4	Same as Q2			
Q5	Same as Q1			
Q6	Same as Q2			
Q7	Transistor	Delco	2N1612	
Q8	Same as Q1			
Q9	Transistor	RCA	2N1711	
Q10	Same as Q1			
Q11	Same as Q2			
Q12	Transistor, Power	Motorola	2N1360	*
Q13	Transistor, Power	RCA	2N1485	
Q14	Same as Q13			
Q15	Transistor, Power	RCA	2N1183B	
Q16	Transistor, Power	Motorola	MP1557	
R1	Resistor, Comp.,150 ohm, ±5%, 1/4W	Allen-Bradley	RC07GF151J	
R2	Resistor, Comp.,680 ohm, ±5%, 1/4W	Allen-Bradley	RC07GF681J	
R3	Resistor, Comp., 6.2 K, ±5%, 1/4W	Allen-Bradley	RC07GF622J	
R4	Resistor, Comp.,820 ohm, ±5%, 1/4W	Allen-Bradley	RC07GF821J	
R5	Resistor, Comp., 1.2 K, ±5%, 1/4W	Allen-Bradley	RC07GF122J	
R6	Same as R5			
R7	Same as R3			
R8	Same as R2			

* Use on 100849-1

PARTS LIST - 100850 POWER SUPPLY

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R9	Resistor, Comp., 47 ohm, ±5%, 1/4W	Allen-Bradley	RC07GF470J	
R10	Resistor, Comp., 220 ohm, ±5%, 1/4W	Allen-Bradley	RC07GF221J	
R11	Resistor, Comp., 3.3 K, ±5%, 1/4W	Allen-Bradley	RC07GF332J	
R12	Resistor, W.W., 1.5 ohm, 1/4W, ±5%	IRC	Type BWH	
R13	Resistor, Comp., 68 ohm, ±5%, 1/4W	Allen-Bradley	RC07GF680J	
R14	Resistor, Comp., 22 ohm, ±5%, 1/4W	Allen-Bradley	RC07GF220J	
R15	Same as R12			
R16	Resistor, Comp., 2.2 K, ±5%, 1/4W	Allen-Bradley	RC07GF222J	
R17	Resistor, Comp., 10 K, ±5%, 1/4W	Allen-Bradley	RC07GF103J	
R18	Same as R17			
R19	Resistor, Comp., 100 ohm, ±5%, 1/4W	Allen-Bradley	RC07GF101J	
R20	Same as R19			
R21	Resistor, Comp., 470 ohm, ±5%, 1 W	Allen-Bradley	RC32GF471J	
R22	Resistor, Comp., 1 K, ±5%, 1W	Allen-Bradley	RC32GF102J	
R23	Resistor, Comp, 270 ohm, 1/4W	Allen-Bradley	RC07GF271J	
R24	Resistor, Film, 1.5K, ±1%, 1/4W	Texas Inst.	RN60B	
R25	Resistor, Film, 1.78K, ±1%, 1/4W	Texas Inst.	RN60B	
R26	Resistor, Comp.,330 ohm, ±5%, 1/4W	Allen-Bradley	RC07GF331J	
R27	Resistor, W.W., 350 ohm, ±5%, 5W	Sprague	Type 27E	*
R28	Same as R16			

* Use on 100849-1

PARTS LIST - 100850 POWER SUPPLY

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
T1	Transformer, Power	Redcor	100842	
TB1	Terminal Barrier Strip	Kulka	600A-4	
TB2	Terminal Barrier Strip	Kulka	600A-6	
TB3	Same as TB1			

INSTRUCTION MANUAL

FOR

MODEL 276 SAMPLE & HOLD

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SECTION I

DESCRIPTION, SPECIFICATIONS & INSTALLATION

1.1 Description and Purpose

1.2 Description - The Model 276 Sample and Hold covers a diverse range of application requiring the sampling then holding of input voltages. The more predominant application of the device is in providing a narrow aperture sample followed by successive conversion into digital format by analog to digital converters.

The aperture size will determine the accuracy of the particular value required when sampling fast moving waveforms.

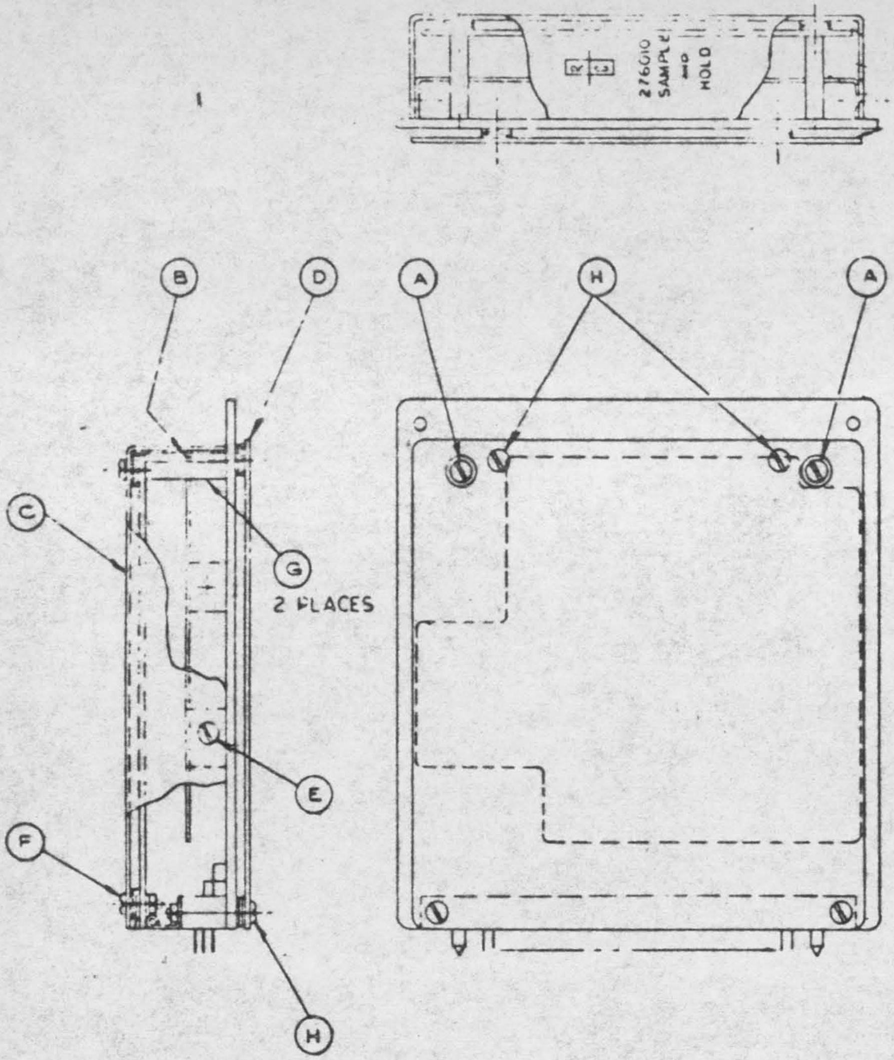
1.3 Special Features - The 276 Sample and Hold can be used as an operational amplifier when in the sample condition and exhibits all of the properties of an operational amplifier, i.e., easy gain change, zero offsetting, summation, impedance buffering, etc.

The sample and hold commands are independently connected via transformers such that isolation between both command lines and ground is achieved.

1.4 Specifications

1.5 Physical Specifications - Physical configuration of the 276 is shown in Figure 1.1. The completed device consists of two etched circuit boards coupled electrically by jumper and mechanically by means of a hinged bracket.

REV	REVISIONS	DRAWN	APP	DATE
	[redacted]			



DIS-ASSEMBLY INSTRUCTIONS

SIZE	NO.	REV
C	276015	A
SH 1 OF 1		

TO REMOVE SHIELD SET COMPLETELY, FOLLOW STEPS LISTED BELOW. FOR ASSEMBLY, REVERSE PROCEDURE. NOTE SPACER USEAGE CAREFULLY FOR ASSEMBLY.

1. REMOVE SCREWS (A) AND OPEN PACKAGE.
2. REMOVE SCREWS (E) AND CAREFULLY LIFT OUT SHIELD (B).
3. REMOVE SCREWS (F) AND SPACERS (G). THIS PERMITS REMOVAL OF SHIELD (C). NOTE THAT BOARD MUST BE WELL SUPPORTED AS SCREWS (F) FASTEN BOARD TO HINGE. NOW RE-INSTALL (2) SCREWS (F) FASTENING BOARD TO HINGE.
4. REMOVE SCREWS (H) AND COVER (D). NOTE BOARD MUST BE WELL SUPPORTED AS SCREWS (H) SECURE BOARD & CONNECTOR TO HINGE. RE-INSTALL (2) SCREWS (H) FASTENING BOARD & CONNECTOR TO HINGE.

THE UNIT IS NOW ACCESSIBLE FOR SERVICE. EXERCISE CARE IN HANDLING THE INTER-CONNECTION CABLING AS EXCESSIVE FLEXING WILL CAUSE FATIGUE OF THE CABLE CONNECTIONS.

NOTE: UNLESS OTHERWISE SPECIFIED

FIGURE 1.1

ITEM	QTY	PART NO.	DESCRIPTION	MFG	REF DESIG

PARTS LIST

276010	DRAWN S.A. HALL, DATE 3-4-63	REDCOR CORPORATION	CANOGA PARK, CALIFORNIA	
NEXT ASSY / USED ON	CHECKED	MODEL 276010	SCALE FULL	DO NOT SCALE DRAWING
THIS DRAWING CONTAINS INFORMATION PROPRIETARY TO THE REDCOR CORP AND MAY NOT BE REPRODUCED OR USED FOR OTHER THAN MAINTENANCE PURPOSES WITHOUT PRIOR WRITTEN PERMISSION FROM AN OFFICER OF THE ABOVE FIRM.	K WATANABE	TITLE 276010, DIS-ASSEMBLY INSTRUCTIONS	C	276015

2 (276

1.5 (continued)

The Model 276 may be disassembled by first removing screws A, indicated by Figure 1.1. Further disassembly entails removing the shield set, items B, C and D. This procedure is lengthy and should not be attempted unless repairs are otherwise impractical to carry out.

The 276 mounts in the standard REDCOR Corporation 100925 and 100775 chassis and requires 3 module spaces.

Input/output connections are made via a 50 pin connector.

1.6 <u>Adjustments</u> - Two adjustments are visible from the top and are the zero adjustment, which adjusts the DC output level of the amplifier when in the sample mode, and the balance adjustment, only operative in the hold mode, which alters the slope or balance of the voltage hold in the internal storage of the device.

1.7 <u>Electrical Characteristics</u>

Gain:	-1 Minimum, -10 Maximum
Accuracy:	±.02% at DC
Linearity:	±.01% at DC
Stability:	±.01% at DC
Bandwidth:	3db down at 50Kc/s 20 volts peak/peak output
Input Impedance:	100K ohms for Gain -1
Output Impedance:	100 milliohms at DC, 10 ohms at 100KC
Noise:	2 MV Peak to Peak Maximum

1.7 (continued)

Output:	±10V at ±10 Milliamps.
Output Load:	2K ohm in parallel with 500 PF
Overload Recovery Time:	150 Milliseconds
Settling time:	10 Microseconds to 0.01%
Sample time:	10 Microseconds Minimum
Hold time:	100 Microseconds Maximum
Aperture time:	Less than 1 Microsecond
Drift:	±1 Millivolt, ±100 Microvolts/°C
Temperature range:	0 to +50°C
Power Requirements:	+12.5 60mA -12.5 60mA 1% regulation, noise less than 10mV RMS

1.8 Installation - Installation will normally occur in one of REDCOR Corporation standard module cases 100775 or 100925, or in a self contained 278 sample and hold case.

The installation precautions to be observed are that the 50 pin connector is correctly aligned and that no pins are bent out of alignment.

1.9 Interconnections - System interconnections are made via the 50 pin connector and the inputs and outputs are tabulated below

Input	19
Output	39
Sample Controls	33, 32
Hold Controls	49, 48
+12.5	43
-12.5	44
GND	42

1.9 (continued)

The power supply gnd and input/output gnd are one and the same and care should be exercised to ensure no ground loops will occur and cause excessive noise.

1.10 Sample & Hold Pulse - The sample and hold pulse can be either polarity but a negative edge at 32 with respect to 33 will cause the device to switch to sample and similarly a negative edge at 49 with respect to 48 will cause the device to switch back to hold.

Note that if a long pulse is applied to the transformer inputs such that the core saturates the edge may not be transmitted through the transformers.

The control signals sometimes affect the hold balance level and the recommended pulse shape is a 10 volt level change with approximately 0.2μSec rise time.

SECTION II

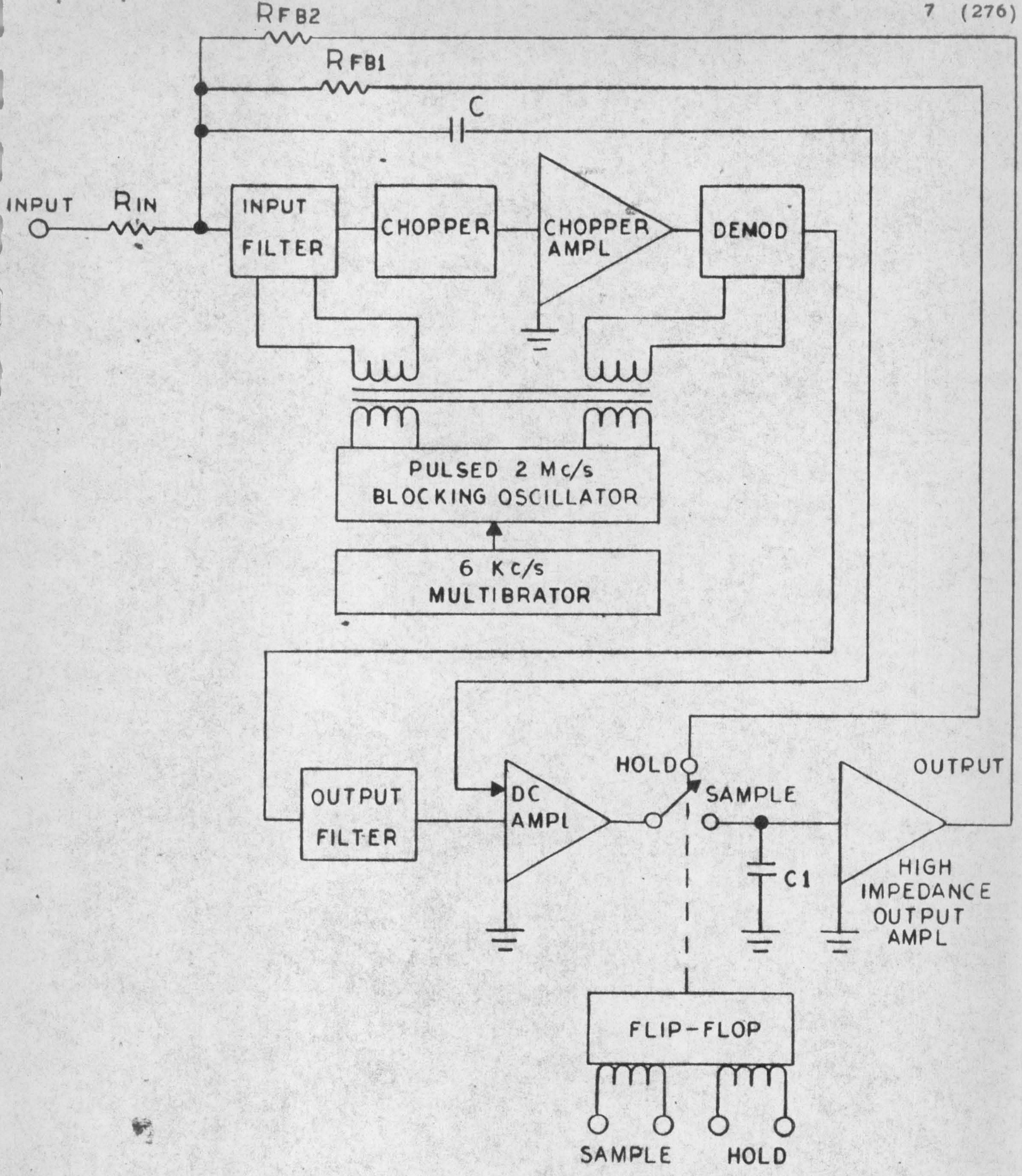
PRINCIPLES OF OPERATION

2.1 General Circuit Analysis

2.2 <u>Basic Principles of Operation</u> - The REDCOR Model 276 Sample and Hold operates in a single ended configuration. The device is a parallel loop chopper stabilized operational amplifier when in the sample condition (see Figure 2-1), and a buffered storage capacitor when in the hold condition.

2.3 The input signal passes through the input summing resistor R_{in} and then has two further parallel paths, one through the chopper amplifier loop for DC and low frequency AC signals, and one directly through C and the DC amplifier for high frequency signals. Capacitor C effectively blocks the DC bias of the DC amplifier from flowing into the summing node and the input and feedback resistors.

2.4 The output of the DC amplifier is connected via an electronic switch to either a storage capacitor C_1 when in the sample mode or to an auxiliary feedback resistor R_{FB1} when in the hold mode. The voltage on the storage capacitor is presented to the output via a high impedance DC amplifier such that with the electronic switch in the sample mode the high impedance amplifier is part of the forward loop of the operational amplifier with overall feedback provided by R_{FB2}.



BLOCK DIAGRAM
MODEL 276.SAMPLE & HOLD
FIGURE 2.1

2.4 (continued)

However, when the switch is in the hold mode, the output will be, via the buffer amplifier, the stored value on the capacitor while the remainder of the amplifier is still left connected in an operational configuration by means of R_{FB2}.

2.5 The state of the electronic switch is determined by a flip flop which has two inputs set to hold and set to sample. These two inputs are available for external control and are transformer coupled such that upon command the Model 276 may be made to sample and hold information occurring at its input terminal and present a held value which can be usefully used as an input to an analog to digital converter.

2.6 The solid state chopper modulates at a 6Kc/s rate the DC input signal appearing after the input filter. This chopped signal is then amplified and demodulated which produces a DC output proportional to the input.

This DC signal is then coupled through an output low pass filter and applied to the DC amplifier input.

The low pass filter reduces chopper hash and provides frequency stability by rolling off the response of the chopper loop.

2.7 The sample and hold gain can be calculated* in the same manner as for an operational amplifier.

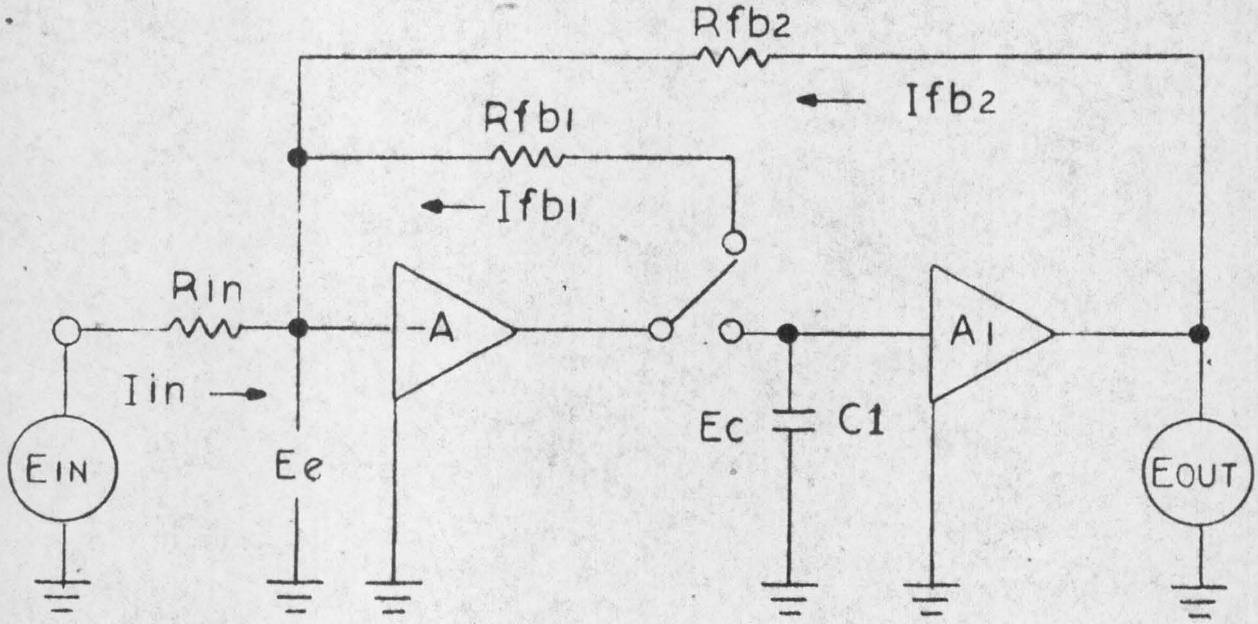


FIGURE 2.2

Thus the error voltage E_e appearing at the input node to the sample and hold will be given in equation (1).

$$E_e = \frac{E_{out}}{-A \times A1} \quad \ldots\ldots \quad (1)$$

With E_{out} limited to 10 volts and A x A1 in excess of 10^8, then

$$E_e = 0.1\mu\text{Volts}$$

* NOTE: When in the sample mode.

2.7 (continued)

This error voltage can be considered zero for all practical purposes, effectively placing the summing junction at ground potential. In this case then the feedback equations are:

$$\frac{E_{in}}{R_{in}} + \frac{E_{out}}{R_{fb2}} = 0 \qquad \ldots\ldots \quad (2)$$

This reduces to

$$\frac{E_{out}}{E_{in}} = \frac{-R_{fb2}}{R_{in}}$$ and is the closed loop

gain of the amplifier.

The voltage appearing at C_1 is then

$$\frac{E_{out}}{A_2} \qquad \ldots\ldots \quad (3)$$

Now in order to maintain stability when the sample and hold switches goes to hold, a feedback loop must be maintained around the first DC amplifier. The output amplifier already having feedback provided internally to give a gain of A1.

Thus, now the gain of the first amplifier must be equal to

$$\frac{E_c}{E_{in}} = \frac{R_{fb1}}{R_{in} \times A_1} \qquad \ldots \quad (4)$$

2.7 (continued)

The output amplifier has a closed loop gain of A_1.

The numerical values actually used in the 276 Sample and Hold are:

$R_{in} = 100K$, $R_{fb2} = 100K$, $R_{fb1} = 10K$, $A_1 = 10$,

$A = 10^7$

It is also important to note that in computing the gain of the amplifier the source resistance can be a significant factor. For 0.02% gain accuracy, for example, the maximum source resistance allowable is then 20 ohms.

2.8 Detailed Circuit Analysis

2.9 Chopper Amplifier Circuit Analysis - The chopper amplifier (Figure 2.3a & b) consists of an input low pass filter, solid state chopper, chopper amplifier, demodulator and output low pass filter. The chopper and demodulator are in turn driven by a floating 6Kc/s square wave which is derived from rectifying and filtering the pulsed 2Mc/s blocking oscillator outputs of the secondaries of T_1. The pulse rate is determined by a multivibrator running freely at approximately 6Kc/s.

2.10 Chopper Circuit - Transistor Q7 is effectively in series with the signal ground return via resistor R22 at the collector. A 6Kc square wave (derived from rectifying the 2Mc blocking oscillator waveform with CR8 and C11) is applied across resistors R23 and R24 between the base and collector of Q7. The square wave appearing at the base

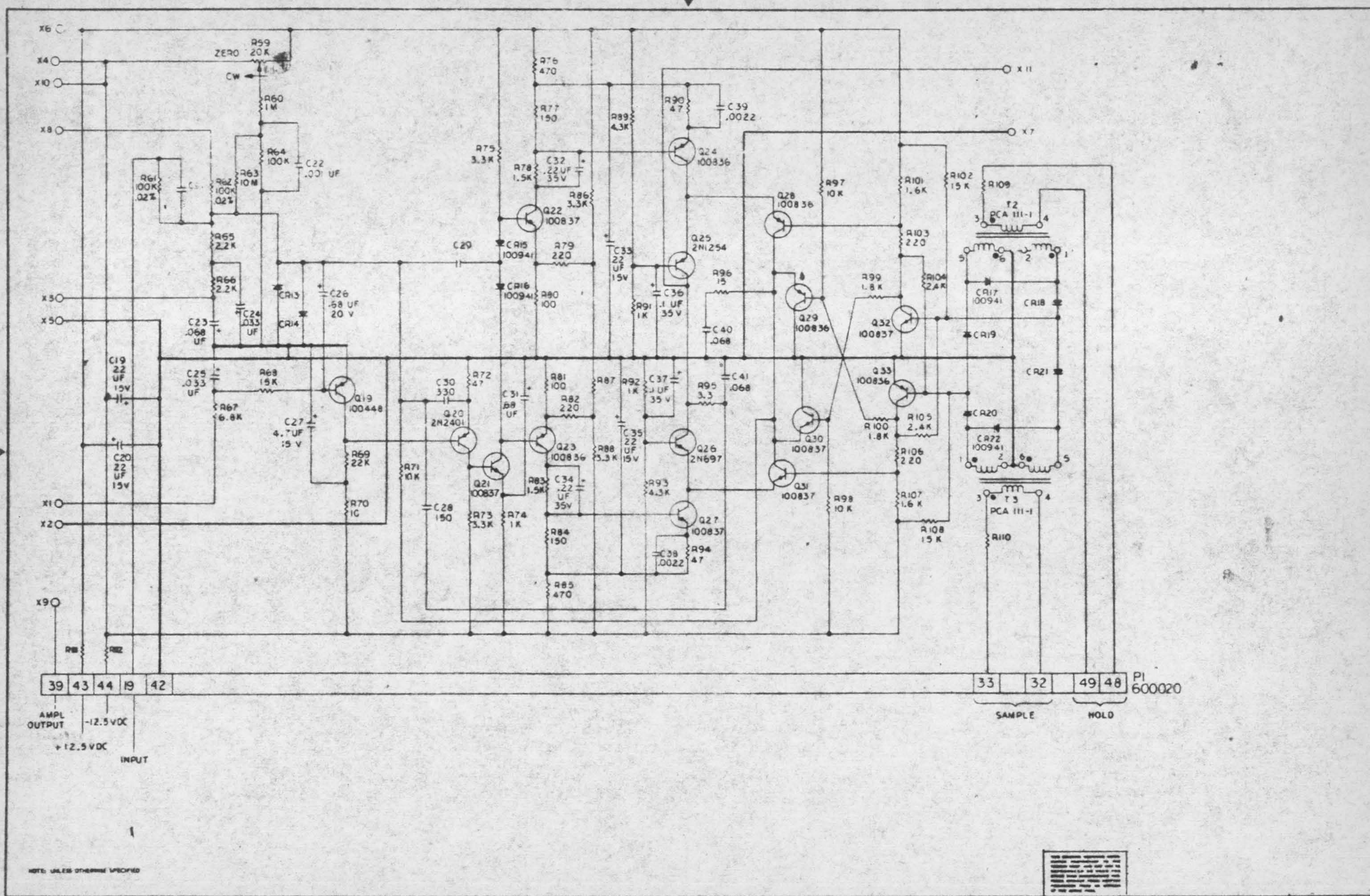
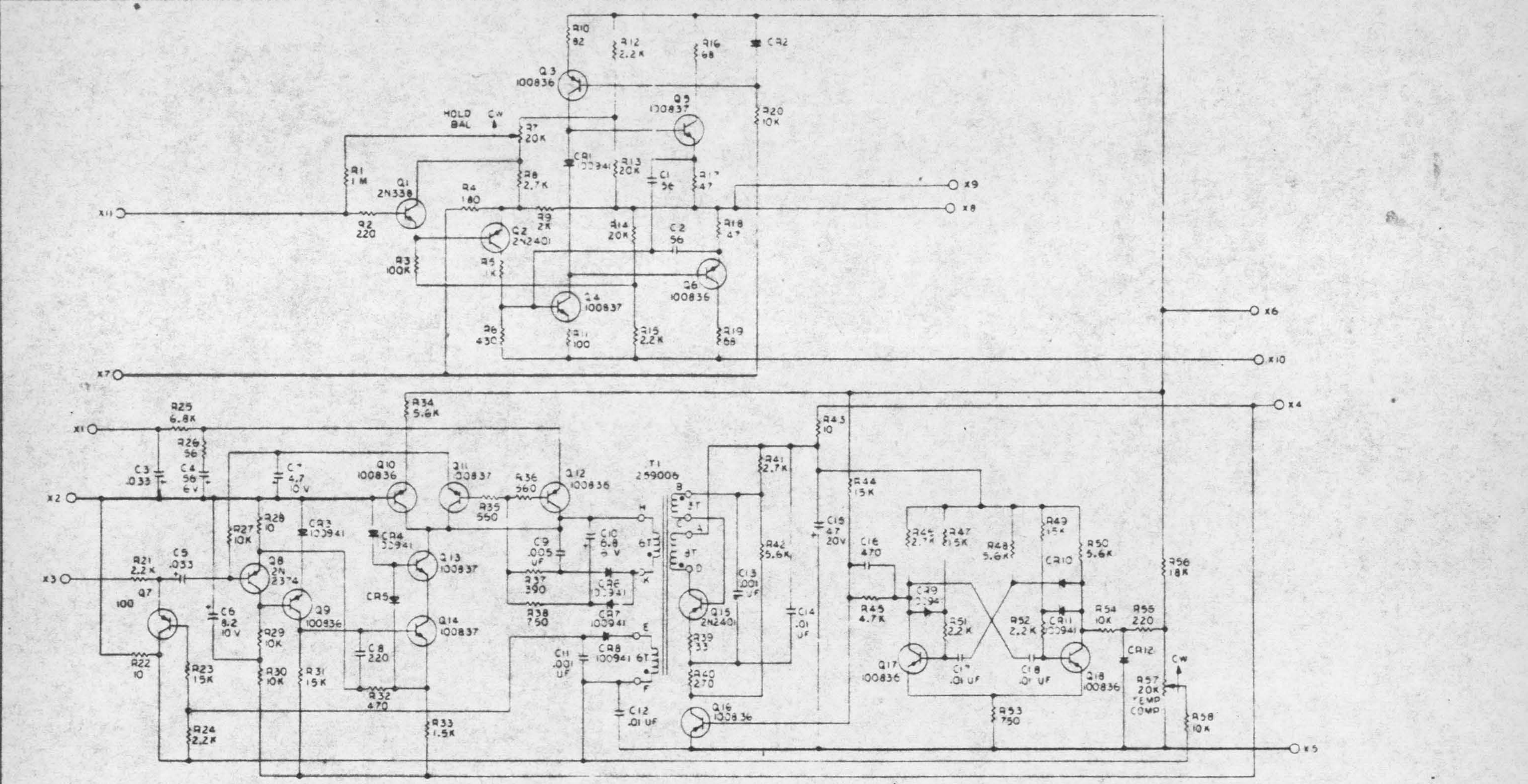


FIGURE 2.3a



3. ALL DIODES ARE REDCOR NO. 100780-1
2. ALL CAPACITOR VALUES ARE IN PICO FARADS.
1. ALL RESISTOR VALUES ARE IN OHMS. 1/4 WATT, ± 5%.
NOTE: UNLESS OTHERWISE SPECIFIED

REFERENCE DESIGNATIONS		
FIRST	LAST	DELETED
R1	R12	
C1	C41	
CR1	CR22	
Q1	Q33	
T1	T3	
P	P1	

FIGURE 2.3b

2.10 (continued)

alternately drives Q7 in and out of saturation effectively grounding the input to Q8 via capacitor C5 at a 6Kc rate to perform the chopper function.

2.11 Chopper Amplifier Circuit - The 6Kc modulated signal is amplified and inverted in Q8 which is self biased by resistor R28. Output from the collector of Q8 is directly coupled to the base of Q9, where it is again amplified and undergoes a second phase inversion. Capacitor C8 from the collector of Q9 to the emitter of Q8 provides feedback stabilization for the input stage. Diode CR3 establishes the emitter bias level for Q9, while the output from the collector is directly coupled to the base of Q14. Transistors Q13 and Q14 are in series, with the base of Q13 referenced by diode CR4. Transistor Q10 is operated in a common base configuration, which in turn provides a constant current supply to the series combination of Q13 and Q14. The output from the amplifier is taken at the common collector junction of Q13 and Q10 and applied to the common collector junction of Q11 and Q12.

2.12 Demodulator Circuit - Transistors Q11 & Q12 function as a balanced demodulator in conjunction with diodes CR7 & CR6. A 6Kc square wave derived from rectifying and filtering the 2Mc blocking oscillator waveform with diodes CR6 & CR7, and capacitors C9 & C10 having the same timing relationship to that of the chopperdrive waveform, is

2.12 (continued)

applied to the base junction of Q11 & Q12. Balance between the two transistors is maintained by resistors R35 & R36. The square wave at the base alternately drives the transistors in phase with the signal at the common collector junction. Output from the emitter of Q12 is then applied to the output low pass filter circuit R25, R26, C3, C4 to the output terminal X1 and then to board #2, Figure 2.3a, via X1 and R67, R68 and C25.

The output from emitter of Q11 is applied through R27 and C7 to provide DC bias stabilization within the chopper amplifier.

2.13 Output Low Pass Filter Circuit - The output signal from Q12 is filtered by a network partially contained on board #1 and the other on board #2, the interconnection between the assemblies being made via X1, Figures 2.3a and 2.3b.

The network comprises resistors R25, R26, R67 and R68 and capacitors C3, C4 and C25. The resultant signal is then applied to the base of Q19, the input transistor of the DC amplifier.

2.14 DC Amplifier Circuit Analysis - Transistors Q19, Q20 and Q21 are each grounded emitter amplification stages which each provide a phase reversal. The output collector load of Q21 comprises R75, CR15, and CR16, the bases of the complementary amplification collector stages Q22 and Q23 being driven from Q21 and CR15 and CR16 in series with the collector of Q21. The diodes CR15 and CR16 provide a means for biasing transistors Q22 and Q23.

2.14 (continued)

Further complementary amplification is provided by transistors Q24 and Q27, and Q25 and Q26. Q24 and Q27 outputs are such that via the collector connection of Q28 and Q31 respectively, these amplification stages can be made to turn on or off.

Transistors Q25 and Q26 are very low leakage silicon transistors such that when the collector junctions of Q24, Q28 and Q27 and Q31 are grounded, the respective transistors Q25 and Q26 are turned off disconnecting the common collector outputs of Q25 and Q26 from the storage capacitor C41.

2.15 Flip Flop and Switch Circuitry - Transistors Q28 and Q31 and capacitor C40 provides a dummy circuit to replace transistors Q25, Q26 and C41 when the flip flop consisting of transistors Q29, Q30, Q32 and Q33 change to the hold condition. In this condition transistors Q28 and Q31 replace Q25 and Q26 and capacitor C40 replaces C41 such that the amplifier consisting of transistors Q19 through Q27 will still be stable, both from the high frequency and DC chopper loop standpoint. Overall feedback is provided by resistor R71.

The flip flop is controlled via pulse transformer T3 and T2 and associated components.

The bias arrangement of the flip flop is such that an immediate turn on the flip flop will always be in the sample condition.

2.16 High Impedance Output Amplifier - Transistors Q1 through Q6 make up an amplifier whose input impedance is controlled to be very high via the silicon input transistor Q1 and potentiometric feedback via resistors R9 and R4. The output of the amplifier is taken from the complementary emitter follower output stage Q5 and Q6. Transistor Q2 is a grounded emitter amplifier followed by another grounded emitter stage Q4, the collector load being provided by transistor Q3.

2.17 Hold Balance Adjustment - Input current can be controlled by potentiometer R7 which in turn controls the hold balance of hold period, i.e., the positive or negative slope of the voltage held on capacitor C41. The input to the amplifier is via X11 and its output is via X9 and X8.

2.18 DC Zero Offset Circuits - The DC zero offset circuit is established by adjustment of potentiometer R59 between the ±12.5 volt power supply. The offset level of the amplifier is controlled via R59, R64 and R63, C22 providing a low pass filter to remove high frequency components.

2.19 Chopper Temp Compensation - The chopper adjustment is provided by potentiometer R57, R58 and R22; once set the potentiometer should not be adjusted unless Q7 is replaced. See maintenance for adjustment procedure.

2.20 Multivibrator Circuit - The multivibrator circuit develops approximately a 6Kc square wave which drives the chopper and demodulator circuits. Transistors Q17 and Q18 are connected in a common emitter configuration to form a free running multivibrator operating at a frequency of 6Kc. Output of this multivibrator is taken from the collector of Q17 through resistor R45 and applied to the base of transistor Q16 in the blocking oscillator circuit. Capacitor C16 provides a "speed up" function to improve the shape of the square wave.

2.21 Blocking Oscillator Circuit - Transistor Q16 is connected in series between the emitter of Q15 and ground. The 6Kc square wave input at the base of Q18 drives it alternately in and out of saturation, in turn triggering Q15 to produce a sharp burst of 2Mc pulses.

Transistor Q15 is connected in a conventional blocking oscillator configuration with transformer T1 providing regenerative feedback and coupling the output signals to the chopper and demodulator windings.

SECTION III

MAINTENANCE

3.1 General

3.2 Troubleshooting and Maintenance Philosophy -

The REDCOR Model 276 Sample & Hold is designed for extensive troublefree operation. This is accomplished by the use of solid-state circuitry throughout, permitting operation of low power supply potentials with the attendant reduction in heat generated within the amplifier. Troubleshooting involves following conventional signal tracing, waveform and voltage measurement techniques, to locate defective components.

3.3 Test Equipment Required for Maintenance -

Test equipment required for maintenance of the Model 276 Sample & Hold is tabulated in Table 3-1.

TABLE 3-1

TEST EQUIPMENT REQUIRED FOR MAINTENANCE

DESCRIPTION	MFG	MODEL NO.
Square wave generator: 60 cps, 1μSec min. rise time	Hewlett Packard	211A
Oscilloscope	Tektronix	502 or 531
Preamplifier (used with Model 531 oscilloscope)	Tektronix	Type D
Vacuum Tube Voltmeter	Hewlett Packard	425A

3.4 Trouble Analysis *

3.5 To locate a defective component within the amplifier perform the following measurements and waveform observations (Component location on the etched circuit board is shown on Figures 3.1 and 3.2).

a. Observe for 12.5 volt peak-to-peak square wave at junction of resistors R40 and R42: If correct waveform is not present, replace transistors Q16, Q17, or Q18 and associated components as necessary.

b. Observe for 3 volt peak-to-peak square wave at junction of resistors R23 and R24: If correct waveform is not present, replace transistor Q7, transformer T1 and associated components as necessary.

c. Perform the following three checks and record:

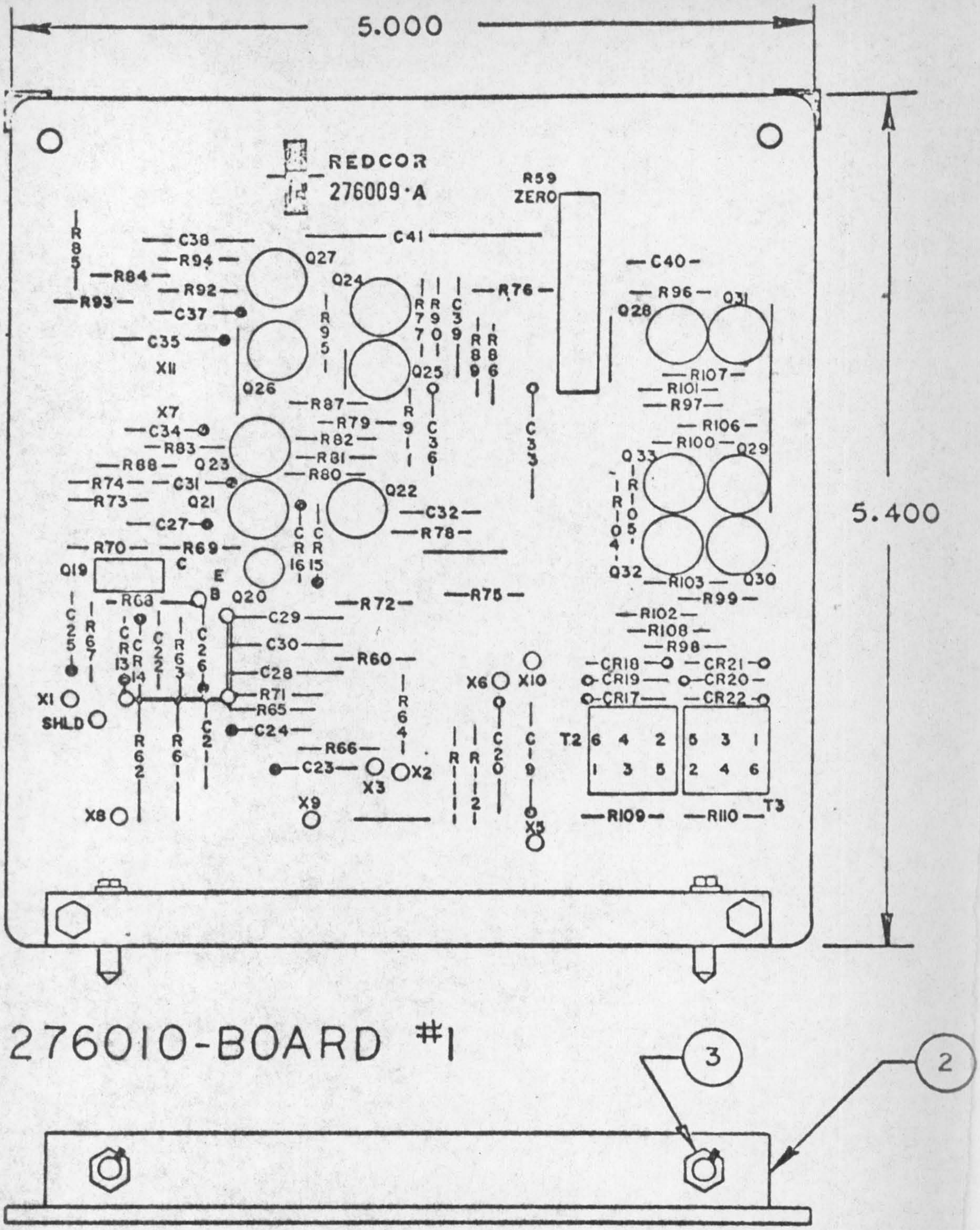
1. Observe for 0, ±100µv at junction of resistors R65 and R66.

2. Observe for -300, ±200 mv at junction of resistor R58 and capacitor C26.

3. Observe for 0, ±200 mv at output.

d. If result in "c1" was + and "c2" was -, or "c1" was - and "c2" was +, the trouble is in the chopper amplifier (transistors Q7 through Q12 and associated components). If "c2" was - and

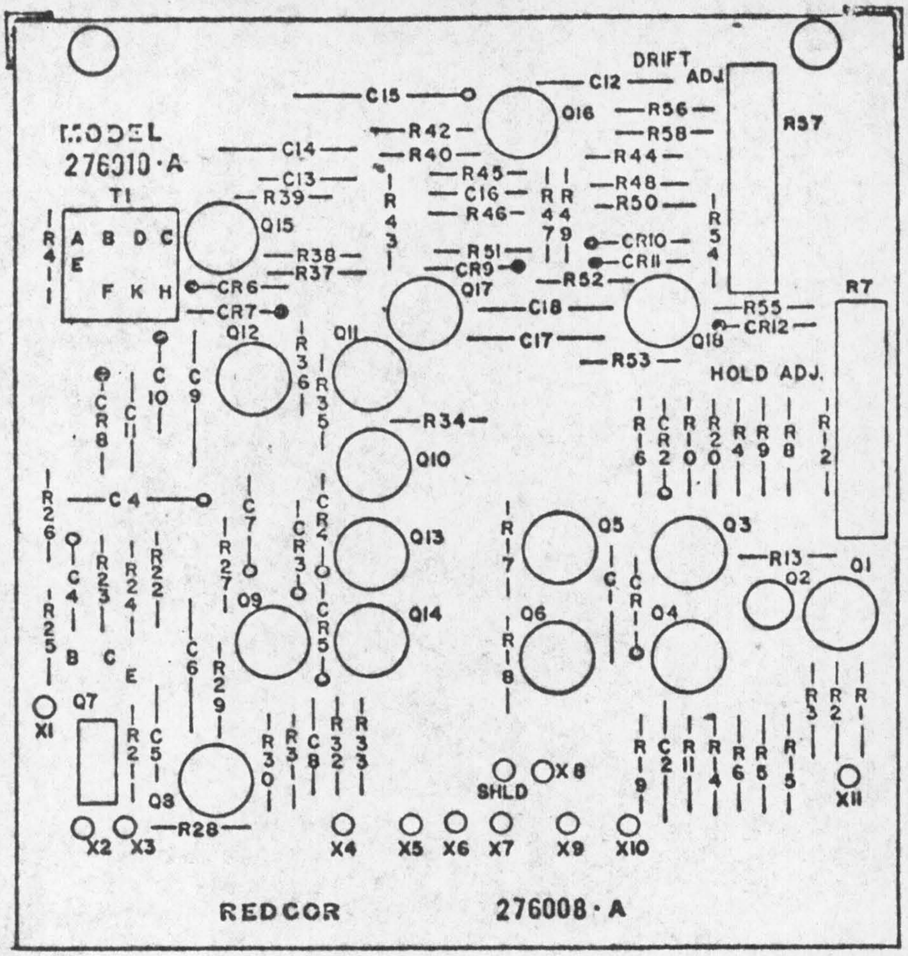
* NOTE: The Sample & Hold shall be in the sample mode for these tests except where otherwise stated.



276010
SAMPLE AND HOLD

Figure 3.1

REFERENCE DWGS: SCHEMATIC NO. 276000 PARTS LIST NO. 276009



276010 - BOARD #2

276010
SAMPLE AND HOLD

Figure 3.2

REFERENCE DWGS: SCHEMATIC NO. 276000, PARTS LIST NO. 276008

3.5 (continued)

"c3" was -, or "c2" was + and "c3" was +, the trouble is in the DC amplifier (transistors Q19 through Q33 and associated components), or high impedance amplifier transistors Q1 through Q6.

NOTE

In the above analysis, the designations + and - refer to voltages outside the tolerances specified.

3.6 Adjustments

3.7 Hold Level Offset - Ground the input to the sample and hold and apply trigger inputs to select repetatively at a 10Kc/s rate the sample and hold mode. The output of the sample and hold should consist of 100μSec of white noise followed by a hold period of slightly lower noise. The level at the end of the 100μSec period should deviate from the next sample period by less than 1mV. If this is not so, the level can be adjusted by means of R7.

If the held level is offset by more than 1mV at the beginning of the hold time, first check the rise time and amplitude of the trigger signals to the sample and hold circuitry. Should these be correct, then transistors Q28 and Q31 may be suspected or associated transistors Q29, Q30, Q32 and Q33.

3.8 Chopper Offset - The chopper offset potentiometer, R57, does not require adjustment unless transistor Q7 is changed. The potentiometer is located on board #2 above the hold adjust potentiometer, and is accessible after the cover is removed. To make this adjustment a heating probe is required, fabricate as shown in Figure 3.3.

3.9 To adjust the chopper offset level proceed in accordance with the following instructions:

a. Ground input to the amplifier by means of a shorting connector at the input and connect the VTVM to the output connector.

b. Apply power to amplifier and record output level of VTVM.

c. Employing the heating probe carefully remove transistor Q7 from the retaining clip and apply heat until a temperature of approximately 55° C (131°F) is reached; record output level on VTVM.

d. Adjust potentiometer R57 until output level on VTVM is the same as that obtained in step "b".

e. Allow Q7 to cool to ambient room temperature and repeat steps "b" through "d" until the VTVM reading changes less than 1/5 of the temperature coefficient of drift (refer to Paragraph 1.7) as Q7 is heated.

f. The DC Zero offset (potentiometer R59) may now be used to zero the amplifier.

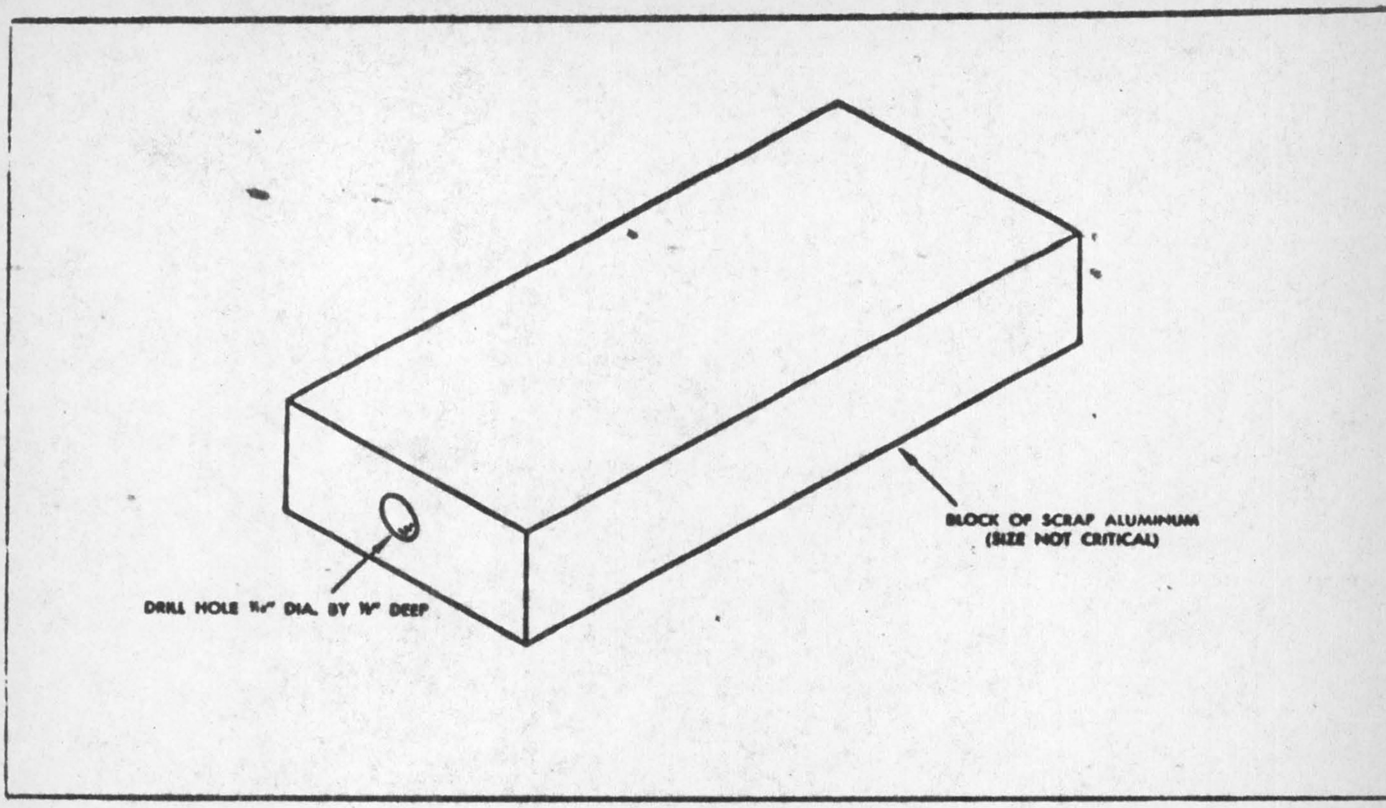


Figure 3.3 Heating Probe

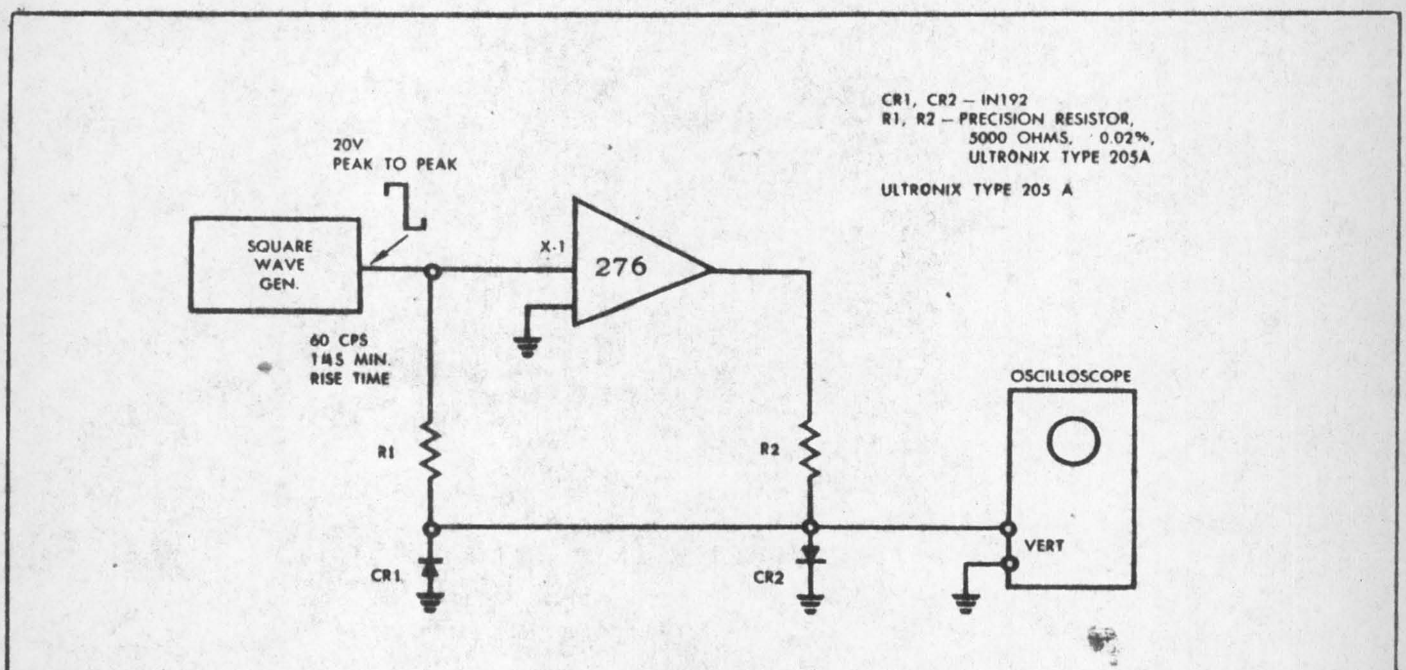


Figure 3.4 Test Setup - Model 276 Sample & Hold

3.10 Settling Time - A settling time adjustment C21 is provided on the Model 276 Sample and Hold. This is a factory setting and should not require adjustment unless the gain resistors are changed. Adjustment or checking of the settling time is accomplished in accordance with the following instructions:

a. Connect the Model 276 Sample and Hold and test equipment as shown in Figure 3.4.

b. Adjust capacitor C21 until settling time is within tolerances specified in Paragraph 1.7.

NOTE

If gains other than x-1 are used in making the settling time adjustment, value of the precision resistors in Figure 3.4 must be changed to obtain a null at the oscilloscope input.

PARTS LIST

MODEL 276 SAMPLE & HOLD

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Mica, 56 PF	Micamold	MCM10D560K	
C2	Same as C1			
C3	Capacitor, Tantalum, .033 MFD, 35 V	Texas Inst.	SCM333F$_1$P035K4	
C4	Capacitor, Tantalum, 56 MFD, 6V	Texas Inst.	SCM566BP006K4	
C5	Same as C3			
C6	Capacitor, Tantalum, 8.2 MFD, 50V	Texas Inst.	SCM825BP020K4	
C7	Capacitor, Tantalum, 4.7 MFD, 10V	Texas Inst.	SCM475F$_2$P010K4	
C8	Capacitor,Cerafil,220 PF	Aerovox	MC80V221AM	
C9	Capacitor,Cerafil,.005 MF	Aerovox	MC80V502AM	
C10	Capacitor, Tantalum, 6.8 MFD, 6V	Texas Inst.	SCM685F$_2$P006K4	
C11	Capacitor,Cerafil,.001 MF	Aerovox	MC80V102AM	
C12	Capacitor,Cerafil,.01 MF	Aerovox	MC80V103AM	
C13	Same as C11			
C14	Same as C12			
C15	Capacitor, Tantalum, 47 MFD, 20V	Texas Inst.	SCM476GP020K4	
C16	Capacitor,Cerafil,470 PF	Aerovox	MC80V471AM	
C17	Same as C12			
C18	Same as C12			
C19	Capacitor, Tantalum, 22MF, 15V	Texas Inst.	SCM226BP015K4	
C20	Same as C19			
C21	Capacitor, Selected			
C22	Same as C11			
C23	Capacitor, Tantalum, .068MF, 35V	Texas Inst.	SCM683F$_1$P035K4	

PARTS LIST

MODEL 276 SAMPLE & HOLD

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C24	Same as C3			
C25	Same as C3			
C26	Capacitor, Tantalum, .68MF, 35V	Texas Inst.	$SCM684F_2P035K4$	
C27	Capacitor, Tantalum, 4.7MF, 35V	Texas Inst.	SCM475BP035K4	
C28	Capacitor, Mica, 150 PF	Arco	CM15E151J	
C29	Same as C1			
C30	Capacitor, Mica, 330 PF	Arco	CM15E331J	
C31	Same as C26			
C32	Capacitor, Tantalum, .22MF, 35V	Texas Inst.	$SCM224F_2P035K4$	
C33	Same as C19			
C34	Same as C32			
C35	Same as C19			
C36	Capacitor, Tantalum, .1MF, 35V	Texas Inst.	$SCM104F_1P035K4$	
C37	Same as C36			
C38	Capacitor,Cerafil,.0022PF	Aerovox	MC80222AM	
C39	Same as C38			
C40	Capacitor, Mylar, .068 MF, 50V	Goodall	Type 602, Style 2	
C41	Capacitor, Mylar, .068 MF, 100V	Hopkins	1P1683C	
CR1	Diode, Germanium	Redcor	100941	
CR2	Diode, Silicon	Redcor	100780-1	
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR2			

PARTS LIST

MODEL 276 SAMPLE & HOLD

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Same as CR1			
CR9	Same as CR1			
CR10	Same as CR2			
CR11	Same as CR1			
CR12	Same as CR2			
CR13	Same as CR2			
CR14	Same as CR2			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR2			
CR19	Same as CR2			
CR20	Same as CR2			
CR21	Same as CR2			
CR22	Same as CR1			
Q1	Transistor	Texas Inst.	2N338	
Q2	Transistor	Philco	2N2401	
Q3	Transistor, PNP	Redcor	100836	
Q4	Transistor, NPN	Redcor	100837	
Q5	Same as Q4			
Q6	Same as Q3			
Q7	Transistor, Red	Redcor	100448	
Q8	Transistor	Philco	2N2374	
Q9	Same as Q3			
Q10	Same as Q3			
Q11	Same as Q4			

PARTS LIST

MODEL 276 SAMPLE & HOLD

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
Q12	Same as Q3			
Q13	Same as Q4			
Q14	Same as Q4			
Q15	Same as Q2			
Q16	Same as Q3			
Q17	Same as Q3			
Q18	Same as Q3			
Q19	Same as Q7			
Q20	Same as Q2			
Q21	Same as Q4			
Q22	Same as Q4			
Q23	Same as Q3			
Q24	Same as Q3			
Q25	Transistor	Hughes	2N1254	
Q26	Transistor	RCA	2N1711	
Q27	Same as Q4			
Q28	Same as Q3			
Q29	Same as Q3			
Q30	Same as Q4			
Q31	Same as Q4			
Q32	Same as Q4			
Q33	Same as Q3			
R1	Resistor, Comp., 1 Meg, 1/4W, ±5%	Allen-Bradley	RC07GF105J	
R2	Resistor, Comp., 220 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF221J	
R3	Resistor, Comp., 100K, 1/4W, ±5%	Allen-Bradley	RC07GF104J	
R4	Resistor, Comp., 180 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF181J	

PARTS LIST

MODEL 276 SAMPLE & HOLD

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R5	Resistor, Comp., 1K, 1/4W, ±5%	Allen-Bradley	RC07GF102J	
R6	Resistor, Comp., 430 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF431J	
R7	Resistor, Variable 20K	Bourns	200P-1-203	
R8	Resistor, Comp., 2.7K, 1/4W, ±5%	Allen-Bradley	RC07GF272J	
R9	Resistor, Comp., 2K, 1/4W, ±5%	Allen-Bradley	RC07GF202J	
R10	Resistor, Comp., 82 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF820J	
R11	Resistor, Comp., 100 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF101J	
R12	Resistor, Comp., 2.2K, 1/4W, ±5%	Allen-Bradley	RC07GF222J	
R13	Resistor, Comp., 20K, 1/4W, ±5%	Allen-Bradley	RC07GF203J	
R14	Same as R13			
R15	Same as R12			
R16	Resistor, Comp., 68 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF680J	
R17	Resistor, Comp., 47 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF470J	
R18	Same as R17			
R19	Same as R16			
R20	Resistor, Comp., 10K, 1/4W, ±5%	Allen-Bradley	RC07GF103J	
R21	Same as R12			
R22	Resistor, Comp., 10 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF100J	
R23	Resistor, Comp., 15K, 1/4W, ±5%	Allen-Bradley	RC07GF153J	

PARTS LIST

MODEL 276 SAMPLE & HOLD

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R24	Same as R12			
R25	Resistor, Comp., 6.8K, 1/4W, ±5%	Allen-Bradley	RC07GF682J	
R26	Resistor, Comp., 56 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF560J	
R27	Same as R20			
R28	Same as R22			
R29	Same as R20			
R30	Same as R20			
R31	Same as R23			
R32	Resistor, Comp., 470 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF471J	
R33	Resistor, Comp., 1.5K, 1/4W, ±5%	Allen-Bradley	RC07GF152J	
R34	Resistor, Comp., 5.6K, 1/4W, ±5%	Allen-Bradley	RC07GF562J	
R35	Resistor, Comp., 560 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF561J	
R36	Same as R35			
R37	Resistor, Comp., 390 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF391J	
R38	Resistor, Comp., 750 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF751J	
R39	Resistor, Comp., 33 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF330J	
R40	Resistor, Comp., 270 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF271J	
R41	Same as R8			
R42	Same as R34			
R43	Same as R22			
R44	Same as R23			

PARTS LIST

MODEL 276 SAMPLE & HOLD

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R45	Resistor, Comp., 4.7K, 1/4W, ±5%	Allen-Bradley	RC07GF472J	
R46	Same as R8			
R47	Same as R23			
R48	Same as R34			
R49	Same as R23			
R50	Same as R34			
R51	Same as R12			
R52	Same as R12			
R53	Same as R38			
R54	Same as R20			
R55	Same as R2			
R56	Resistor, Comp., 18K, 1/4W, ±5%	Allen-Bradley	RC07GF183J	
R57	Same as R7			
R58	Same as R20			
R59	Same as R7			
R60	Same as R1			
R61	Resistor, W.W., 100K, .02%	Redcor	101012-B-100001-A	
R62	Same as R61			
R63	Resistor, Comp., 10 Meg, 1/4W, ±5%	Allen-Bradley	RC07GF106J	
R64	Same as R3			
R65	Same as R12			
R66	Same as R12			
R67	Same as R25			
R68	Same as R23			
R69	Resistor, Comp., 22K, 1/4W, ±5%	Allen-Bradley	RC07GF223J	

PARTS LIST

MODEL 276 SAMPLE & HOLD

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R70	Same as R20			
R71	Same as R20			
R72	Same as R17			
R73	Resistor, Comp., 3.3K, 1/4W, ±5%	Allen-Bradley	RC07GF332J	
R74	Same as R5			
R75	Same as R73			
R76	Same as R32			
R77	Resistor, Comp, 150 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF151J	
R78	Same as R33			
R79	Same as R2			
R80	Same as R11			
R81	Same as R11			
R82	Same as R2			
R83	Same as R33			
R84	Same as R77			
R85	Same as R32			
R86	Same as R73			
R87	Not Used			
R88	Same as R73			
R89	Resistor, Comp., 4.3K, 1/4W, ±5%	Allen-Bradley	RC07GF432J	
R90	Same as R17			
R91	Same as R5			
R92	Same as R5			
R93	Same as R89			
R94	Same as R17			

PARTS LIST

MODEL 276 SAMPLE & HOLD

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R95	Resistor, M.Film, 3.3 ohm, 10%	Key	Series KC50	
R96	Resistor, M.Film, 15 ohm, 5%	Key	Series KC50	
R97	Same as R20			
R98	Same as R20			
R99	Resistor, Comp., 1.8K, 1/4W, ±5%	Allen-Bradley	RC07GF182J	
R100	Same as R99			
R101	Resistor, Comp., 1.6K, 1/4W, ±5%	Allen-Bradley	RC07GF162J	
R102	Same as R23			
R103	Same as R2			
R104	Resistor, Comp., 2.4K, 1/4W, ±5%	Allen-Bradley	RC07GF242J	
R105	Same as R104			
R106	Same as R2			
R107	Same as R101			
R108	Same as R23			
R109	Same as R5			
R110	Same as R5			
R111	Resistor, Selected			
R112	Resistor, Selected			
T1	Transformer	Redcor	259006	
T2	Transformer	PCA	111-1	
T3	Same as T2			

INSTRUCTION MANUAL

FOR

POWER SUPPLY 600035

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Canoga Park, Calif.

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List of Illustrations

POWER SUPPLY 600035

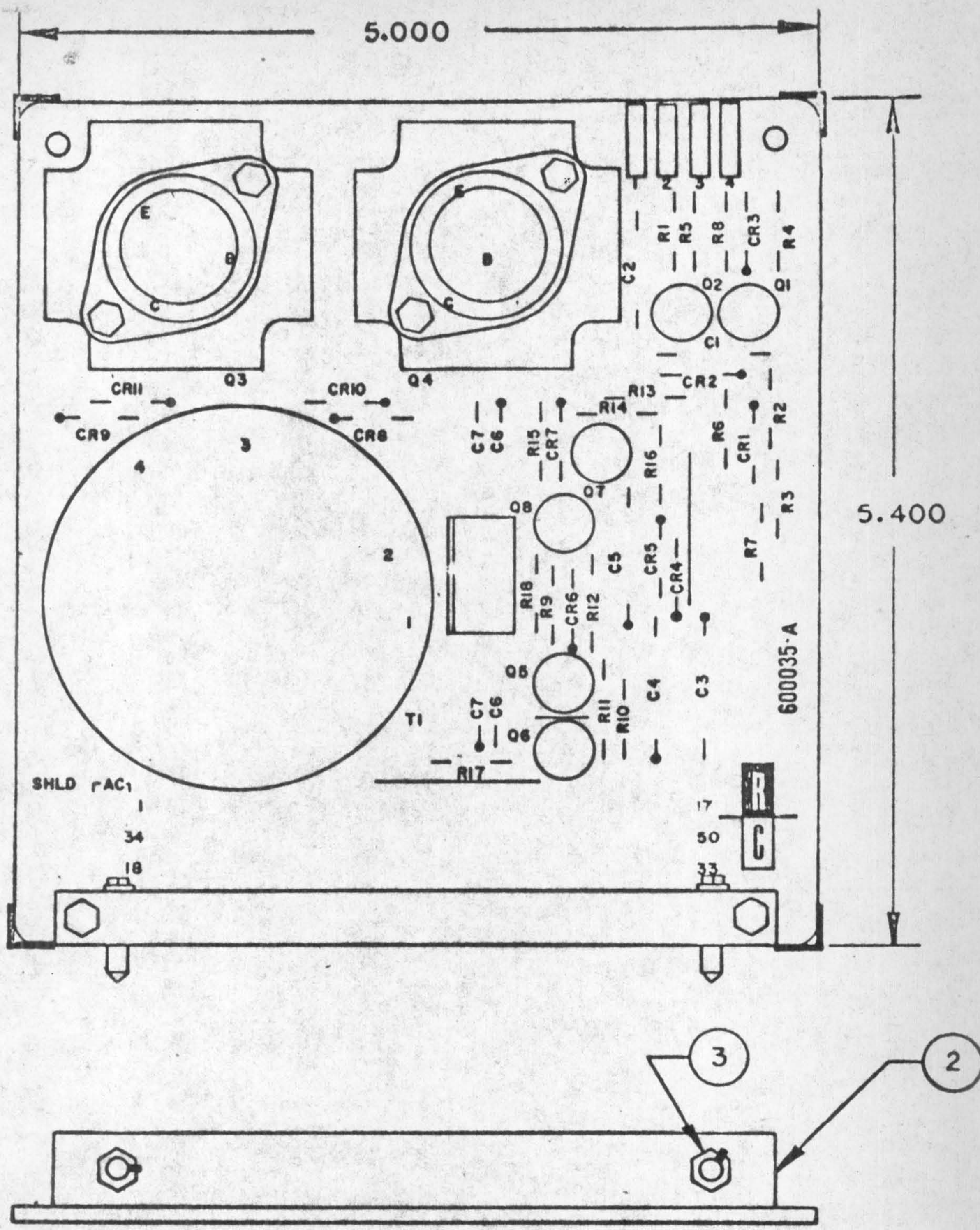
1.0 General Description

1.1 Mechanical - (See Figure 1.1) The power supply card is constructed on a 5" x 5.4" x .090 glass epoxy printed circuit board. All input output connections are made via a 50 pin connector mounted integrally with the printed circuit board. The completed assembly requires 2 card spaces in the Redcor Corporation 100775 and 100925 Module Cases.

1.2 Electrical - The power supply card derives power from a 60 cps 115VAC input and provides ±12.5VDC regulated power for general use in modular component construction. The power supply has, in addition a bistable multivibrator which serves as a frequency source for operating multivibrator power drivers.

1.3 Specifications -

Output voltages:	+12.5 volts -12.5 volts
Output loading:	150mA
Output ripple (120cps)	
No load:	5mV peak/peak
Full load:	10mV peak/peak
Regulation:	
No load/full load:	100mV



600035
POWER SUPPLY

Figure 1.1

REFERENCE DWGS: SCHEMATIC NO. 600036, PARTS LIST NO. 600034

1.3 (continued)

Line regulation	
103 - 126 AC	±100mV
Multivibrator output	
Voltage:	0 to -12.5 volts
Frequency:	5 - 7 Kc/s
Loading:	To gnd 1000 ohms
Input power:	115VAC 50-500cps
Isolation:	20μμfd
Mechanical size:	5" x 5.4" x 1"
Operating Temperature:	0 - 50°C
Connector type:	50 pin

1.4 Principle of Operation - The circuit diagram is as shown in Figure 1.2. The power supply consists of two parts, the regulated power supplies and multivibrator. The multivibrator is powered from the ±12.5 regulated power supply contained on the same circuit board.

1.5 Regulated Power Supply - The 115V AC (±10%) 50-600 cps power input is applied between pins 19 and 35 to the primary of the power transformer T, Pin 18 of the connector provides a shield ground for the input voltage. The center tapped secondary winding between pins 2 and 3 is connected across a fullwave bridge rectifier circuit consisting of diodes CR8, CR9, CR10 and CR11, with the center-tap forming the power ground reference point.

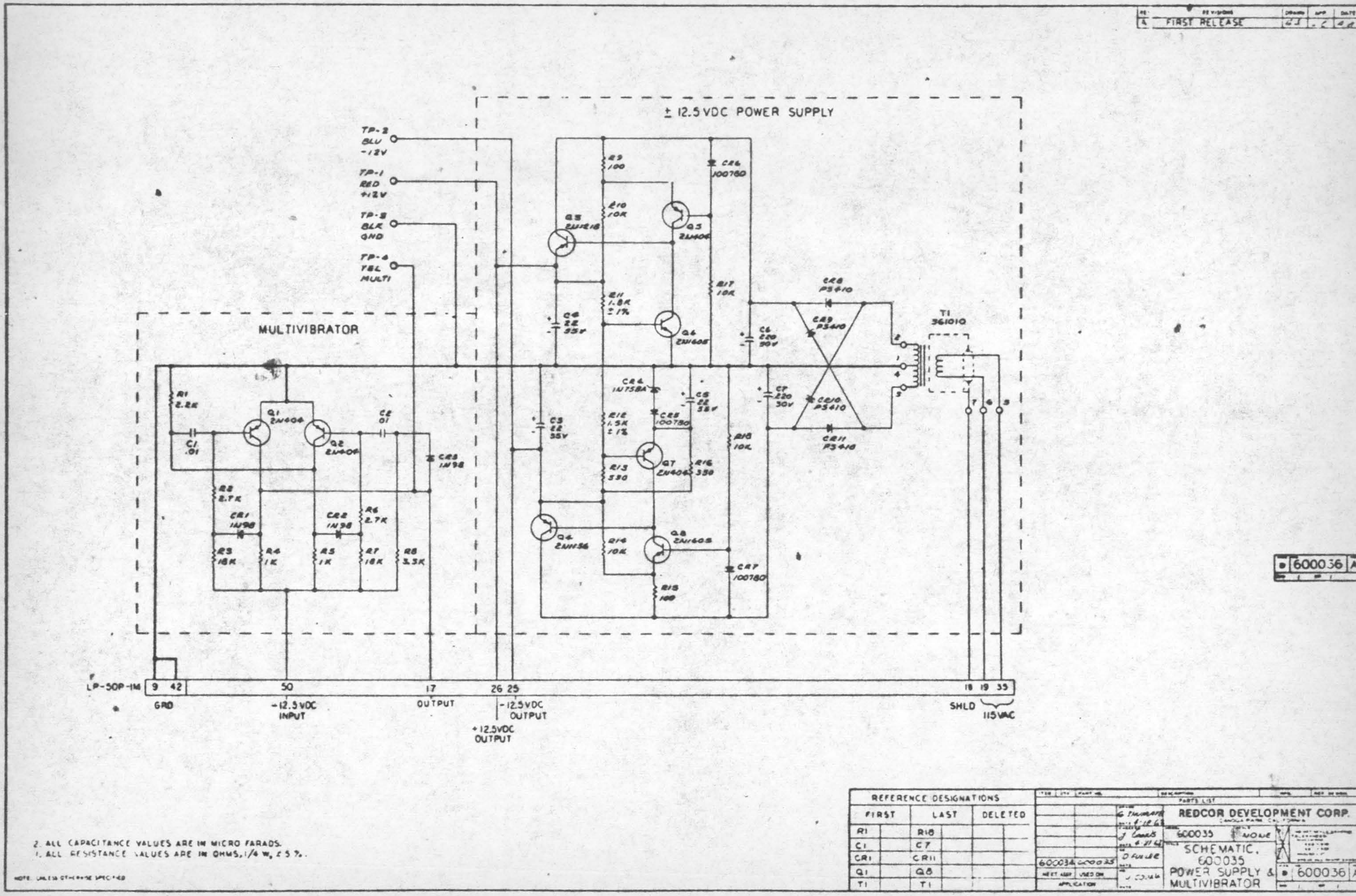

FIRST RELEASE
± 12.5 VDC POWER SUPPLY
MULTIVIBRATOR
TP-2 BLU -12V
TP-1 RED +12V
TP-3 BLK GND
TP-4 YEL MULTI
T1 361010
LP-50P-1M
GRD
-12.5VDC INPUT
OUTPUT
+12.5VDC OUTPUT
-12.5VDC OUTPUT
SHLD
115VAC
600036 A
2. ALL CAPACITANCE VALUES ARE IN MICRO FARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 W, ± 5 %.
NOTE: UNLESS OTHERWISE SPECIFIED
REFERENCE DESIGNATIONS
FIRST LAST DELETED
R1 R18
C1 C7
CR1 CR11
Q1 Q8
T1 T1
REDCOR DEVELOPMENT CORP.
SCHEMATIC, 600035 POWER SUPPLY & MULTIVIBRATOR
600034 600035

Figure 1.2

1.5 (continued)

the +12.5 DC output is taken from cathode junction of diodes CR8 and CR9 and filtered by capacitor C4 to remove the ripple component. Similarly the -12.5V DC output is taken from the anode junction of diodes CR10 and CR11, filtering being accomplished by capacitor C7.

The output voltages are series regulated by transistors Q3 and Q4 for the +12.5 and -12.5 volt DC outputs respectively. Transistors Q7 and Q8 function as the control amplifier with zener CR5 as the reference to the emitter of Q7.

Transistors Q3 and Q4 function as the control amplifier for the +12.5 power supply. The two power supplies are made to track each other by means of resistors R11, R12 and R13, overall feedback to both regulators also being provided by there resistors.

1.6 Multivibrator - Transistors Q1 and Q2 operate as a bistable multivibrator. The frequency of repetition is established by resistors R2 and R6 and capacitors C1 and C2 respectively. No power is normally connected to this circuit to reduce power drain; pin 50 must be connected to the -12.5 volts output at pin 25 in order to derive an output at pin 17.

1.7 Maintenance - One important note is that the two power supplies are referenced together such that any fault in the -12.5 supply will affect the +12.5.

The unregulated voltages may be measured at the common cathodes of CR 8 and CR9 and the common anode of CR10 and CR11, and should be ±15 volts ±1 volt.

1.8 Test Points

No of test points: 4

Test point 1 Red +12.5 volts
Test point 2 Blue -12.5 volts
Test point 3 Black Ground
Test point 4 Yellow Multivibrator

PARTS LIST

600035 POWER SUPPLY

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Disc .01 µF	Sprague	40C-387	
C2	Same as C1			
C3	Capacitor, Tantalum 22µF, 35V	Texas Inst.	SCM226GP035K4	
C4	Same as C3			
C5	Same as C3			
C6	Capacitor, 220 µF, 30V	Sprague	112D227C7030M1	
C7	Same as C6			
CR1	Diode, Germanium	Redcor	100941	
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Diode, Zener	Western Semiconductor	1N758A	
CR5	Diode, Silicon	Redcor	100780	
CR6	Same as CR5			
CR7	Same as CR5			
CR8	Diode, Rectifier, Ceramit	Redcor	101449	
CR9	Same as CR8			
CR10	Same as CR8			
CR11	Same as CR8			
P1	Connector, 50 Pin, Male	Redcor	600020	
Q1	Transistor	Redcor	100836	
Q2	Same as Q1			
Q3	Transistor	Sylvania	2N1218	
Q4	Transistor	Bendix	2N1136	
Q5	Same as Q1			
Q6	Transistor	Redcor	100837	
Q7	Same as Q1			
Q8	Same as Q6			

PARTS LIST

600035 POWER SUPPLY

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R1	Resistor, Comp., 2.2K 1/4W, 5%	Allen-Bradley	RC07GF222J	
R2	Resistor, Comp., 2.7K 1/4, 5%	Allen-Bradley	RC07GF272J	
R3	Resistor, Comp., 18K 1/4, 5%	Allen-Bradley	RC07GF183J	
R4	Resistor, Comp., 1K 1/4W, 5%	Allen-Bradley	RC07GF102J	
R5	Same as R4			
R6	Same as R2			
R7	Same as R3			
R8	Resistor, Comp., 3.3K 1/4W, 5%	Allen-Bradley	RC07GF332J	
R9	Resistor, Comp., 100ohm 1/4W, 5%	Allen-Bradley	RC07GF101J	
R10	Resistor, Comp., 10K 1/4W, 5%	Allen-Bradley	RC07GF103J	
R11	Resistor, M Film, W.W., 1.78K, ±1%	Redcor	101211-17800-A	
R12	Resistor, M Film, W.W., 1.5K, 1%	Redcor	101211-15000-A	
R13	Resistor, Comp., 330 OHM 1/4, 5%	Allen-Bradley	RC07GF331J	
R14	Same as R10			
R15	Same as R9			
R16	Same as R13			
R17	Same as R10			
R18	Same as R10			

INSTRUCTION MANUAL

FOR

MODEL 600330 & 600345

SERIES OF AMPLIFIERS

(Revised 2-7-64)

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I L L U S T R A T I O N S

T A B L E S

SECTION I
DESCRIPTION, SPECIFICATIONS AND INSTALLATION

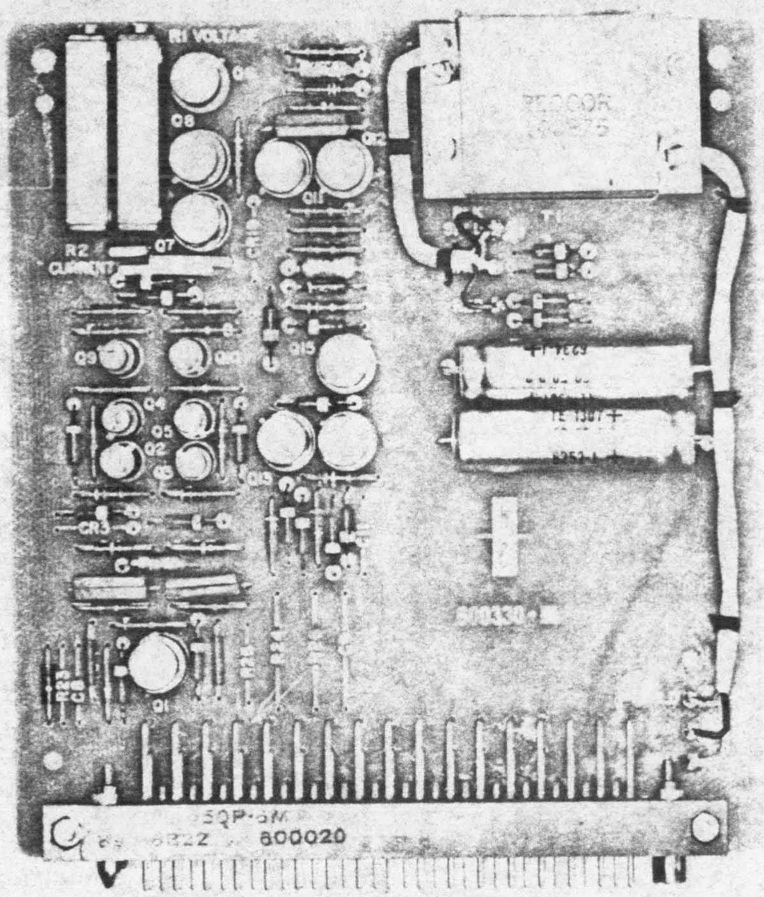
1.1 DESCRIPTION AND PURPOSE

1.2 Description - The REDCOR Model 600330 & 600345 Series of Amplifiers (Figures 1.1a & 1.1b) cover a diverse range of applications requiring wide-band accurate amplification. The amplifier employs solid state circuitry throughout.

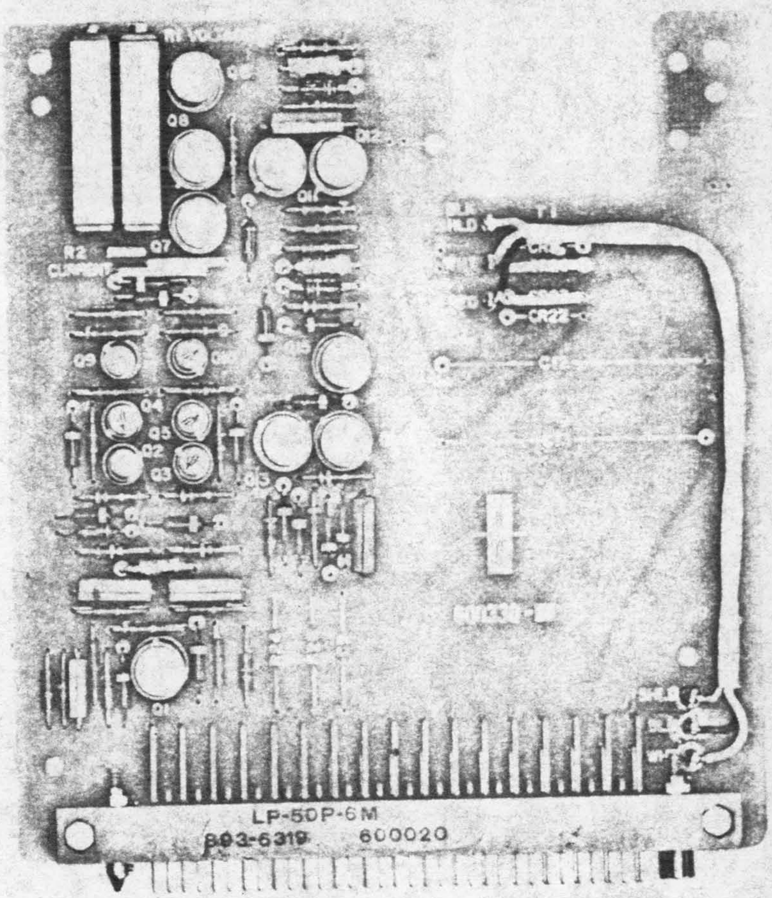
1.3 Special Features - The Model 600330 can be used as a single channel potentiometric DC amplifier, providing non-inverting gains of 1-10; as an operational amplifier with resistive or capacitive feedback; or as a differential amplifier of the balanced bridge type. The 600345-1 provides two channels identical to the 600330 and can be used in the same manner. The 600345-2 however, provides resistors to connect the two amplifiers together as a single dynamic bridge differential amplifier with the attendant increased performance characteristics. The assemblies are identical, however, only differing in the parts actually assembled onto the card. The applications are where impedance buffering, scaling or offsetting, integrating, ground isolation or low impedance output functions are required.

1.4 SPECIFICATIONS

1.5 Physical Specifications - Physical configuration of the amplifiers is shown in the Outline and Dimension Drawings (Figures 1.2a, 1.2b, 1.2c). Each consists of a single etched circuit board containing the electrical components.



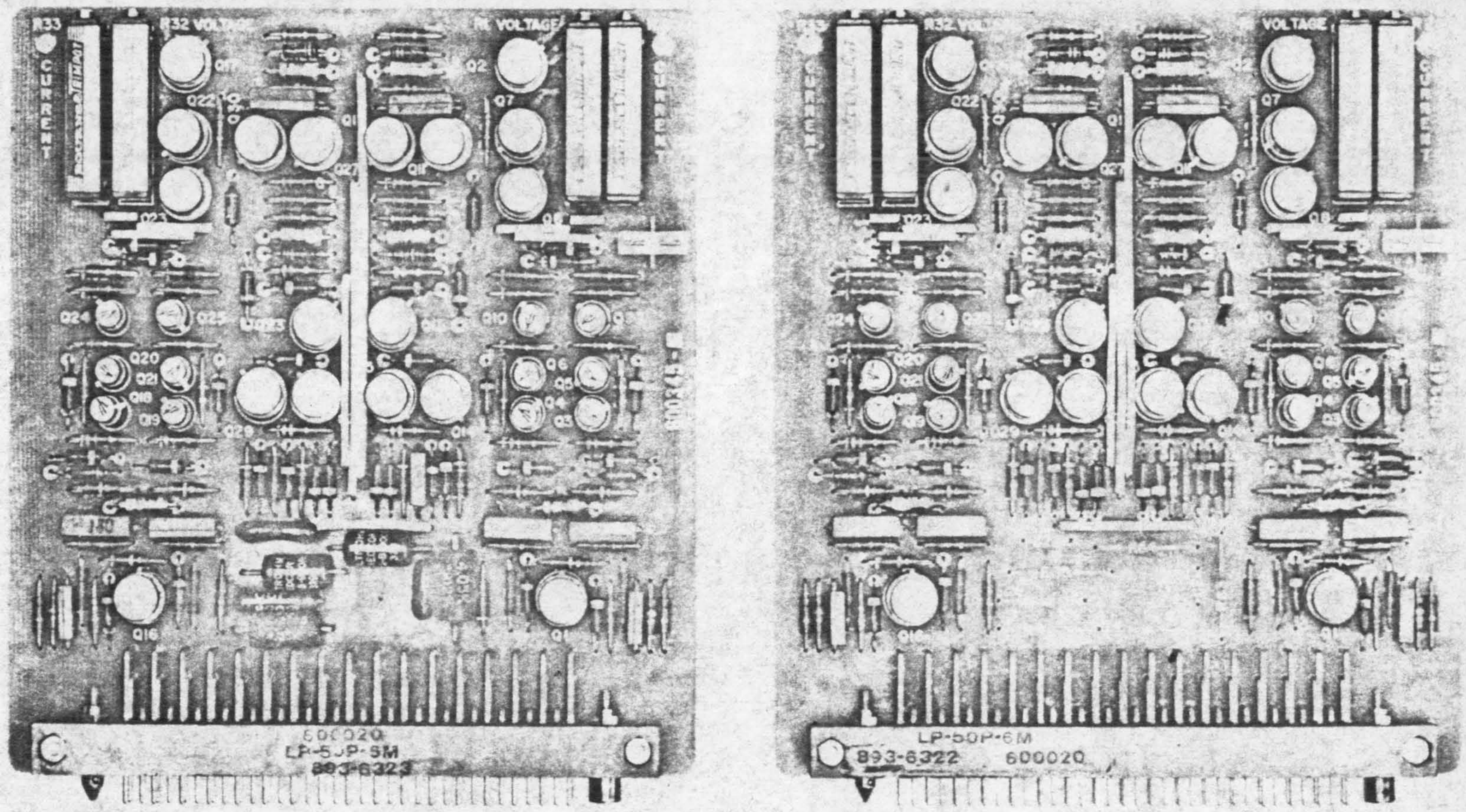
600330-1



600330-2

Figure 1.1a

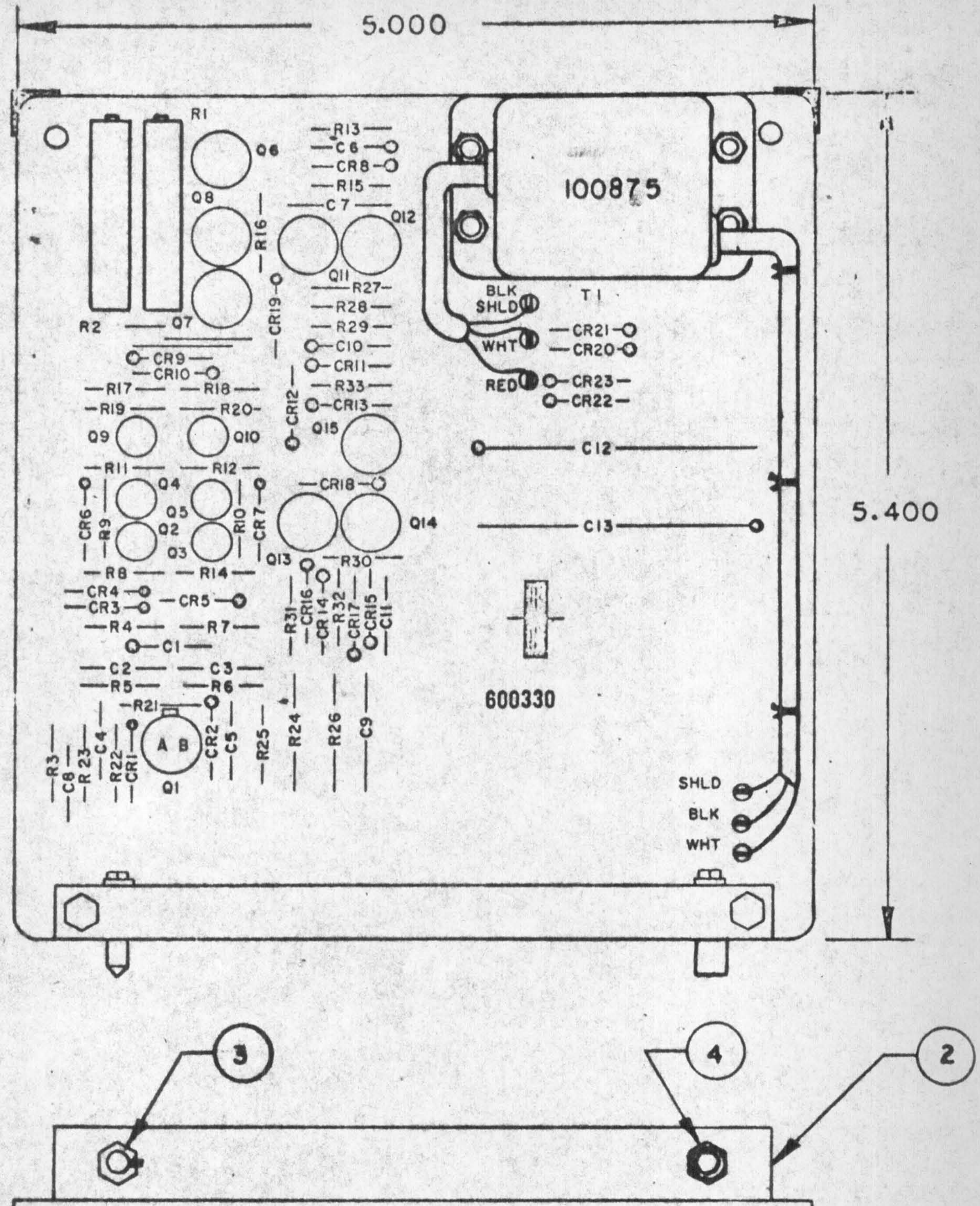
REDCOR CORPORATION



600345-2

600345-1

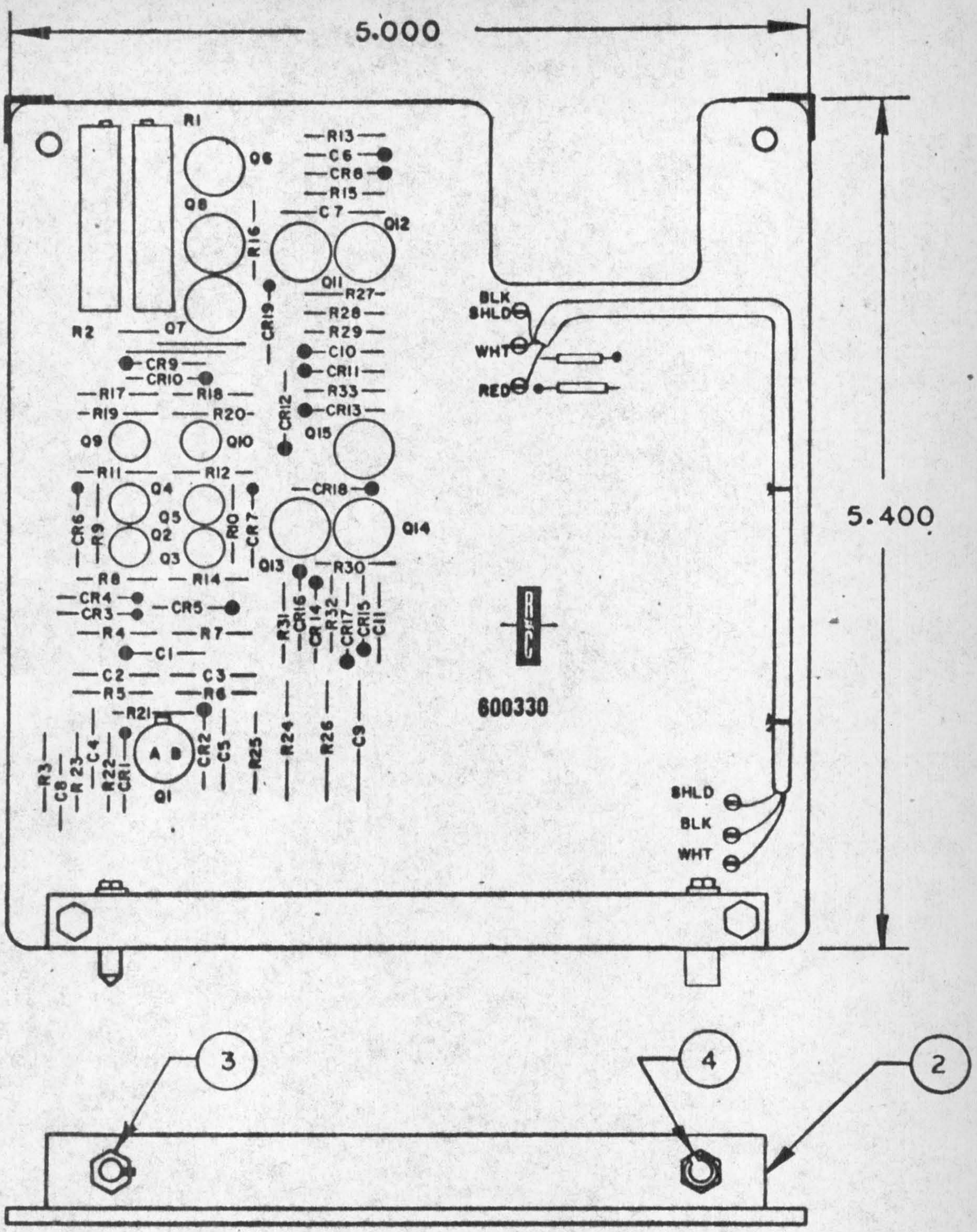
Figure 1.1b



600330 -1
GENERAL PURPOSE AMPLIFIER

Figure 1.2a

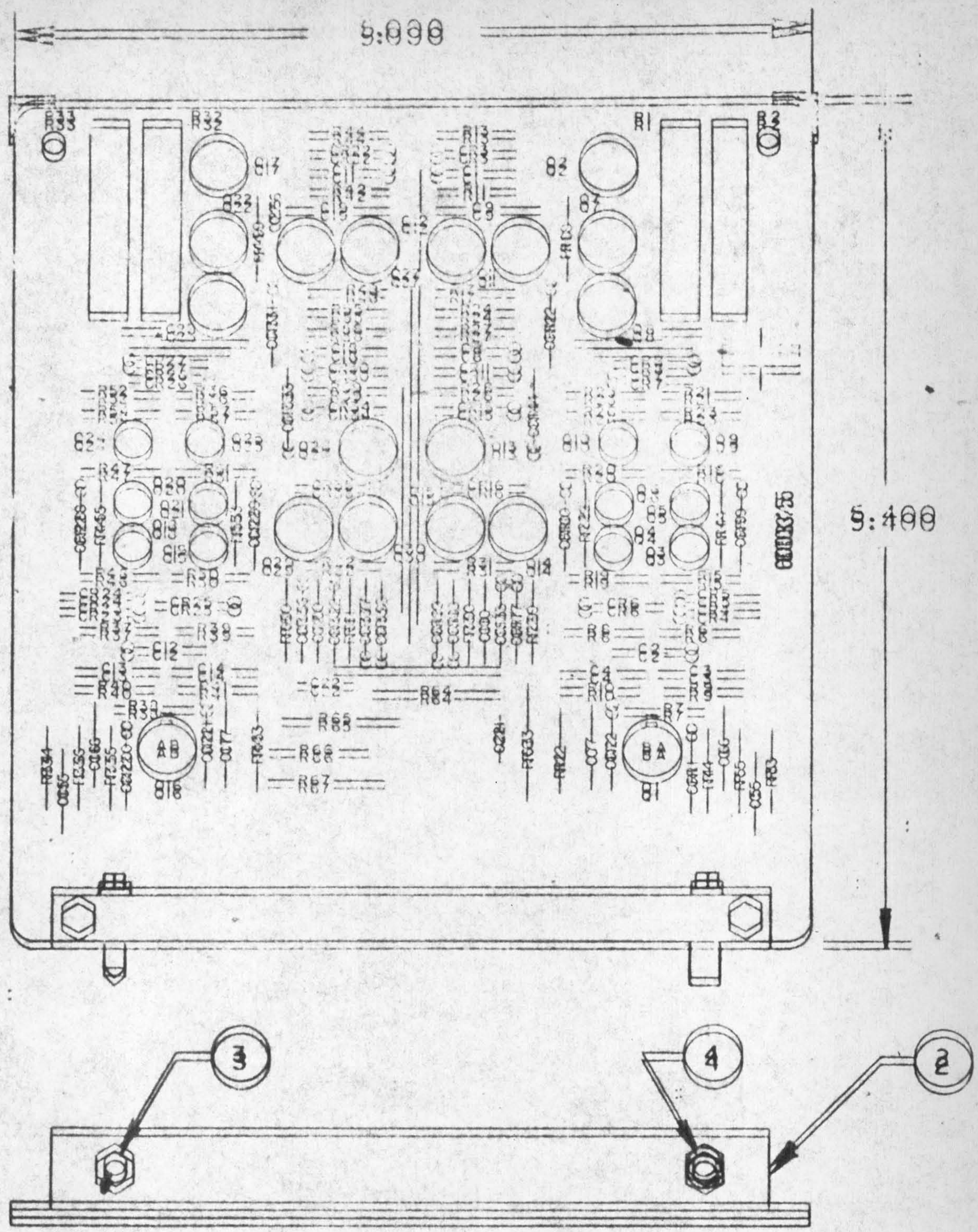
REFERENCE DWGS: SCHEMATIC NO. 600327 PARTS LIST NO. 600330



600330-2
GENERAL PURPOSE AMPLIFIER

Figure 1.2b

REFERENCE DWGS: SCHEMATIC NO. 600327 PARTS LIST NO. 600330



600345
DUAL AMPLIFIER

Figure 1.2c

REFERENCE DWGS: SCHEMATIC NO: 600349 PARTS LIST NO: 600345

1.6 Electrical Characteristics - Electrical characteristics of the Model 600330 and 600345 Amplifiers are tabulated in Table 1-1.

TABLE 1-1	
SPECIFICATIONS: REDCOR MODEL 600330 and 600345 (Potentiometric Configuration)	
Gain	+1 → +10 Single ended
Accuracy	±0.02% at DC
Linearity	±0.01% at DC
Stability	±0.01% at DC
Bandwidth	Down 3db at 200 Kc/s minimum
Drift	±300 microvolts referred to the output ±30 microvolts/°C temperature coefficient referred to input
Noise	0.5mV referred to the output, peak/peak 200μV referred to the input, DC to 200Kc/s
Input Impedance	1000 megohms minimum at DC
Input	
Current Injection	1 nanoamp at null 0.5 nanoamp/°C temperature coefficient
Source Resistance	All specifications apply for 0 to 5K
Settling Time	Full-scale step input: 10 microseconds to within 0.01% of final value
Output	±10 volts, ±10 milliamperes Unconditional short circuit proof
Loading (maximum)	500 micromicrofarads in parallel with 1 K
Impedance	100 milliohms at DC to 5 Kc/s 15 ohms at 200 Kc/s
Settling Time	Full-scale step load: 10 microseconds to within 0.01% of final value
	continued . . . .

TABLE 1-1 - (continued)	
Overload Conditions	20 volts input overload
Overload Recovery Time	10mV referred to the input, 50μSecs 1mV referred to the input, 500μSecs 100μV referred to the input, 1mS
Input Voltage	±50 volts (peak maximum safe value)
Additional 600345-2 Specifications	
Common Mode Voltage	±10V DC or peak AC
Common Mode Rejection	80db @ gain 10
Source Unbalance	5000 ohms
Temperature Operating Range	All Specifications apply for 0 to 50°C
Power Requirement (600330-1)	±12.5 volts: 10mA no load 20mA full load 30mA short circuited output All supplies to be regulated to within 5% Multivibrator waveform 6Kc/s ±12.5 volts at 45mA (See Figure 1.3)
(600330-2)	±22.5 volts: 20mA all conditions ±12.5 volts: 10mA no load 20mA full load 30mA short circuited output All supplies to be regulated to within 5%
(600345-1 & 600345-2)	±12.5V: 20mA no load 40mA full load 60mA short circuit output ±22.5V: 40mA all conditions All supplies to be regulated to within 5%

1.7 INSTALLATION

1.8 Inspection - Carefully inspect the amplifier for any evidence of damage incurred during shipment. All captive locking screws should be tight. Check that no foreign matter obstructs the input connector and that no pins are bent out of alignment.

1.9 Mounting Requirements - The amplifier may be mounted in any position. The free flow of air should not be restricted around the amplifier, nor should it be located near other equipment operating at high temperature. Installation would normally occur in a Redcor Corporation 100925 or 100775 Module Chassis.

1.10 Primary Power Requirements - The Model 600330-2 & 600345-1,-2 Amplifiers will operate from an external power source capable of supplying ±12.5V and ±22.5 volts with regulation of better than 5% and noise and ripple less than 5mV RMS. (See Specification Sheet for additional information.)
The Model 600330-1 requires a 6Kc/s ±12 volts trapezoidal power supply as supplied within Redcor equipment. The load is a standard 1 unit.

1.11 Adjustments--All references are with respect to 600330 type amplifier. Two adjustments are provided at the top of the printed circuit card labeled R1 and R2. These adjustments control the base input current to Q1 Section B and Section A respectively.(See Fig.2.4). When the amplifier is connected in a potentiometric configuration, potentiometer R2 controls the injection current to the input amplifier. This current can be adjusted to less than 1 nanoamp by open circuiting input 1 and adjusting R2 until the output just changes from either +12 volts to -12 volts or vice versa. R1 may now be used to zero the output of the amplifier with input 1 grounded. With the amplifier connected operationally, the operational node becomes input 2 and input 1 is grounded so that R2 may be used as a voltage adjustment and R1 as the current. The method of zeroing the current input here is to connect a 100K feedback resistor between 41 and 4, and then connect an additional 100K to pin 4, and alternately open and close the other end of the input 100K with respect to the output while adjusting R2 until no observable output change results(100μ volts). R1 may now be used as a voltage zero adjust.

1.12 Connector Information 600330

Pin designations are as follows: (See Fig.2.4)

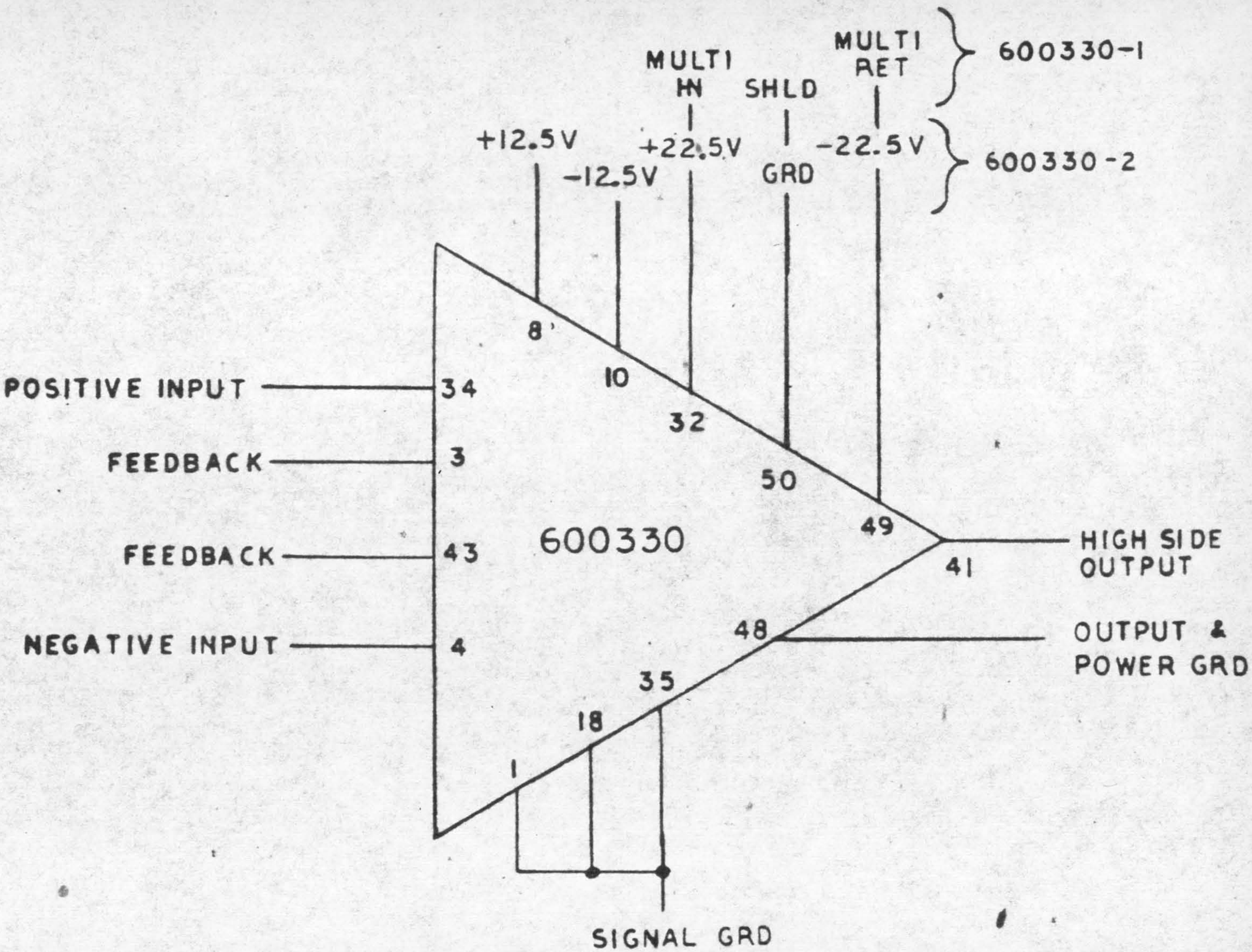
Pin Number	Description
34	Input 1, positive gain with respect to the output.
4	Input 2, negative gain with respect to the output.
41	Output, high side.
1, 18, 35	Input ground used for terminating input signal ground.
* 3, 43	Feedback interconnection, and should be tied together for normal applications.
8, 10	Power supply connection 8, +12.5 volts; 10, -12.5 volts
48	Power ground used for returns for 8 and 10, and as the low side of the output.
49, 50, 32	600330-1--used as 6Kc/s multivibrator drive input to provide ±22.5v floating power on the circuit card. 32, multi input; 49, multi return; 50, shield
49, 50, 32	600330-2--Used to provide an external source of ±22.5 power to the card. 49, -22.5; 32, +22.5; 50, ground return

*** Later versions of the amplifier do not require this connection.**

1.13 Connector Information 600345 (See Figure 2.5)

Pin Number for Chan.1	Chan.2	Description
1 50	2 50	Input 1, positive gain with respect to the output.
14	4	Input 2, negative gain with respect to the output.
13	6	Output high side.
17 33 49	1 18 35	Input gnd. used for terminating input gnd. and must be returned to power gnd.

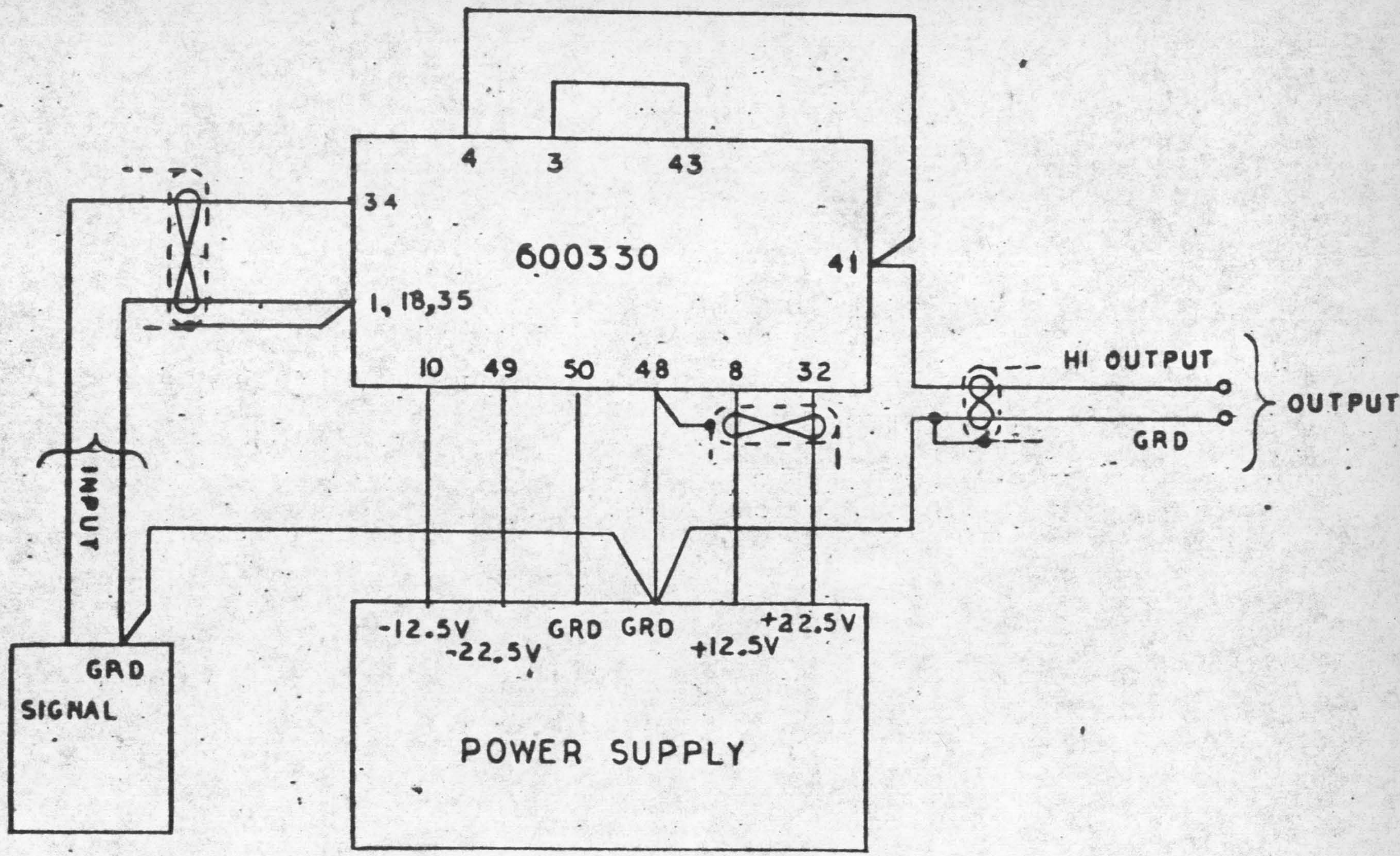
Common	Description
9 42	Power gnd. used for returns to 25, 26, 43 & 41 and as the low side of the outputs.
25	-12.5 volts input
26	+12.5 volts input
43	+22.5 volts input
41	-22.5 volts input
40	Used in 600345-2 differential amplifier configuration connects to pin 14 either directly or via external potentiometer provides variable gain.
7	Ground return and is used to return to 9, 42 when channel 1 is used single ended gain configuration. When used as dynamics bridge differential amplifier ties to 6.
8	Ground return and is used to return to 9, 42 in either single ended gain configuration or dynamic bridge configuration.



NOTE: Pins 3 and 43 not required on later versions of the amplifier.

600330 PIN DESIGNATIONS

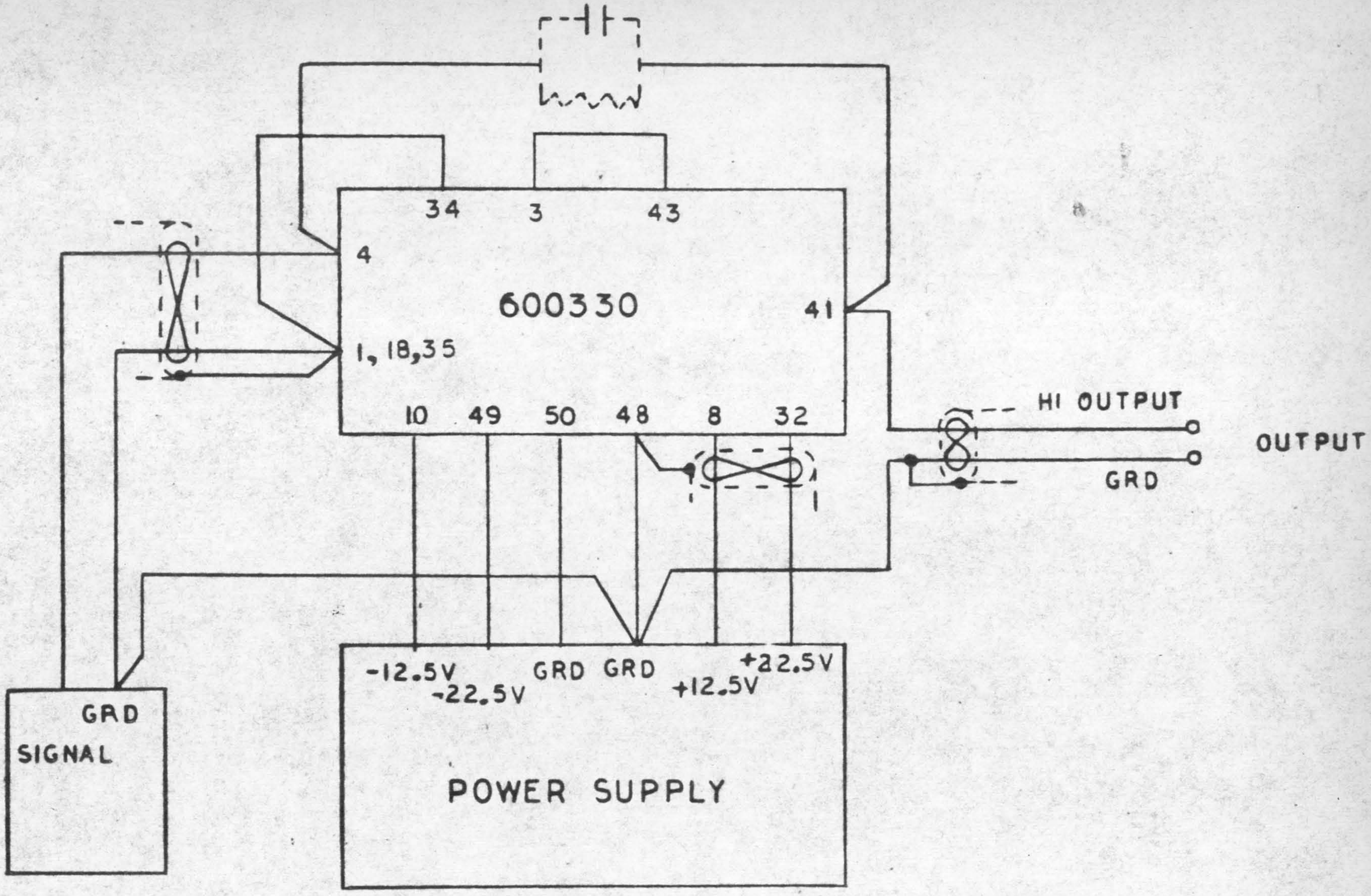
FIGURE 1.3



NOTE: Pins 3 and 43 not required on later versions of the amplifier.

POTENTIOMETRIC CONFIGURATION

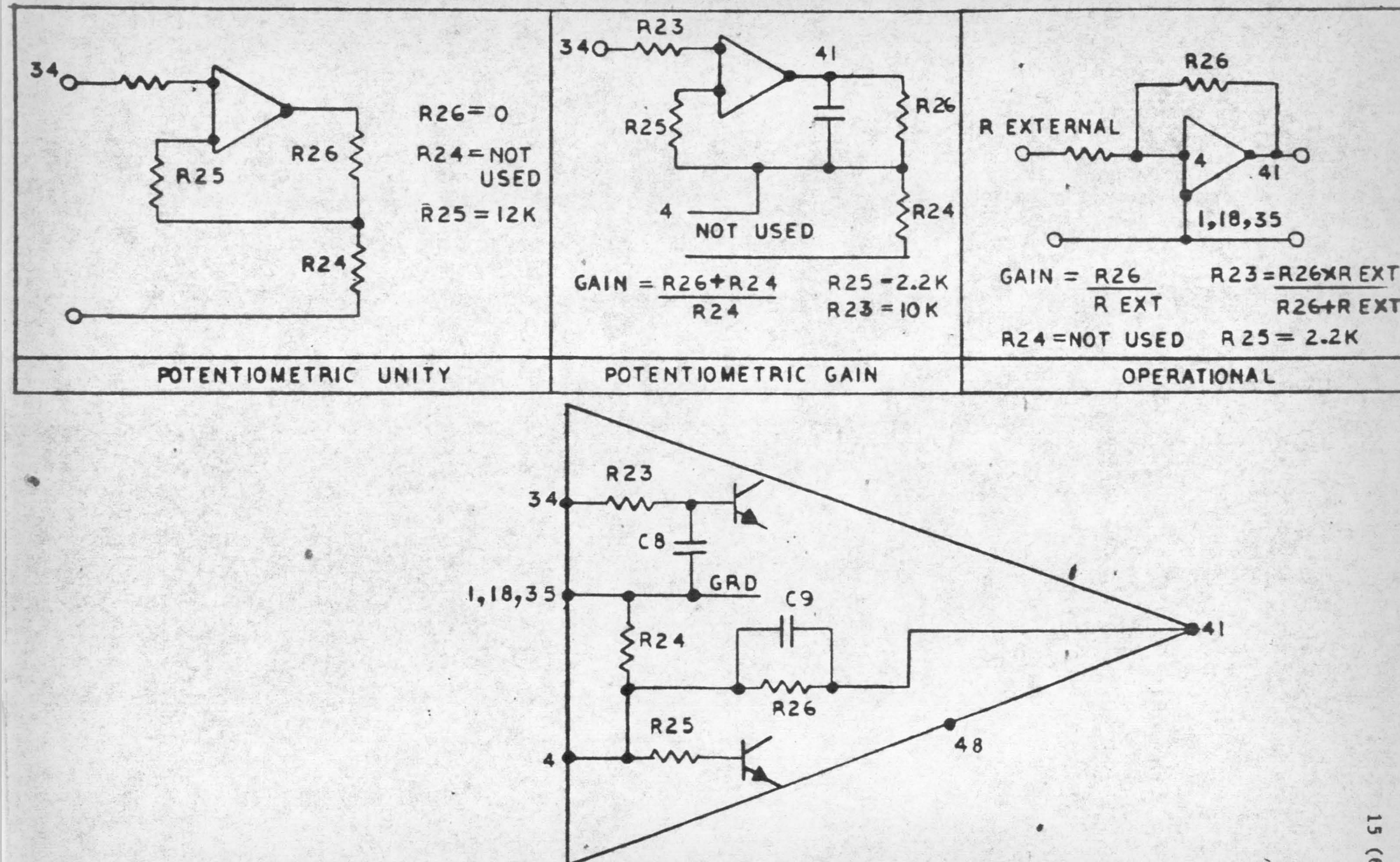
FIGURE 1.4



NOTE: Pins 3 and 43 not required on later versions of the amplifier.

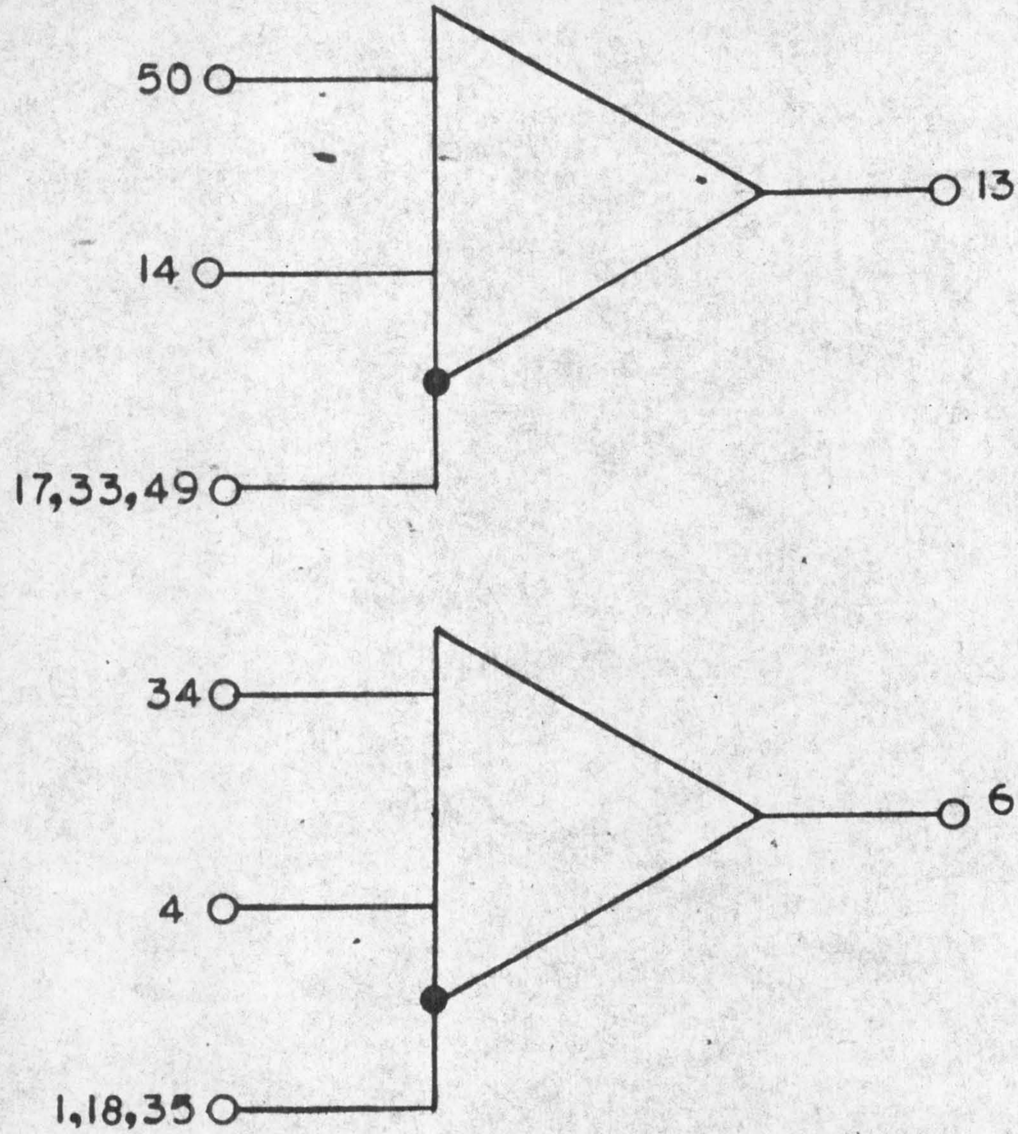
OPERATIONAL CONFIGURATION

FIGURE 1.5



600330 CONFIGURATION

FIGURE 1.6



26	+12.5 V
25	−12.5 V
43	+22.5 V
41	−22.5 V
9,42	GRD

FIGURE 1.7

DUAL AMPLIFIER
600345-1 CONFIGURATION

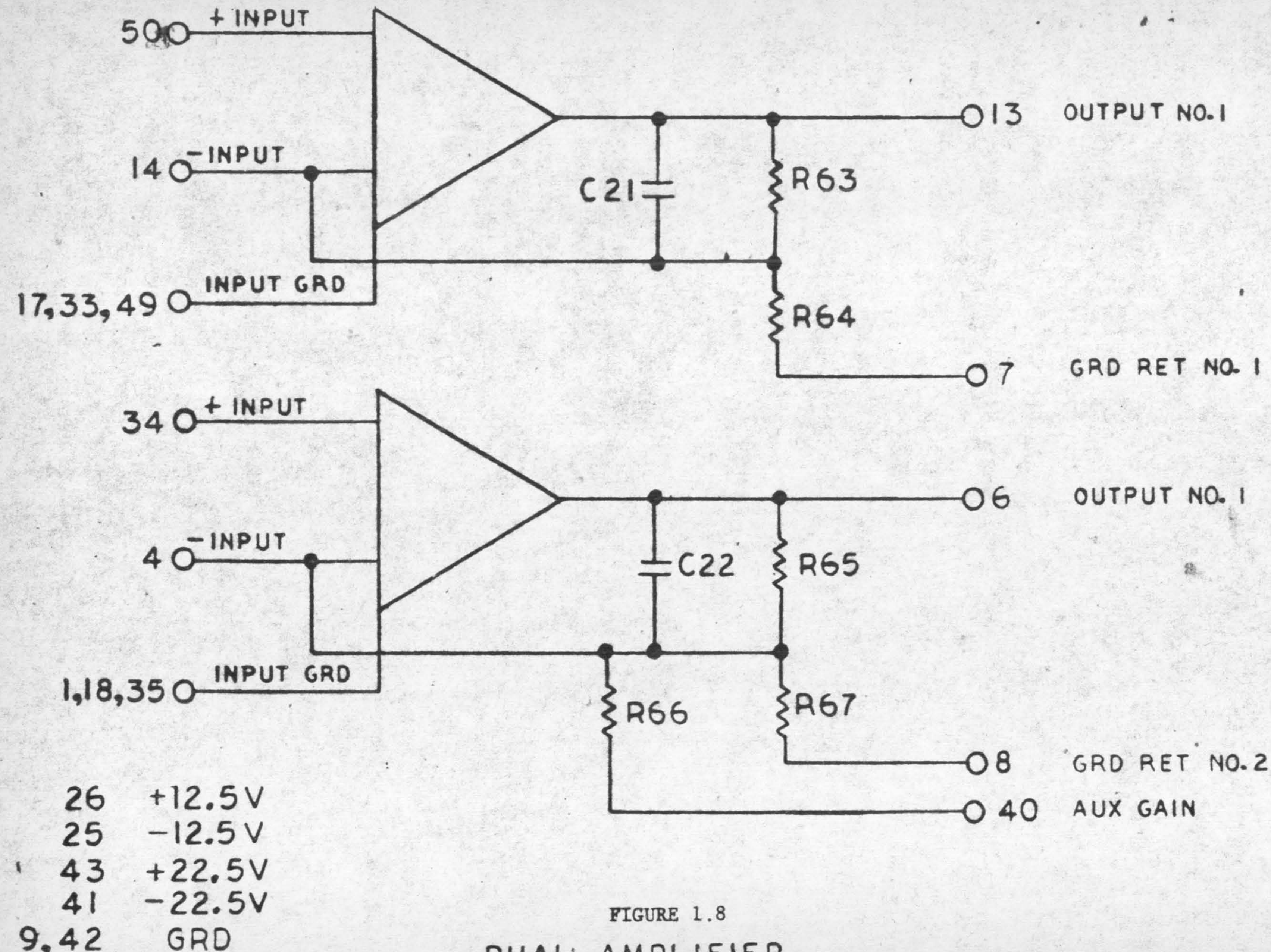
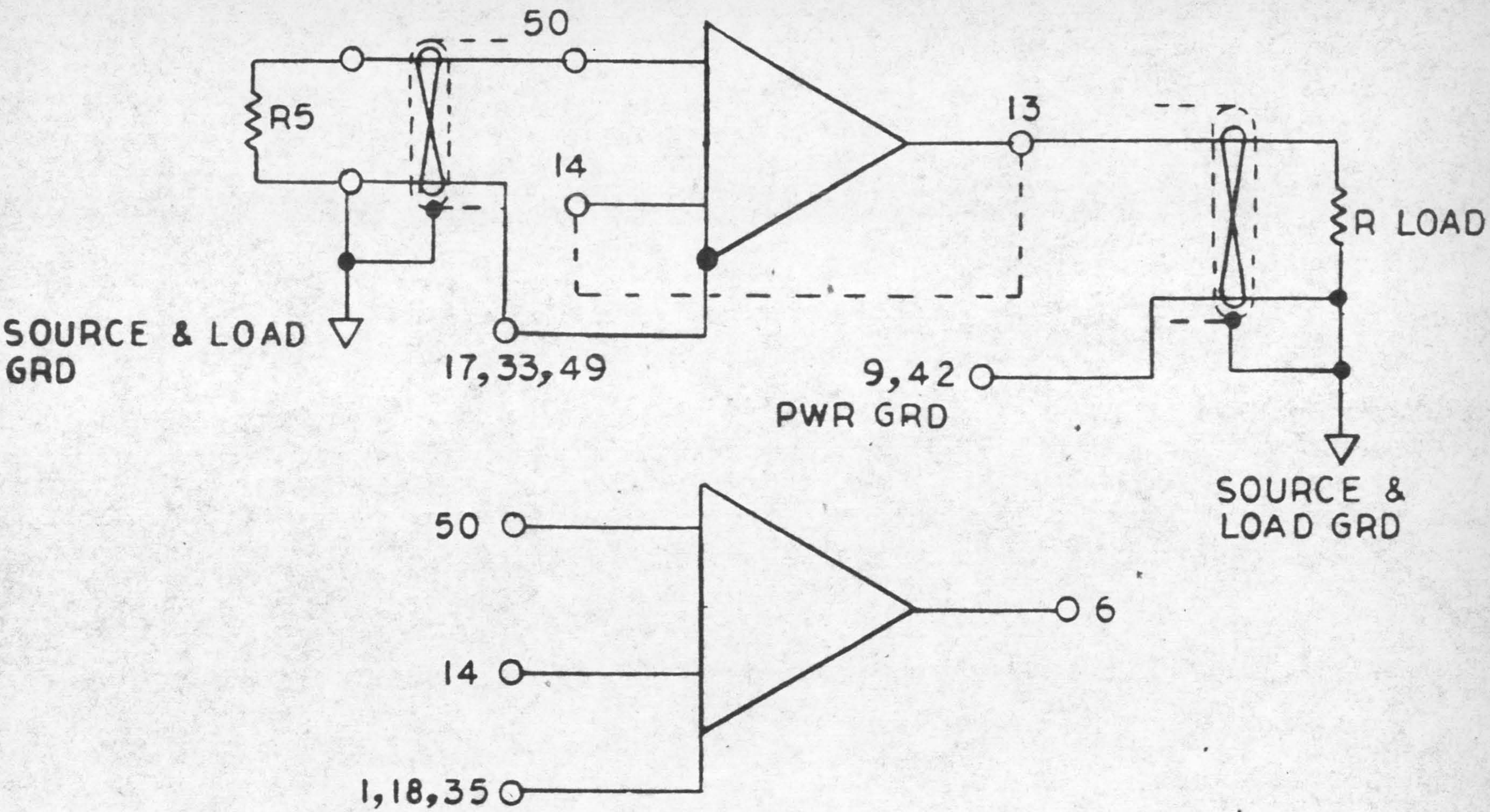


FIGURE 1.8

DUAL AMPLIFIER

600345-1 CONFIGURATION



NOTE: SOURCE & LOAD GRD MUST BE THE SAME RETURN AS A CONNECTION MUST EXIST BETWEEN 9,42 & 17, 33,49.

FIGURE 1.9

600345-1 CONFIGURATION
(WITH +1 GAIN HOOK UP)

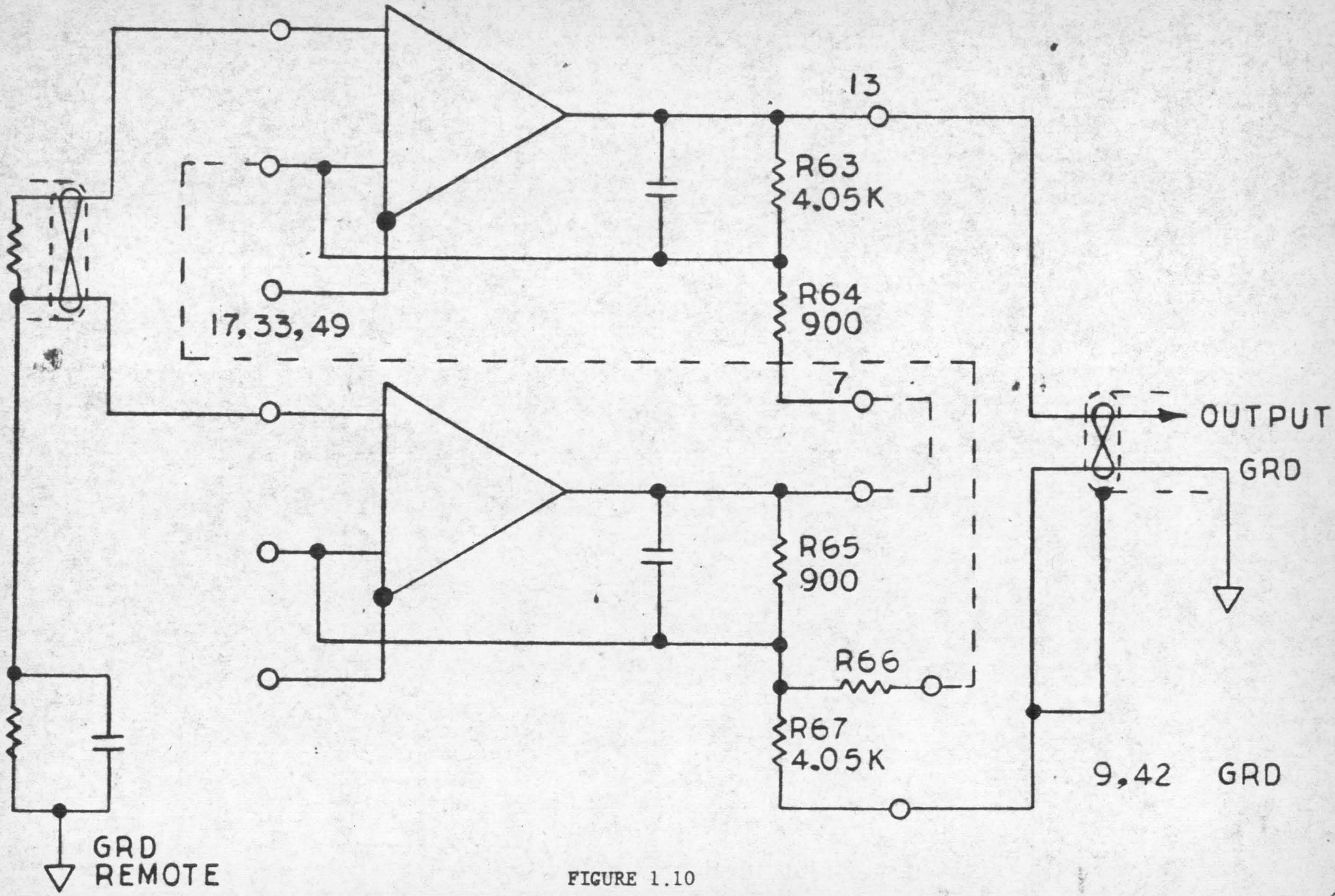


FIGURE 1.10

600345-2 CONFIGURATION
CONNECTED AS A DYNAMIC BRIDGE
DIFFERENTIAL AMPLIFIER (PATENT PENDING)

SECTION II
PRINCIPLES OF OPERATION

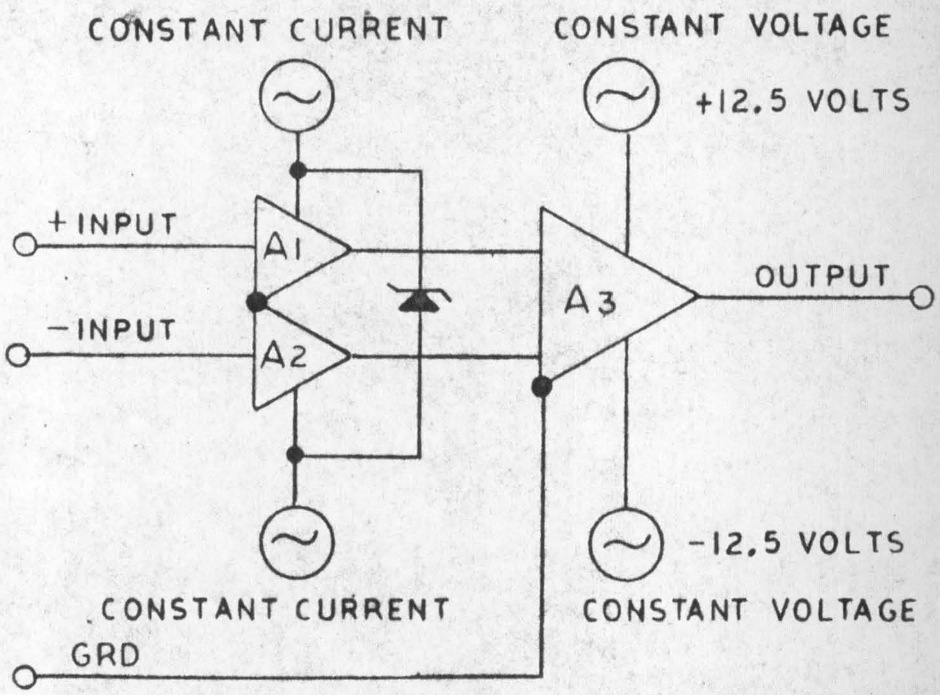


Figure 2.1

2.1 General Theory of Operation - The 600330 & 600345 amplifiers consist of two input amplifiers A1 and A2 connected differentially and powered by constant current sources to obtain a floating power supply. A grounded output is obtained by coupling via a differential input grounded output amplifier A3 which is powered by grounded power supplies. The amplifier concept utilized in the 600330 & 600345 provides very high input impedance both with respect to ground and between the differential inputs. The 600330 & 600345 may be connected in a variety of configurations.

2.2 Potentiometric Unity Gain - In this configuration, (see Figure 2.2 with R2 removed) 100% of the output is fed back to the negative input. The loop gain of the amplifier will always tend to keep the signal between the differential inputs very small so that the negative input and the output will follow the signal applied at the positive input.

2.3 Potentiometric Positive Gain - In the configuration (see Figure 2.2), a proportion of the output is fed back to the negative input. The gain established is calculated from the potentiometer divider,

$$A = \frac{R1 + R2}{R2}$$

again using the principle that the error signal between the inputs is very small.

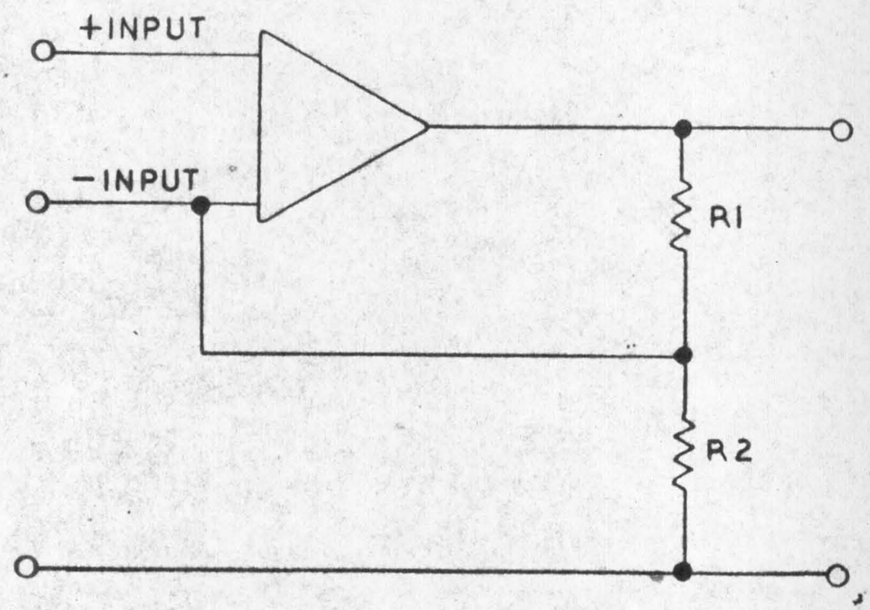


Figure 2.2

2.4 Operational, As a Scaling, Summing, or Integrating Amplifier - In this configuration the positive input is grounded and either a resistance or capacitance returned to the negative input from the output. The value of resistance that can be utilized in the feedback can range from approximately 1000 ohms to 100 kilohms with little degradation of performance. However, it should be remembered that the injection current will flow in the feedback resistor and cause a DC zero error. As an integrator the injection current will also flow into the capacitor such that an integration time constant error can be calculated, i.e.,

$$\frac{dv}{dt} = \frac{i}{c} \qquad \text{for} \quad \begin{array}{l} i = 1 \text{ nanoamp} \\ c = 1\ \mu\text{fd} \end{array}$$

$$\frac{dv}{dt} = 1\text{mv/sec.}$$

With an input resistor of 1 megohm and a feedback capacitor of 1μfd an integration time constant of 1 sec can be derived. However, it must be remembered that for a 0.01% integration time constant a maximum of 1 sec can be allowed before 1 mV (i.e., 0.01% of 10V) error is possible.

2.5 <u>Differential Balanced Bridge</u> - In this configuration see Figure 2.3

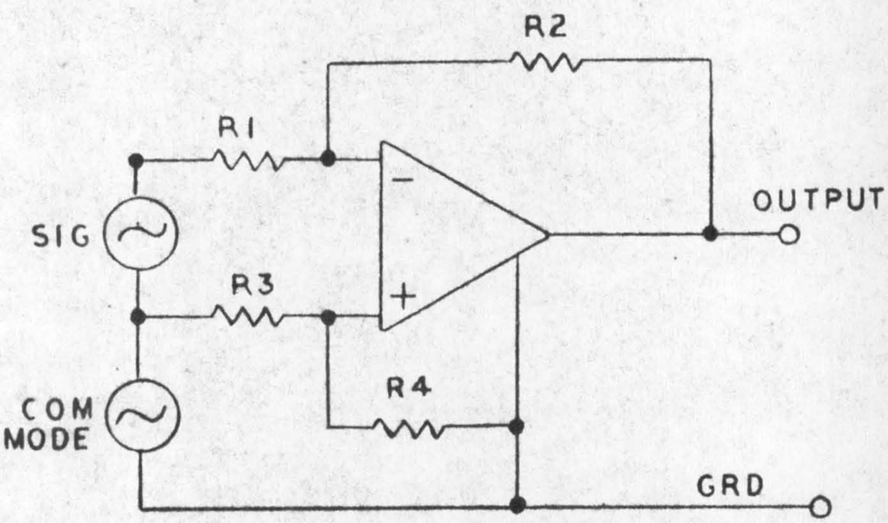


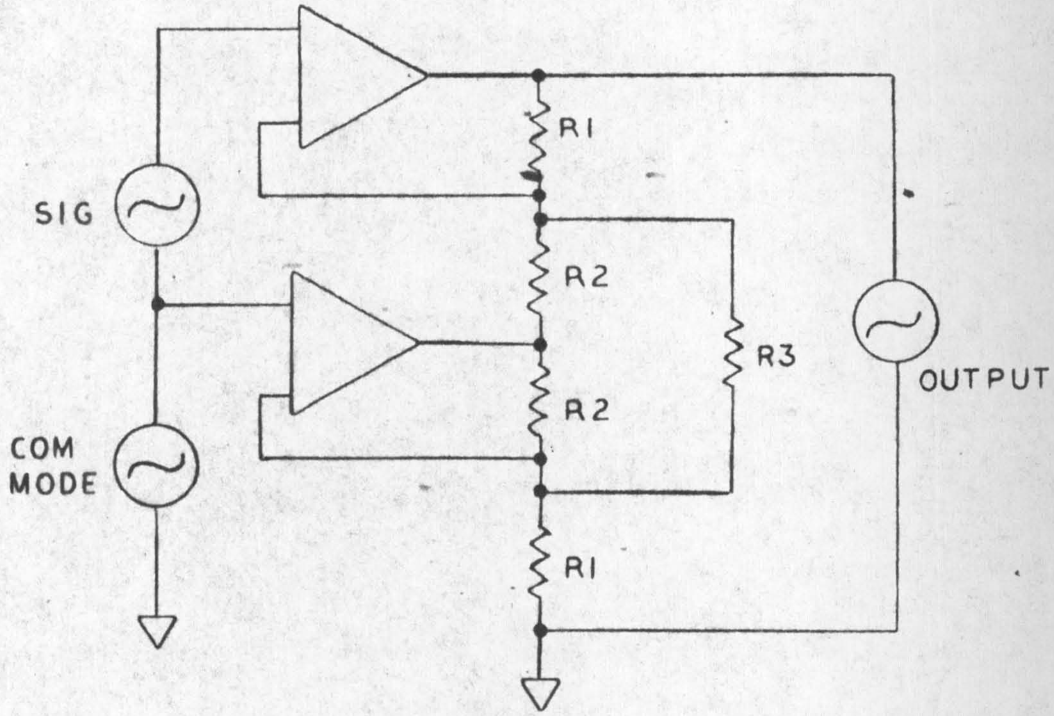
Figure 2.3

The gain of the amplifier is controlled by the resistor ratio $G = \frac{R2}{R1}$

The common mode rejection ratio is governed by the ratio $\frac{R2}{R1} : \frac{R4}{R3}$

It is important to note that this ratio must be balanced not only for resistance but for capacitance as well, if the common mode voltage is of a varying nature, i.e., 60 cps say.

2.6 Dynamic Bridge Operation (600345-2 only)



In this configuration both amplifiers contained on the 600345 card are utilized and form a dynamic bridge differential amplifier.

The importance of this circuit is that the common mode rejection increases in direct proportion to the gain and is insensitive to source resistance unbalance.

Gain is given by:

$$R_3 = \frac{2R_1}{\text{Gain} - \frac{R_1 + R_2}{R_1}}$$

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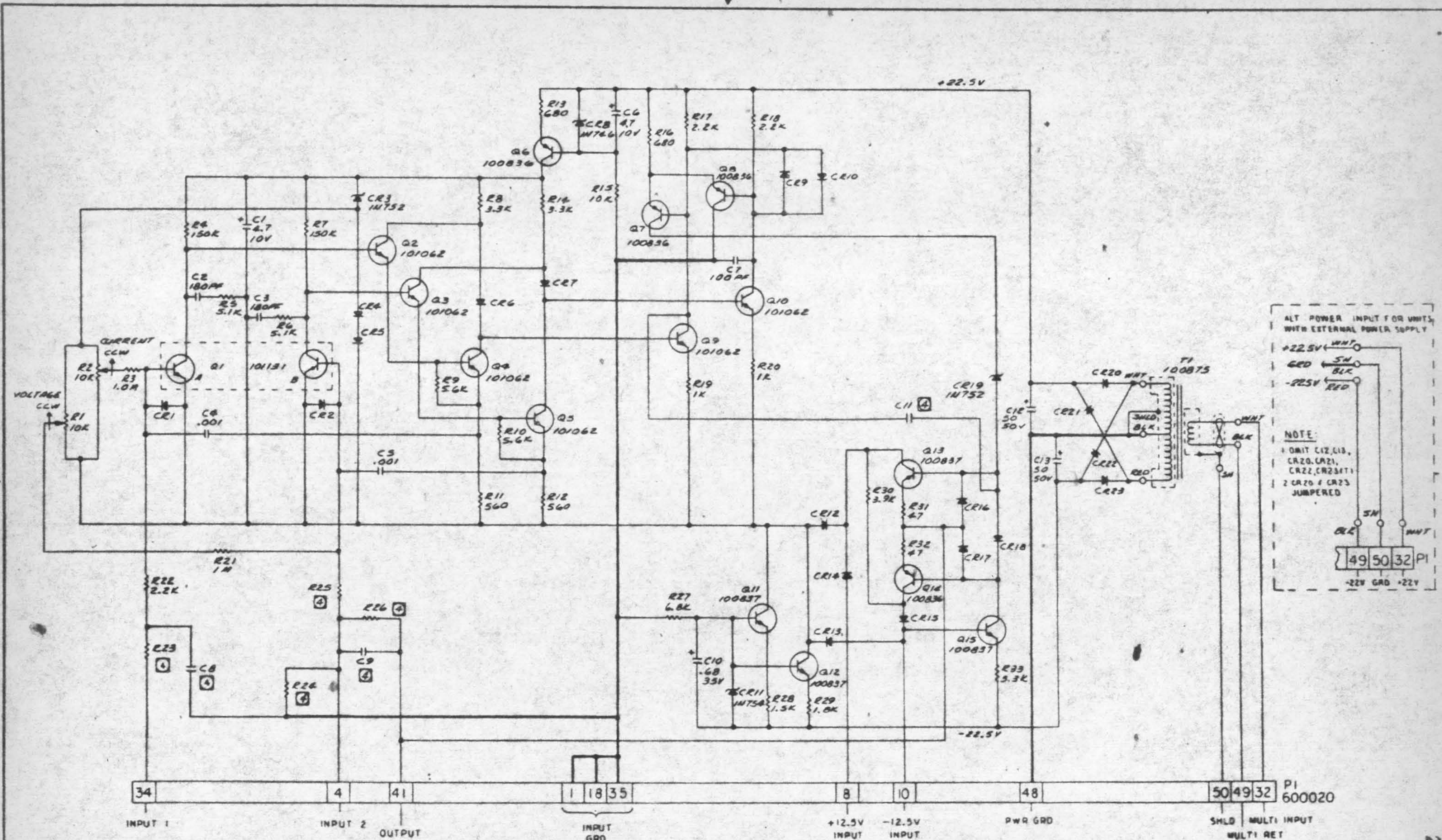
2.7 Detailed Circuit Description(600330 only)See Fig.2.4

The two input amplifiers A1 and A2 are made up of Section A of Q1, Q2, Q4, and Q9 for A1, and Section B of Q1, Q3, Q5 and Q10 for A2, and their respective associated parts. Potentiometers R2 and R1 control the injection current level into their respective amplifiers A1 and A2. Transister Q6, zener CR8 and associated parts make up the positive current supply, and transistors Q11, Q12, and CR11 and associated parts make up the negative constant current supply. The output amplifier is made up of Q7, Q8, Q13, Q14 and Q15 and their respective parts. Q7 and Q8 provide the differential input and Q15 is a simple inverter stage to couple between the differential input pair and the complementary symmetry output transistors Q13 and Q14.

2.8 Selected Values Contained on Circuit Card

Resistors R24 and R26 are normally utilized in the potentiometric gain configuration and are normally precision resistors. Resistors R22, R23, and R25 are 5% carbon type which are used to provide to both inputs (in conjunction with C8 and C9) frequency compensation and to balance both inputs resistively with respect to ground. Capacitors C8, C9 and C11 are all chosen for optimum frequency response and settling time to step changes in the input.

NOTE: All circuit references apply to the 600330 (Fig. 2.4) amplifier. 600345 is identical but reference designations are different. See Figure 2.5.



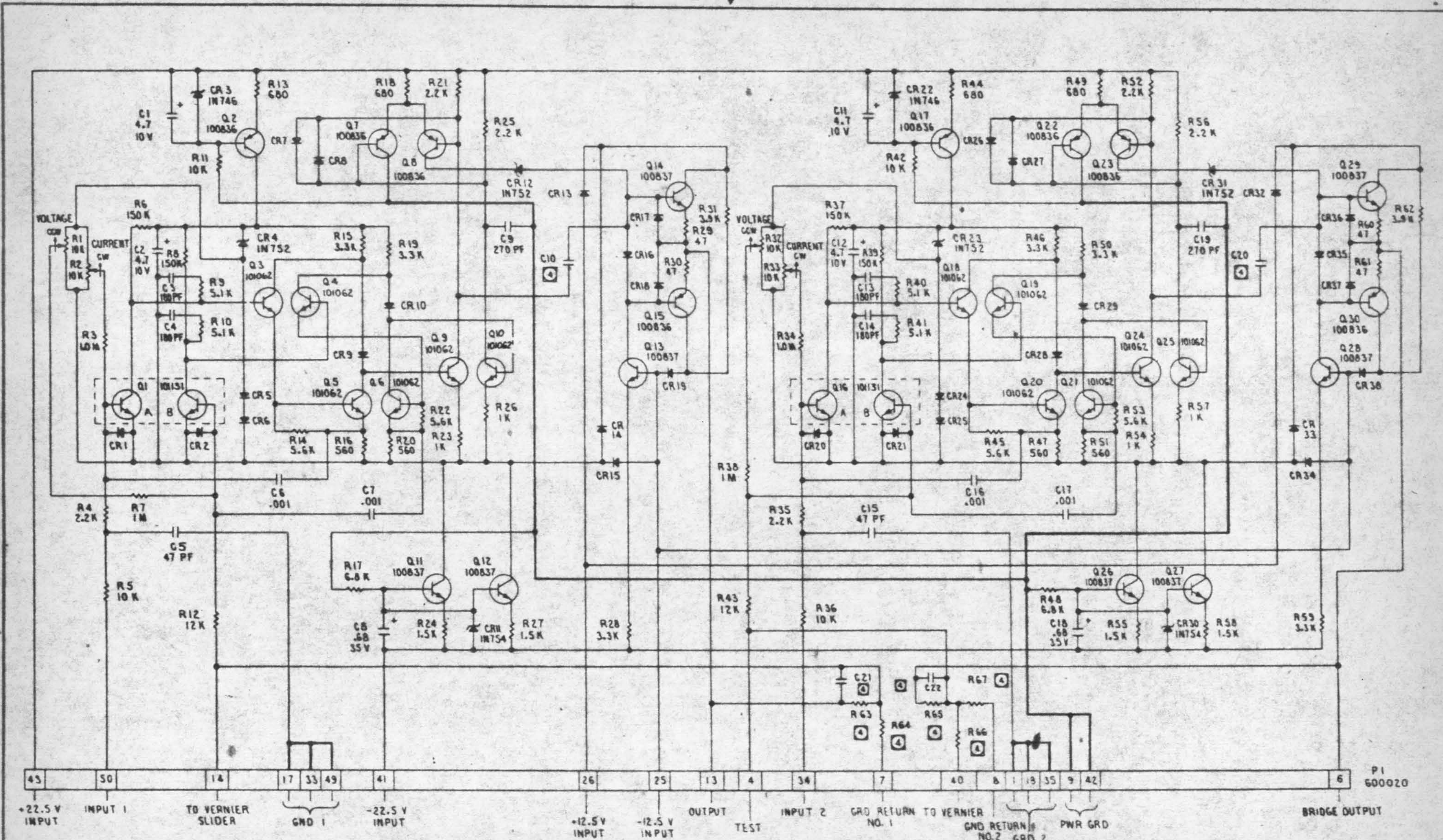
4 THE VALUES OF R23 R24, R25, R26, C8, C9 & C11 ARE DETERMINED BY GAIN. SEE TABULATION.

3. ALL DIODES ARE REDCOR NO. 100780-3.
2. ALL CAPACITOR VALUES ARE IN MICRO FARADS.
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 WATT, ±5%.
NOTE: UNLESS OTHERWISE SPECIFIED

VALUE TABULATION								
	GAIN	R23	R24	R25	R26	C8	C9	C11
POT.	1	10 K	NOT USED	12 K	NOT USED	47 PF	NOT USED	82 PF
	2	10 K	4.05 K	12 K	4.05 K	47 PF	100 PF	33 PF
	10	10 K	450 Ω	12 K	4.05 K	47 PF	270 PF	18 PF
OPER.	—	47 K	NOT USED	2.2 K	100 K	10 PF	5 PF	10 PF

REFERENCE DESIGNATIONS		
FIRST	LAST	DELETED
R1	R33	
C1	C13	
CR1	CR23	
Q1	Q15	
T1	T1	
P1	P1	

FIGURE 2.4



4 THE VALUES OF C10,C20,C21,C22, AND R63 THRU R67 ARE DETERMINED BY GAIN. SEE TABULATION.
3 ALL DIODES ARE REDCOR NO. 100780-3.
2 ALL CAPACITOR VALUES ARE IN MICRO FARADS.
1 ALL RESISTORS VALUES ARE IN OHMS, ¼ WATT, ±5%.
NOTE: UNLESS OTHERWISE SPECIFIED

4 VALUE TABULATION											REFERENCE DESIGNATIONS		
DASH NO.	GAIN	C10	C20	C21	C22	R63	R64	R65	R66	R67	FIRST	LAST	DELETED
-2	10	NOT USED	100 PF	250 PF	1500 PF	4.05K±.02%	900±.1%	900±.1%	850±1%	4.35K±.02%	R1	R67	
-1	1	150 PF	100 PF	NOT USED	NOT USED	JUMPER	NOT USED	JUMPER	NOT USED	NOT USED	C1	C22	
											CR1	CR38	
											Q1	Q30	
											P1	P1	

FIGURE 2.5

SECTION III
MAINTENANCE

3.1 Maintenance and Trouble-Shooting Philosophy

The Redcor Model 600330 & 600345 Amplifiers are designed for extensive trouble free operation. This is accomplished by use of solid state circuitry throughout permitting operation at low power supply potentials with the attendant reduction in heat generated within the amplifier. Trouble-shooting involves following conventional signal tracing, waveform and voltage measurement techniques, to locate a defective component.

3.2 Test Equipment Required for Maintenance

Test equipment required for maintenance of the Model 600330 & 600345 Amplifiers is tabulated in Table 3-1

Table 3-1 - Test Equipment Required for Maintenance

DESCRIPTION	MFG	MODEL NO.
Multimeter	Simpson	270
Oscilloscope	Tektronix	502 or 531
Preamplifier used with 531 Oscilloscope	Tektronix	Type D
Vacuum Tube Voltmeter	Hewlett Packard	425A

NOTE: All circuit references apply to the 600330 (Fig. 2.4) amplifier. 600345 is identical but reference designations are different. See Fig. 2.5

SECTION IV

PARTS LIST - 600330 AMPLIFIER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Tantalytic, 4.7 MF, 10V	Texas Instr.	$SCM475F_2P010K4$	
C2	Capacitor, Mica, 180 PF, 500V, ±5%	ARCO	CM15E181J	
C3	Same as C2			
C4	Capacitor, Cerifil, .001 MF, 100V	Aerovox	MC80V102-AM	
C5	Same as C4			
C6	Same as C1			
C7	Capacitor, Mica, 100 PF, 500V, ±5%	ARCO	CM15E101J	
C8	Capacitor, Selected			
C9	Same as C8			
C10	Capacitor, Tantalytic, .68 MF, 35V	Texas Instr.	$SCM684F_2P035K4$	
C11	Same as C8			
C12	Capacitor, Electrolytic, 50 MF, 50V	Sprague	TE-1307	*
C13	Same as C12			*
CR1	Diode, Silicon	Redcor	100780-3	
CR2	Same as CR1			
CR3	Diode, Zener	Motorola	IN752	
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Diode, Zener	Motorola	IN746	
CR9	Same as CR1			
CR10	Same as CR1			
CR11	Diode, Zener	Motorola	IN754	
CR12	Same as CR1			
CR13	Same as CR1			

* Used on 600330-1

PARTS LIST - 600330 AMPLIFIER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR14	Same as CR1			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR1			
CR19	Same as CR3			
CR20	Same as CR1			*
CR21	Same as CR1			*
CR22	Same as CR1			*
CR23	Same as CR1			*
Q1	Transistor,Pair,Silicon	Redcor	101131	
Q2	Transistor, Silicon	Redcor	101062	
Q3	Same as Q2			
Q4	Same as Q2			
Q5	Same as Q2			
Q6	Transistor	Redcor	100836	
Q7	Same as Q6			
Q9	Same as Q2			
Q10	Same as Q2			
Q11	Transistor	Redcor	100837	
Q12	Same as Q11			
Q13	Same as Q11			
Q14	Same as Q6			
Q15	Same as Q11			
R1	Trimpot, W.W., 10K	Bourns	275-1-103	
R2	Same as R1			
R3	Resistor, Comp., 1MEG, 1/4W, ±5%	Allen-Bradley	RC07GF105J	
R4	Resistor, Comp., 150K, 1/4W, ±5%	Allen-Bradley	RC07GF154J	

* Used on 600330-1

PARTS LIST - 600330 AMPLIFIER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R5	Resistor, Comp., 5.1K, 1/4W, ±5%	Allen-Bradley	RC07GF512J	
R6	Same as R5			
R7	Same as R4			
R8	Resistor, Comp., 3.3K, 1/4W, ±5%	Allen-Bradley	RC07GF332J	
R9	Resistor, Comp., 5.6K, 1/4W, ±5%	Allen-Bradley	RC07GF562J	
R10	Same as R9			
R11	Resistor, Comp., 560 Ohms, 1/4W, ±5%	Allen-Bradley	RC07GF561J	
R12	Same as R11			
R13	Resistor, Comp., 680 Ohms, 1/4W, ±5%	Allen-Bradley	RC07GF681J	
R14	Same as R8			
R15	Resistor, Comp., 10K, 1/4W, ±5%	Allen-Bradley	RC07GF103J	
R16	Same as R13			
R17	Resistor, Comp., 2.2K, 1/4W, ±5%	Allen-Bradley	RC07GF222J	
R18	Same as R17			
R19	Resistor, Comp., 1K, 1/4W, ±5%	Allen-Bradley	RC07GF102J	
R20	Same as R19			
R21	Same as R3			
R22	Same as R17			
R23	Resistor, Selected			
R24	Same as R23			
R25	Same as R23			
R26	Same as R23			
R27	Resistor, Comp., 6.8K, 1/4W, ±5%	Allen-Bradley	RC07GF682J	

PARTS LIST - 600330 AMPLIFIER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R28	Resistor, Comp., 1.5K, 1/4W, ±5%	Allen-Bradley	RC07GF152J	
R29	Resistor, Comp., 1.8K, 1/4W, ±5%	Allen-Bradley	RC07GF182J	
R30	Resistor, Comp., 3.9K, 1/4W, ±5%	Allen-Bradley	RC07GF392J	
R31	Resistor, Comp., 47 Ohms, 1/4W, ±5%	Allen-Bradley	RC07GF470J	
R32	Same as R31			
T1	Transformer, Multi	Redcor	100875	*

* Used on 600330-1

PARTS LIST - 600345 AMPLIFIER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Tantalytic, 4.7 MF, 10V	Texas Inst.	$SCM475F_2P010K4$	
C2	Same as C1			
C3	Capacitor, Mica, 180 PF, 500V, ±5%	Arco	CM15E181J	
C4	Same as C3			
C5	Capacitor, Mica, 47 PF, 100V, ±10%	Micamold	MCM10D470K	
C6	Capacitor, Cerifil, .001 MF, 100V	Aerovox	MC80V102-AM	
C7	Same as C6			
C8	Capacitor, Tantalytic, .68 MF, 35V	Texas Inst.	$SCM684F_2P035K4$	
C9	Capacitor, Mica, 270 PF, 500V, ±5%	Arco	CM15E271J	
C10	Capacitor, Cerifil, 100 PF, 100V	Aerovox	MC80V101-AM	*
C11	Same as C1			
C12	Same as C1			
C13	Same as C3			
C14	Same as C3			
C15	Same as C5			
C16	Same as C6			
C17	Same as C6			
C18	Same as C8			
C19	Same as C9			
C20	Same as C10			
C21	Capacitor, Duramica, 200 PF, 100V	Arco	DM15201J	**
C22	Capacitor, Duramica, 1500 PF, 100V	Arco	DM20152J	**

* Used on 600345-1
** Used on 600345-2

PARTS LIST - 600345 AMPLIFIER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR1	Diode, Silicon	Redcor	100780-3	
CR2	Same as CR1			
CR3	Diode, Zener	Motorola	1N746	
CR4	Diode, Zener	Motorola	1N752	
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Same as CR1			
CR9	Same as CR1			
CR10	Same as CR1			
CR11	Diode, Zener	Motorola	1N754	
CR12	Same as CR4			
CR13	Same as CR1			
CR14	Same as CR1			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR1			
CR19	Same as CR1			
CR20	Same as CR1			
CR21	Same as CR1			
CR22	Same as CR3			
CR23	Same as CR4			
CR24	Same as CR1			
CR25	Same as CR1			
CR26	Same as CR1			
CR27	Same as CR1			
CR28	Same as CR1			
CR29	Same as CR1			
CR30	Same as CR11			

PARTS LIST - 600345 AMPLIFIER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR31	Same as CR4			
CR32	Same as CR1			
CR33	Same as CR1			
CR34	Same as CR1			
CR35	Same as CR1			
CR36	Same as CR1			
CR37	Same as CR1			
CR38	Same as CR1			
Q1	Transistor,Pair,Silicon	Redcor	101131	
Q2	Transistor	Redcor	100836	
Q3	Transistor, Silicon	Redcor	101062	
Q4	Same as Q3			
Q5	Same as Q3			
Q6	Same as Q3			
Q7	Same as Q2			
Q8	Same as Q2			
Q9	Same as Q3			
Q10	Same as Q3			
Q11	Transistor	Redcor	100837	
Q12	Same as Q11			
Q13	Same as Q11			
Q14	Same as Q11			
Q15	Same as Q2			
Q16	Same as Q1			
Q17	Same as Q2			
Q18	Same as Q3			
Q19	Same as Q3			
Q20	Same as Q3			
Q21	Same as Q3			
Q22	Same as Q2			

PARTS LIST - 600345 AMPLIFIER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
Q23	Same as Q2			
Q24	Same as Q3			
Q25	Same as Q3			
Q26	Same as Q11			
Q27	Same as Q11			
Q28	Same as Q11			
Q29	Same as Q11			
Q30	Same as Q2			
R1	Trimpot, W.W., 10K	Bourns	275-1-103	
R2	Same as R1			
R3	Resistor, Comp., 1 Meg, 1/4W, ±5%	Allen-Bradley	RC07GF105J	
R4	Resistor, Comp., 2.2K, 1/4W, ±5%	Allen-Bradley	RC07GF222J	
R5	Resistor, Comp., 10K, 1/4W, ±5%	Allen-Bradley	RC07GF103J	
R6	Resistor, Comp., 150K, 1/4W, ±5%	Allen-Bradley	RC07GF154J	
R7	Same as R3			
R8	Same as R6			
R9	Resistor, Comp., 5.1K, 1/4W, ±5%	Allen-Bradley	RC07GF512J	
R10	Same as R9			
R11	Same as R5			
R12	Resistor, Comp., 12K, 1/4W, ±5%	Allen-Bradley	RC07GF123J	
R13	Resistor, Comp.,680 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF681J	
R14	Resistor, Comp., 5.6K, 1/4W, ±5%	Allen-Bradley	RC07GF562J	
R15	Resistor, Comp., 3.3K, 1/4W, ±5%	Allen-Bradley	RC07GF332J	
R16	Resistor, Comp., 560 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF561J	

PARTS LIST - 600345 AMPLIFIER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R17	Resistor, Comp., 6.8 K, 1/4W, ±5%	Allen-Bradley	RC07GF682J	
R18	Same as R13			
R19	Same as R15			
R20	Same as R16			
R21	Same as R4			
R22	Same as R14			
R23	Resistor, Comp., 1K, 1/4W, ±5%	Allen-Bradley	RC07GF102J	
R24	Resistor, Comp., 1.5K, 1/4W, ±5%	Allen-Bradley	RC07GF152J	
R25	Same as R4			
R26	Same as R23			
R27	Same as R24			
R28	Same as R15			
R29	Resistor, Comp., 47 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF470J	
R30	Same as R29			
R31	Resistor, Comp., 3.9K, 1/4W, ±5%	Allen-Bradley	RC07GF392J	
R32	Same as R1			
R33	Same as R1			
R34	Same as R3			
R35	Same as R4			
R36	Same as R5			
R37	Same as R6			
R38	Same as R3			
R39	Same as R6			
R40	Same as R9			
R41	Same as R9			
R42	Same as R5			
R43	Same as R12			

PARTS LIST - 600345 AMPLIFIER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R44	Same as R13			
R45	Same as R14			
R46	Same as R15			
R47	Same as R16			
R48	Same as R17			
R49	Same as R13			
R50	Same as R15			
R51	Same as R16			
R52	Same as R4			
R53	Same as R14			
R54	Same as R23			
R55	Same as R24			
R56	Same as R4			
R57	Same as R23			
R58	Same as R24			
R59	Same as R15			
R60	Same as R29			
R61	Same as R29			
R62	Same as R31			
R63	Resistor, W.W., 4.05K, 1/4W, ±.02%	Redcor	101012-B-4050R0-A	**
R64	Resistor, W.W., 900 ohm, 1/4W, ±.1%	Redcor	101012-B-900R00-B	**
R65	Same as R64			**
R66	Resistor, M.Film, 820 ohm, 1/8W, ±1%	Key	RN60C8200F	**
R67	Same as R63			**

** Used on 600345-2

INSTRUCTION MANUAL

FOR

608005 SWITCH MODULE
(Revised June 1964)

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Canoga Park, Calif.

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List of Illustrations

608005 SWITCH MODULE

1.0 General Description - Mechanical

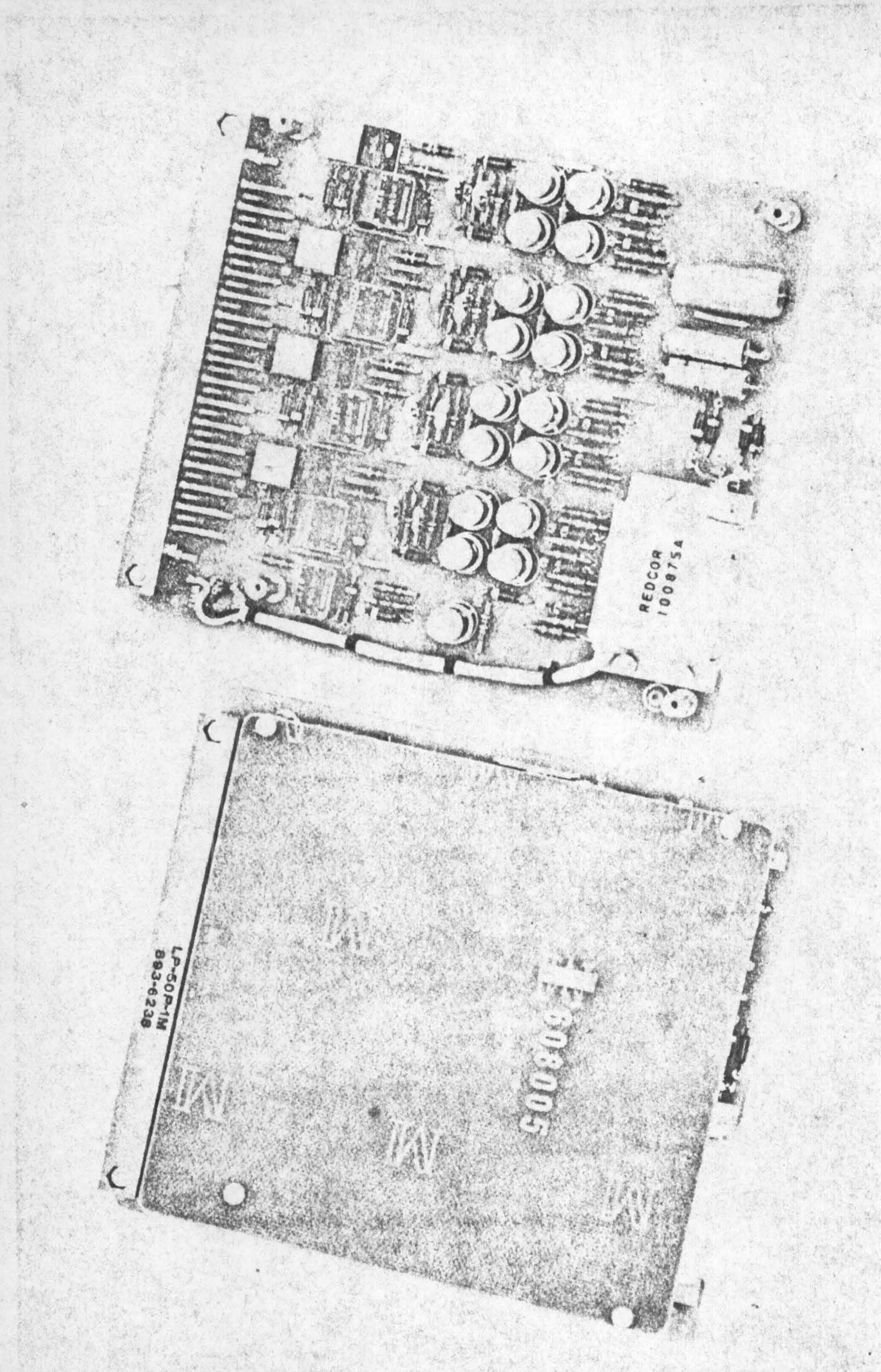
1.1 - The model 608005 module is constructed on a .090 thk epoxy glass laminated printed circuit board 5 x 5.4" in size. Electrical connections are made via a 50 pin plug which mounts as an integral part of the circuit board.

A shield assembly covers the board for mechanical and electrical protection. One completed assembly requires a space of 0.625 inches, .085 inches clear the plated circuit on one side of the connector and 0.45 inches above the surface of epoxy glass board. One space or slot is required for each 608005 Switch Module mounted in a standard REDCOR 100775 or 100925 Module Case.

1.2 - When with the mating connector contained in a chassis, the total mounted height of the module, mating connector and input connections with adequate clearance is 7 inches.

1.3 Electrical

1.4 - The board assembly contains four identical switching circuits designed to switch analog signals in the range of 10 volts into a common output line under the control of digital set and reset inputs. To power the circuits on the assembly a floating power supply is derived from


REDCOR
100875A
LP-50P-1M
893-6238
608005

1.4 (continued)

a precision transformer and a rectifier-capacitor circuit in the same manner as a conventional power supply. The prime power source in this case being a trapezoidal repetitive waveform operating at approximately 6Kc. The voltage derived in this manner is utilized to power a storage flip flop the output of which either forward or reverse biases a precision silicon diode quad. The control inputs to this flip flop are transformer coupled. One transformer being utilized on each flip flop set input and one being common to all reset sides of the flip flops contained on one card.

1.5 Isolation Characteristics

This manner of isolation ensures that no connection is made from the control or power grounds of the multiplexer to the analog signals being switched, and thus of course no load. The isolation between the analog common output, the unselected channels, and each input is derived by the reversed biased silicon diode quad.

1.6 Detailed Circuit Description

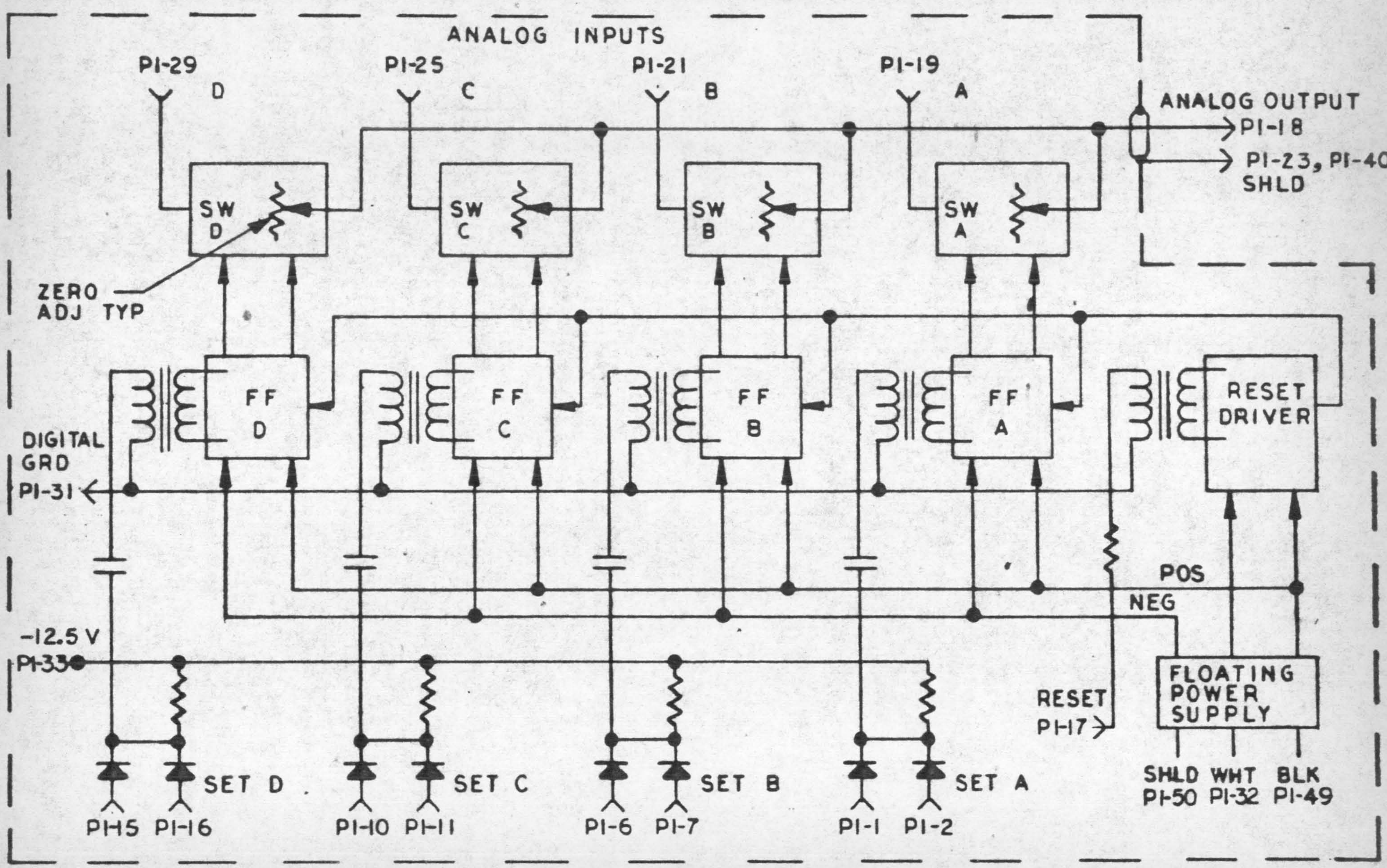
Referring to the Block Diagram Figure 1, the reference designations P1 of the diagram applies to the 50 pin input connector. The analog inputs are shown as A, B, C, and D connected respectively to pins 19, 21, 25, and 29. These inputs are then connected to the switches, the

1.6 (continued)

outputs of which are commoned and brought out to pin 18. The channel selection control signals are shown coupled through transformers T2, T3, T4, T5 and T6. T3, T4, T5 and T6 being set inputs and T2 the reset common. Should it be desired, channel selection can be achieved directly by connecting -12V between pin 33 and 31 and providing a fast rise 0.1μSec, to 0 volts on one of the input diodes pins 15 or 16, 10 or 11, 6 or 7 and 1 or 2 for selection of channels D, C, B or A, respectively. A direct input to pin 17 of a similar fast rising waveform from -12 volts to ground will reset all channels.

T1, CR1, CR2, CR3 and CR4, R1, C1, C2 and C3 are the components in the power supply forming a conventional bridge rectifier capacitor filter circuitry. The output voltage from this supply is 46V ±2V.

The switching quads are CR10, CR18, CR26 and CR34. One channel thus consists of, taking A as typical, transistors Q2, Q3, Q4, and Q5 and associated resistors forming a flip flop circuit controlled by T3. The reset circuitry is common to all switches and is made up of T2 and Q1 and associated components.



BLOCK DIAGRAM - 608005 SWITCH MODULE

Figure 1

1.7 Large Channel Selection Methods

In large multiplexer installations where the decoding circuitry for many channels would be required, the selection of any particular channel can be greatly simplified by utilizing the two term AND gates on each set input. In this case coincidence of two -12 volts levels at any input diode pair followed by a fast rise to ground (0.1μSec) of either input will cause the related channel to set or "turn on".

The maximum repetitive switching speed of each individual channel is 100 Kc/s, there being no minimum speed restriction as storage is provided on the switch.

1.8 Timing Requirements

Control signals are successively applied to first the reset input to reset all the channels and then to set any one input desired. The reset signal is timed to precede the select signal by typically 1μSec. This timing is desirable in order that no two channels be selected simultaneously which would then tie, through the quad, two analog input channels together. If inadvertently however, two or more channels should be selected simultaneously, no harm can befall the multiplexer as the maximum current that can be passed (100 volts) is limited to 1mA maximum. If the PIV of the diodes is exceeded however, the current is limited by the source impedance of the input signal.

1.9 Adjustments Required

The individual channel DC levels contributed by the multiplexer switch can be adjusted by means of a single turn potentiometer. The method of adjustment being to ground the related channel through 0 to 1000 ohms and to observe the output of the multiplexer while this channel is selected either dynamically or statically. The range of adjustment of this potentiometer being ±10mV.

1.10 Maintenance

The simplicity of the circuitry lends itself to ease of maintenance. The secondary power derived by the floating power supply is insufficient to cause any damage to the components on the printed circuit board. The silicon diodes have a peak inverse voltage rating of 100 volts requiring a 200 volt signal between two "off" channels to cause damage to the switching quads. Any failure in transistors will typically exhibit itself as an excessively low power supply voltage outside the range 46V ±2V.

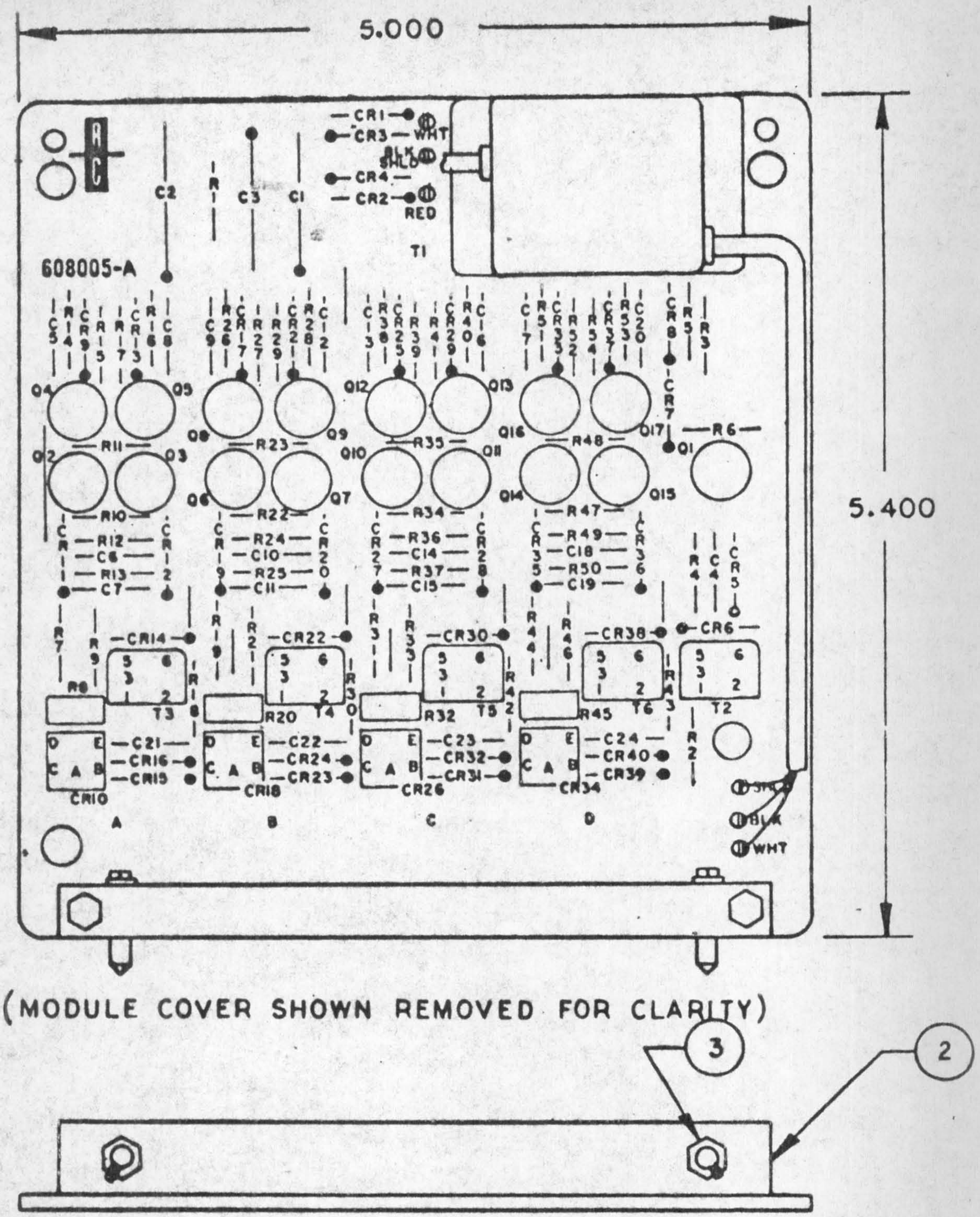
If correct power supply's voltages are in evidence and the card still does not operate, the reset circuitry can be suspected. This may be checked by observing that all the four channels remain selected, that is all four inputs connected to the output. Tracing signals from the reset transformer T2 and associated transistor Q1 will exhibit the faulty component.

1.10 (continued)

Any fault in one of the flip flops will be exhibited by failure of the associated diode quad to either switch on or off in sympathy with the input reset or set signals. Standard point checking will easily locate the faulty part.

An important note in trouble shooting the multiplexer switches and flip flops is that the ground return of the test equipment must be connected to the ground of the related floating power supply.

Whereas in trouble shooting input diode gates, the ground must be made at the appropriate power supply return.

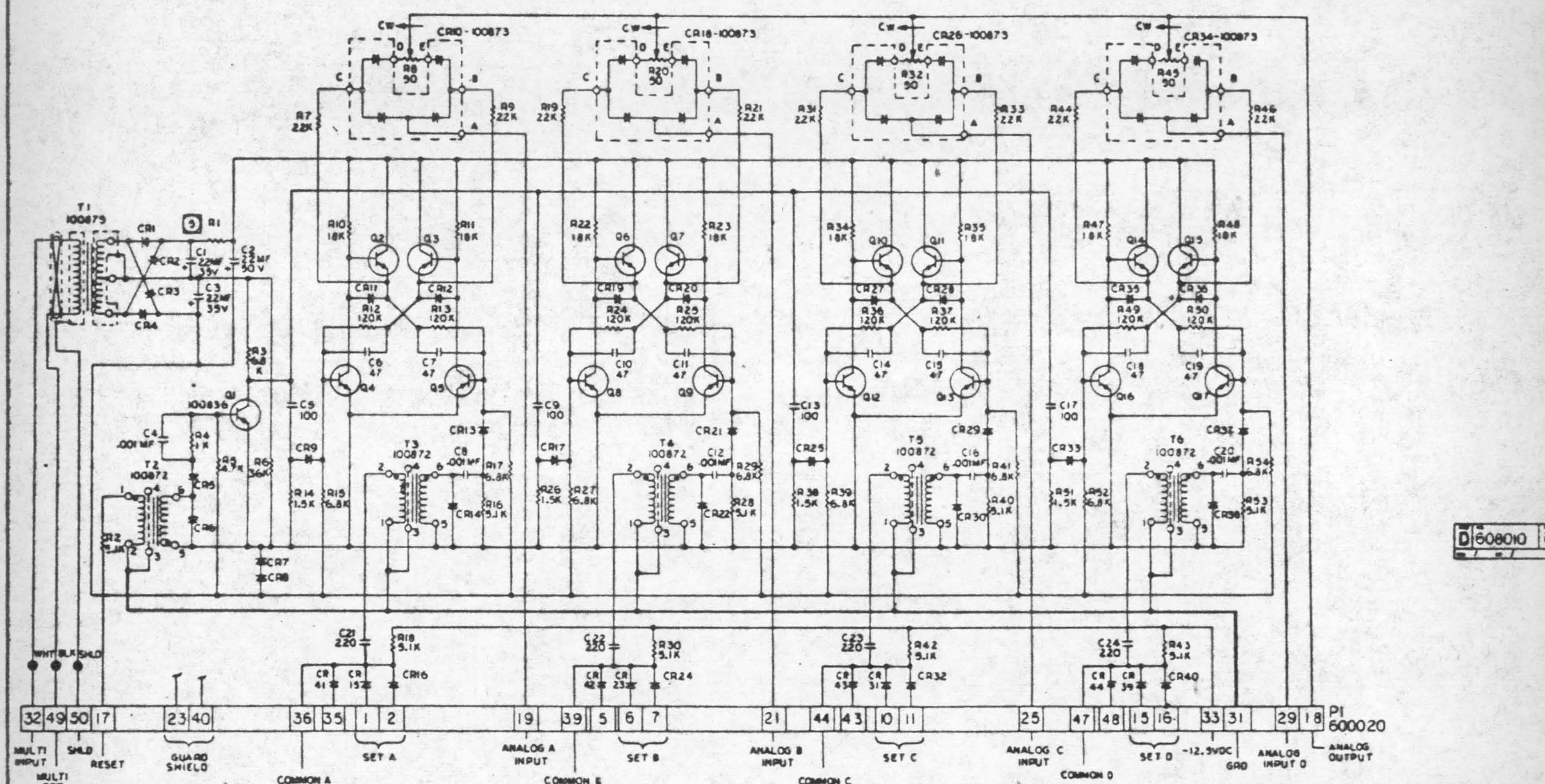


(MODULE COVER SHOWN REMOVED FOR CLARITY)

608005
MULTIPLEX SWITCHES

REFERENCE DWGS: SCHEMATIC NO. 608010, PARTS LIST NO. 608006

REV	DESCRIPTION
A	FIRST RELEASE
B	CHGD VALUES OF 21 COMP. ADDED GUARD SHIELD TO PINS 24 & 40
C	ADDED PIN NO. 38, 39, 44, 47
D	REV PER E.O.#1340



5 FACTORY SELECTED VALUE.
4. ALL TRANSISTORS ARE REDCOR NO. 100887.
3. ALL DIODES ARE REDCOR NO. 100780
2. ALL CAPACITANCE VALUES ARE IN PICO-FARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT, ±5%.
NOTE: UNLESS OTHERWISE SPECIFIED

REFERENCE DESIGNATIONS

FIRST	LAST	DELETED
R1	R54	
C1	C24	
CR1	CR44	
Q1	Q17	
T1	T6	
P1	P1	

REDCOR CORPORATION

608005 MULTIPLEX SWITCHES, SCHEMATIC DIAG.

D 608010 D

10 (608005)

PARTS LIST

608005 MULTIPLEX SWITCHES

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Tantalum, 22MF, 35V	Texas Inst.	SCM226GP035K4	
C2	Capacitor, Tantalum, 22MF, 50V	Sprague	109D226C7050F2	
C3	Same as C1			
C4	Capacitor, Disc, 1000PF	ARCO	CCD-102	
C5	Capacitor, Disc, 100PF	ARCO	CCD-101	
C6	Capacitor, Disc, 47 PF,	ARCO	CCD-470	
C7	Same as C6			
C8	Same as C4			
C9	Same as C5			
C10	Same as C6			
C11	Same as C6			
C12	Same as C4			
C13	Same as C5			
C14	Same as C6			
C15	Same as C6			
C16	Same as C4			
C17	Same as C5			
C18	Same as C6			
C19	Same as C6			
C20	Same as C4			
C21	Capacitor, Disc 220PF	ARCO	CCD-221	
C22	Same as C21			
C23	Same as C21			
C24	Same as C21			
CR1	Diode, Silicon	Redcor	100780	

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Same as CR1			
CR9	Same as CR1			
CR10	Diode, Quad	Redcor	100873	
CR11	Same as CR1			
CR12	Same as CR1			
CR13	Same as CR1			
CR14	Same as CR1			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR10			
CR19	Same as CR1			
CR20	Same as CR1			
CR21	Same as CR1			
CR22	Same as CR1			
CR23	Same as CR1			
CR24	Same as CR1			
CR25	Same as CR1			
CR26	Same as CR10			
CR27	Same as CR1			
CR28	Same as CR1			
CR29	Same as CR1			
CR30	Same as CR1			

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR31	Same as CR1			
CR32	Same as CR1			
CR33	Same as CR1			
CR34	Same as CR10			
CR35	Same as CR1			
CR36	Same as CR1			
CR37	Same as CR1			
CR38	Same as CR1			
CR39	Same as CR1			
* CR40	Same as CR1			
Q1	Transistor, PNP	Redcor	100836	
Q2	Transistor, PNP	Redcor	100887	
Q3	Same as Q2			
Q4	Same as Q2			
Q5	Same as Q2			
Q6	Same as Q2			
Q7	Same as Q2			
Q8	Same as Q2			
Q9	Same as Q2			
Q10	Same as Q2			
Q11	Same as Q2			
Q12	Same as Q2			
Q13	Same as Q2			
Q14	Same as Q2			
Q15	Same as Q2			
Q16	Same as Q2			
Q17	Same as Q2			
R1	Resistor, Comp., Factory Selected			

* add CR41 thru CR44 Same as CR1

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R2	Resistor, Comp., 5.1K, 1/4W, 5%	Allen-Bradley	RC07GF512J	
R3	Resistor, Comp., 6.8K, 1/4W, 5%	Allen-Bradley	RC07GF682J	
R4	Resistor, Comp., 1K, 1/4W, 5%	Allen-Bradley	RC07GF102J	
R5	Resistor, Comp., 4.7K, 1/4W, 5%	Allen-Bradley	RC07GF472J	
R6	Resistor, Comp., 36K, 1/4W, 5%	Allen-Bradley	RC07GF363J	
R7	Resistor, Comp., 22K, 1/4W, 5%	Allen-Bradley	RC07GF223J	
R8	Potentiometer, 50 Ohm	Spectrol	82-3-8-500	
R9	Same as R7			
R10	Resistor, Comp., 18K, 1/4W, 5%	Allen-Bradley	RC07GF183J	
R11	Same as R10			
R12	Resistor, Comp., 120K, 1/4W, 5%	Allen-Bradley	RC07GF124J	
R13	Same as R12			
R14	Resistor, Comp., 1.5K, 1/4W, 5%	Allen-Bradley	RC07GF152J	
R15	Same as R3			
R16	Same as R2			
R17	Same as R3			
R18	Same as R2			
R19	Same as R7			
R20	Same as R8			
R21	Same as R7			
R22	Same as R10			
R23	Same as R10			
R24	Same as R12			

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R25	Same as R12			
R26	Same as R14			
R27	Same as R3			
R28	Same as R2			
R29	Same as R3			
R30	Same as R2			
R31	Same as R7			
R32	Same as R8			
R33	Same as R7			
R34	Same as R10			
R35	Same as R10			
R36	Same as R12			
R37	Same as R12			
R38	Same as R14			
R39	Same as R3			
R40	Same as R2			
R41	Same as R3			
R42	Same as R2			
R43	Same as R2			
R44	Same as R7			
R45	Same as R8			
R46	Same as R7			
R47	Same as R10			
R48	Same as R10			
R49	Same as R12			
R50	Same as R12			
R51	Same as R14			
R52	Same as R3			
R53	Same as R2			

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	*MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R54	Same as R3			
T1	Transformer, Power	Redcor	100875	
T2	Transformer, Pulse	Redcor	100872	
T3	Same as T2			
T4	Same as T2			
T5	Same as T2			
T6	Same as T2			

INSTRUCTION MANUAL

600305 POWER DRIVERS AND ONE SHOT

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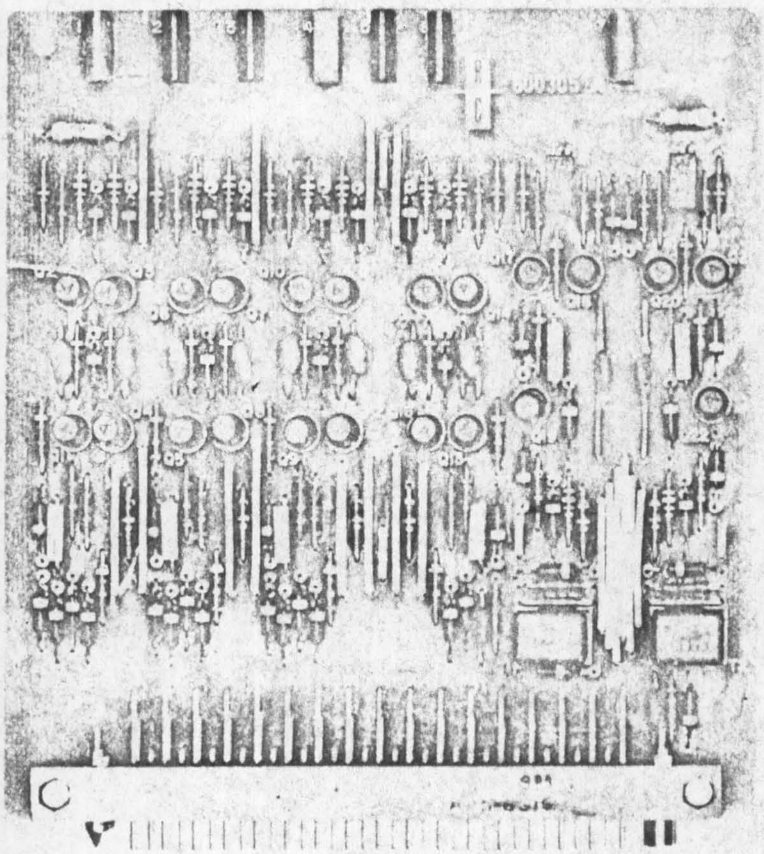


Figure 1 - 600305 Card

DESCRIPTION AND PURPOSE

This module contains 4 independent DC power driver circuits suitable for driving both heavy loads to ground and to -12 volts. In addition to the driver circuits, 2 independent monostable multivibrator circuits, 2 DC 2-term "AND" gates, and 2 single-term AC "AND" gates are included.

The gating inputs to the one shots can be directly coupled, or via the AC "AND" gates. Both the input returns are then referenced to the power ground, utilization of transformer coupled inputs either directly or again via the AC "AND" gates will allow the ground return to be isolated.

This combination card is primarily intended to provide isolated control signal inputs to ADC's and multiplexers, thus enabling the control signal sources to float. The two one shots are intended to provide start or sequence inputs and reset inputs.

SPECIFICATIONS

Module type:	Power drivers and one shots
No. of circuits:	4 power drivers 2 one shots 2 two-term expandable DC "AND" gates 2 single-term expandable AC "AND" gates
Type of logic:	DC and AC negative true

Power Driver Section

Voltage outputs:	
True:	-9 ±3 volts
False:	0 -0.5 volts
Input gating structure:	
Minimum:	"AND" OR
Maximum:	"AND" "AND" "AND", "OR"
Gating provided:	4 term "AND" single "OR"
Noise Rejection:	1.5 volts
Minimum input level:	- 6 volts
Trigger point:	negative falling edge
Fall time requirements:	To maintain output rise and fall times min. 300 nanosecs. Otherwise none.
Output loading:	
To ground:	300 ohms
To -12 volts:	65 mA
Output Capacitive loading:	800pf with full resistive load to ground

Maximum repetition rate:	1 Megacycle
Delay to last moving point:	100 nanosecs full load
Output rise time:	
No load:	30 nanosecs
Full load:	60 nanosecs
Output fall time:	
No load:	30 nanosecs
Full load:	70 nanosecs

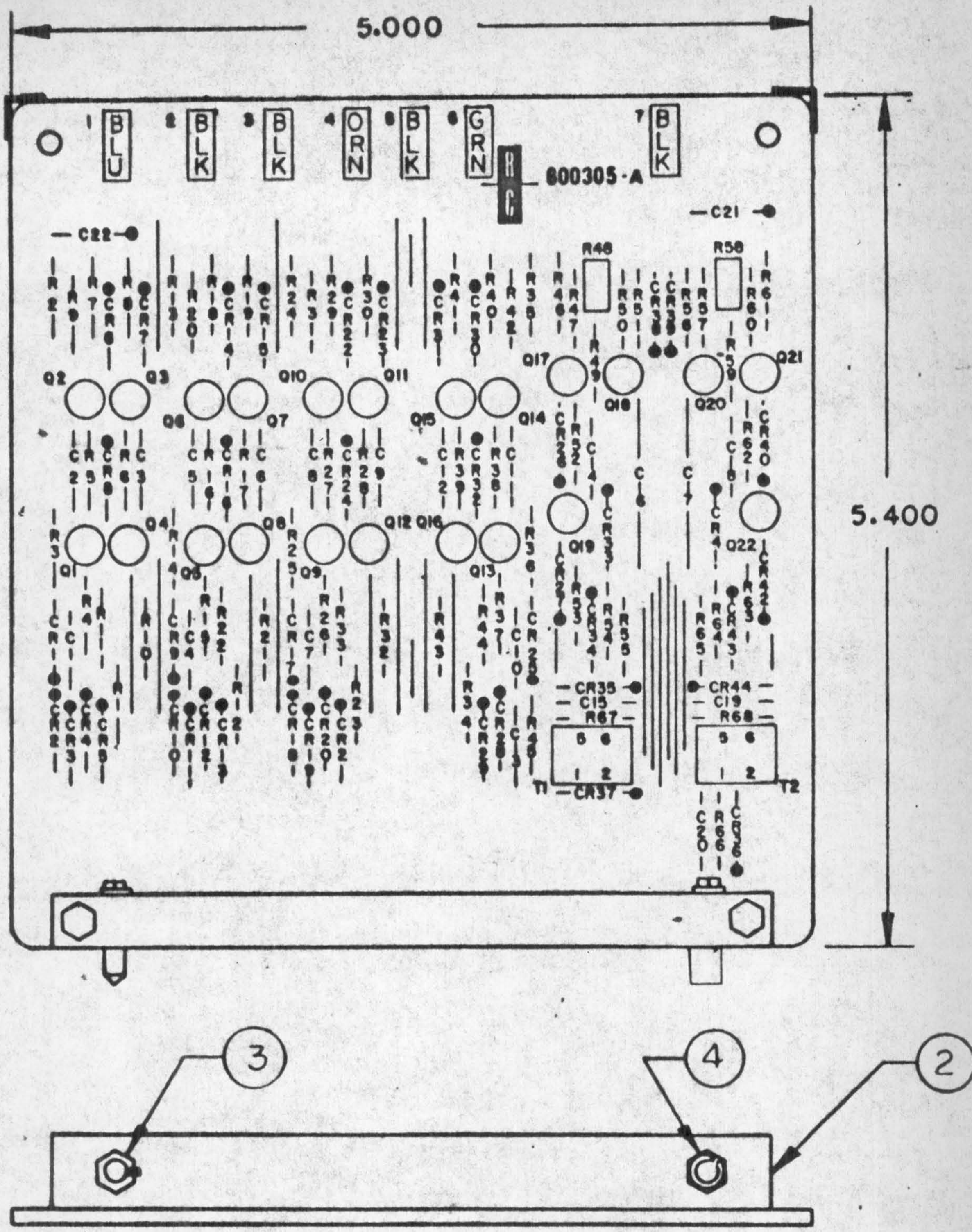
Output short circuit proof with respect to ground.

One Shot Section

Type of logic:	Negative true AC coupled
Voltage output:	
True:	-9±3 volts
False:	-0±0.5 volts
Input gating structure:	
Minimum:	"AND" "OR"
Maximum:	"AND" "AND" "OR"
Input structure provided:	
Set:	2 term "AND"
Auxiliary:	"OR"
Transformer:	Direct
Max DC voltage primary/secondary:	50 V
Expandable gates:	4 two term "AND"

Noise rejection:	2 volts
Minimum trigger transition:	6 volts
Trigger point:	Positive edge to ground or either via transformer coupling
Transition time:	300nS minimum
Output loading:	
True:	1.5K to ground 20mA to negative voltage
False:	400 ohms to ground 20mA to negative voltage
Capacity:	Maximum 200pf
Timing requirements	
False output:	
Fall time:	70nS no load, 100nS full load
Rise time:	40nS no load, 100nS full load
Delay time:	100nS no load, 120nS full load
True output:	
Fall time:	200nS no load, 250nS full load
Rise time:	100nS no load, 150nS full load
Delay time: Min.	500nS
Max.	Variable
Delay time adjustment	
Line:	Potentiometer 2:1
External:	Capacitor
Max. repetition rate:	1 Megacycle

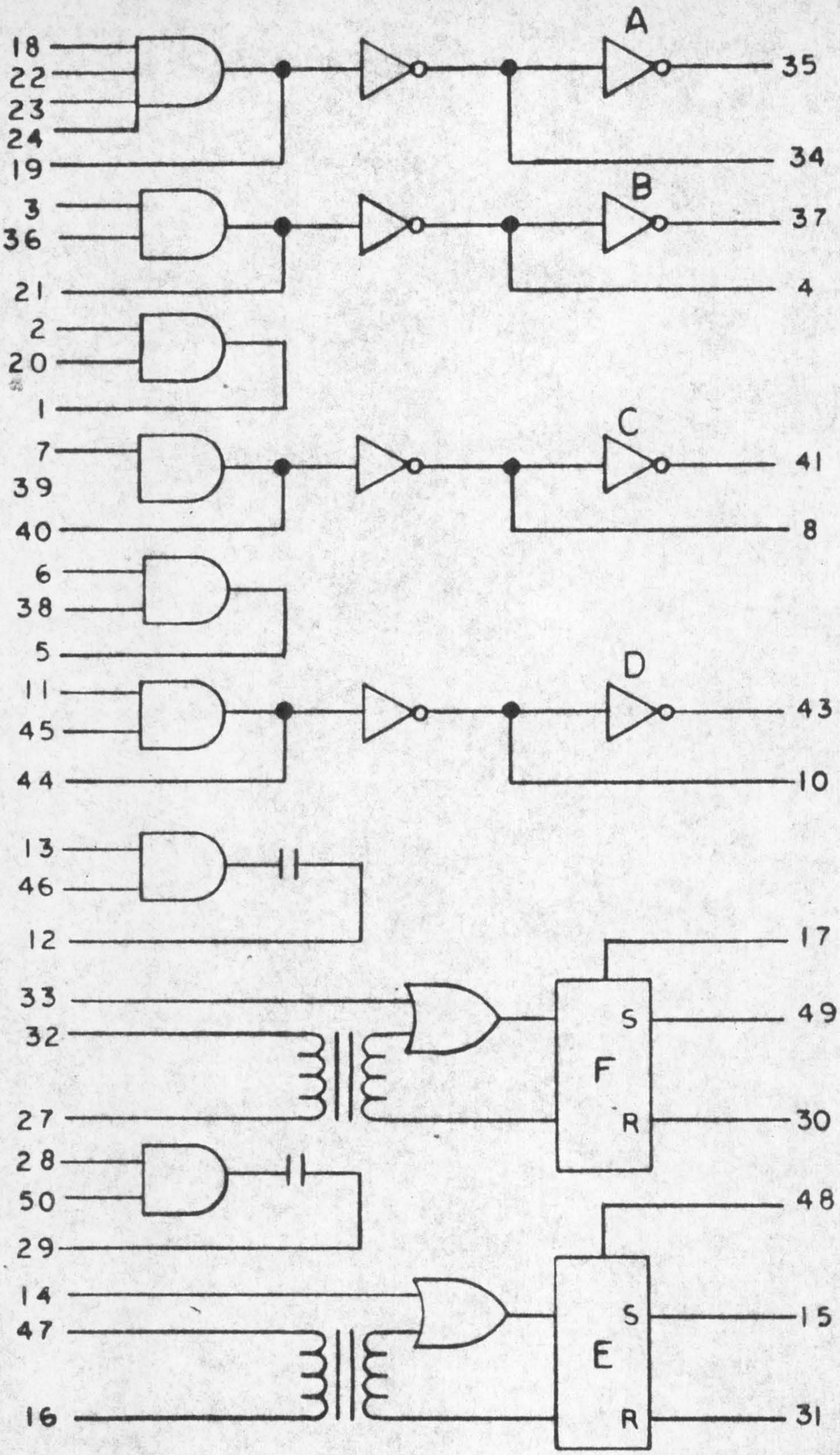
Power requirements:	+12.5 22.5mA -12.5 120mA
Operating temperature:	0 - 50°C
Mechanical size:	5" x 5.4" x 0.4"
Connector type:	50 pin
Board type:	.090 Thk glass epoxy
No. of test points:	4
Test points:	1 -12.5 volts 2 A power driver true output 3 B power driver true output 4 C power driver true output 5 Power ground 6 D power driver true output 7 +12.5 volts



600305

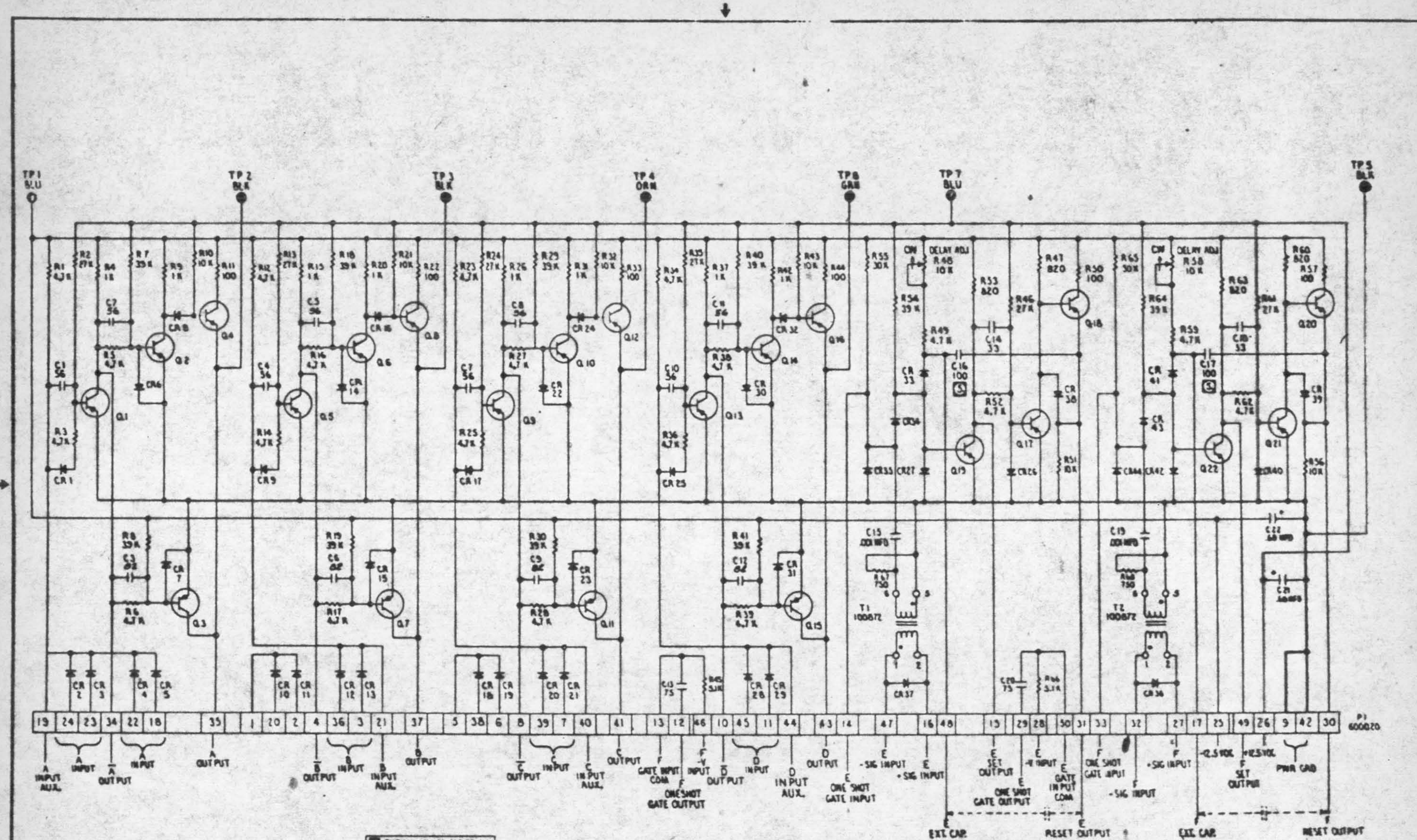
POWER DRIVERS & ONE SHOT

REFERENCE DWGS: SCHEMATIC NO. 600306 PARTS LIST NO. 600305



-12V 25
+12V 26
GRD 9,42

ONE SHOT & DRIVERS
600305



$\boxed{5}$ C16/C17 CHOSEN FOR DESIRED DELAY, SEE TABLE.
4. ALL TRANSISTORS ARE 2N2401
3. ALL DIODES ARE REDCOR NO. 100780-3.
2. ALL CAPACITOR VALUES ARE IN PICO FARADS.
1. ALL RESISTOR VALUES ARE IN OHMS, ¼ WATT, ±5%.
NOTES: UNLESS OTHERWISE SPECIFIED

$\boxed{5}$ TYPICAL VALUES FOR DELAY	
DELAY	VALUE
1 μSEC	150 PF
10 μSEC	1500 PF
100 μSEC	.015 MFD
1 MSEC.	.15 MFD
1 SEC	150 MFD

REFERENCE DESIGNATIONS					
FIRST		LAST		DELETED	
R1	TP1	R68	TP7		
C1		C22			
CR1		CR44			
Q1		Q22			
P1		P1			
T1		T2			

PARTS LIST

600305 CARD

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Disc, 56 PF	Arco	CCD-560	
C2	Same as C1			
C3	Capacitor, Disc, 82 PF	Arco	CCD-820	
C4	Same as C1			
C5	Same as C1			
C6	Same as C3			
C7	Same as C1			
C8	Same as C1			
C9	Same as C3			
C10	Same as C1			
C11	Same as C1			
C12	Same as C3			
C13	Capacitor, Disc, 75 PF	Arco	CCD-750	
C14	Capacitor, Disc, 33 PF	Arco	CCD-330	
C15	Capacitor, Disc, .001 MFD	Arco	CCD-102	
C16	Capacitor, Mica, 100 PF	Arco	SCDM15101K	
C17	Same as C16			
C18	Same as C14			
C19	Same as C15			
C20	Same as C13			
C21	Capacitor, Tant., .68 MFD	Texas Inst.	SCM684F$_2$P035K4	
C22	Same as C21			
CR1	Diode, Silicon	Redcor	100780-3	
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			

Revised July 1964

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR8	Same as CR1			
CR9	Same as CR1			
CR10	Same as CR1			
CR11	Same as CR1			
CR12	Same as CR1			
CR13	Same as CR1			
CR14	Same as CR1			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR1			
CR19	Same as CR1			
CR20	Same as CR1			
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CR32	Same as CR1			
CR33	Same as CR1			
CR34	Same as CR1			
CR35	Same as CR1			
CR36	Same as CR1			
CR37	Same as CR1			
CR38	Same as CR1			
CR39	Same as CR1			
CR40	Same as CR1			

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR41	Same as CR1			
CR42	Same as CR1			
CR43	Same as CR1			
CR44	Same as CR1			
Q1	Transistor, PNP	Philco	2N2401	
Q2	Same as Q1			
Q3	Same as Q1			
Q4	Same as Q1			
Q5	Same as Q1			
Q6	Same as Q1			
Q7	Same as Q1			
Q8	Same as Q1			
Q9	Same as Q1			
Q10	Same as Q1			
Q11	Same as Q1			
Q12	Same as Q1			
Q13	Same as Q1			
Q14	Same as Q1			
Q15	Same as Q1			
Q16	Same as Q1			
Q17	Same as Q1			
Q18	Same as Q1			
Q19	Same as Q1			
Q20	Same as Q1			
Q21	Same as Q1			
Q22	Same as Q1			
R1	Resistor, Comp., 4.7 K, 1/4W, ±5%	Allen-Bradley	RC07GF472J	
R2	Resistor, Comp., 27K, 1/4W, ±5%	Allen-Bradley	RC07GF273J	
R3	Same as R1			

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R4	Resistor, Comp., 1 K, 1/4W, ±5%	Allen-Bradley	RC07GF102J	
R5	Same as R1			
R6	Same as R1			
R7	Resistor, Comp., 39K, 1/4W, ±5%	Allen-Bradley	RC07GF393J	
R8	Same as R7			
R9	Same as R4			
R10	Resistor, Comp., 10 K, 1/4W, ±5%	Allen-Bradley	RC07GF103J	
R11	Resistor, Comp., 100 Ohms, 1/4W, ±5%	Allen-Bradley	RC07GF101J	
R12	Same as R1			
R13	Same as R2			
R14	Same as R1			
R15	Same as R4			
R16	Same as R1			
R17	Same as R1			
R18	Same as R7			
R19	Same as R7			
R20	Same as R4			
R21	Same as R10			
R22	Same as R11			
R23	Same as R1			
R24	Same as R2			
R25	Same as R1			
R26	Same as R4			
R27	Same as R1			
R28	Same as R1			
R29	Same as R7			
R30	Same as R7			
R31	Same as R4			
R32	Same as R10			
R33	Same as R11			
R34	Same as R1			

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R35	Same as R2			
R36	Same as R1			
R37	Same as R4			
R38	Same as R1			
R39	Same as R1			
R40	Same as R7			
R41	Same as R7			
R42	Same as R4			
R43	Same as R10			
R44	Same as R11			
R45	Resistor, Comp., 5.1K, 1/4W, ±5%	Allen-Bradley	RC07GF512J	
R46	Same as R2			
R47	Resistor, Comp., 820 Ohms, 1/4W, ±5%	Allen-Bradley	RC07GF821J	
R48	Potentiometer, 10K	Techno	40-10K	
R49	Same as R1			
R50	Same as R11			
R51	Same as R10			
R52	Same as R1			
R53	Same as R47			
R54	Same as R7			
R55	Resistor, Comp., 30K, 1/4W, ±5%	Allen-Bradley	RC07GF303J	
R56	Same as R10			
R57	Same as R11			
R58	Same as R48			
R59	Same as R1			
R60	Same as R47			
R61	Same as R2			
R62	Same as R1			
R63	Same as R47			
R64	Same as R7			
R65	Same as R55			
R66	Same as R45			

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R67	Resistor, Comp., 750 Ohms, 1/4W, ±5%	Allen-Bradley	RC07GF751J	
R68	Same as R67			
T1	Transformer, Pulse	Redcor	100872	
T2	Same as T1			
TP1	Test Jack, Blu	Ucinite	119437-G	
TP2	Test Jack, Blk	Ucinite	119437-C	
TP3	Same as TP2			
TP4	Test Jack, Orn	Ucinite	119437-E	
TP5	Same as TP2			
TP6	Test Jack, Grn	Ucinite	119437-F	
TP7	Same as TP2			

Revised July 1964

INSTRUCTION MANUAL

FOR

NAND 600300 CARD

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Canoga Park, Calif.

SPECIFICATIONS

NAND 600300 CARD

The module card contains 6 independent nand circuits. Each circuit has two term expandable "AND" gates. No collector loads are tied directly to the inverter stage such that an "OR" may be formed by tieing collectors together. Collector load resistors are provided on the card should it be necessary. In addition, 4 independent 3 term "AND" gates are provided for easy expansion.

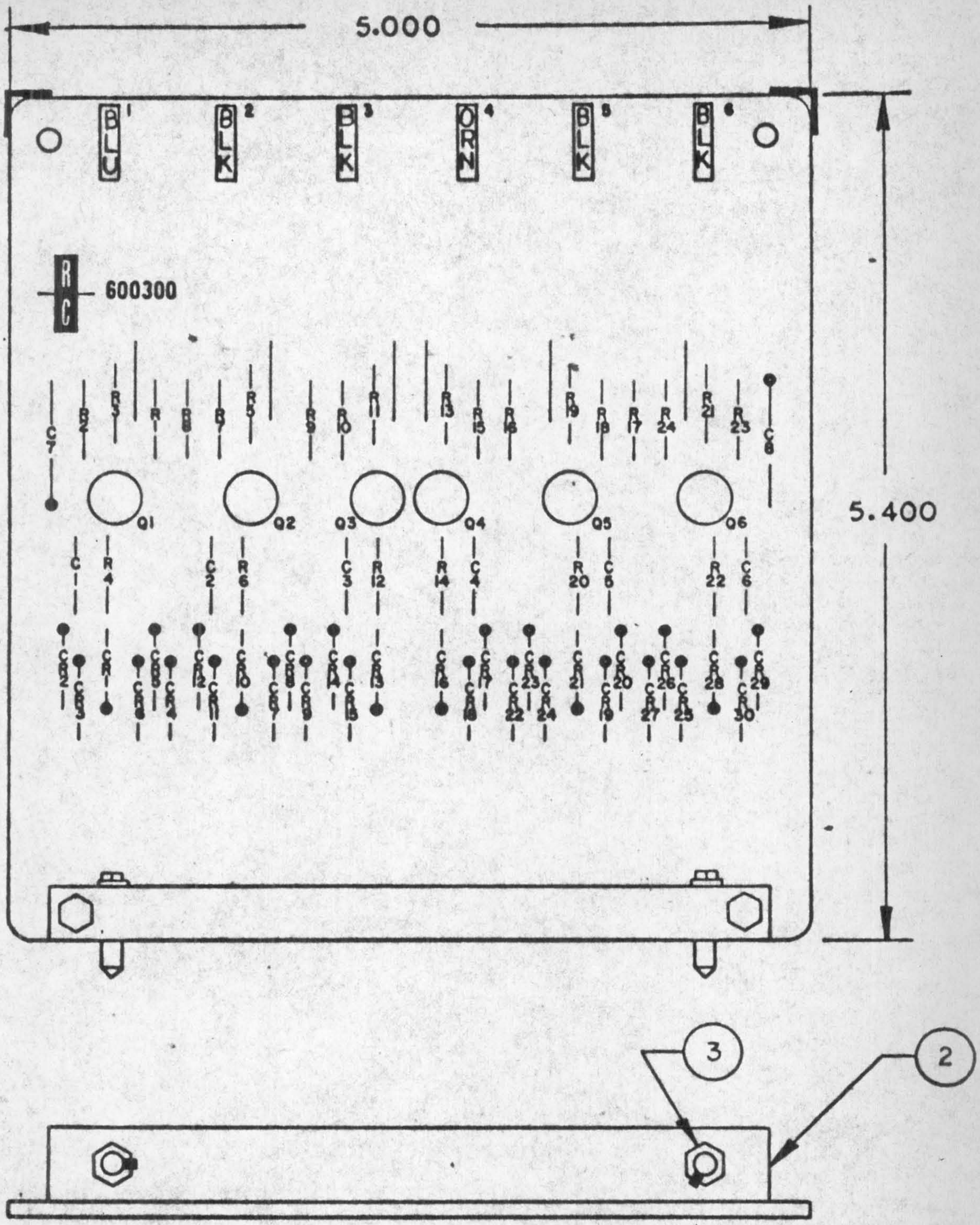
Type of Module:	NAND or $\overline{\text{AND}}$
No. of Circuits:	6
Type of logic:	Negative true
Logic levels:	
True:	-9 volts ±3 volts
False:	0 -0.5 volts

Note by inverting logic levels and using positive true signals, this module becomes a NOR or $\overline{\text{OR}}$.

Output loading:	
True:	1.5K to gnd when using 1K collector resistances
False:	20mA to negative voltage
Capacitance:	400pf maximum
Gating structure:	
Minimum:	"AND" OR
Maximum:	"AND", "AND" "AND" "OR"

(600300 continued)

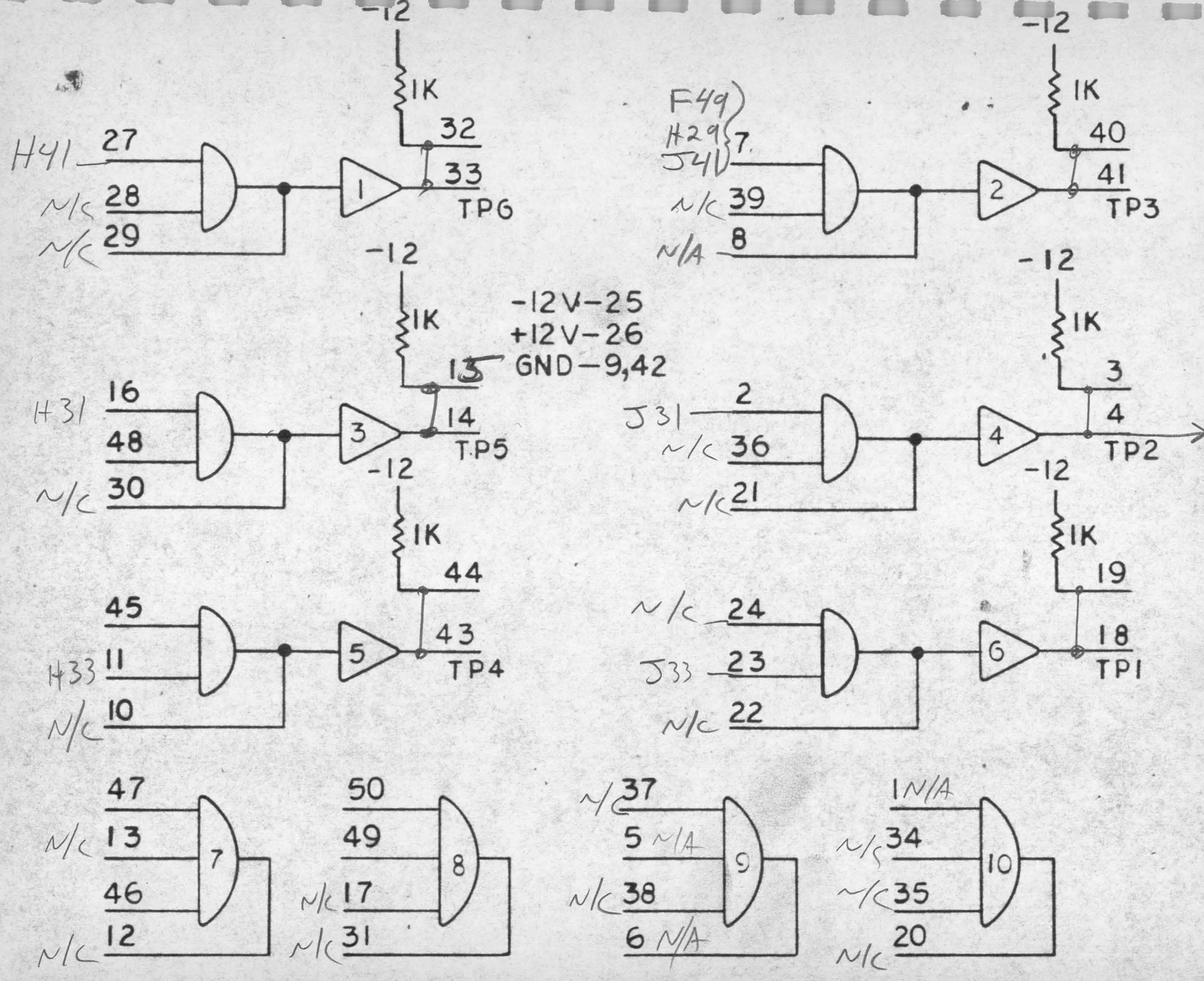
Gating provided:	Expandable 2 term "AND" "OR"
Additional gates:	4 independent 3 term "AND" no gate load provided.
Noise rejection:	2 volts
Trigger level:	-6 volts
Trigger point:	Negative falling edge
Trigger transition:	None but to maintain delay rise and fall times 300nS
Delay time:	100 nS
Output:	
Fall time:	100nS no load, 200nS full load
Rise time:	40nS no load, 150nS full load
Maximum repetition rate:	1 Megacycle
Power required:	+12.5 volts 10mA
	-12 volts 80mA worst case or 15mA per nand utilized, with collector returned to -12V via 1K resistor
Mechanical Size:	5" x 5.4" x 0.5"
Operating Temperature:	0 - 50°C
Board type:	.090 thick glass epoxy
Connector type:	50 pin
No. of test points:	6
Test points:	Each collector output.



600300

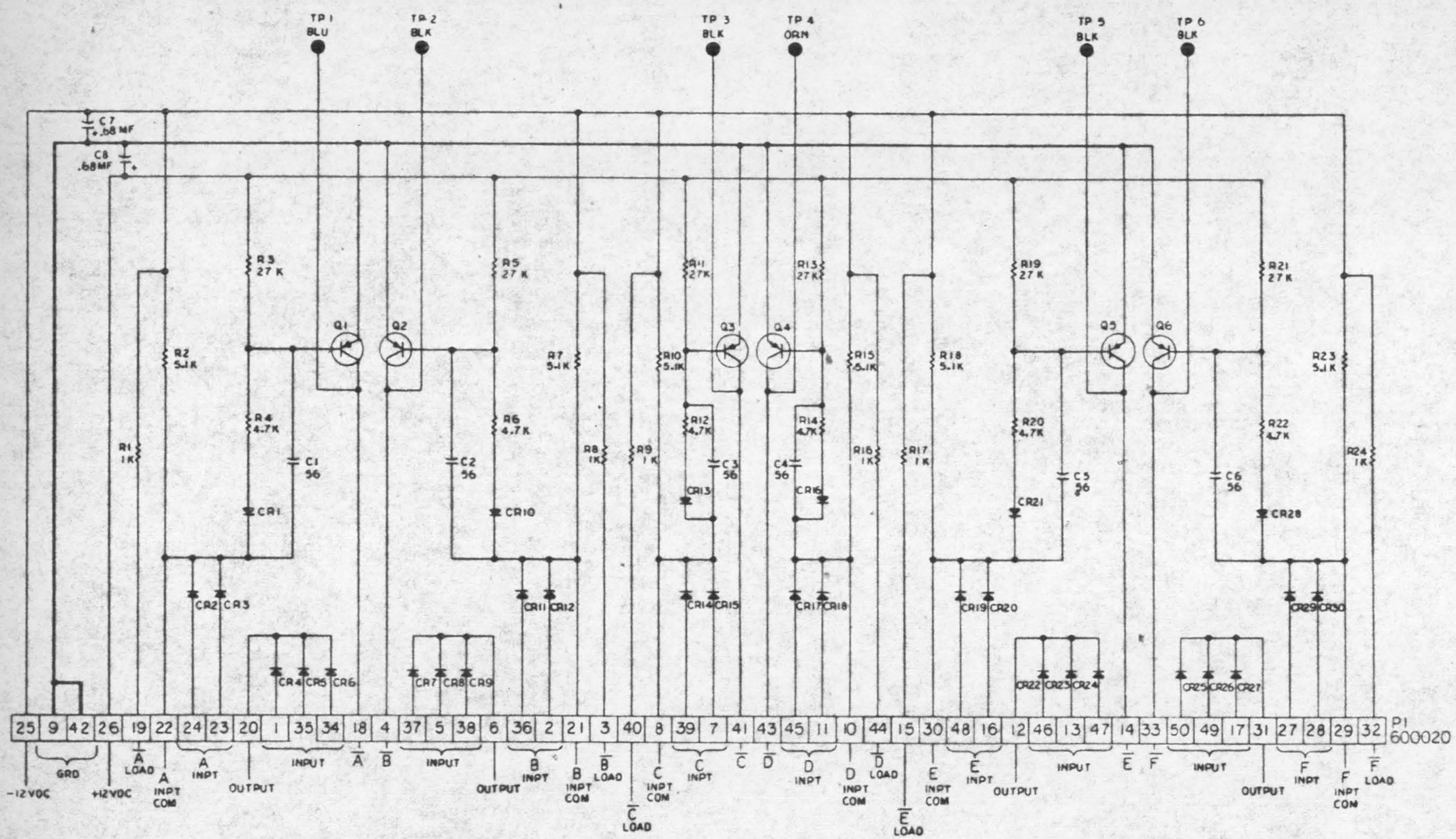
NAND CIRCUITS

REFERENCE DWGS: SCHEMATIC NO. 600032 PARTS LIST NO. 600013


-12
1K
32
33
TP6
H41
27
N/C 28
N/C 29
F49
H29
J41
7
40
41
TP3
N/C 39
N/A 8
-12V-25
+12V-26
GND-9,42
H31
16
48
N/C 30
13
14
TP5
J31
2
N/C 36
N/C 21
3
4
TP2
45
H33 11
N/C 10
44
43
TP4
N/C 24
J33 23
N/C 22
19
18
TP1
47
N/C 13
46
N/C 12
50
49
N/C 17
N/C 31
N/C 37
5 N/A
N/C 38
6 N/A
1 N/A
N/C 34
N/C 35
N/C 20

NAND

600300



4. ALL TRANSISTORS ARE 2N2401.
3. ALL CAPACITANCE VALUES ARE IN PICO-FARADS.
2. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT, ±5%.
1. ALL DIODES ARE REDCOR 100780

NOTE: UNLESS OTHERWISE SPECIFIED

REFERENCE DESIGNATIONS		
FIRST	LAST	DELETED
R1	R24	
C1	C6	
CR1	CR30	
Q1	Q6	
P1	P1	
TP1	TP6	

PARTS LIST

600300 NAND CIRCUITS

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Mica, 56PF	Mica Mold	MCM10D560K	
C2	Same as C1			
C3	Same as C1			
C4	Same as C1			
C5	Same as C1			
C6	Same as C1			
C7	Capacitor, Tantalum, .68MF, 35V	Texas Inst.	$SCM684F_2P035K4$	
C8	Same as C7			
CR1	Diode, Silicon	Redcor	100780-3	
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Same as CR1			
CR9	Same as CR1			
CR10	Same as CR1			
CR11	Same as CR1			
CR12	Same as CR1			
CR13	Same as CR1			
CR14	Same as CR1			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR1			
CR19	Same as CR1			
CR20	Same as CR1			

PARTS LIST

600300 NAND CIRCUITS

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR21	Same as CR1			
CR22	Same as CR1			
CR23	Same as CR1			
CR24	Same as CR1			
CR25	Same as CR1			
CR26	Same as CR1			
CR27	Same as CR1			
CR28	Same as CR1			
CR29	Same as CR1			
CR30	Same as CR1			
P1	Connector, 50 Pin, Plug	Redcor	600020	
Q1	Transistor	Philco	2N2401	
Q2	Same as Q1			
Q3	Same as Q1			
Q4	Same as Q1			
Q5	Same as Q1			
Q6	Same as Q1			
R1	Resistor, Comp., 1K, 1/4W, ±5%	Allen-Bradley	RC07GF102J	
R2	Resistor, Comp., 5.1K, 1/4W, ±5%	Allen-Bradley	RC07GF512J	
R3	Resistor, Comp., 27K, 1/4W, ±5%	Allen-Bradley	RC07GF273J	
R4	Resistor, Comp., 4.7K, 1/4W, ±5%	Allen-Bradley	RC07GF472J	
R5	Same as R3			
R6	Same as R4			
R7	Same as R2			
R8	Same as R1			
R9	Same as R1			

PARTS LIST

600300 NAND CIRCUITS

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R10	Same as R2			
R11	Same as R3			
R12	Same as R4			
R13	Same as R3			
R14	Same as R4			
R15	Same as R2			
R16	Same as R1			
R17	Same as R1			
R18	Same as R2			
R19	Same as R3			
R20	Same as R4			
R21	Same as R3			
R22	Same as R4			
R23	Same as R2			
R24	Same as R1			
TP1	Test Jack, Blu	Ucinite	119437-G	
TP2	Test Jack, Blk	Ucinite	119437-C	
TP3	Same as TP2			
TP4	Test Jack, Orn	Ucinite	119437-E	
TP5	Same as TP2			
TP6	Same as TP2			

INSTRUCTION MANUAL FOR

6-BIT STORAGE AND 3V POWER SUPPLY MODEL 600215

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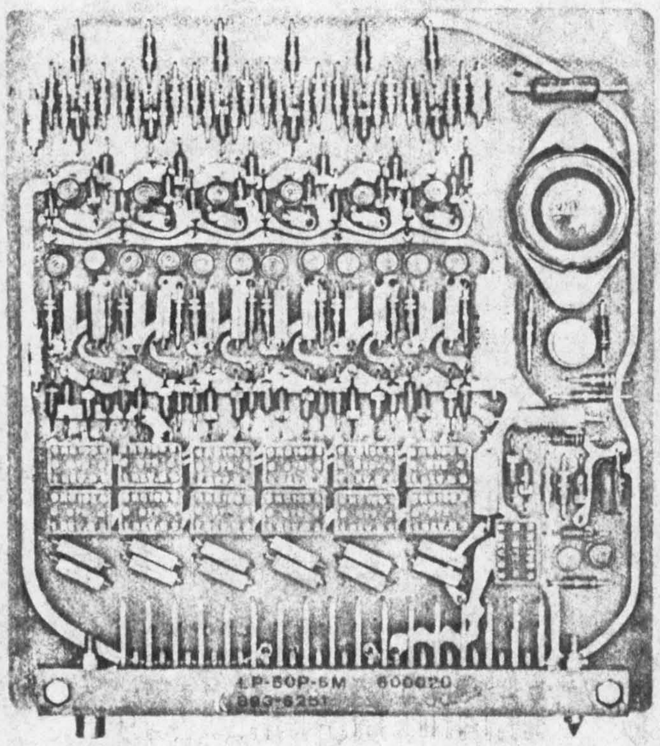


Figure 1 - 6-Bit Storage & 3V P.S. Model 600215

1. DESCRIPTION AND PURPOSE

2. Description - The REDCOR Model 600215 6-Bit Storage flip flop (see Figure 1) is a printed circuit board module consisting of six independent flip flop circuits with transformer-coupled set and reset inputs,one transformer-coupled common reset amplifier and a +3-volt power supply. The circuit board is a standard 50-pin module card with components mounted on one side. The board assembly measures 5 x 5.4 inches and requires one standard card space.

3. Purpose - The storage flip flop is used for logical storage purposes in analog-to-digital and digital-to-analog converters. Each flip flop circuit provides a -12.5 volt true output and a +3 volt false output. The two output voltages are suitable for driving a switch and resistor matrix card. The transformer-coupled inputs provide complete analog and digital ground isolation. The transformer-coupled common reset amplifier sets flip flop A to the true state (see Figure 2) and resets the remaining five flip flops to the false state. The output of the common reset amplifier is available at the connector for use in resetting other transformer-coupled flip flops such as the REDCOR Model 600150 8-bit storage flip flop module. The +3 volt power supply biases the output side of the flip

flops to provide the +3 volt false level and is available at the connector for use in biasing other transformer-coupled flip flops such as the REDCOR Model 600150 8-bit storage flip flop module.

4. CIRCUIT DESCRIPTION (See Figures 2 and 3)

5. Flip Flop Circuits - The 6-bit storage flip flop contains five identical flip flops and one special flip flop (A). The true sides of all the flip flops are biased to +3 volts to provide the +3 volt false signal. The true output lines utilize emitter followers to provide current gain and isolation, thus, the output waveform maintains the proper shape under heavy loading. Flip flop (A) is unique in that both sides of the flip flop are biased to +3 volts and the flip flop is set by the common reset signal.

6. Common Reset Amplifier - The common reset circuit amplifies the differentiated pulse from the input transformer and the amplified signal is emitter-follower-coupled to the common reset inputs of the flip flops.

7. +3 Volt Power Supply - The +3 volt power supply is a two stage transistor circuit utilizing a zener diode as a reference. Stage Q22 operates as a series regulator. Stage Q21 samples the +3 volt output and controls stage Q22. Any change in the output is inverted and amplified by Q21 and causes a corresponding change on the base of Q22, returning the output voltage to the proper level.

7. SPECIFICATIONS

Number of Circuits.............6 transformer-coupled flip flops
1 transformer-coupled reset amplifier
1 +3V power supply

Logic.........................Negative true, transformer-coupled

Input Structure Provided.......Capacitive input to transformers
Transformers have common input return

Minimum Input Transition........6V

Trigger Point..................Positive edge

Trigger Rise Time...............100 NS

Noise Rejection.................1V

Output Logic Levels:

True........................-12.5V ±0.5V
False.......................+3V ±0.5V

Output Loading:

To Ground....................2K
To Negative Voltage..........5ma
Capacitance..................100pf max

Timing Relationships:

Repetition Rate..............1mc max
Delay to last moving point...100nSec.
Rise Time....................100nSec.
Fall Time....................100nSec.

+3V Power Supply Circuit:

Output Voltage...............+3V ±0.5V
Output Current...............0 - 150ma
Output Regulation, No Load
to Full Load.................less than 10%
Output Noise.................less than 1mv RMS

Power Requirements:

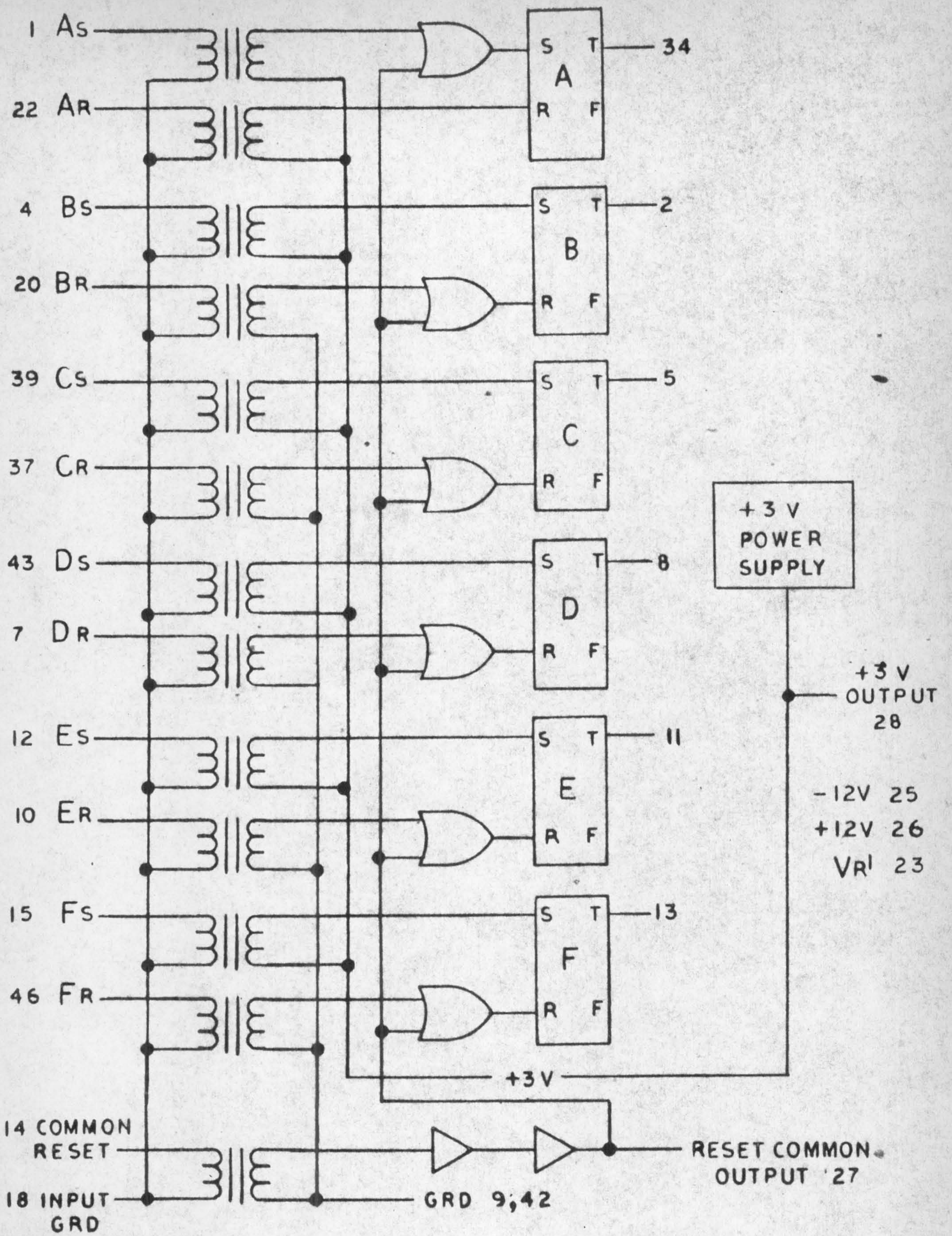
+12 Volts....................175ma
-12 Volts....................100ma
$-V_1$ Volts (nominally -12.5V) 20ma

Operating Temperature........0 - 50°C

Mechanical Size..............5" x 5.4" x 0.5"

Connector Type...............50 Pin

Board Type...................(.090") thick glass epoxy



6 BIT FLIP FLOP & +3V POWER SUPPLY
600215
Figure 2

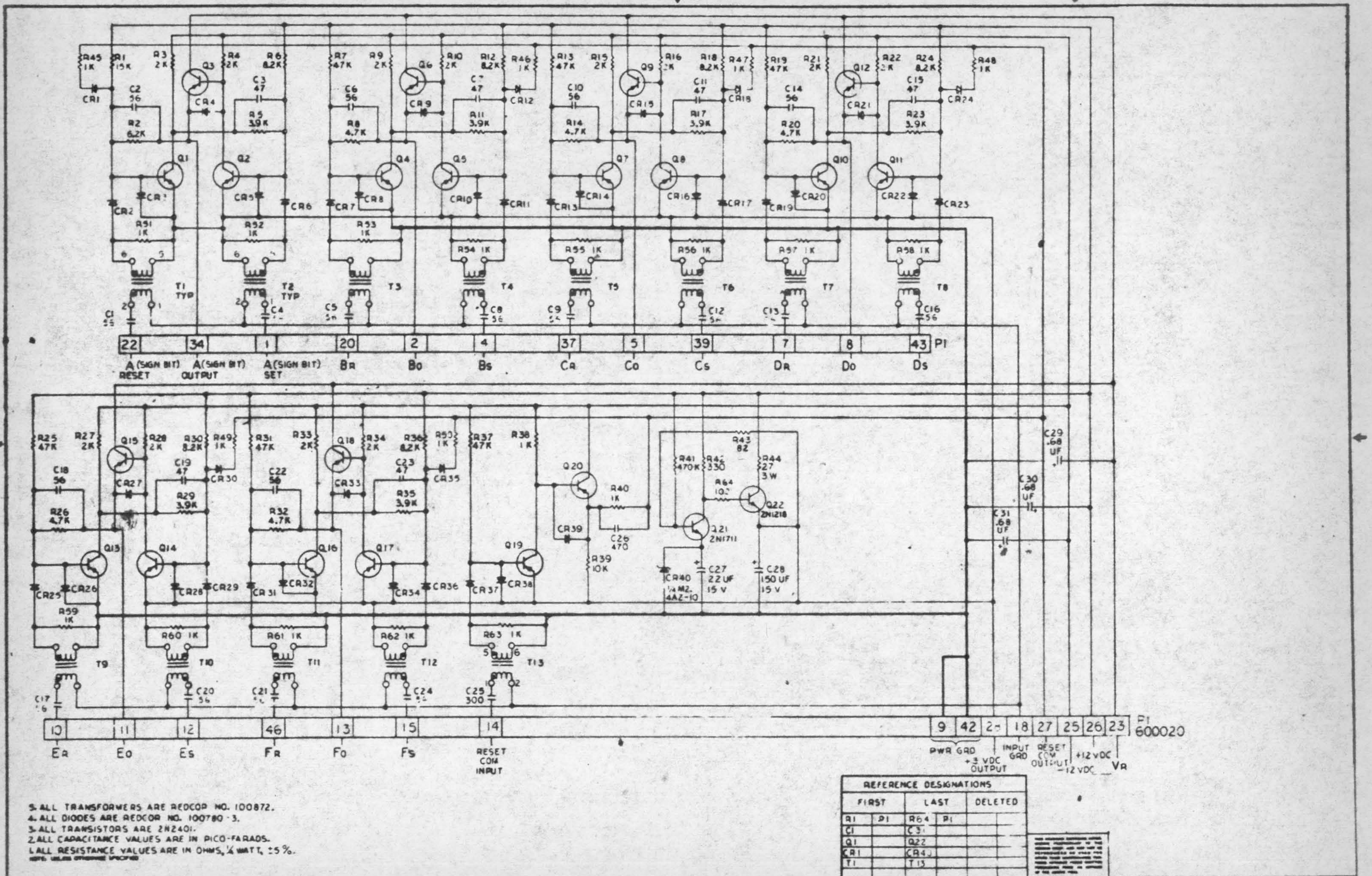
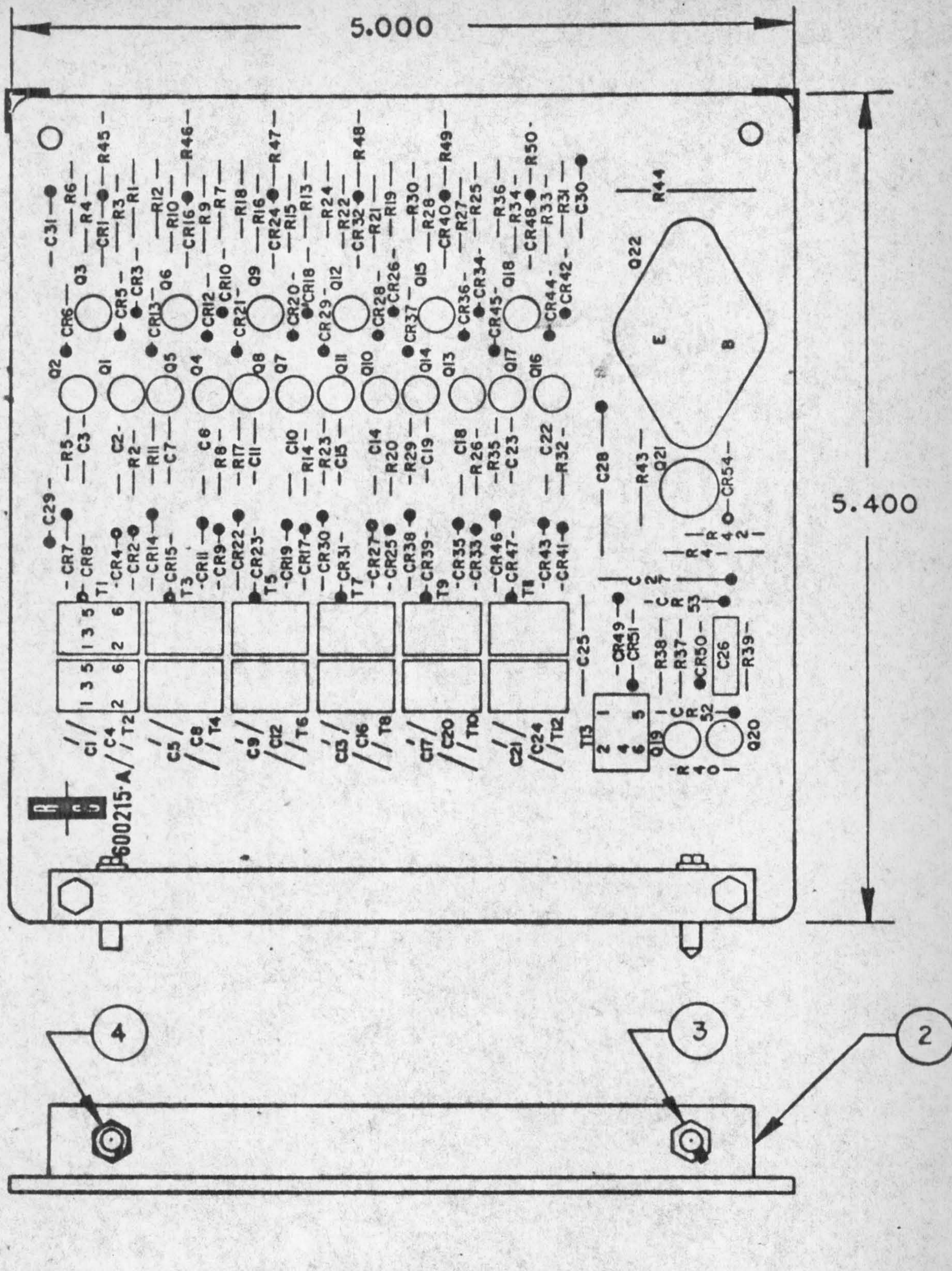


Figure 3 - 600215 Schematic Diag.



600215
6 BIT STORAGE AND 3V P.S.

Figure 4

REFERENCE DWGS: SCHEMATIC NO. 600220, PARTS LIST NO. 600216

PARTS LIST

600215 (6) BIT STORAGE & 3 V.P.S.

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Disc, 56PF	Arco	CCD-560	
C2	Capacitor, Mica, 56PF, 300V	Micamold	MCM10D560K	
C3	Capacitor, Mica, 47PF, 300V	Micamold	MCM10D470K	
C4	Same as C1			
C5	Same as C1			
C6	Same as C2			
C7	Same as C3			
C8	Same as C1			
C9	Same as C1			
C10	Same as C2			
C11	Same as C3			
C12	Same as C1			
C13	Same as C1			
C14	Same as C2			
C15	Same as C3			
C16	Same as C1			
C17	Same as C1			
C18	Same as C2			
C19	Same as C3			
C20	Same as C1			
C21	Same as C1			
C22	Same as C2			
C23	Same as C3			
C24	Same as C1			
C25	Capacitor, Mica, 300PF, 500V	Arco	CM15E301J	
C26	Capacitor, Mica, 470PF, 300V	Arco	DM15-471-J	

PARTS LIST

600215 (6) BIT STORAGE & 3 V.P.S.

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C27	Capacitor, Tant., 22MF, 15V	Texas Inst.	SCM226BP015K4	
C28	Capacitor, Tant., 150MF, 15V	Texas Inst.	SCM157HP015K4	
C29	Capacitor, Tant., .68MF, 35V	Texas Inst.	SCM684F$_2$P035K4	
C30	Same as C29			
C31	Same as C29			
CR1	Diode, Silicon	Redcor	100780	
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Same as CR1			
CR9	Same as CR1			
CR10	Same as CR1			
CR11	Same as CR1			
CR12	Same as CR1			
CR13	Same as CR1			
CR14	Same as CR1			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR1			
CR19	Same as CR1			
CR20	Same as CR1			
CR21	Same as CR1			
CR22	Same as CR1			

PARTS LIST

600215 (6) BIT STORAGE & 3 V.P.S.

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR23	Same as CR1			
CR24	Same as CR1			
CR25	Same as CR1			
CR26	Same as CR1			
CR27	Same as CR1			
CR28	Same as CR1			
CR29	Same as CR1			
CR30	Same as CR1			
CR31	Same as CR1			
CR32	Same as CR1			
CR33	Same as CR1			
CR34	Same as CR1			
CR35	Same as CR1			
CR36	Same as CR1			
CR37	Same as CR1			
CR38	Same as CR1			
CR39	Same as CR1			
CR40	Diode, Zener	Motorola	1/4 M2.4AZ-10	
P1	Connector, 50 Pin, Male	Redcor	600020	
Q1	Transistor, P.N.P.	Philco	2N2401	
Q2	Same as Q1			
Q3	Same as Q1			
Q4	Same as Q1			
Q5	Same as Q1			
Q6	Same as Q1			
Q7	Same as Q1			
Q8	Same as Q1			
Q9	Same as Q1			
Q10	Same as Q1			

PARTS LIST

600215 (6) BIT STORAGE & 3 V.P.S.

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
Q11	Same as Q1			
Q12	Same as Q1			
Q13	Same as Q1			
Q14	Same as Q1			
Q15	Same as Q1			
Q16	Same as Q1			
Q17	Same as Q1			
Q18	Same as Q1			
Q19	Same as Q1			
Q20	Same as Q1			
Q21	Transistor, NPN	R.C.A.	2N1711	
Q22	Transistor, Silicon,Power	R.C.A.	2N1218	
R1	Resistor, Comp., 15K, 1/4W, ±5%	Allen-Bradley	RC07GF153J	
R2	Resistor, Comp., 6.2K, 1/4W, ±5%	Allen-Bradley	RC07GF622J	
R3	Resistor, Comp., 2K, 1/4W, ±5%	Allen-Bradley	RC07GF202J	
R4	Same as R3			
R5	Resistor, Comp., 3.9K, 1/4W, ±5%	Allen-Bradley	RC07GF392J	
R6	Resistor, Comp., 8.2K, 1/4W, ±5%	Allen-Bradley	RC07GF822J	
R7	Resistor, Comp., 47K, 1/4W, ±5%	Allen-Bradley	RC07GF473J	
R8	Resistor, Comp., 4.7K, 1/4W, ±5%	Allen-Bradley	RC07GF472J	
R9	Same as R3			
R10	Same as R3			
R11	Same as R5			
R12	Same as R6			

PARTS LIST

600215 (6) BIT STORAGE & 3 V.P.S.

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R13	Same as R7			
R14	Same as R8			
R15	Same as R3			
R16	Same as R3			
R17	Same as R5			
R18	Same as R6			
R19	Same as R7			
R20	Same as R8			
R21	Same as R3			
R22	Same as R3			
R23	Same as R5			
R24	Same as R6			
R25	Same as R7			
R26	Same as R8			
R27	Same as R3			
R28	Same as R3			
R29	Same as R5			
R30	Same as R6			
R31	Same as R7			
R32	Same as R8			
R33	Same as R3			
R34	Same as R3			
R35	Same as R5			
R36	Same as R6			
R37	Same as R7			
R38	Resistor, Comp., 1K, 1/4W, ±5%	Allen-Bradley	RC07GF102J	
R39	Resistor, Comp., 10K, 1/4W, ±5%	Allen-Bradley	RC07GF103J	
R40	Same as R38			

PARTS LIST

600215 (6) BIT STORAGE & 3 V.P.S.

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R41	Resistor, Comp., 470K, 1/4W, ±5%	Allen-Bradley	RC07GF474J	
R42	Resistor, Comp., 330 Ohm, 1/4W, ±5%	Allen-Bradley	RC07GF331J	
R43	Resistor, Comp., 82 Ohm, 1/4W, ±5%	Allen-Bradley	RC10GF820J	
R44	Resistor, W.W., 27 Ohm, 3W, ±5%	Sprague	Type 151E	
R45	Same as R38			
R46	Same as R38			
R47	Same as R38			
R48	Same as R38			
R49	Same as R38			
R50	Same as R38			
R51	Same as R38			
R52	Same as R38			
R53	Same as R38			
R54	Same as R38			
R55	Same as R38			
R56	Same as R38			
R57	Same as R38			
R58	Same as R38			
R59	Same as R38			
R60	Same as R38			
R61	Same as R38			
R62	Same as R38			
R63	Same as R38			
R64	Resistor, Comp., 100 Ohm, 1/4W, ±5%	Allen-Bradley	RC07GF101J	
T1	Transformer, Pulse	Redcor	100872	

PARTS LIST

600215 (6) BIT STORAGE & 3 V.P.S.

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
T2	Same as T1			
T3	Same as T1			
T4	Same as T1			
T5	Same as T1			
T6	Same as T1			
T7	Same as T1			
T8	Same as T1			
T9	Same as T1			
T10	Same as T1			
T11	Same as T1			
T12	Same as T1			
T13	Same as T1			

INSTRUCTION MANUAL FOR COMPARATOR AMPLIFIER MODEL 600205

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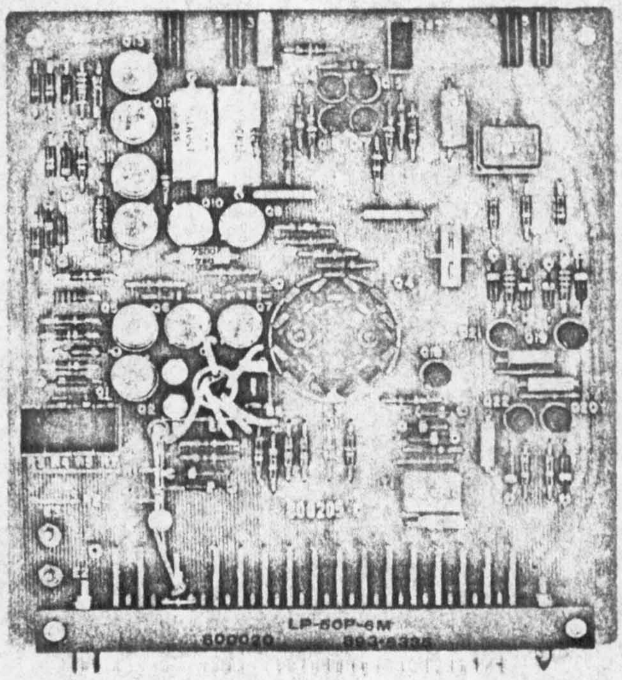

Figure 1. Model 600205 Comparator Amplifier

1. DESCRIPTION AND PURPOSE

2. Description - The Model 600205 Comparator Amplifier Trigger (see figure 1) is a printed circuit board module consisting of a resistance adder network, an amplifier, strobed amplifier, and a flip-flop. The circuit board is a standard 50-pin module card with components mounted on one side. The board assembly measures 5 x 5.4 inches and requires one standard card space. Test points are provided on the top edge of the card for waveform observation and trouble shooting during operation.

3. Purpose - The usual application of the comparator module is in analog-to-digital converters where very high speed accurate comparisons, with respect to ground, are necessary. The comparator compares the analog input against a switch matrix output. The algebraic sum of the two voltages are amplified by the amplifier and fed to the strobed amplifier. When the strobed amplifier is strobed, it sets or resets, as appropriate, the flip-flop. Setting or resetting the flip-flop causes the selection or rejection of the voltage supplied by the switch matrix.

4. CIRCUIT DESCRIPTION (See figures 2, 3, and 4)

5. Resistance Adder Network - The resistance adder network receives three inputs. The analog input is received through 1 to R3, the switch matrix output is applied to pin 20, and a +10-volt reference is applied to pin 18. The analog input is the input applied to the basic equipment. The switch matrix provides a precise voltage dependent upon its selected resistance value. The +10-volt reference is used whenever an offsetting voltage is required to provide bipolar operation. Refer to figure 2 for a simplified schematic of the resistance adder network. The amplifier input is obtained at the junction of the three resistances (R1 + R3 + R4), (R2 + R5), and (RX). Assume a balanced condition such that (R1 + R3 + R4) equals (R2 + R5) equals (RX)/2. If E_{ref} equals -10 volts, E1 is at the ground position and the amplifier input is at null,

then

$$\frac{E_{in}}{(R1 + R3 + R4)} = \frac{E_{ref}}{Rx}$$

$$E_{in} = +20 \text{ volts}$$

and when E_{ref} equals 0

$$E_{in} = 0 \text{ volts}$$

If E1 is at the +10-volt position and E_{ref} equals -10 volts,

then

$$\frac{E_{in}}{(R1 + R3 + R4)} = \frac{10}{(R2 + R5)} = \frac{E_{ref}}{RX}$$

$$E_{in} = +10 \text{ volts}$$

and when E_{ref} equals 0

$$E_{in} = -10 \text{ volts}$$

The input resistors R3 and R4 can be used to adjust the full scale input, as indicated by:

$$E_{in} = E_{ref} \frac{(R1 + R3 + R4)}{RX}$$

Zero adjustment can be made by adjusting R5 as indicated by:

$$\frac{E_{in}}{(R1 + R3 + R4)} + \frac{10}{(R2 + R5)} = \frac{E_{ref}}{RX}$$

$$E_{in} = E_{ref} \frac{(R1 + R3 + R4)}{10} - \frac{10\,(R1 + R3 + R4)}{R2 + R5}$$

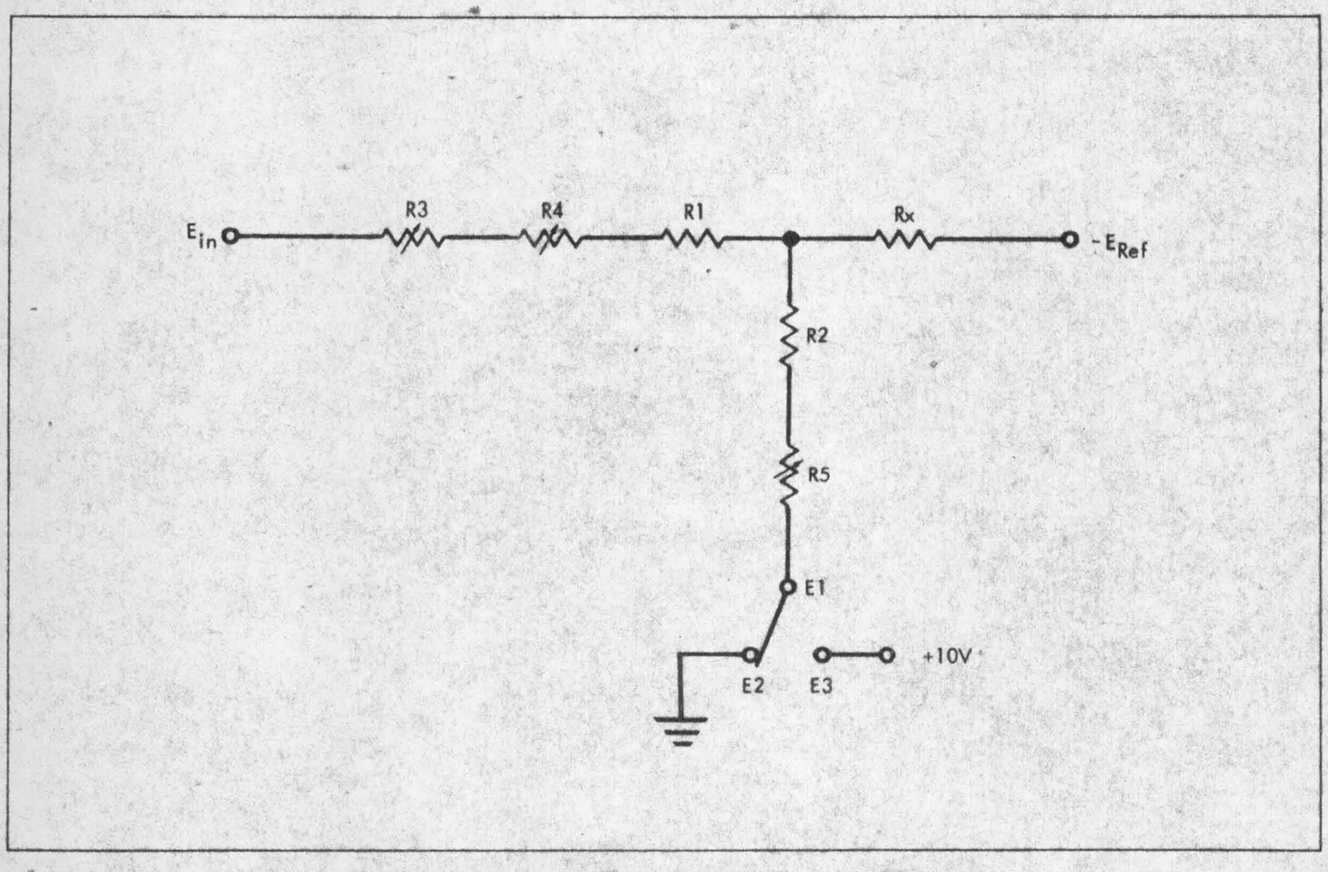

Figure 2. Resistance Adder Network, Simplified Schematic

6. Amplifier Circuits - The amplifier consists of differential amplifier Q1-Q2, differential amplifier Q3-Q4-Q7, complementary emitter-followers Q5 and Q6, -3 V power supply, and +3 V power supply.

Transistor Q2 is a differential amplifier pair constructed, for uniformity of specifications, from a silicon wafer. Q1 is a constant current stage which provides an effectively high common emitter resistance. Initial adjustment of the operating bias of Q2 is provided by R7, which should not require adjustment, in the field, in normal use. The second differential amplifier and constant current stage Q3-Q4-Q7 provides additional amplification. Complementary emitter-followers Q5 and Q6 provide current gain and isolation. The output of Q5 and Q6 is fed to the strobed amplifier.

In order to maintain drift free amplification, required of the amplifier, regulated power supply voltages are required. The -3 V power supply and the +3 V power supply provide these regulated voltages. The -3 V supply consists of Q8, Q9, and Q10. Stage Q8 is a series regulator controlled by Q9 and Q10. Stage Q9 is referenced by zener diode CR8 and stage Q10 by CR6 and CR7. The +3 V power supply consists of Q11, Q12, and Q13. Stage Q13 is a series regulator controlled by Q11 and Q12. Stage Q12 is referenced by zener diode CR9. Resistors R26, R27, and R28 reference the two supplies together.

7. Strobed Amplifier - The strobed amplifier consists of differential amplifiers Q14-Q15 and Q16-Q17-Q18. The output of the amplifier is applied to differential amplifier Q14-Q15. The output of Q14-Q15 is fed to differential amplifier and constant current stage Q15-Q17-Q18. Constant current stage Q18 is normally biased so that no collector current can flow, thus the collectors of Q16 and Q17 are normally held at -12 V. When a negative pulse is applied to the base of Q18 it turns on and allows either Q16 or Q17 to conduct. Collector output signals from Q14 and Q15 determine whether Q16 or Q17 conducts. The polarity of the pulse applied to the primary of transformer T2 depends upon the conduction of Q16 and Q17. Potentiometer R42 functions as a zero or threshold adjustment of the strobed amplifier. This adjustment provides a method of zero adjusting the complete converter, in the case of a unipolar analog-to-digital converter. Transformer T1 and T2 provide isolation interface. Both transformers will sustain a pulse of 0.5 usec. Transformer T1 receives the strobe input. When the negative strobe pulse is received the strobed amplifier provides an output, through transformer T2 to the flip-flop. Dependent upon polarity of the pulse, provided to the primary, either a negative-going or positive-going pulse is provided by the secondary. The negative-going or positive-going pulse is applied to the flip-flop circuit.

8. Flip-Flop Circuit - The flip-flop circuit consists of Q19 through Q22 and is a conventional DC bi-stable circuit. The flip-flop is reset by a clock pulse input on pin 16. Depending upon the output of the strobed amplifier, the flip-flop remains in the reset state or is driven into the set state. An input of -0.25 mv, to the amplifier, causes the flip-flop to remain reset and a false output appears at pin 32 and a true output appears at pin 49. An input of +0.25 mv, to the amplifier, causes the flip-flop to be driven to the set state and a true output appears at pin 32 and a false output appears at pin 49. A false output at pin 49 causes the bit weight to be rejected.

9. MAINTENANCE

Standard circuit board maintenance practices apply. Replacement parts shall be those specified in the parts list.

CAUTION

When soldering and replacing electronic components on the circuit board, the circuit board and replacement components should not be overheated. Use an appropriate heatsink.

Trouble shooting is easily accomplished using test points TP1 through TP5 and observing voltages and waveforms.

10. REPLACEMENT PARTS

Replacement parts for the comparator are listed in the following parts list. For location and identification of parts see figure 5.

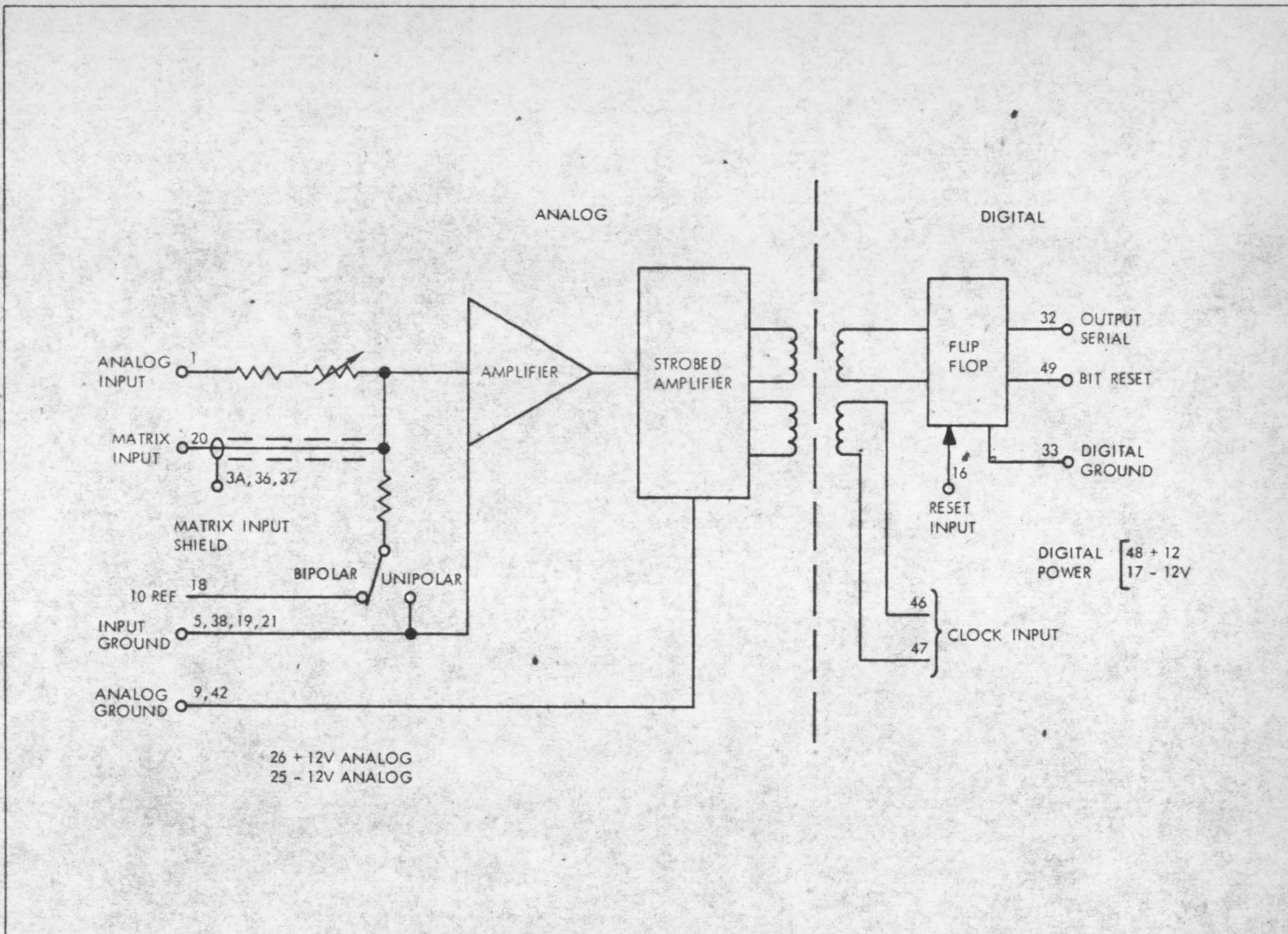

Figure 3. Model 600205 Comparator Amplifier, Logic Diagram

REDCOR 600205

11. SPECIFICATIONS

Analog Input:

Input sensitivity	200 uV
Input overload maximum	±10 V or 4 ma
Recovery time	1.5 usec to within 200 uv of final value after 10 V overload
Source resistance	2K
Input impedance	10K
Long term drift	Less than 200 uV in 30 days, referred to input
Temperature coefficient of drift	10 uV per degree C referred to input

Digital Input:

Strobe	Transformer coupled
Rise time	60 nsec
Pulse duration	1 usec minimum to 10 usec maximum
Level change	6 V minimum
Maximum DC primary/secondary	50 V
Capacitive isolation	5 pf
Input loading between lines	2.7K
Maximum repetition rate	1 mc

Digital Output:

Type of output	DC flip-flop

Output levels:

True	-9 ±3 V
False	-0.5 V

Output loading:

To ground	1K
To -12 V line	12 ma
Capacitive	400 pf

Output timing:

Rise time	30 nsec no load, 40 nsec full load
Fall time	40 nsec no load, 60 nsec full load

Delay time from strobe input	100 nsec
Maximum repetition rate	1 mc

Power Requirements:

Analog:

+12 V	25 ma
-12 V	25 ma

Digital:

+12 V	5 ma
-12 V	15 ma

Operating temperature	0 - 50°C
Mechanical size	5" x 5.4" x 0.5"
Connector type	50-pin
Board type	0.90" thick glass epoxy

Test Points:

Number	5
Data provided	1 amplifier output 2 ±3 V power supply 1 strobed amplifier output 1 flip-flop output

Designation	Color	Data
TP1		+3 V
TP2		-3 V
TP3		amplifier output
TP4		strobed amplifier output
TP5		flip-flop serial output

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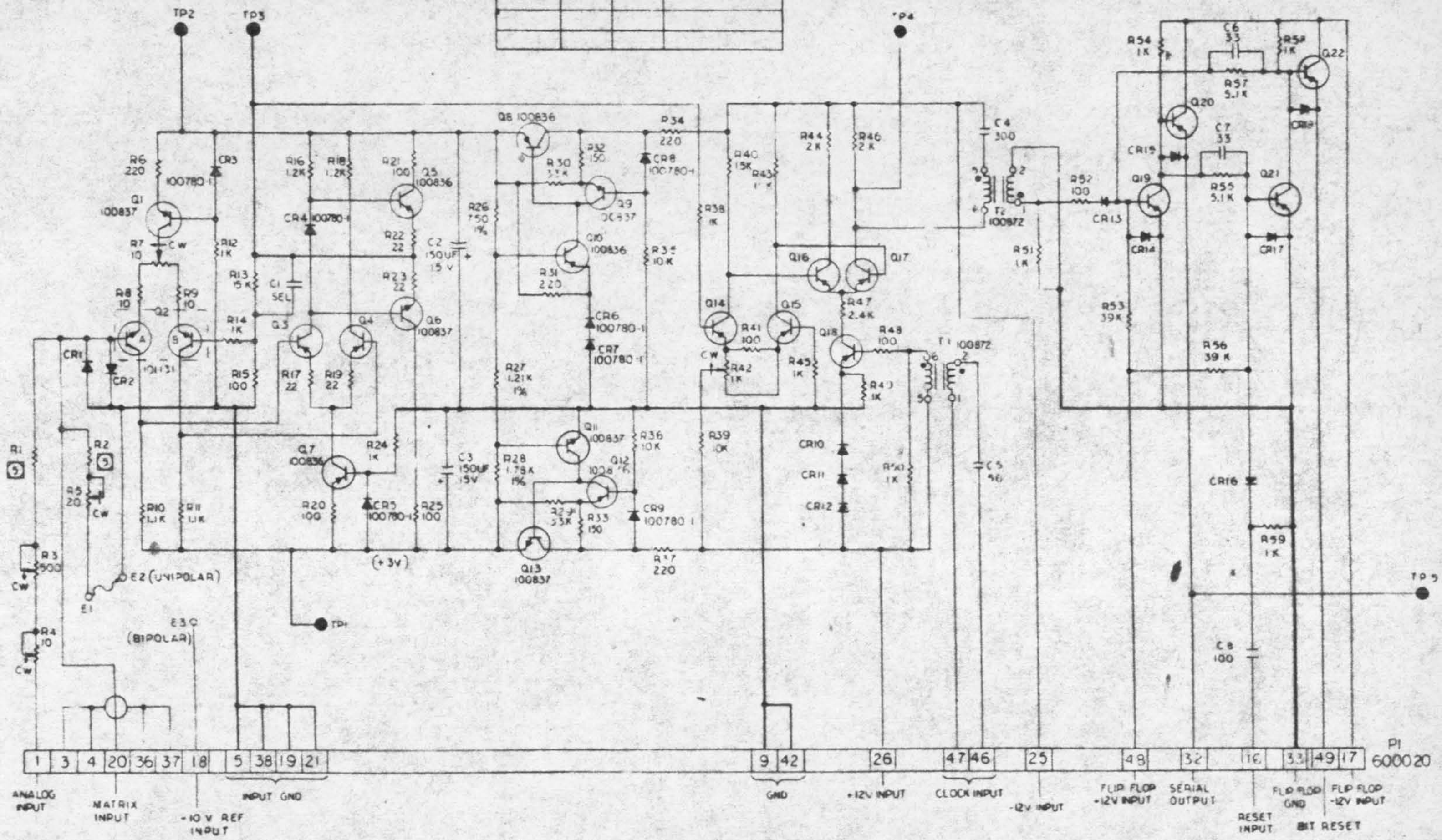
RESISTOR VALUE TABULATION (5)			
DASH NO.	R1	R2	REFERENCE
600205-1	4.75K	4.[illegible]K	ALL BINARY UNITS
600205-2	3.75K	3.33K	ALL B.C.D. UNITS



(5) R1 & R2 ARE [illegible]
4. ALL DIODES ARE REDCOR NO 100780-3
3. ALL TRANSISTORS ARE PHILCO 2N2401.
2. ALL CAPACITOR VALUES ARE IN PICO FARADS
1. ALL RESISTOR VALUES ARE IN OHMS, 1/2 WATT, ±5%

NOTE: UNLESS OTHERWISE SPECIFIED

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Figure 4. Model 600205 Comparator Amplifier, Schematic Diagram

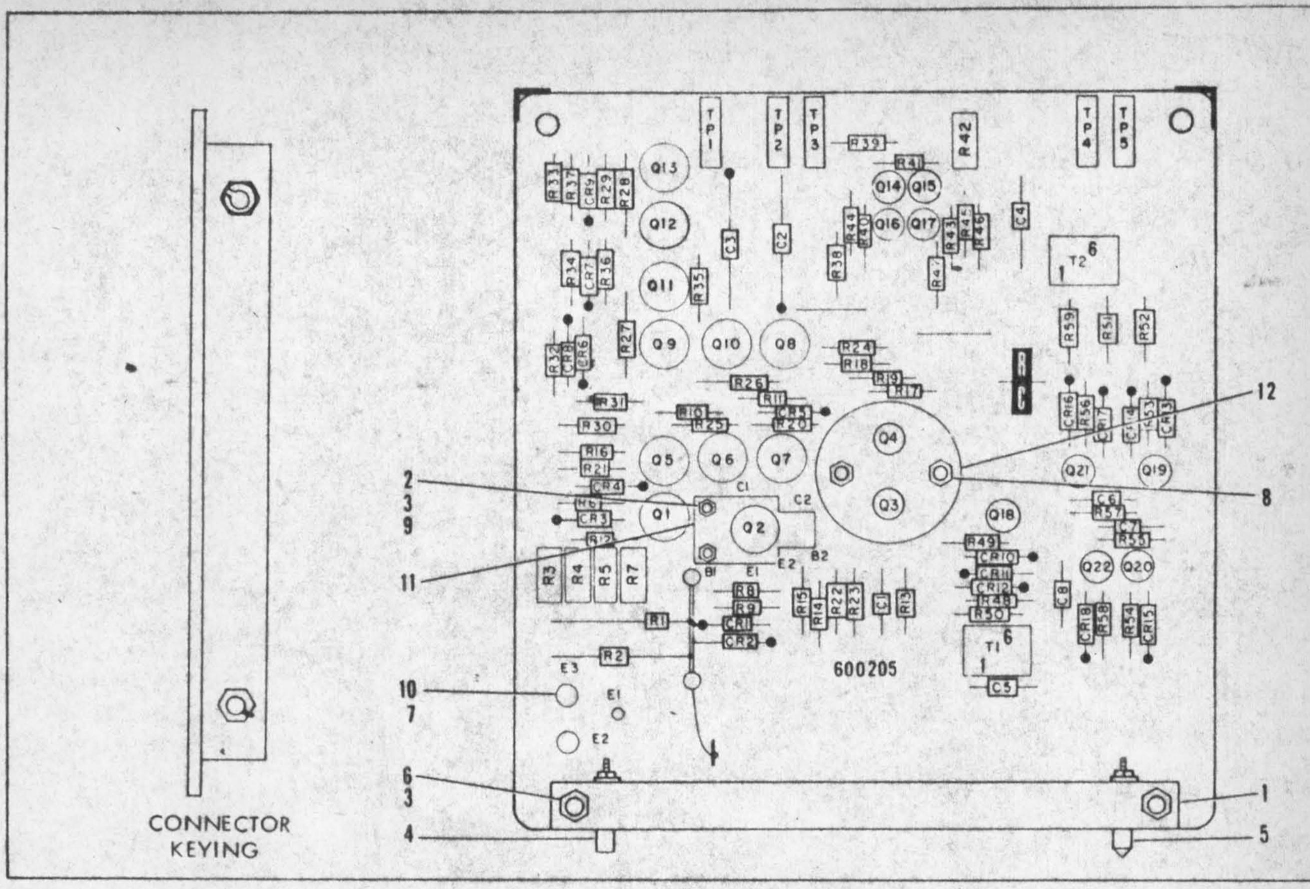

Figure 5. Model 600205 Comparator Amplifier, Parts Location

PARTS LIST

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
1	Connector, 50 Pin, Male	Redcor	600020
2	Screw, Bind. Hd., 4-40, 7/61 lg., Cad. Stl.		
3	Nut, Hex, S. Pat., 4-40, Cad. Stl.		
4	Pin, Polarizing, Female	Redcor	600022
5	Pin, Polarizing, Male	Redcor	600021
6	Screw, F. H., #4-40, 100° csk, 1/2 lg., Cad. Stl.		
7	Nut, Hex, 2-56, Cad. Stl.		
8	Washer, Lock, #2, Internal Tooth, Small Pattern, Cad. Stl.		
9	Washer, Lock, #4, Internal Tooth, Small Pattern, Cad. Stl.		
10	Clip, Diode	C. T. C.	
11	Heat Sink	Astro-Dynamics	2801
12	Heat Sink	I. E. R. C.	LP18A4
C1	Capacitor, Selected		
C2	Capacitor, Tant., 150 mf, 15 V	T. I.	SCM157HP015K4
C3	Capacitor, Tant., 150 mf, 15 V	T. I.	SCM157HP015K4
C4	Capacitor, Mica, 300 pf	Arco	CM15E301J
C5	Capacitor, Mica, 56 pf	Micamold	MCM10D560K
C6	Capacitor, Mica, 33 pf	Micamold	MCM10D330K
C7	Capacitor, Mica, 33 pf	Micamold	MCM10D330K
C8	Capacitor, Cerafil, 100 pf	Aerovox	MC80V101AM
CR1	Diode, Silicon	Redcor	100780

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
CR2	Diode, Silicon	Redcor	100780
CR3	Diode, Silicon	Redcor	100780
CR4	Diode, Silicon	Redcor	100780
CR5	Diode, Silicon	Redcor	100780
CR6	Diode, Silicon	Redcor	100780
CR7	Diode, Silicon	Redcor	100780
CR8	Diode, Silicon	Redcor	100780
CR9	Diode, Silicon	Redcor	100780
CR10	Diode, Silicon	Redcor	100780
CR11	Diode, Silicon	Redcor	100780
CR12	Diode, Silicon	Redcor	100780
CR13	Diode, Silicon	Redcor	100780
CR14	Diode, Silicon	Redcor	100780
CR15	Diode, Silicon	Redcor	100780
CR16	Diode, Silicon	Redcor	100780
CR17	Diode, Silicon	Redcor	100780
CR18	Diode, Silicon	Redcor	100780
Q1	Transistor	Redcor	100837
Q2	Transistor	Redcor	101131
Q3	Transistor	Philco	2N2401
Q4	Transistor	Philco	2N2401
Q5	Transistor	Redcor	100836
Q6	Transistor	Redcor	100837
Q7	Transistor	Redcor	100836
Q8	Transistor	Redcor	100836
Q9	Transistor	Redcor	100837
Q10	Transistor	Redcor	100836
Q11	Transistor	Redcor	100837
Q12	Transistor	Redcor	100836
Q13	Transistor	Redcor	100837
Q14	Transistor	Philco	2N2401
Q15	Transistor	Philco	2N2401
Q16	Transistor	Philco	2N2401
Q17	Transistor	Philco	2N2401
Q18	Transistor	Philco	2N2401
Q19	Transistor	Philco	2N2401
Q20	Transistor	Philco	2N2401
Q21	Transistor	Philco	2N2401
Q22	Transistor	Philco	2N2401
R1*	Resistor, W. W., 4. 75K, ±. 02%	Redcor	101015-B-4750R0
R1**	Resistor, W. W., 3. 75K, ±. 02%	Redcor	101015-B-3750R0
R2*	Resistor, W. W., 4. 99K, ±. 02%	Redcor	101015-B-4990R0
R2**	Resistor, W. W., 3. 99K, ±. 02%	Redcor	101015-B-3990R0
R3	Potentiometer, 500 ohm	Teledyne	361, End. Adj.
R4	Potentiometer, 10 ohm	Teledyne	361, End Adj.
R5	Potentiometer, 20 ohm	Teledyne	361, End Adj.
R6	Resistor, Comp., 200 ohm, 1/4W, ±5%	A. B.	RC07GF221J
R7	Potentiometer, 10 ohm	Teledyne	361, End Adj.
R8	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R9	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R10	Resistor, Comp., 1. 1K, 1/4W, ±5%	A. B.	RC07GF112J
R11	Resistor, Comp., 1. 1K, 1/4W, ±5%	A. B.	RC07GF112J
R12	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R13	Resistor, Comp., 15K, 1/4W, ±5%	A. B.	RC07GF153J
R14	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R15	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R16	Resistor, Comp., 1. 2K, 1/4W, ±5%	A. B.	RC07GF122J
R17	Resistor, Comp., 22 ohm, 1/4W, ±5%	A. B.	RC07GF220J
R18	Resistor, Comp., 1. 2K, 1/4W, ±5%	A. B.	RC07GF122J
R19	Resistor, Comp., 22 ohm, 1/4W, ±5%	A. B.	RC07GF220J
R20	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J

*For -1 Units Only
**For -2 Units Only

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
R21	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R22	Resistor, Comp., 22 ohm, 1/4W, ±5%	A. B.	RC07GF220J
R23	Resistor, Comp., 22 ohm, 1/4W, ±5%	A. B.	RC07GF220J
R24	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R25	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R26	Resistor, Dep. Car., 750 ohm, ±1%	T. I.	RN60B7500F
R27	Resistor, Dep. Car., 1.21K, ±1%	T. I.	RN60B1211F
R28	Resistor, Dep. Car., 1.78K, ±1%	T. I.	RN60B1781F
R29	Resistor, Comp., 33K, 1/4W, ±5%	A. B.	RC07GF333J
R30	Resistor, Comp., 33K, 1/4W, ±5%	A. B.	RC07GF333J
R31	Resistor, Comp., 220 ohm, 1/4W, ±5%	A. B.	RC07GF221J
R32	Resistor, Comp., 150 ohm, 1/4W, ±5%	A. B.	RC07GF151J
R33	Resistor, Comp., 150 ohm, 1/4W, ±5%	A. B.	RC07GF151J
R34	Resistor, Comp., 220 ohm, 1/4W, ±5%	A. B.	RC07GF221J
R35	Resistor, Comp., 10K, 1/4W, ±5%	A. B.	RC07GF103J
R36	Resistor, Comp., 10K, 1/4W, ±5%	A. B.	RC07GF103J
R37	Resistor, Comp., 220 ohm, 1/4W, ±5%	A. B.	RC07GF221J
R38	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R39	Resistor, Comp., 10K, 1/4W, ±5%	A. B.	RC07GF103J
R40	Resistor, Comp., 15K, 1/4W, ±5%	A. B.	RC07GF153J
R41	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R42	Potentiometer, 1K	Teledyne	361, End Adj
R43	Resistor, Comp., 15K, 1/4W, ±5%	A. B.	RC07GF153J
R44	Resistor, Comp., 2K, 1/4W, ±5%	A. B.	RC07GF202J
R45	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R46	Resistor, Comp., 2K, 1/4W, ±5%	A. B.	RC07GF202J
R47	Resistor, Comp., 2.4K, 1/4W, ±5%	A. B.	RC07GF242J
R48	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R49	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R50	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R51	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R52	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R53	Resistor, Comp., 39K, 1/4W, ±5%	A. B.	RC07GF393J
R54	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R55	Resistor, Comp., 5.1K, 1/4W, ±5%	A. B.	RC07GF512J
R56	Resistor, Comp., 39K, 1/4W, ±5%	A. B.	RC07GF393J
R57	Resistor, Comp., 5.1K, 1/4W, ±5%	A. B.	RC07GF512J
R58	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R59	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
T1	Transformer	Redcor	100872
T2	Transformer	Redcor	100872
TP1	Test Jack, Black	Ucinite	119437-C
TP2	Test Jack, Black	Ucinite	119437-C
TP3	Test Jack, Red	Ucinite	119437-B
TP4	Test Jack, Black	Ucinite	119437-C
TP5	Test Jack, Green	Ucinite	119437-F

NOTE

Two versions of 600205 Manual are included in the 600975 System Manual.

600975 Systems, previous to Serial No. 2095 utilized the original 600205 card (appropriate manual has reduced print); Serial No. 2095 and up utilized the revised 600205 card.

Refer to picture in manual if uncertain which manual is effective for a specific card.

then

$$\frac{E_{in}}{(R1 + R3 + R4)} = \frac{E_{ref}}{Rx}$$

$$E_{in} = +20 \text{ volts}$$

and when E_{ref} equals 0

$$E_{in} = 0 \text{ volts}$$

If E1 is at the +10-volt position and E_{ref} equals -10 volts,

then

$$\frac{E_{in}}{(R1 + R3 + R4)} = \frac{10}{(R2 + R5)} = \frac{E_{ref}}{RX}$$

$$E_{in} = +10 \text{ volts}$$

and when E_{ref} equals 0

$$E_{in} = -10 \text{ volts}$$

The input resistors R3 and R4 can be used to adjust the full scale input, as indicated by:

$$E_{in} = E_{ref} \frac{(R1 + R3 + R4)}{RX}$$

Zero adjustment can be made by adjusting R5 as indicated by:

$$\frac{E_{in}}{(R1 + R3 + R4)} + \frac{10}{(R2 + R5)} = \frac{E_{ref}}{RX}$$

$$E_{in} = E_{ref} \frac{(R1 + R3 + R4)}{10} - \frac{10\,(R1 + R3 + R4)}{R2 + R5}$$

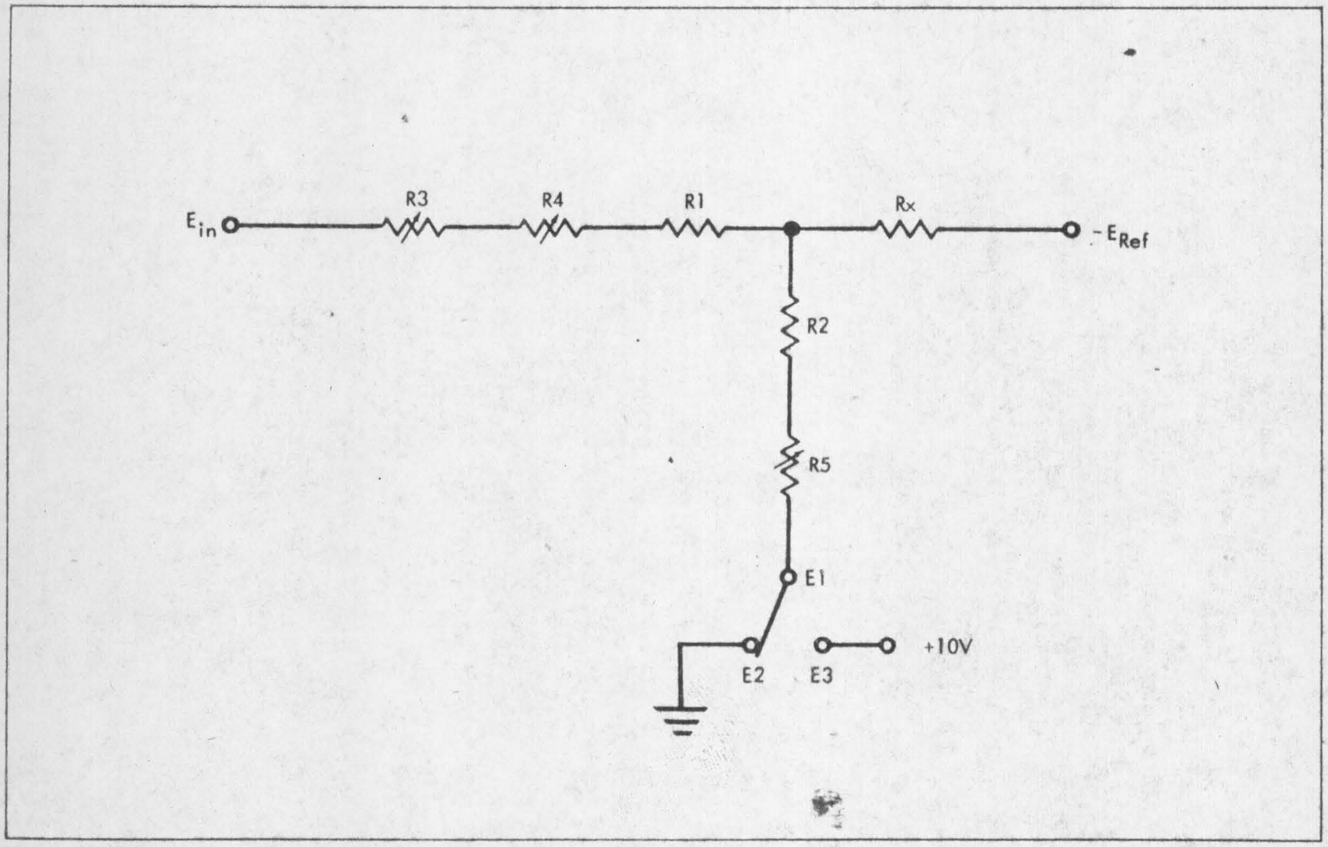

Figure 2. Resistance Adder Network, Simplified Schematic

6. Amplifier Circuits - The amplifier consists of differential amplifier Q1-Q2, differential amplifier Q3-Q4-Q7, complementary emitter-followers Q5 and Q6, -3 V power supply, and +3 V power supply.

Transistor Q2 is a differential amplifier pair constructed, for uniformity of specifications, from a silicon wafer. Q1 is a constant current stage which provides an effectively high common emitter resistance. Initial adjustment of the operating bias of Q2 is provided by R7, which should not require adjustment, in the field, in normal use. The second differential amplifier and constant current stage Q3-Q4-Q7 provides additional amplification. Complementary emitter-followers Q5 and Q6 provide current gain and isolation. The output of Q5 and Q6 is fed to the strobed amplifier.

In order to maintain drift free amplification, required of the amplifier, regulated power supply voltages are required. The -3 V power supply and the +3 V power supply provide these regulated voltages. The -3 V supply consists of Q8, Q9, and Q10. Stage Q8 is a series regulator controlled by Q9 and Q10. Stage Q9 is referenced by zener diode CR8 and stage Q10 by CR6 and CR7. The +3 V power supply consists of Q11, Q12, and Q13. Stage Q13 is a series regulator controlled by Q11 and Q12. Stage Q12 is referenced by zener diode CR9. Resistors R26, R27, and R28 reference the two supplies together.

7. Strobed Amplifier - The strobed amplifier consists of differential amplifiers Q14-Q15 and Q16-Q17-Q18. The output of the amplifier is applied to differential amplifier Q14-Q15. The output of Q14-Q15 is fed to differential amplifier and constant current stage Q15-Q17-Q18. Constant current stage Q18 is normally biased so that no collector current can flow, thus the collectors of Q16 and Q17 are normally held at -12 V. When a negative pulse is applied to the base of Q18 it turns on and allows either Q16 or Q17 to conduct. Collector output signals from Q14 and Q15 determine whether Q16 or Q17 conducts. The polarity of the pulse applied to the primary of transformer T2 depends upon the conduction of Q16 and Q17. Potentiometer R42 functions as a zero or threshold adjustment of the strobed amplifier. This adjustment provides a method of zero adjusting the complete converter, in the case of a unipolar analog-to-digital converter. Transformer T1 and T2 provide isolation interface. Both transformers will sustain a pulse of 0.5 usec. Transformer T1 receives the strobe input. When the negative strobe pulse is received the strobed amplifier provides an output, through transformer T2 to the flip-flop. Dependent upon polarity of the pulse, provided to the primary, either a negative-going or positive-going pulse is provided by the secondary. The negative-going or positive-going pulse is applied to the flip-flop circuit.

8. Flip-Flop Circuit - The flip-flop circuit consists of Q19 through Q22 and is a conventional DC bi-stable circuit. The flip-flop is reset by a clock pulse input on pin 16. Depending upon the output of the strobed amplifier, the flip-flop remains in the reset state or is driven into the set state. An input of -0.25 mv, to the amplifier, causes the flip-flop to remain reset and a false output appears at pin 32 and a true output appears at pin 49. An input of +0.25 mv, to the amplifier, causes the flip-flop to be driven to the set state and a true output appears at pin 32 and a false output appears at pin 49. A false output at pin 49 causes the bit weight to be rejected.

9. MAINTENANCE

Standard circuit board maintenance practices apply. Replacement parts shall be those specified in the parts list.

CAUTION

When soldering and replacing electronic components on the circuit board, the circuit board and replacement components should not be overheated. Use an appropriate heatsink.

Trouble shooting is easily accomplished using test points TP1 through TP5 and observing voltages and waveforms.

10. REPLACEMENT PARTS

Replacement parts for the comparator are listed in the following parts list. For location and identification of parts see figure 5.

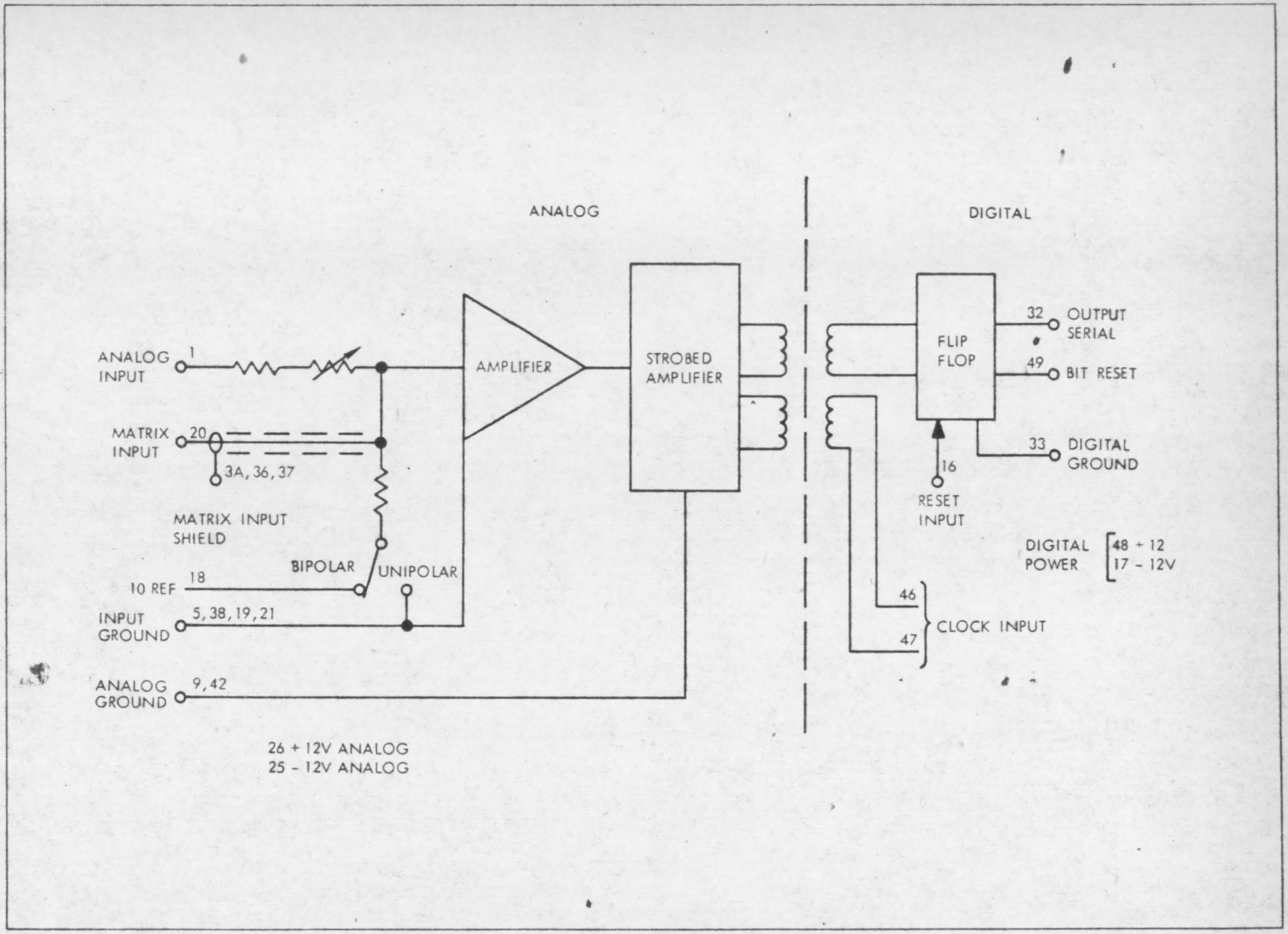

Figure 3. Model 600205 Comparator Amplifier, Logic Diagram

11. SPECIFICATIONS

Analog Input:

Input sensitivity	200 uV
Input overload maximum	±10 V or 4 ma
Recovery time	1.5 usec to within 200 uv of final value after 10 V overload
Source resistance	2K
Input impedance	10K
Long term drift	Less than 200 uV in 30 days, referred to input
Temperature coefficient of drift	10 uV per degree C referred to input

Digital Input:

Strobe	Transformer coupled
Rise time	60 nsec
Pulse duration	1 usec minimum to 10 usec maximum
Level change	6 V minimum
Maximum DC primary/secondary	50 V
Capacitive isolation	5 pf
Input loading between lines	2.7K
Maximum repetition rate	1 mc

Digital Output:

Type of output	DC flip-flop

Output levels:

True	-9 ±3 V
False	-0.5 V

Output loading:

To ground	1K
To -12 V line	12 ma
Capacitive	400 pf

Output timing:

Rise time	30 nsec no load, 40 nsec full load
Fall time	40 nsec no load, 60 nsec full load

Delay time from strobe input	100 nsec
Maximum repetition rate	1 mc

Power Requirements:

Analog:

+12 V	25 ma
-12 V	25 ma

Digital:

+12 V	5 ma
-12 V	15 ma

Operating temperature	0 - 50°C
Mechanical size	5" x 5.4" x 0.5"
Connector type	50-pin
Board type	0.90" thick glass epoxy

Test Points:

Number	5
Data provided	1 amplifier output 2 ±3 V power supply 1 strobed amplifier output 1 flip-flop output

Designation	Color	Data
TP1		+3 V
TP2		-3 V
TP3		amplifier output
TP4		strobed amplifier output
TP5		flip-flop serial output

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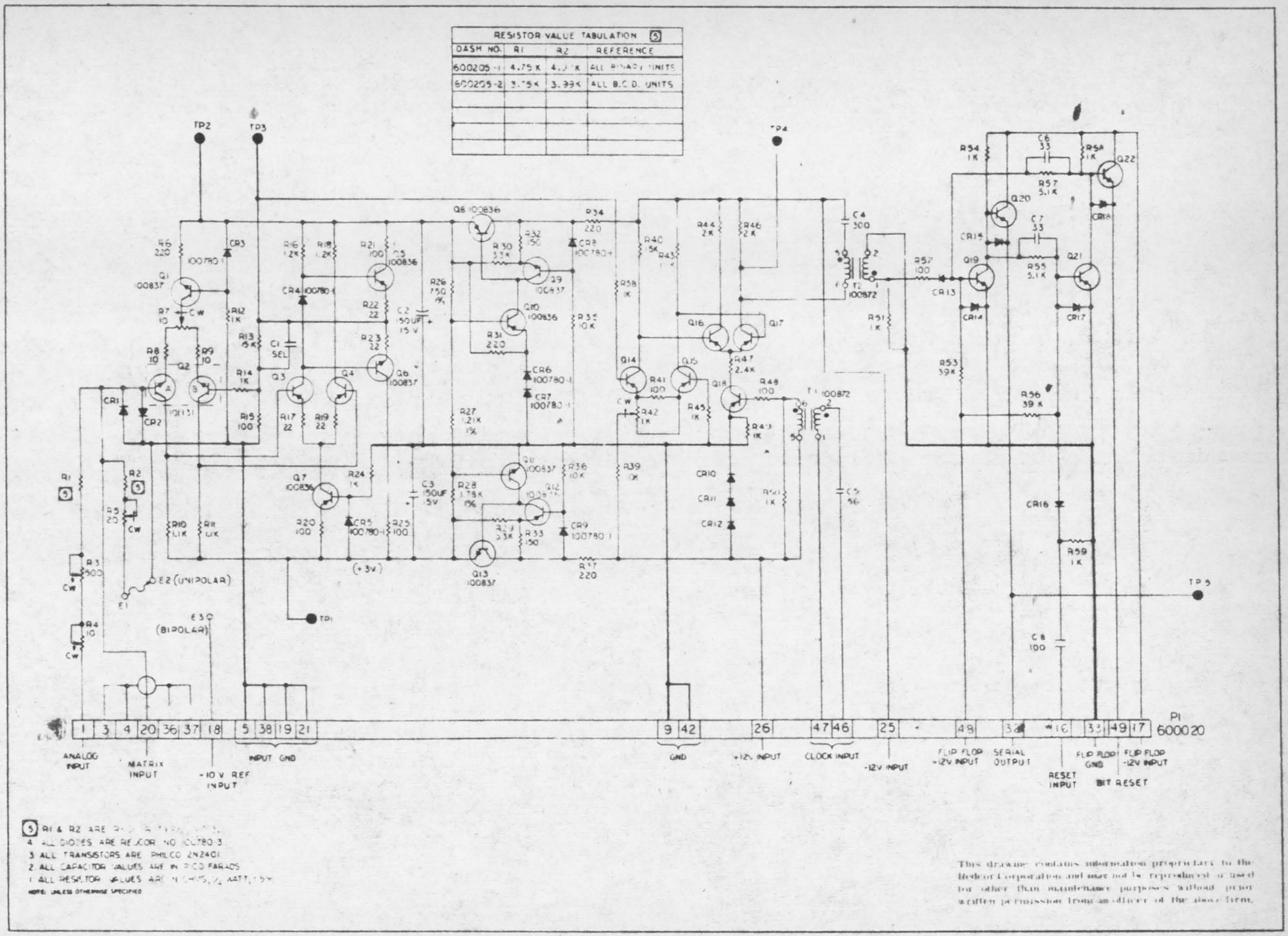

RESISTOR VALUE TABULATION 5			
DASH NO.	R1	R2	REFERENCE
600205-1	4.75 K	[illegible] K	ALL BINARY UNITS
600205-2	3.75K	3.39K	ALL B.C.D. UNITS

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Figure 4. Model 600205 Comparator Amplifier, Schematic Diagram

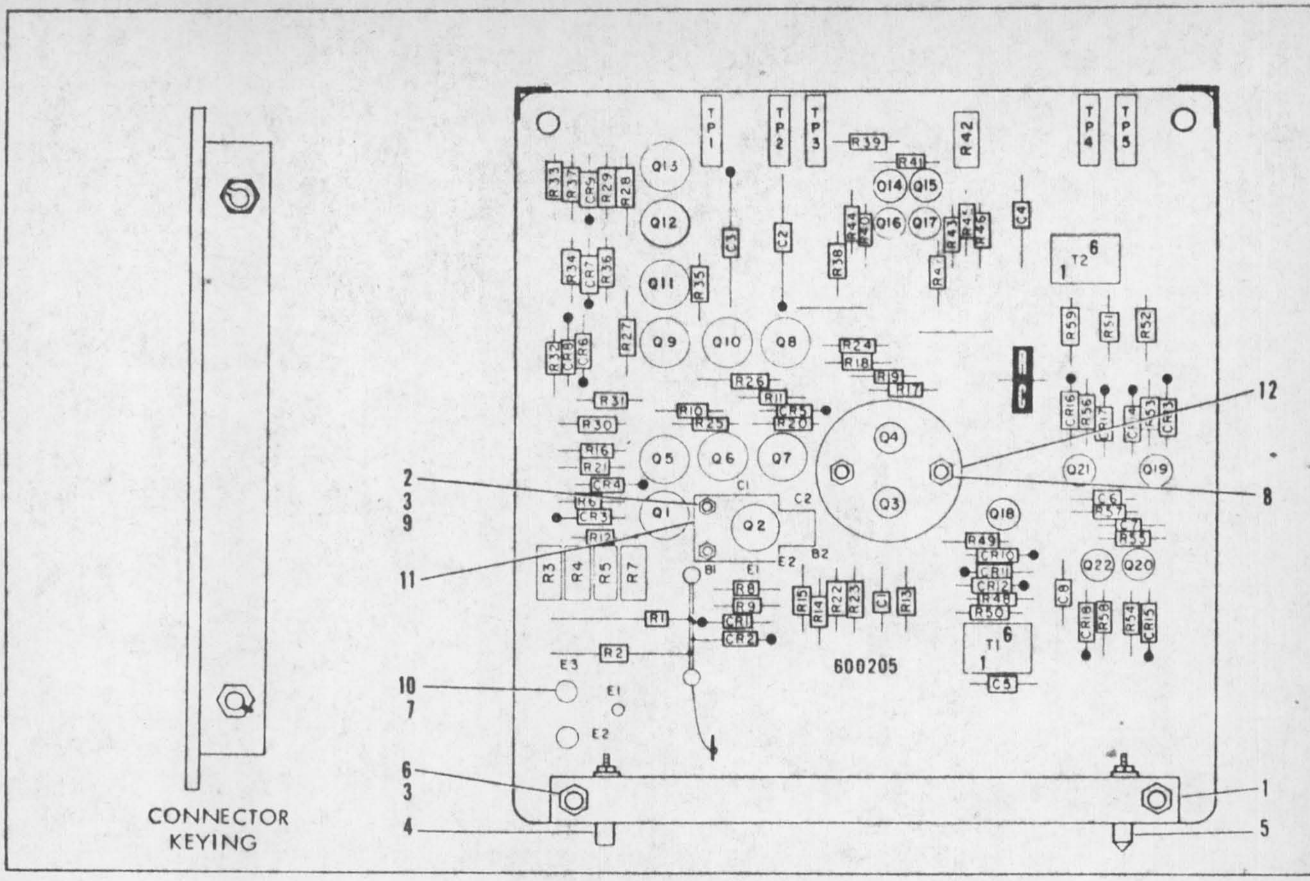

Figure 5. Model 600205 Comparator Amplifier, Parts Location

PARTS LIST

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
1	Connector, 50 Pin, Male	Redcor	600020
2	Screw, Bind. Hd., 4-40, 7/61 lg., Cad. Stl.		
3	Nut, Hex, S. Pat., 4-40, Cad. Stl.		
4	Pin, Polarizing, Female	Redcor	600022
5	Pin, Polarizing, Male	Redcor	600021
6	Screw, F. H., #4-40, 100° csk, 1/2 lg., Cad. Stl.		
7	Nut, Hex, 2-56, Cad. Stl.		
8	Washer, Lock, #2, Internal Tooth, Small Pattern, Cad. Stl.		
9	Washer, Lock, #4, Internal Tooth, Small Pattern, Cad. Stl.		
10	Clip, Diode	C. T. C.	
11	Heat Sink	Astro-Dynamics	2801
12	Heat Sink	I. E. R. C.	LP18A4
C1	Capacitor, Selected		
C2	Capacitor, Tant., 150 mf, 15 V	T. I.	SCM157HP015K4
C3	Capacitor, Tant., 150 mf, 15 V	T. I.	SCM157HP015K4
C4	Capacitor, Mica, 300 pf	Arco	CM15E301J
C5	Capacitor, Mica, 56 pf	Micamold	MCM10D560K
C6	Capacitor, Mica, 33 pf	Micamold	MCM10D330K
C7	Capacitor, Mica, 33 pf	Micamold	MCM10D330K
C8	Capacitor, Cerafil, 100 pf	Aerovox	MC80V101AM
CR1	Diode, Silicon	Redcor	100780

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
CR2	Diode, Silicon	Redcor	100780
CR3	Diode, Silicon	Redcor	100780
CR4	Diode, Silicon	Redcor	100780
CR5	Diode, Silicon	Redcor	100780
CR6	Diode, Silicon	Redcor	100780
CR7	Diode, Silicon	Redcor	100780
CR8	Diode, Silicon	Redcor	100780
CR9	Diode, Silicon	Redcor	100780
CR10	Diode, Silicon	Redcor	100780
CR11	Diode, Silicon	Redcor	100780
CR12	Diode, Silicon	Redcor	100780
CR13	Diode, Silicon	Redcor	100780
CR14	Diode, Silicon	Redcor	100780
CR15	Diode, Silicon	Redcor	100780
CR16	Diode, Silicon	Redcor	100780
CR17	Diode, Silicon	Redcor	100780
CR18	Diode, Silicon	Redcor	100780
Q1	Transistor	Redcor	100837
Q2	Transistor	Redcor	101131
Q3	Transistor	Philco	2N2401
Q4	Transistor	Philco	2N2401
Q5	Transistor	Redcor	100836
Q6	Transistor	Redcor	100837
Q7	Transistor	Redcor	100836
Q8	Transistor	Redcor	100836
Q9	Transistor	Redcor	100837
Q10	Transistor	Redcor	100836
Q11	Transistor	Redcor	100837
Q12	Transistor	Redcor	100836
Q13	Transistor	Redcor	100837
Q14	Transistor	Philco	2N2401
Q15	Transistor	Philco	2N2401
Q16	Transistor	Philco	2N2401
Q17	Transistor	Philco	2N2401
Q18	Transistor	Philco	2N2401
Q19	Transistor	Philco	2N2401
Q20	Transistor	Philco	2N2401
Q21	Transistor	Philco	2N2401
Q22	Transistor	Philco	2N2401
R1*	Resistor, W. W., 4. 75K, ±. 02%	Redcor	101015-B-4750R0
R1**	Resistor, W. W., 3. 75K, ±. 02%	Redcor	101015-B-3750R0
R2*	Resistor, W. W., 4. 99K, ±. 02%	Redcor	101015-B-4990R0
R2**	Resistor, W. W., 3. 99K, ±. 02%	Redcor	101015-B-3990R0
R3	Potentiometer, 500 ohm	Teledyne	361, End. Adj.
R4	Potentiometer, 10 ohm	Teledyne	361, End Adj.
R5	Potentiometer, 20 ohm	Teledyne	361, End Adj.
R6	Resistor, Comp., 200 ohm, 1/4W, ±5%	A. B.	RC07GF221J
R7	Potentiometer, 10 ohm	Teledyne	361, End Adj.
R8	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R9	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R10	Resistor, Comp., 1. 1K, 1/4W, ±5%	A. B.	RC07GF112J
R11	Resistor, Comp., 1. 1K, 1/4W, ±5%	A. B.	RC07GF112J
R12	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R13	Resistor, Comp., 15K, 1/4W, ±5%	A. B.	RC07GF153J
R14	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R15	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R16	Resistor, Comp., 1. 2K, 1/4W, ±5%	A. B.	RC07GF122J
R17	Resistor, Comp., 22 ohm, 1/4W, ±5%	A. B.	RC07GF220J
R18	Resistor, Comp., 1. 2K, 1/4W, ±5%	A. B.	RC07GF122J
R19	Resistor, Comp., 22 ohm, 1/4W, ±5%	A. B.	RC07GF220J
R20	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J

*For -1 Units Only
**For -2 Units Only

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
R21	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R22	Resistor, Comp., 22 ohm, 1/4W, ±5%	A. B.	RC07GF220J
R23	Resistor, Comp., 22 ohm, 1/4W, ±5%	A. B.	RC07GF220J
R24	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R25	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R26	Resistor, Dep. Car., 750 ohm, ±1%	T. I.	RN60B7500F
R27	Resistor, Dep. Car., 1.21K, ±1%	T. I.	RN60B1211F
R28	Resistor, Dep. Car., 1.78K, ±1%	T. I.	RN60B1781F
R29	Resistor, Comp., 33K, 1/4W, ±5%	A. B.	RC07GF333J
R30	Resistor, Comp., 33K, 1/4W, ±5%	A. B.	RC07GF333J
R31	Resistor, Comp., 220 ohm, 1/4W, ±5%	A. B.	RC07GF221J
R32	Resistor, Comp., 150 ohm, 1/4W, ±5%	A. B.	RC07GF151J
R33	Resistor, Comp., 150 ohm, 1/4W, ±5%	A. B.	RC07GF151J
R34	Resistor, Comp., 220 ohm, 1/4W, ±5%	A. B.	RC07GF221J
R35	Resistor, Comp., 10K, 1/4W, ±5%	A. B.	RC07GF103J
R36	Resistor, Comp., 10K, 1/4W, ±5%	A. B.	RC07GF103J
R37	Resistor, Comp., 220 ohm, 1/4W, ±5%	A. B.	RC07GF221J
R38	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R39	Resistor, Comp., 10K, 1/4W, ±5%	A. B.	RC07GF103J
R40	Resistor, Comp., 15K, 1/4W, ±5%	A. B.	RC07GF153J
R41	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R42	Potentiometer, 1K	Teledyne	361, End Adj
R43	Resistor, Comp., 15K, 1/4W, ±5%	A. B.	RC07GF153J
R44	Resistor, Comp., 2K, 1/4W, ±5%	A. B.	RC07GF202J
R45	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R46	Resistor, Comp., 2K, 1/4W, ±5%	A. B.	RC07GF202J
R47	Resistor, Comp., 2.4K, 1/4W, ±5%	A. B.	RC07GF242J
R48	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R49	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R50	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R51	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R52	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R53	Resistor, Comp., 39K, 1/4W, ±5%	A. B.	RC07GF393J
R54	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R55	Resistor, Comp., 5.1K, 1/4W, ±5%	A. B.	RC07GF512J
R56	Resistor, Comp., 39K, 1/4W, ±5%	A. B.	RC07GF393J
R57	Resistor, Comp., 5.1K, 1/4W, ±5%	A. B.	RC07GF512J
R58	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R59	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
T1	Transformer	Redcor	100872
T2	Transformer	Redcor	100872
TP1	Test Jack, Black	Ucinite	119437-C
TP2	Test Jack, Black	Ucinite	119437-C
TP3	Test Jack, Red	Ucinite	119437-B
TP4	Test Jack, Black	Ucinite	119437-C
TP5	Test Jack, Green	Ucinite	119437-F

NOTE

Two versions of 600205 Manual are included in the 600975 System Manual.

600975 Systems, previous to Serial No. 2095 utilized the original 600205 card (appropriate manual has reduced print); Serial No. 2095 and up utilized the revised 600205 card.

Refer to picture in manual if uncertain which manual is effective for a specific card.

INSTRUCTION MANUAL FOR

COMPARATOR AMPLIFIER MODEL 600205

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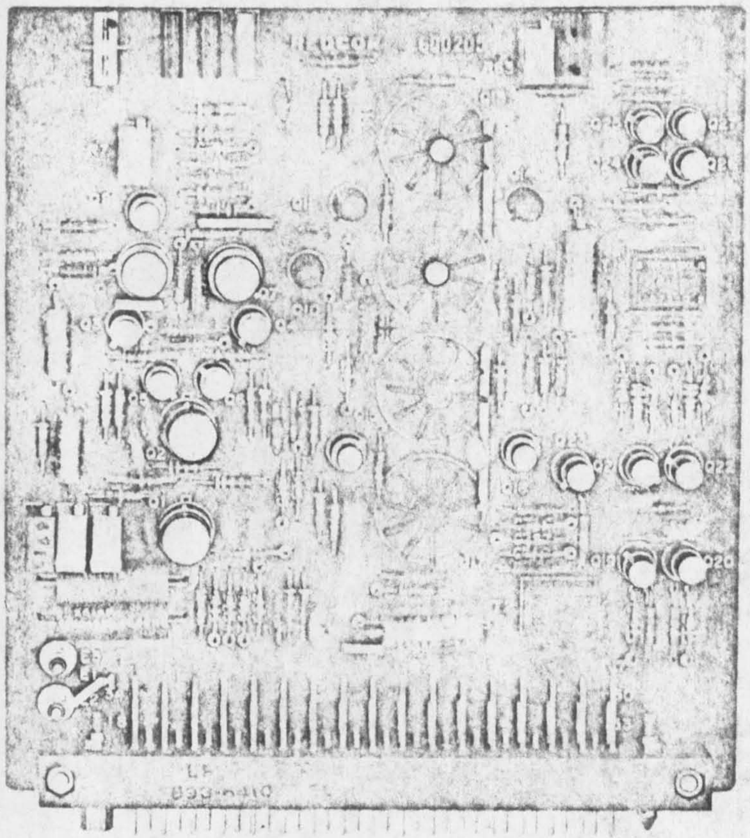


FIGURE 1 MODEL 600205 COMPARATOR AMPLIFIER

1. GENERAL DESCRIPTION

2. Mechanical - The model 600205 Comparator Amplifier is a printed circuit board module consisting of a resistance adder network, fast overload recovery amplifier, strobed amplifier, and a flip-flop. The circuit board is a standard 50 pin module card with components mounted on one side. The board assembly measures 5" x 5.4" inches and requires one standard card space. Test points are provided on top edge of the card for waveform observation and trouble shooting during operation.

3. Purpose - The usual application of the comparator module is in analog to digital converters where very high speed accurate comparisons, with respect to ground, are necessary. The comparator compares a voltage analog input against a precisely generated voltage (See 600122 modules) of the opposite polarity. The algebraic sum of the two voltages are amplified successfully by the fast recovery and strobed amplifiers. The strobed amplifier is interrogated at a

precise time so as to determine the polarity and magnitude of the two input signals and the result either resets the output flip-flop or leaves it in the set condition. Setting or resetting of this flip-flop causes the selection or rejection of the voltage supplied by the resistor matrix.

4. CIRCUIT DESCRIPTION (See figures 2, 3 and 4)

5. Resistance Adder Network - The resistance adder network receives three inputs. The analog input is received through P1 pin 1 to R4, the resistor matrix input is applied to pin 20, and a +10-volt reference is applied to pin 18. The analog input is the input applied to the complete A-D converter equipment and is the voltage analog desired to be converted into digital form. The resistor matrix provides a precision voltage dependent upon its selected resistance value in combination with a reference power supply (600085). The 600085 in addition provides a +10-volts reference which is used as an offsetting voltage to provide A-D bipolar operation. Refer to figure 2 for a simplified schematic of the resistance adder network. Note that when a unipolar converter is required a selector contained on the module can be changed to select ground instead of +10 volts reference (See figure 3).

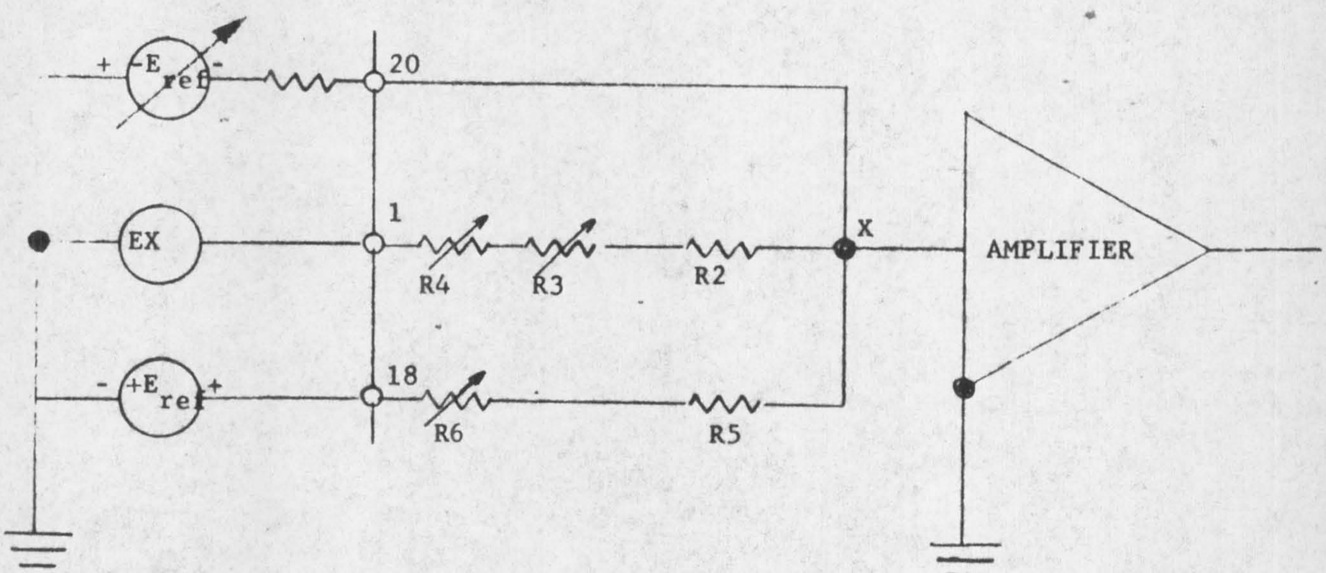


Figure 2

The amplifier input is obtained at X

EX is the analog input and the unknown

$-E_{ref}$ variable from 0 volts to -10 volts

$+E_{ref}$ is fixed and is +10 volts

R7 is the sourse resistance of $-E_{ref}$ and is constant at 2.5K

R4 is a fine input range adjustment and is 20 ohms

R3 is a coarse input range adjustment and is 200 ohms

R2 is the main input resistor and is 4.75 Kilohms

R6 is a fine offsetting adjustment and is 20

R5 is the main offsetting resistor and is 4.99 Kilohms

The voltage equation for X to be zero i.e. the null condition is

$$0 = \frac{EX}{R2 + R3 + R4} + \frac{E_{ref}}{R6 + R5} - \frac{E_{ref}}{R7}$$

With normal values for R2 + R3 + R4 + and R5 + R6 at 5000 ohms, R7 at 2500 ohm and $\pm E_{ref}$ = 10 volts then the equation balances with EX = +10 volts, therefore, full scale of $-E_{ref}$ = 10 volts is obtained when EX = +10 volts.

When EX = -10 volts the equation balances when $-E_{ref}$ = 0 volts, and when EX = 0 volts, $-E_{ref}$ = -5 volts.

Thus the reference gives a magnitude and sign determination of the input signal.

6. Fast Overload Recovery Amplifier - The fast overload recovery amplifier consists of transistors Q1 thru Q18.

A floating input amplifier consisting of transistors Q1, Q2, Q3, Q4, Q5, and Q6 amplify the input signal in successive differential stages. The voltage across the input amplifier is maintained constant by CR9 and the current for operating the amplifier is derived from the ±12.5 power supplies and Q7 and Q8 acting as constant current generators.

The output from Q3 collector is fed to a ground referenced stage in a single ended common emitter configuration consisting of Q9. Successive gain stages Q10, Q11 and Q13 provide further amplification. Q10 is a driver for the above and complementary amplifier stages of Q15, Q16 and Q17. The Q14 and Q18 form a complementary symmetrical emitter follower output stage. For small signal inputs the closed loop gain is established by resistors R42 and R11 in a potentiometric fashion. When the output voltage from the common collectors of Q13 and Q17 exceeds the diode drops of CR6 and CR7, the gain reduces to approximately unity by bypassing the output stage and R42.

For large overloads the input diodes CR3 and CR4 conduct limiting the maximum swing to approximately ±0.75 volts at this point the output also reduces to ±0.75 volts because of the output limiting such that the overall closed loop gain is approximately unity.

For small signal inputs the gain is approximately 100.

7. Strobed Amplifier - The output from the fast recovery amplifier is fed to the base of Q27. Q27 and Q26 forming a differential pair gain stage. R63 provides a means of compensating for any residual zero output level from the input amplifier. The differential output of Q26 and Q27 are fed in turn to another differential pair, Q24 and Q25. This stage has a constant current source provided by Q23. Q23 is normally biased off such that both Q24 and Q25 are also in the off condition. When T2 is pulsed by a clock input however, Q23 conducts and provides a current source for both Q24 and Q25. If Q24 conducts, which is determined by the previous amplification stages, a pulse is transmitted to the

output flip-flop setting it. Should Q25 conduct then the output flip-flop which has already been reset by a clock pulse at pin 16 is left in the reset condition.

8. Bit Reset Flip-Flop - The bit reset flip-flop is a conventional flip-flop with emitter follower output stages consisting of Q19, Q20, Q22 and Q23. The set input is provided by the strobe amplifier and the reset input is provided by the A-D clock which controls the sequencing.

9. Timing Sequence - The normal sequence of operation is as follows. The most significant bit weight of the A-D is set by the sequence control simultaneously the bit reset flip-flop is reset by a pulse at pin 16. A waiting period is now allowed for the analog settling times of the resistor matrix (600122) reference power supply (600085) and the amplifier sections of the 600205 modules. When sufficient time has been allowed for the error to reduce below the threshold of 1/2 of a least significant bit, the strobe amplifier is strobed and the bit reset is either left in the reset condition or set dependent upon the input signal to the comparator. If the flip-flop is set then at the time of the next clock sequence, the most significant bit is rejected and the next bit weight is tried, etc.

10. Analog and Digital Isolation - Note that the strobe input to the comparator is transformer coupled and that the power supplies and grounds for the bit reset flip-flop and the remainder of the comparator are separated. This feature allows isolation of the analog and digital domains.

11. Maintenance - Standard circuit board maintenance practices apply. Replacement parts shall be those specified in the parts list.

CAUTION

When soldering and replacing electronic components on the circuit board, the circuit board and replacement components should not be overheated. Use an appropriate heatsink.

Trouble shooting is easily accomplished using test points TP1 through TP5 and observing voltages and waveforms.

12. SPECIFICATIONS

Fast Recovery Amplifier

Gain:	100 ±20% @ DC in the high gain region
Input Sensitivity:	±1mV
Input Signal Maximum:	5 volts or 5mA
Settling Time:	1.3μSecs from a 5 volt step to within 250mV of final value RTO
Source Resistance:	All specifications apply for a source resistance of 1.25 Kilohms
Output Drift:	±100 millivolts over temperature range of 25°C ±25°C
Output Noise:	30mV RMS
Bandwidth:	3db down at 750Kc

Digital Input		
Strobe:	Transformer coupled	
Rise Time:	60 nanosecs	
Pulse Duration:	1μSecs	
Pulse Amplitude:	9 volts ±3 volts	
Primary/Secondary Voltage:	50 volts maximum	
Maximum Repetition Rate:	1Mc	
Digital Output (Flip-Flop)		
True:	-9v ±3v	
False:	0.5v ±0.5v	
Output Loads		
True:	25mA to negative voltage	
False:	25mA to negative voltage	
Time Relationships	Fall Time	Rise Time
True:	60 nanosecs	40 nanosecs
False:	60 nanosecs	40 nanosecs
Delay From Strobe Input:	100 nanosecs	
Minimum Repetition Rate:	1Mc	
Power Requirements		
Analog Section:	+12.5v -12.5v	150mA 125mA
Digital Section:	+12.5v -12.5v	5mA 20mA
Operating Temperature:	0-50°C	
Mechanical Size:	5" x 5.4"	
Connector Type:	50 pin	
Test Points		
Number:	5	

Designation	Color	Function
1	Black	Analog ground
2	Black	+12.5v analog power supply
3	Red	Fast recovery amplifier output
4	Black	Strobe amplifier output
5	Green	Serial output

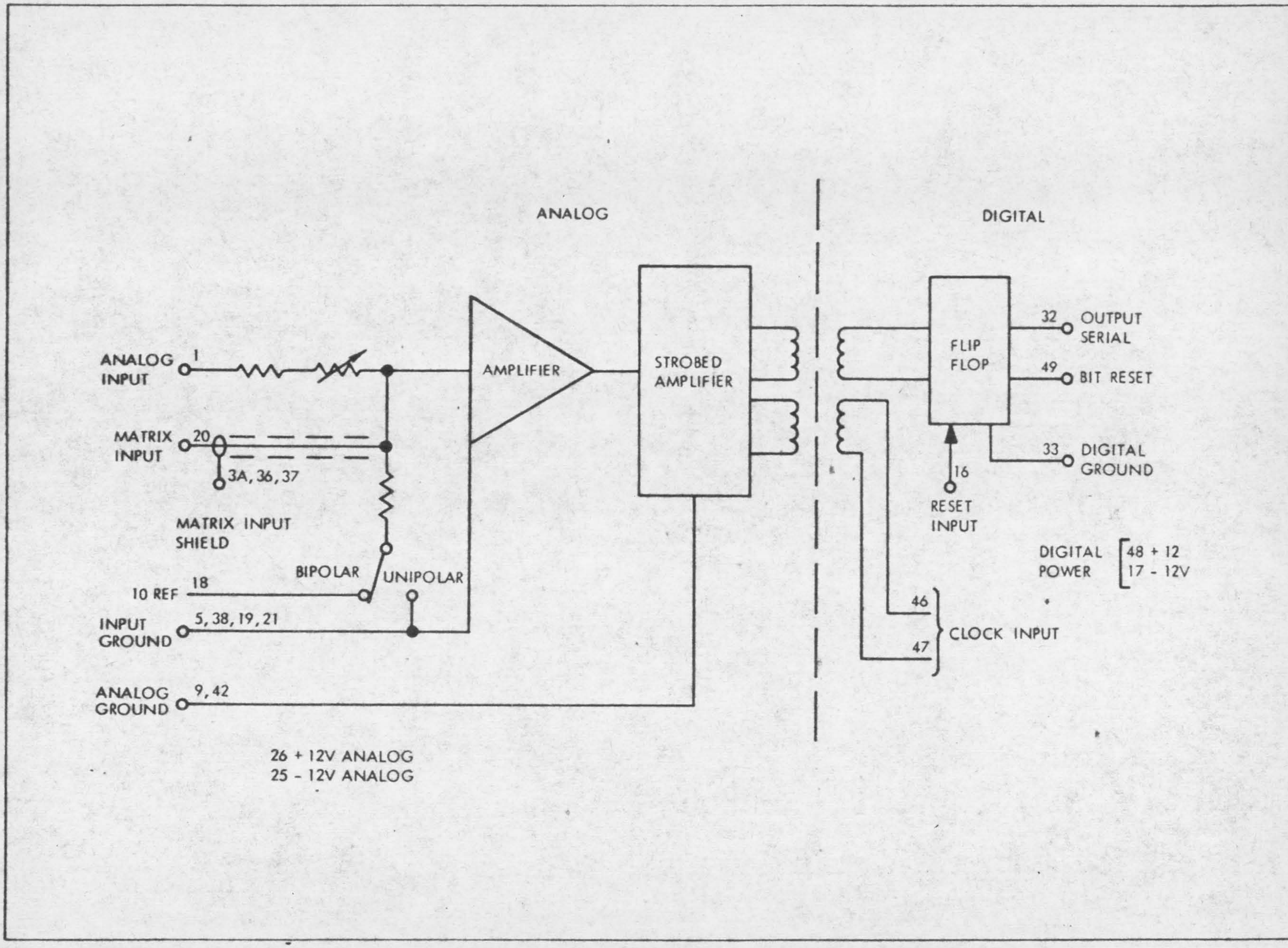
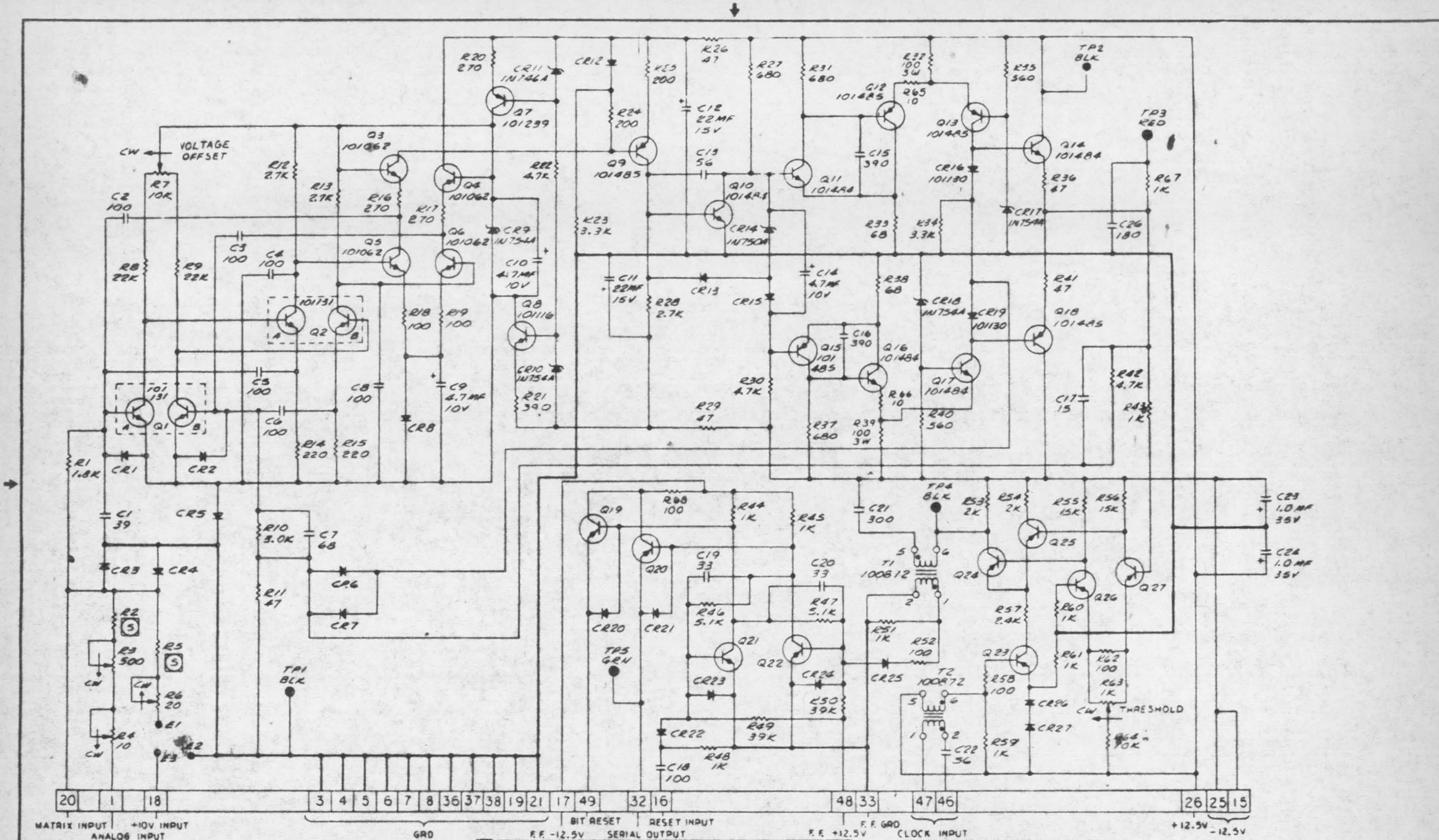


Figure 3. Model 600205 Comparator Amplifier, Logic Diagram



5 R2 & R5 VALUES ARE TABULATED FOR RESPECTIVE DASH NO.
4 ALL TRANSISTORS ARE 101497.
3 ALL DIODES ARE 100780.
2 ALL CAPACITOR VALUES ARE IN PICO FARADS.
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 WATT, ±5%.
NOTE: UNLESS OTHERWISE SPECIFIED

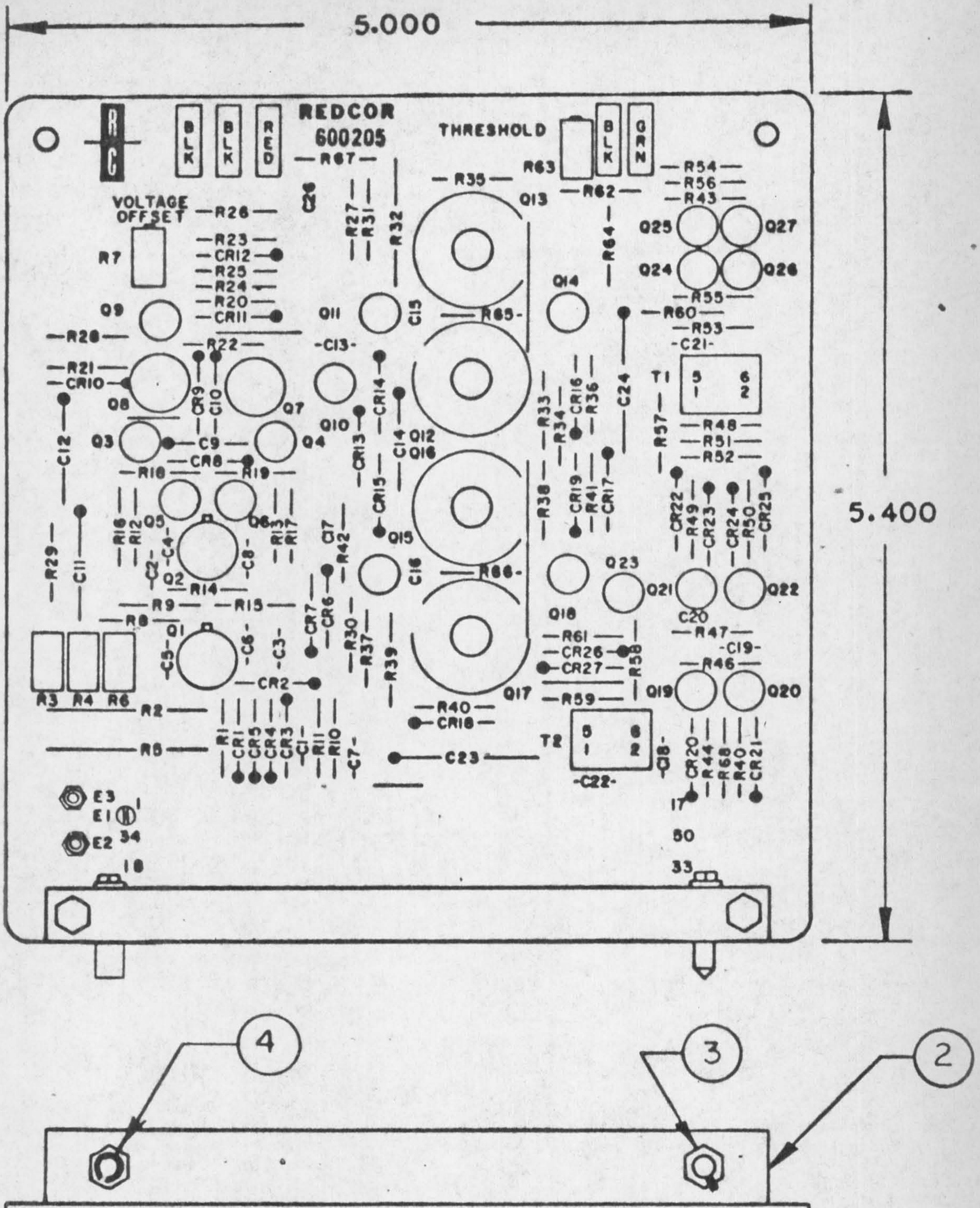
5 TABULATION

DASH NO.	R2	R5	APPLICATION
-1	4.75K, .02%	4.99K, .02%	ALL BINARY UNITS
-2	3.75K, .02%	3.99K, .02%	ALL BCD UNITS
-3	4.99K, 1%	4.99K, 1%	ALL 8 BIT BINARY UNITS

REFERENCE DESIGNATIONS

FIRST		LAST		DELETED	
C1		C26		CR28	
CR1		CR27		C25	
Q1		Q27			
R1		R68			
T1		T2			
TP1	P1	TP5	P1		

Figure 4. Model 600205 Comparator Amplifier, Schematic



600205

Figure 5. Model 600205 Comparator Amplifier, Parts Location

REFERENCE DWGS: SCHEMATIC NO. 600178 PARTS LIST NO. 600205

PARTS LIST

600205 Comparator Amplifier

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Mica, 47 PF	Arco	SCDM-15-470K	
C2	Capacitor, Disc, 100 PF	Arco	CCD-101	
C3	Same as C2			
C4	Same as C2			
C5	Same as C2			
C6	Same as C2			
C7	Capacitor, Disc, 68 PF	Arco	CCD-680	
C8	Same as C2			
C9	Capacitor, Tant., 4.7 MFD, 10V	Texas Inst.	SCM475F$_2$P010K4	
C10	Same as C9			
C11	Capaciotr, Tant., 22 MFD, 15V	Texas Inst.	SCM226BP015K4	
C12	Same as C11			
C13	Capacitor, Disc, 36 PF	Arco	CCD-360	
C14	Same as C9			
C15	Capacitor, Disc, 470 PF	Arco	CCD-471	
C16	Same as C15			
C17	Capacitor, Mica, 5 PF	Arco	SCDM-15-050K	
C18	Same as C2			
C19	Capacitor, Disc, 33 PF	Arco	CCD-330	
C20	Same as C19			
C21	Capacitor, Disc, 300 PF	Arco	CCD-301	
C22	Same as C13			
C23	Capacitor, Tant, 1.0 MFD, 35V	Texas Inst.	SCM105FP035K4	
C24	Same as C23			
C25	Capacitor, Mica, 18 PF	Arco	SCDM-15-180K	
C26	Capacitor, Disc, 180 PF	Arco	CCD-181	

PARTS LIST

600205 Comparator Amplifier

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR1	Diode, Silicon	Redcor	100780	
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Same as CR1			
CR9	Diode, Zener	Texas Inst.	1N754A	
CR10	Same as CR9			
CR11	Diode, Zener	Texas Inst.	1N746A	
CR12	Same as CR1			
CR13	Same as CR1			
CR14	Diode, Zener	Texas Inst.	1N750A	
CR15	Same as CR1			
CR16	Diode	Redcor	101130	
CR17	Same as CR9			
CR18	Same as CR9			
CR19	Same as CR16			
CR20	Same as CR1			
CR21	Same as CR1			
CR22	Same as CR1			
CR23	Same as CR1			
CR24	Same as CR1			
CR25	Same as CR1			
CR26	Same as CR1			
CR27	Same as CR1			
CR28	Same as CR1			
E1	Not Used			

PARTS LIST

600205 Comparator Amplifier

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
E2	Clip, Component	C. T. C.	2146-1	
E3	Same as E2			
P1	Connector, 50 Pin, Male	Redcor	600020	
Q1	Transistor, Dual, SM Signal, NPN, Silicon	Redcor	101131	
Q2	Same as Q1			
Q3	Transistor, SM Signal, NPN, Silicon	Redcor	101062	
Q4	Same as Q3			
Q5	Same as Q3			
Q6	Same as Q3			
Q7	Transistor, Med Power, NPN, Silicon	Redcor	101239	
Q8	Transistor, Med Power, NPN, Silicon	Redcor	101116	
Q9	Transistor, High Speed Switching, PNP, Silicon	Redcor	101485	
Q10	Transistor, High Speed Switching, NPN, Silicon	Redcor	101484	
Q11	Same as Q10			
Q12	Same as Q9			
Q13	Same as Q9			
Q14	Same as Q10			
Q15	Same as Q9			
Q16	Same as Q10			
Q17	Same as Q10			
Q18	Same as Q9			
R1	Resistor, Comp, 1.8K, 1/4W, ±5%	A. B.	RC07GF182J	
R2	See Note			
R3	Potentiometer, 500 ohm	Techno	40-500	

PARTS LIST

600205 Comparator Amplifier

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R4	Potentiometer, 10 ohm	Techno	40-10	
R5	See Note			
R6	Potentiometer, 20 ohm	Techno	40-20	
R7	Potentiometer, 10K	Techno	40-10K	
R8	Resistor, Comp, 22K, 1/4W, ±5%	A. B.	RC07GF223J	
R9	Same as R8			
R10	Resistor, Comp, 3.0K, 1/4W, ±5%	A. B.	RC07GF302J	
R11	Resistor, Comp, 47 ohm, 1/4W, ±5%	A. B.	RC07GF470J	
R12	Resistor, Comp, 2.7K, 1/4W, ±5%	A. B.	RC07GF272J	
R13	Same as R12			
R14	Resistor, Comp, 330 ohm, 1/4W, ±5%	A. B.	RC07GF331J	
R15	Same as R14			
R16	Resistor, Comp, 470 ohm, 1/4W, ±5%	A. B.	RC07GF471J	
R17	Same as R16			
R18	Resistor, Comp, 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J	
R19	Same as R18			
R20	Same as R16			
R21	Resistor, Comp, 560 ohm, 1/4W, ±5%	A. B.	RC07GF561J	
R22	Resistor, Comp, 4.7K, 1/4W, ±5%	A. B.	RC07GF472J	
R23	Resistor, Comp, 3.3K, 1/4W, ±5%	A. B.	RC07GF332J	
R24	Resistor, Comp, 200 ohm 1/4W, ±5%	A. B.	RC07GF201J	
R25	Same as R24			

PARTS LIST

600205 Comparator Amplifier

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R26	Same as R11			
R27	Resistor, Comp, 680 ohm, 1/4W, ±5%	A. B.	RC07GF681J	
R28	Same as R12			
R29	Same as R12			
R30	Same as R22			
R31	Same as R27			
R32	Resistor, W.W., 3W, ±5%	Sprague	242E1015	
R33	Resistor, Comp, 68 ohm, 1/4W, ±5%	A. B.	RC07GF680J	
R34	Same as R23			
R35	Same as R21			
R36	Same as R11			
R37	Same as R27			
R38	Same as R33			
R39	Same as R32			
R40	Same as R21			
R41	Same as R11			
R42	Same as R22			
R43	Resistor, Comp, 1 K, 1/4W, ±5%	A. B.	RC07GF102J	
R44	Same as R43			
R45	Same as R43			
R46	Resistor, Comp, 5.1 K, 1/4W, ±5%	A. B.	RC07GF512J	
R47	Same as R46			
R48	Same as R43			
R49	Resistor, Comp, 39 K, 1/4W, ±5%	A. B.	RC07GF393J	
R50	Same as R49			

PARTS LIST

600205 Comparator Amplifier

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R51	Same as R43			
R52	Same as R18			
R53	Resistor, Comp, 2 K, 1/4W, ±5%	A. B.	RC07GF202J	
R54	Same as R53			
R55	Resistor, Comp, 15 K, 1/4W, ±5%	A. B.	RC07GF153J	
R56	Same as R55			
R57	Resistor, Comp, 2.4 K, 1/4W, ±5%	A. B.	RC07GF242J	
R58	Same as R18			
R59	Same as R43			
R60	Same as R43			
R61	Same as R43			
R62	Same as R18			
R63	Potentiometer, 1K	Techno	40-1K	
R64	Resistor, Comp, 10 K, 1/4W, ±5%	A. B.	RC07GF103J	
R65	Resistor, Comp, 220 ohm, 1/4W, ±5%	A. B.	RC07GF221J	
R66	Same as R65			
R67	Same as R43			
T1	Transformer	Redcor	100872	
T2	Same as T1			
TP1	Test Jack - Blk	Ucinite	119437-C	
TP2	Same as TP1			
TP3	Test Jack - Red	Ucinite	119437-B	
TP4	Same as TP1			
TP5	Test Jack - Grn	Ucinite	119437-E	

PARTS LIST

600205 Comparator Amplifier

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
NOTE FOR R2 and R5 APPLICATION				
R2	Resistor, W.W., 4.75 K, ±.02%	Redcor	101015-B-4750R0	*
R5	Resistor, W.W., 4.99 K, ±.02%	Redcor	101015-B-4990R0	*
R2	Resistor, W.W., 3.75 K, ±.02%	Redcor	101015-B-3750R0	**
R5	Resistor, W.W., 3.99 K, ±.02%	Redcor	101015-B-3990R0	**
R2 & R5	Resistor, W.W., 4.99 K, 1/8W, ±1%	Redcor	101211-B-49900-A	***
DASH NO.	APPLICATION			
* - 1	All Binary Units			
** - 2	All BCD Units			
*** - 3	All 8 Bit Binary Units			

INSTRUCTION MANUAL

600200 GATING CIRCUITS

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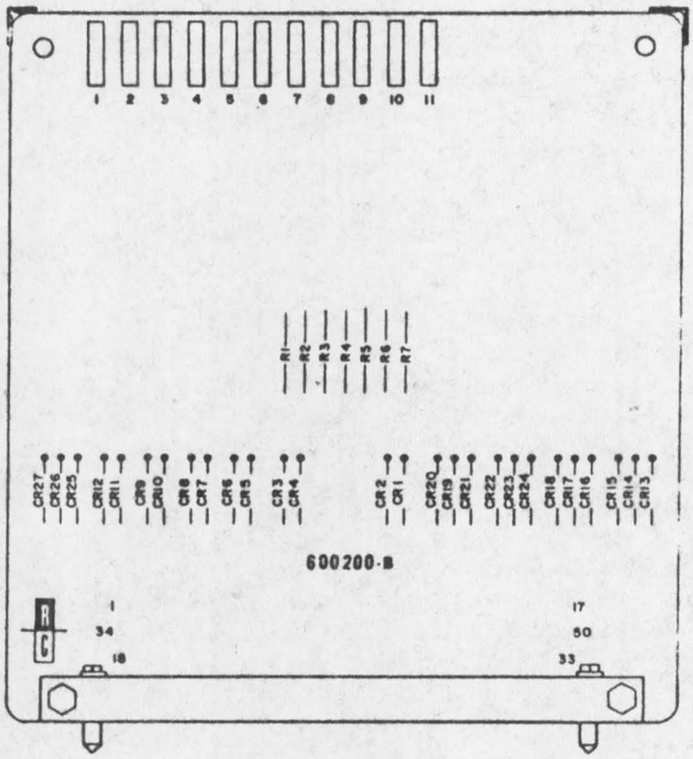


Figure 1 - 600200 Gating Circuits

1. DESCRIPTION AND PURPOSE

2. Description - The Model 600200 Gating Circuit (see Figure 1) is a printed circuit board module consisting of six four-term AND gates and five three-term AND gates with seven separate pull down resistors. The circuit board is a standard 50 pin module card with components mounted on one side. The board assembly measures 5 x 5.4 inches and requires one standard card space. Test points are provided on the top edge of the card for waveform observation and troubleshooting during operation.

3. Purpose - The Gating Circuit is used to AND logical levels as used in digital systems. The gates may be joined together at the outputs for expansion with a single resistor, or the gates may be used to expand input gate structures on driver or flip flop modules.

4. CIRCUIT DESCRIPTION (See Figure 2)

5. The standard negative true AND gate is comprised of silicon diodes in

conjunction with 4.7Kohm resistors for pull down to a -12.5V. The resistors may be connected to a logical term, as a common input to all gates, if that term is from a low impedance source, as each resistor offers a 4.7Kohm load to ground on an inhibited gate. Refer to Figure 2 for a logical representation of the gating structure.

6. SPECIFICATIONS

Number of Circuits................6 4-term AND gates
5 3-term AND gates
7 resistors

Logic.............................Negative true, dc coupled

Minimum Input.....................-6V

Maximum Noise Rejection...........-1V

Maximum Reverse Recovery Time.....100nSec

Maximum Output Loading:

To Ground.....................5.1K
To Negative Voltage...........50ma (or max load of input source)

General Specifications:

Power Requirements................-12V 18.5ma

Operating Temperature.............0-50°C

Mechanical Size...................5" x 5.4" x 0.5"

Connector Type....................50 pin

Board Type........................0.090" thick glass epoxy

Test Points:

Number........................11
Data Provided.................Each gate output

7. MAINTENANCE - Standard circuit board maintenance practices apply. Replacement parts shall be those specified in the Parts List.

CAUTION: When soldering and replacing electronic components on the printed circuit, the circuit board and replacement components should not be overheated. Use an appropriate heat sink.

Troubleshooting is easily accomplished using test points TP1 through TP11 and observing voltages.

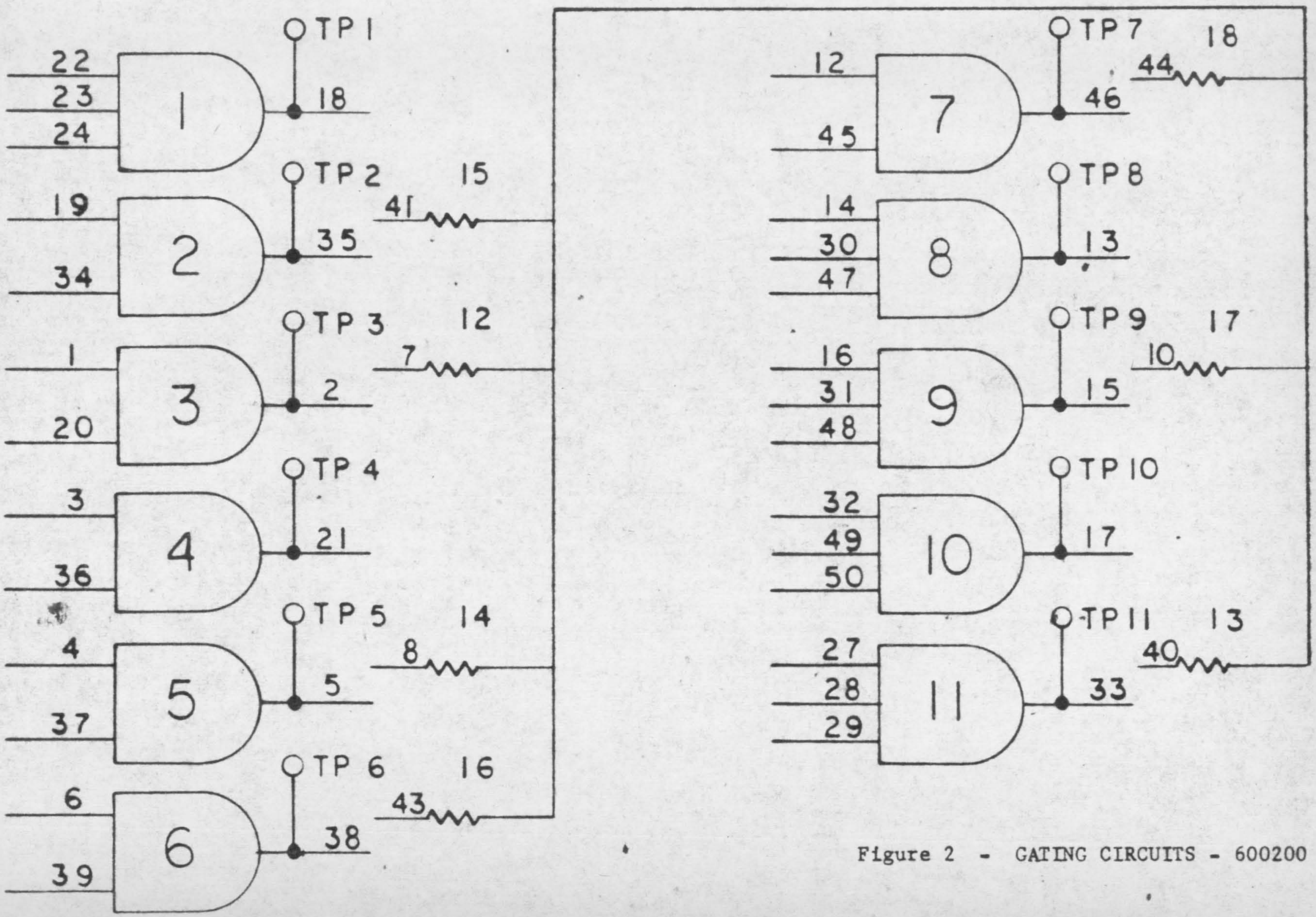
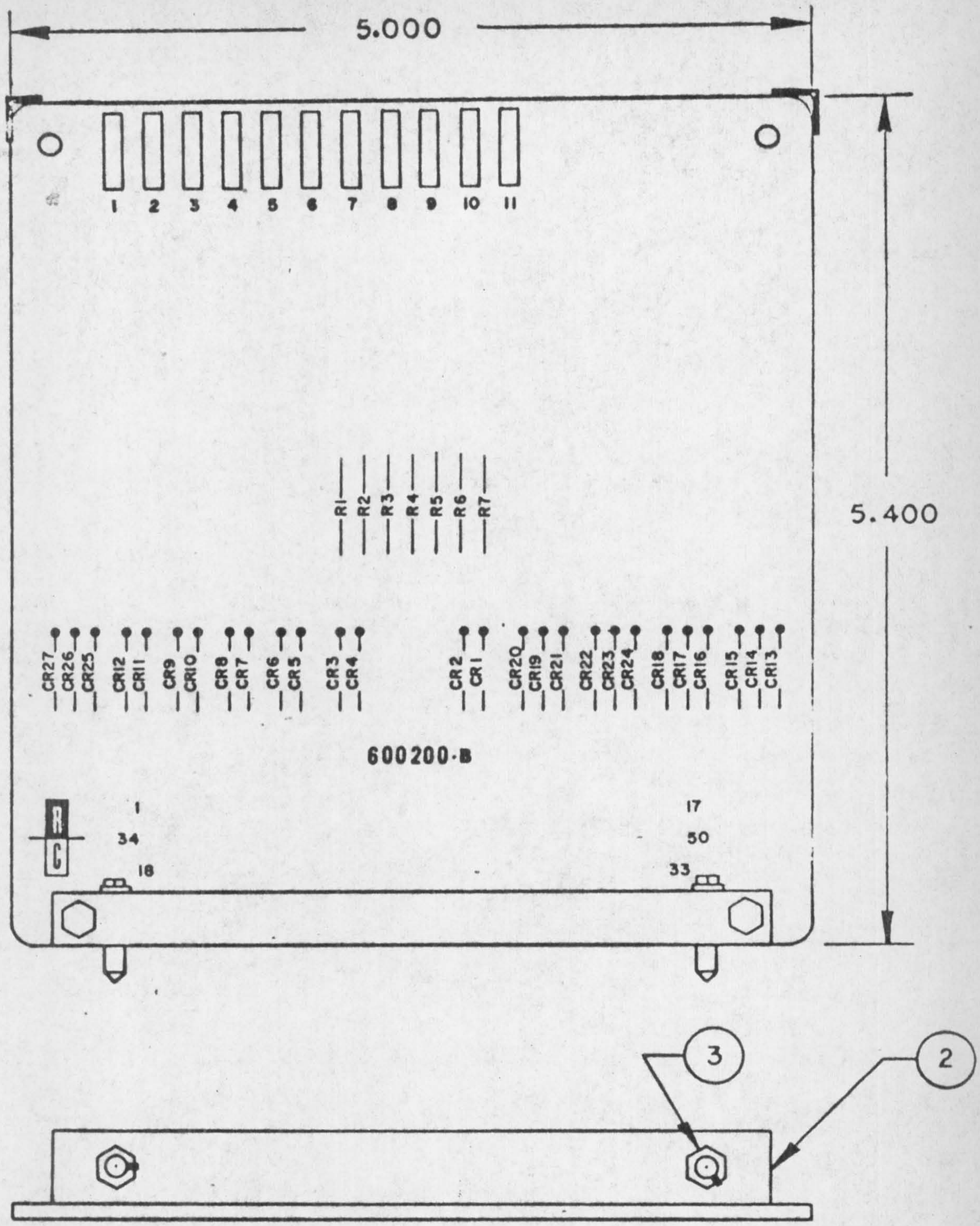


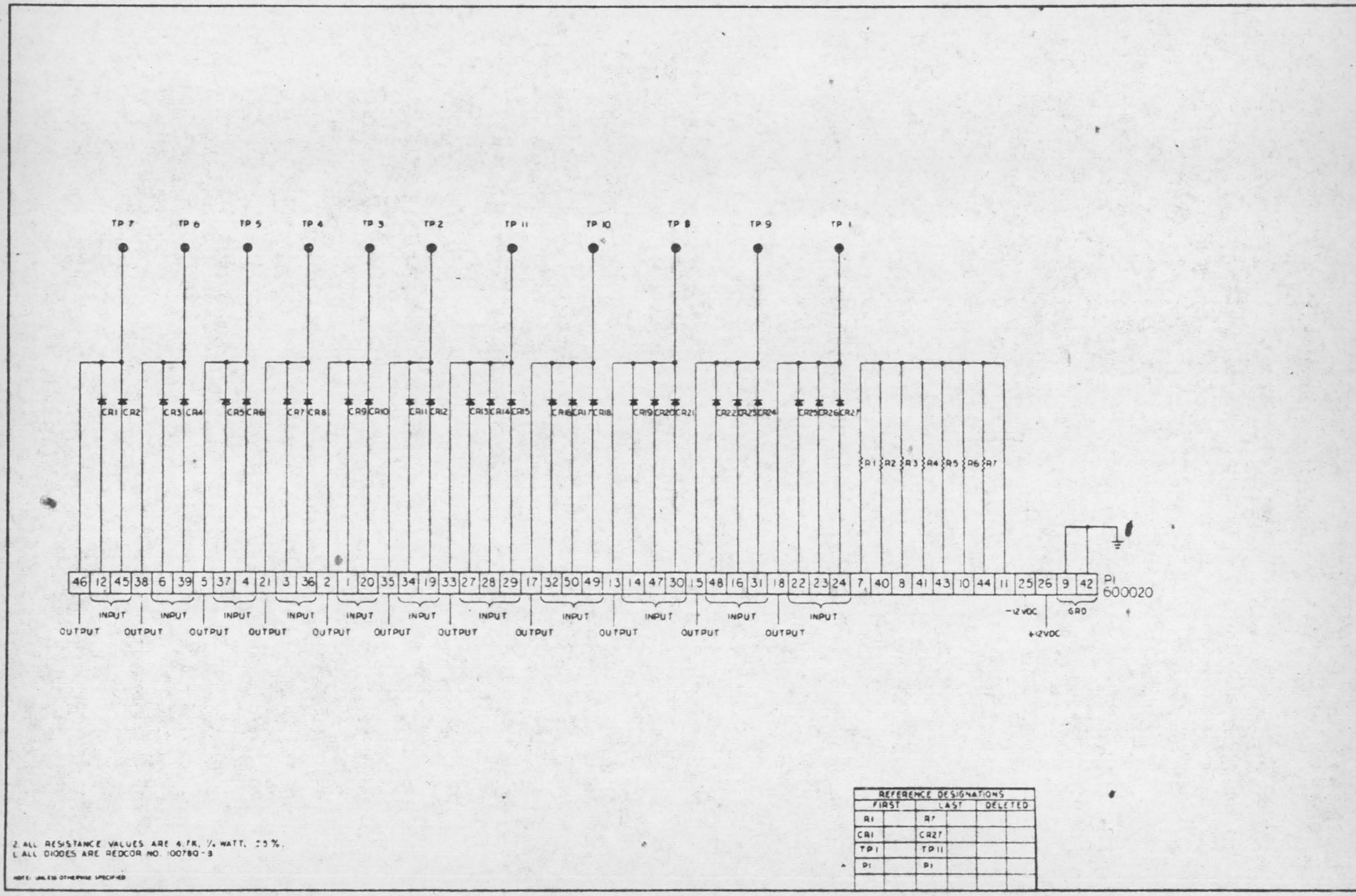
Figure 2 - GATING CIRCUITS - 600200



600200
GATING CIRCUITS

Figure 3

REFERENCE DWGS: SCHEMATIC NO. 600012, PARTS LIST NO. 600015



REFERENCE DESIGNATIONS			
FIRST	LAST	DELETED	
R1	R7		
CR1	CR27		
TP1	TP11		
P1	P1		

Figure 4 - 600200 Schematic

PARTS LIST

600200 GATING CIRCUITS

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR1	Diode, Silicon	Redcor	100780-3	
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Same as CR1			
CR9	Same as CR1			
CR10	Same as CR1			
CR11	Same as CR1			
CR12	Same as CR1			
CR13	Same as CR1			
CR14	Same as CR1			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR1			
CR19	Same as CR1			
CR20	Same as CR1			
CR21	Same as CR1			
CR22	Same as CR1			
CR23	Same as CR1			
CR24	Same as CR1			
CR25	Same as CR1			
CR26	Same as CR1			
CR27	Same as CR1			
P1	Connector, 50 Pin	Redcor	600020	
R1	Resistor, Comp., 4.7K, 1/4W, ±5%	Allen-Bradley	RC07GF472J	

PARTS LIST

600200 GATING CIRCUITS

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R2	Same as R1			
R3	Same as R1			
R4	Same as R1			
R5	Same as R1			
R6	Same as R1			
R7	Same as R1			
TP1	Test Probe Receptacle,Blu	Ucinite	119437-G	
TP2	Test Probe Receptacle,Blk	Ucinite	119437-C	
TP3	Same as TP2			
TP4	Test Probe Receptacle,Red	Ucinite	119437-B	
TP5	Same as TP2			
TP6	Same as TP2			
TP7	Test Probe Receptacle,Yel	Ucinite	119437-H	
TP8	Same as TP7			
TP9	Same as TP7			
TP10	Same as TP7			
TP11	Same as TP7			

INSTRUCTION MANUAL FOR POWER DRIVER AND ONE SHOT MODEL 600170

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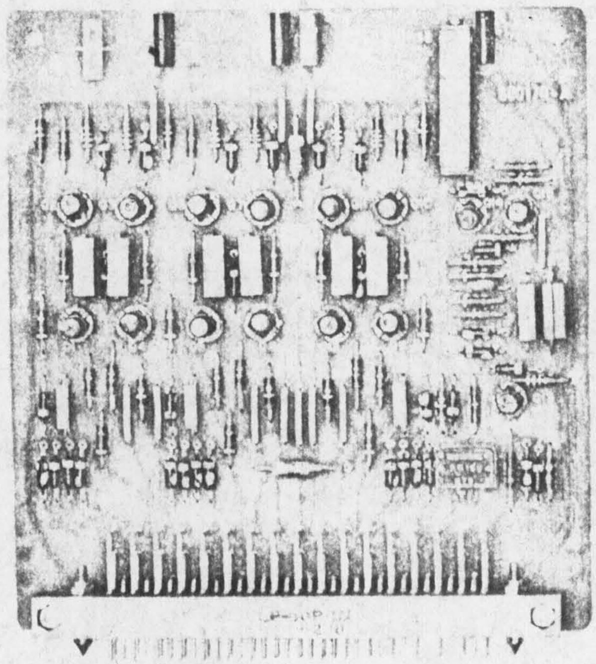


Figure 1. Power Driver and One Shot Model 600170

1. DESCRIPTION AND PURPOSE

2. Description - The Model 600170 Power Driver and One Shot (see Figure 1) is a printed circuit board module consisting of three identical independent DC power driver circuits and a single monostable multivibrator (one shot). The circuit board is a standard 50-pin module card with components mounted on one side. The board assembly measures 5 x 5. 4 inches and requires one standard space. Test points are provided on the top edge of the card for waveform observation and trouble shooting during operation.

3. Purpose - The power driver circuits are suitable for driving heavy loads to ground and -12 volts. The primary use for the driver is to provide isolated clock pulses to analog-to-digital converters and multiplexers and for clock drivers in general. Input gating is included on the card to facilitate gating of clock lines for function select operations. The one shot is primarily used to provide a start pulse upon receiving an external start command. The input to the one shot can be either direct or transformer coupled. One output pulse is generated upon receipt of each input pulse.

4. CIRCUIT DESCRIPTION (See Figures 2 and 3)

5. Driver Circuits - Each driver circuit consists of input gating circuits, a common-emitter amplifier, two parallel common-emitter amplifiers, and an emitter-follower. The output of the first amplifier is fed to the bases of the parallel amplifiers and provided as a false output. Parallel amplifiers are utilized to achieve power. The emitter-follower is used to maintain a good true output waveshape.

6. One Shot Circuit - The one shot consists of a conventional two-transistor monostable multivibrator and emitter-follower. The emitter-follower output is fed through capacitors C10, C11 and an external capacitor connected between pins 29 and 30 to the input of the one shot, completing the feedback circuit. The emitter-follower is utilized to provide current gain and isolation to the reset output, thus, providing a stiff output voltage and clean waveform.

7. Maintenance - Standard circuit board maintenance practices apply. Replacement parts shall be those specified in the parts list.

CAUTION

When soldering and replacing electronic components on the circuit board, the circuit board and replacement components should not be overheated. Use an appropriate heatsink.

Troubleshooting is easily accomplished using test points TP1 through TP4 and observing waveforms.

8. Replacement Parts - Replacement parts for the power driver and one shot are listed in the parts list. For location and identification of parts see Figure 4.

9. SPECIFICATIONS

Number of circuits . . . . 3 power drivers, 1 one shot

Logic . . . . Negative true

Power Driver

Input gating structure:

- Minimum . . . . AND, OR
- Maximum . . . . AND, AND, AND, OR

Gating provided . . . . . 4 term AND, single OR

Noise rejection . . . . 2.0 V

Minimum input level . . . . -6 V

Trigger point . . . . Negative falling edge

Fall time requirements . . . . To maintain output rise and fall times minimum 300 nsec. Otherwise none

Maximum repetition rate . . . . 1 mc

Delay to last moving point . . . . 100 nsec, full load

Output voltage:

- True . . . . -9 ±3 V
- False . . . . 0 ±0.5 V

Output loading:

- To ground . . . . 300 ohms
- To -12 V . . . . 65 ma

Output capacitive loading . . . . 800 pf with full resistive load to ground

Output rise time:

- No load . . . . 30 nsec
- Full load . . . . 60 nsec

Output fall time:

- No load . . . . 30 nsec
- Full load . . . . 70 nsec

Output short protection . . . Output short circuit proof with respect to ground

One Shot

Input gating structure:

- Minimum . . . . AND, OR
- Maximum . . . . AND, AND, OR

Input structure provided:

- Set . . . . 2-term AND
- Auxiliary . . . . OR
- Transformer . . . . Direct
- Maximum DC voltage primary/secondary . . . . 50 V

Expandable gates . . . . 4 2-term AND

Noise rejection . . . . 2 V

Minimum trigger transition . . . . 6 V

Trigger points. . . . Positive edge to ground or either via transformer coupling

Transition point . . . . . . 300 nsec minimum

Output voltage:

- True . . . . -9 ±3 V
- False . . . . -0 ±0.5 V

Output loading:

- True . . . . 1.5 K to ground, 20 ma to negative voltage
- False . . . . 400 ohms to ground, 20 ma to negative voltage

Capacity . . . . Maximum 200 pf

Timing requirements

False output:

- Fall time . . . . 70 nsec no load, 100 nsec full load
- Rise time . . . . 40 nsec no load, 100 nsec full load
- Delay time . . . . 100 nsec no load, 120 nsec full load

True output:

- Fall time . . . . 200 nsec no load, 250 nsec full load
- Rise time . . . . 100 nsec no load, 150 nsec full load
- Delay time . . . . Minimum: 500 nsec, Maximum: variable

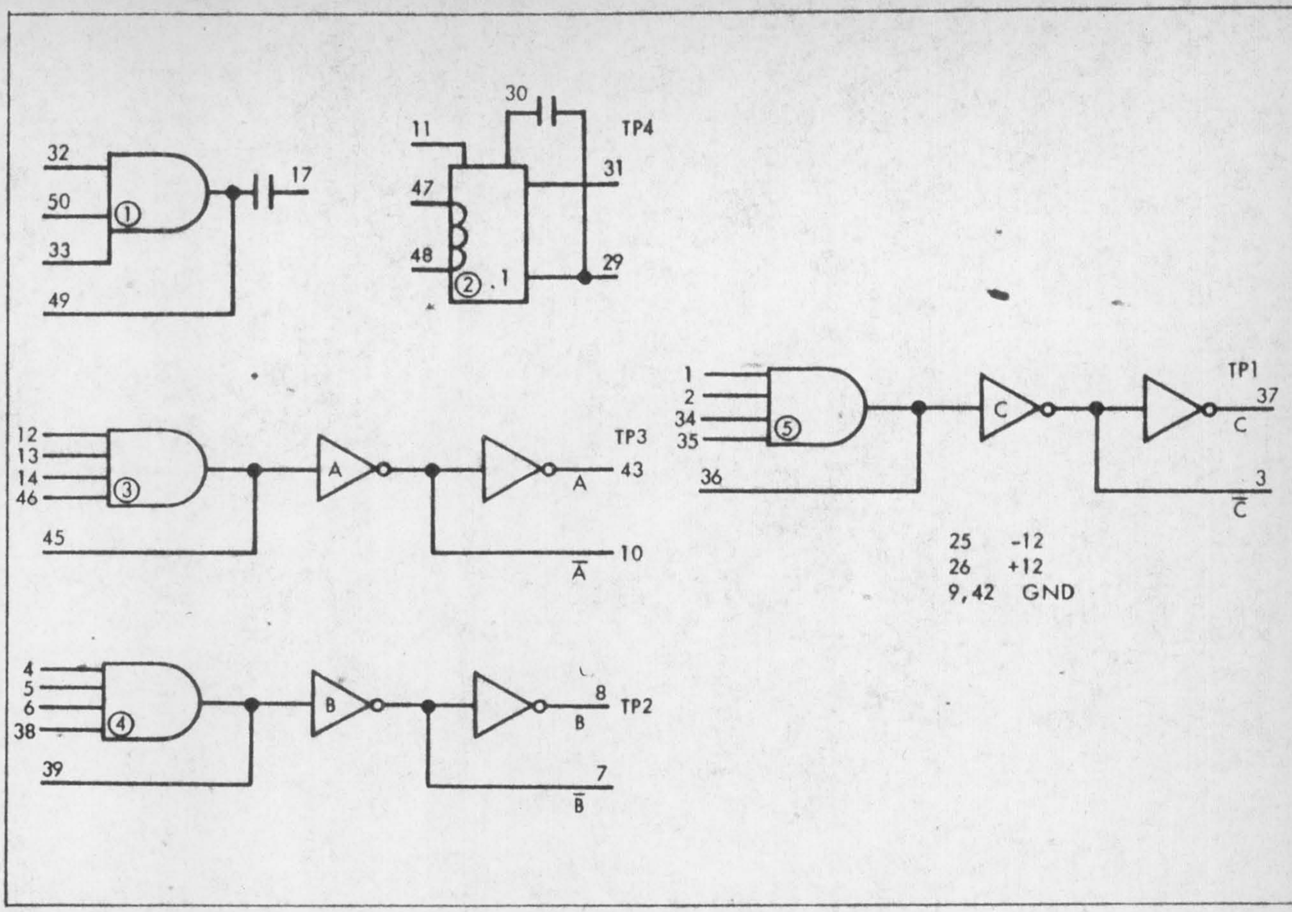


Figure 2. Power Driver and One Shot Model 600170, Logic Diagram

Delay time adjustment:

- Internal . . . . Potentiometer 2:1
- External . . . . Capacitor selection

Repetition rate . . . . 1 MC maximum

Power requirements . . . . +12.5 V @ 15 ma
. . . . -12.5 V @ 80 ma

Operating temperature . . . . 0 - 50°C

Mechanical size . . . . 5" x 5.4" x 0.4"

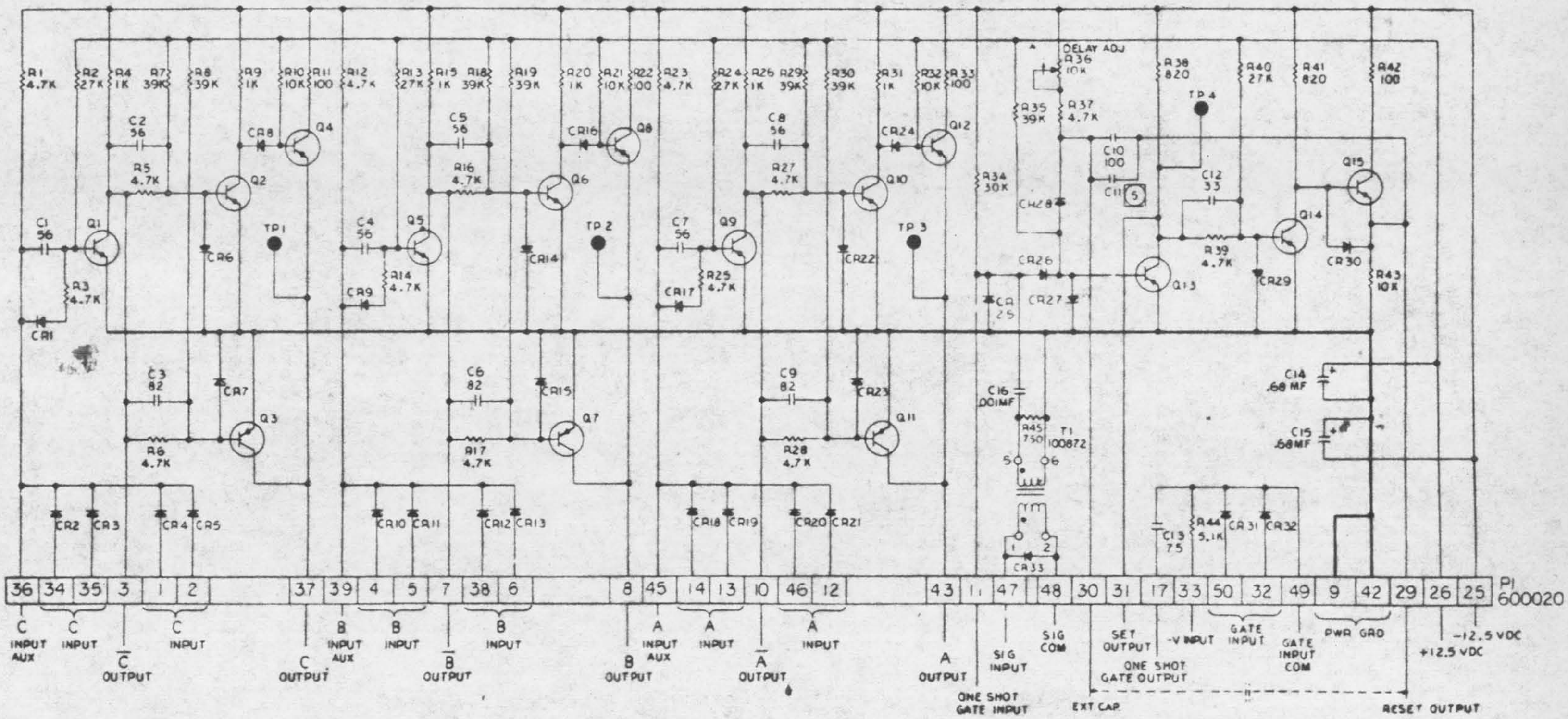
Connector type 50-pin

Board type . . . . 0.90" thick glass epoxy

Test points:

- Number 4
- Data provided . . . . 3 driver true output
1 one shot set output

Designation	Color	Data
1	Black	C output
2	Brown	B output
3	Violet	A output
4	Black	One-shot set output



5. C11 CHOSEN FOR DESIRED DELAY.
4. ALL TRANSISTORS ARE 2N2401.
3. ALL DIODES ARE REDCOR NO. 100780-3.
2. ALL CAPACITANCE VALUES ARE IN PICO FARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT, ±5%.
NOTE: UNLESS OTHERWISE SPECIFIED

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Figure 3. Power Driver and One Shot Model 600170, Schematic Diagram

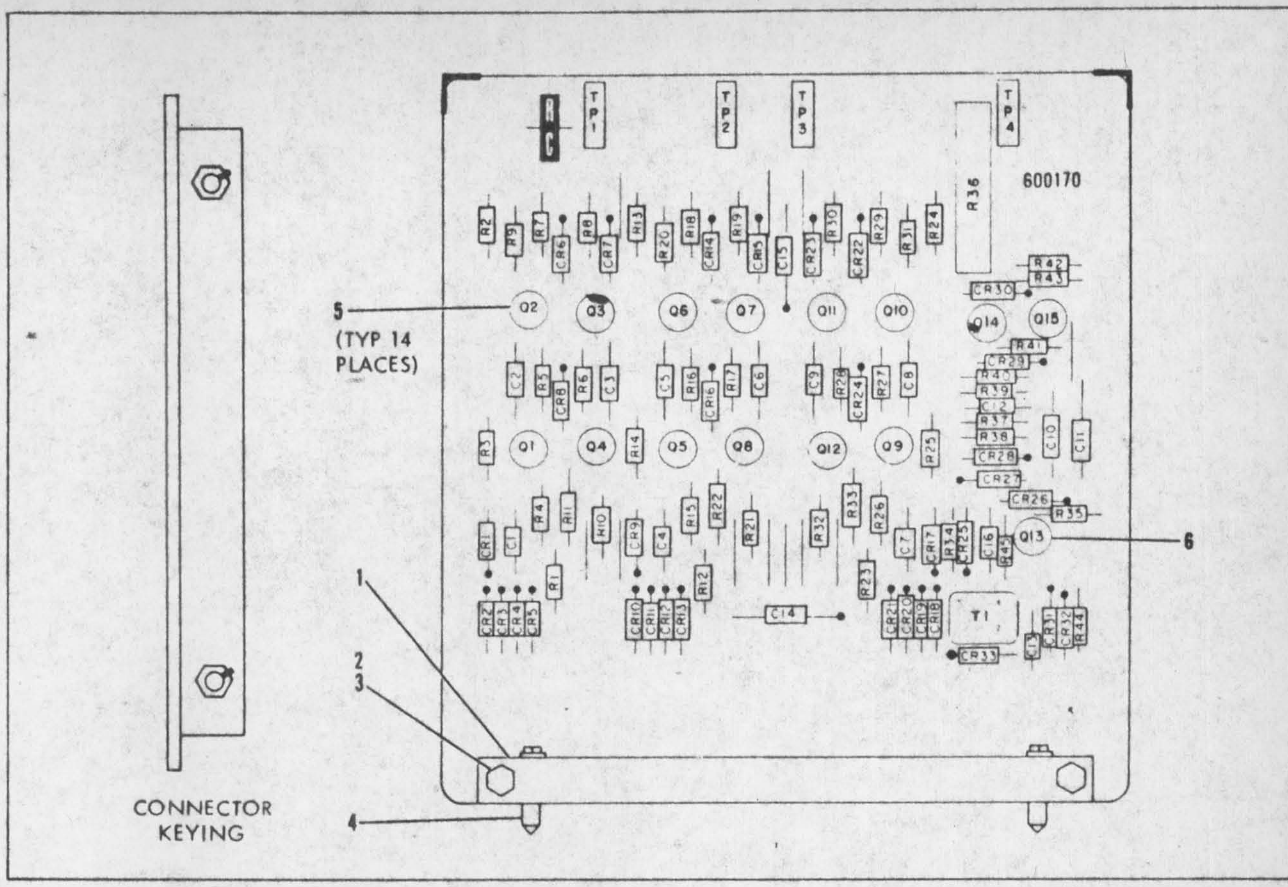

Figure 4. Power Driver and One Shot Model 600170, Parts Location

PARTS LIST

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
1	Connector, 50 Pin, Male	Redcor	600020
2	Screw, F. H. Cad. Stl. #4-40 x 1/2 lg.		
3	Nut, Hex, Cad. Stl., #4-40		
4	Pin, Polarizing, Male		600021
5	Transipad, (TO-18 to TO-5)	Milton Ross	10044
6	Transipad	Milton Ross	10117
C1	Capacitor, Disc, 56 pf	Arco	CCD-560
C2	Capacitor, Disc, 56 pf	Arco	CCD-560
C3	Capacitor, Disc, 82 pf	Arco	CCD-820
C4	Capacitor, Disc, 56 pf	Arco	CCD-560
C5	Capacitor, Disc, 56 pf	Arco	CCD-560
C6	Capacitor, Disc, 82 pf	Arco	CCD-820
C7	Capacitor, Disc, 56 pf	Arco	CCD-560
C8	Capacitor, Disc, 56 pf	Arco	CCD-560
C9	Capacitor, Disc, 82 pf	Arco	CCD-820
C10	Capacitor, Mica, 100 pf	Arco	CM15-E-101J
*C11	Capacitor (selected)		
C12	Capacitor, Disc, 33 pf	Arco	CCD-330
C13	Capacitor, Disc, 75 pf	Arco	CCD-750
C14	Capacitor, Tant., .68 uf, 35V	T. I.	SCM684FP035A2
C15	Capacitor, Tant., .68 uf, 35V	T. I.	SCM684FP035A2
C16	Capacitor, Disc, .001 uf	Arco	CCD-102
CR1	Diode, Silicon	Redcor	100780

* Capacitor, C11, will be selected for one shot delay. Value and type to be determined by application.

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
CR2	Diode, Silicon	Redcor	100780
CR3	Diode, Silicon	Redcor	100780
CR4	Diode, Silicon	Redcor	100780
CR5	Diode, Silicon	Redcor	100780
CR6	Diode, Silicon	Redcor	100780
CR7	Diode, Silicon	Redcor	100780
CR8	Diode, Silicon	Redcor	100780
CR9	Diode, Silicon	Redcor	100780
CR10	Diode, Silicon	Redcor	100780
CR11	Diode, Silicon	Redcor	100780
CR12	Diode, Silicon	Redcor	100780
CR13	Diode, Silicon	Redcor	100780
CR14	Diode, Silicon	Redcor	100780
CR15	Diode, Silicon	Redcor	100780
CR16	Diode, Silicon	Redcor	100780
CR17	Diode, Silicon	Redcor	100780
CR18	Diode, Silicon	Redcor	100780
CR19	Diode, Silicon	Redcor	100780
CR20	Diode, Silicon	Redcor	100780
CR21	Diode, Silicon	Redcor	100780
CR22	Diode, Silicon	Redcor	100780
CR23	Diode, Silicon	Redcor	100780
CR24	Diode, Silicon	Redcor	100780
CR25	Diode, Silicon	Redcor	100780
CR26	Diode, Silicon	Redcor	100780
CR27	Diode, Silicon	Redcor	100780
CR28	Diode, Silicon	Redcor	100780
CR29	Diode, Silicon	Redcor	100780
CR30	Diode, Silicon	Redcor	100780
CR31	Diode, Silicon	Redcor	100780
CR32	Diode, Silicon	Redcor	100780
CR33	Diode, Silicon	Redcor	100780
Q1	Transistor, PNP	Redcor	101120
Q2	Transistor, PNP	Redcor	101120
Q3	Transistor, PNP	Redcor	101120
Q4	Transistor, PNP	Redcor	101120
Q5	Transistor, PNP	Redcor	101120
Q6	Transistor, PNP	Redcor	101120
Q7	Transistor, PNP	Redcor	101120
Q8	Transistor, PNP	Redcor	101120
Q9	Transistor, PNP	Redcor	101120
Q10	Transistor, PNP	Redcor	101120
Q11	Transistor, PNP	Redcor	101120
Q12	Transistor, PNP	Redcor	101120
Q13	Transistor, PNP	Redcor	101120
Q14	Transistor, PNP	Redcor	101120
Q15	Transistor, PNP	Redcor	101120
R1	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R2	Resistor, Comp., 27K, 1/4W, ±5%	A. B.	RC07GF273J
R3	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R4	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R5	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R6	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R7	Resistor, Comp., 39K, 1/4W, ±5%	A. B.	RC07GF393J
R8	Resistor, Comp., 39K, 1/4W, ±5%	A. B.	RC07GF393J
R9	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R10	Resistor, Comp., 10K, 1/4W, ±5%	A. B.	RC07GF103J
R11	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R12	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R13	Resistor, Comp., 27K, 1/4W, ±5%	A. B.	RC07GF273J
R14	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R15	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R16	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
R17	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R18	Resistor, Comp., 39K, 1/4W, ±5%	A. B.	RC07GF393J
R19	Resistor, Comp., 39K, 1/4W, ±5%	A. B.	RC07GF393J
R20	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R21	Resistor, Comp., 10K, 1/4W, ±5%	A. B.	RC07GF103J
R22	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R23	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R24	Resistor, Comp., 27K, 1/4W, ±5%	A. B.	RC07GF273J
R25	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R26	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R27	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R28	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R29	Resistor, Comp., 39K, 1/4W, ±5%	A. B.	RC07GF393J
R30	Resistor, Comp., 39K, 1/4W, ±5%	A. B.	RC07GF393J
R31	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R32	Resistor, Comp., 10K, 1/4W, ±5%	A. B.	RC07GF103J
R33	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R34	Resistor, Comp., 30K, 1/4W, ±5%	A. B.	RC07GF303J
R35	Resistor, Comp., 39K, 1/4W, ±5%	A. B.	RC07GF393J
R36	Potentiometer, 10K, 1/4W	Bourns	275-1-103
R37	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R38	Resistor, Comp., 820 ohm, 1/4W, ±5%	A. B.	RC07GF821J
R39	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R40	Resistor, Comp., 27K, 1/4W, ±5%	A. B.	RC07GF273J
R41	Resistor, Comp., 820 ohm, 1/4W, ±5%	A. B.	RC07GF821J
R42	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R43	Resistor, Comp., 10K, 1/4W, ±5%	A. B.	RC07GF103J
R44	Resistor, Comp., 5.1K, 1/4W, ±5%	A. B.	RC07GF512J
R45	Resistor, Comp., 750 ohm, 1/4W, ±5%	A. B.	RC07GF751J
T1	Transformer, Pulse	Redcor	100872
TP1	Test Jack, Black	Ucinite	119437-C
TP2	Test Jack, Brown	Ucinite	119437-D
TP3	Test Jack, Violet	Ucinite	119437-K
TP4	Test Jack, Black	Ucinite	119437-C

INSTRUCTION MANUAL

FOR

OCTAL COUNTER AND

DECODER 600160

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Canoga Park, Calif.

OCTAL COUNTER AND DECODER 600160

This module contains 3 AC coupled flip flops interconnected as a 3 bit binary counter. The outputs of these 3 flip flops are then decoded into 8 dual inverters thus providing both true and false outputs of an octal decoder. One additional dual inverter stage is also provided with direct "OR" input. Additional gating is provided to enable the counter, to reset it in parallel, or to enable the inverter outputs by a common gate input to the eight 3-term decode gates.

The true and false outputs of the counter flip flops are also available.

Specifications

Module Type:	Octal counter and decoder
No. of circuits:	3 flip flop and 9 dual inverters
Type of logic:	Negative true
Logic levels:	
True	-9 volts ±3 volts
False	0 volts -0.5 volts

Counter Section 3 flip flops

Input gate structure fined:	Clocked binary counter with common reset and direct input gates on first counter stage for inhibiting.
Noise rejection:	1.5 volts - start of count
Minimum input:	6 volts transition
Trigger point:	Positive edge from negative voltage
Trigger rise time:	200 nanosec minimum

600160 Specification (continued)

<u>Output loading</u>

To ground:	3 Kilohms
To negative voltage:	2.5mA
Capacitance:	less than 100pf

<u>Timing relationships</u>

Maximum repetition rate:	1 Megacycle
Delay to last moving point:	100 nanosecs

Rise time

No load:	40 nanosecs
Full load	60 nanosecs

Fall time

No load:	60 nanosecs
Full load	100 nanosecs

<u>Decoder Section - 9 Circuits</u>

<u>Input gating</u>

8 circuits:	Octal decoding gates plus one common gate input to all gates
1 circuit:	Direct "OR" input

<u>Output loading</u>

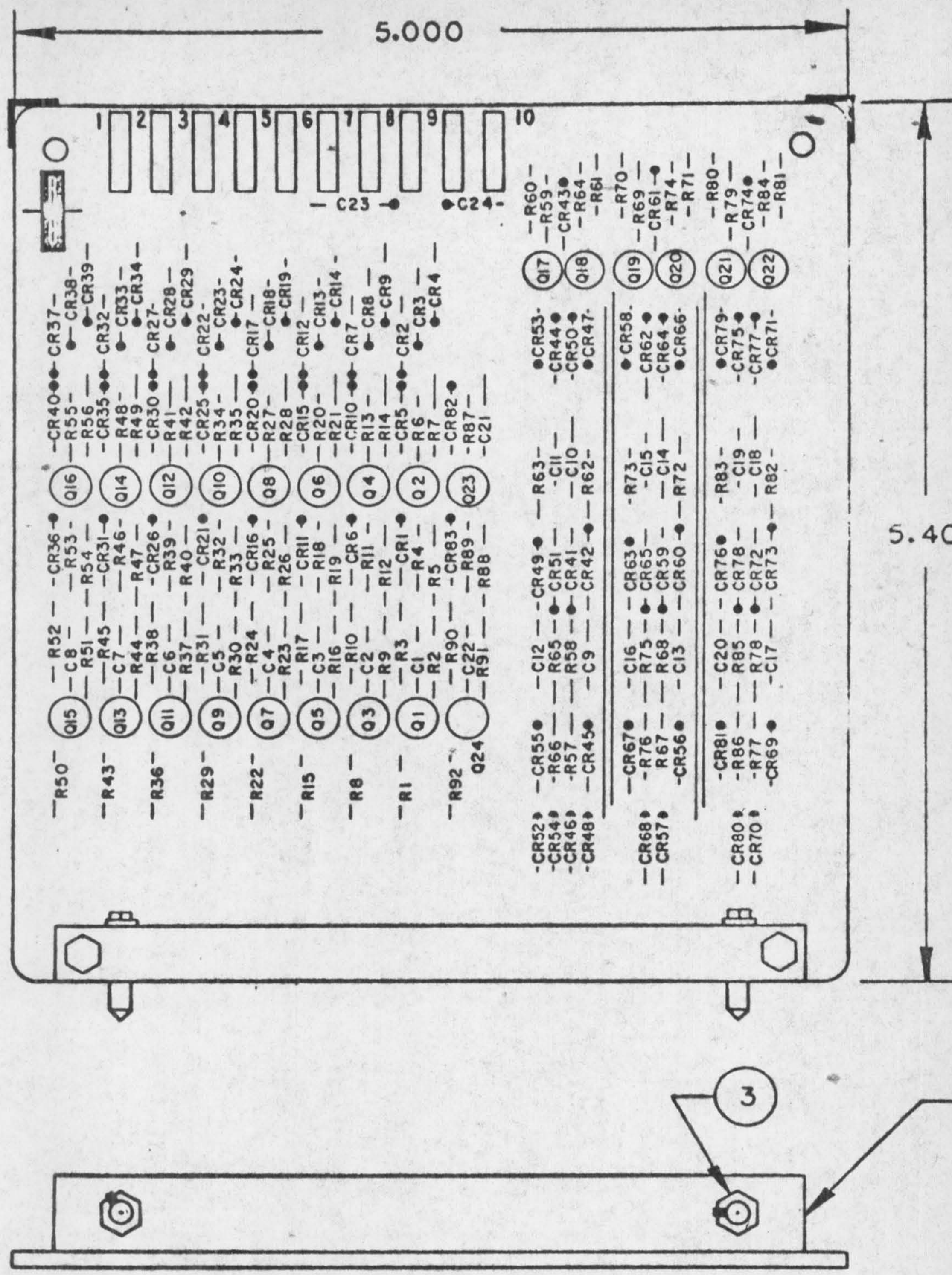
To ground:	1 kilohms
To negative voltage:	15mA
Capacitance	1000 pf

<u>Timing relationships</u>

Maximum repetition rate:	1 Megacycle
Delay to last moving point:	From clock input to decoded output 200 nanosecs

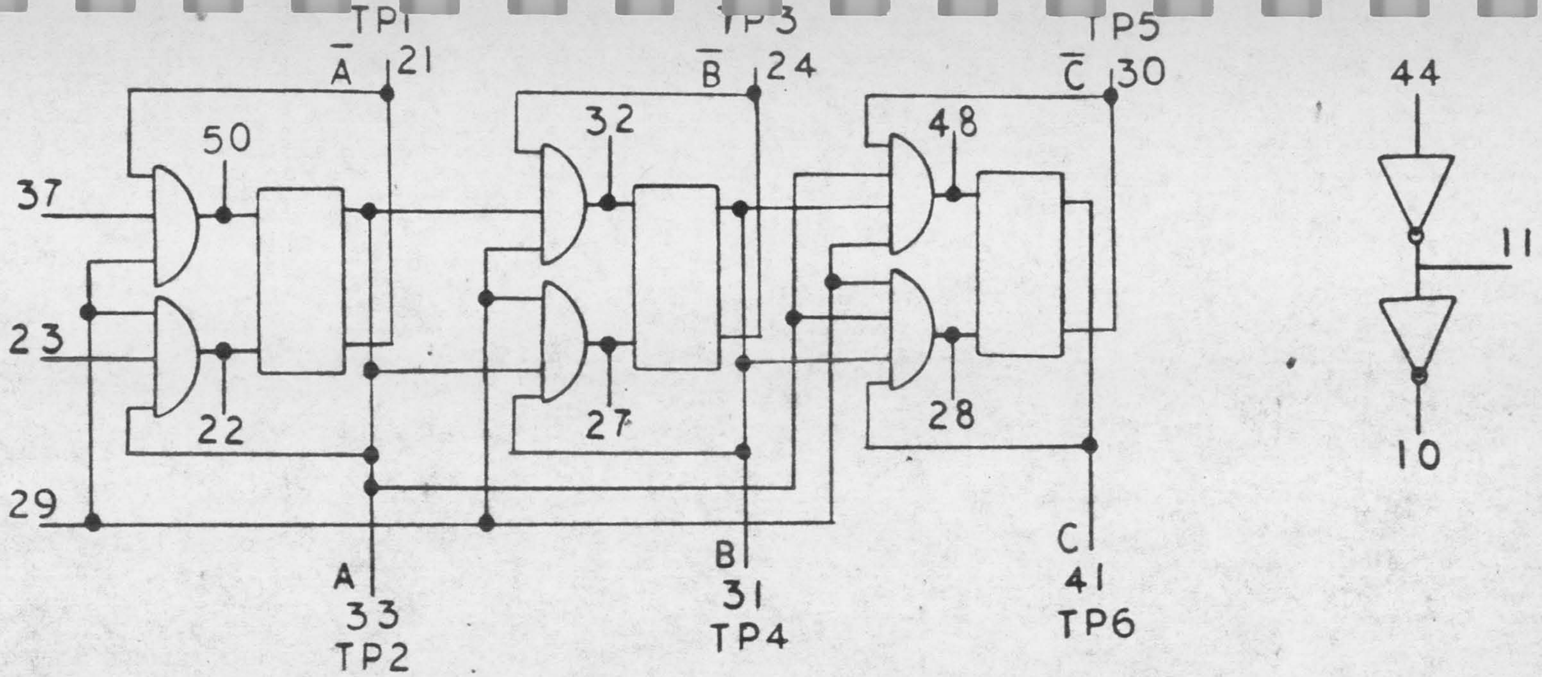
600160 Specification (continued)

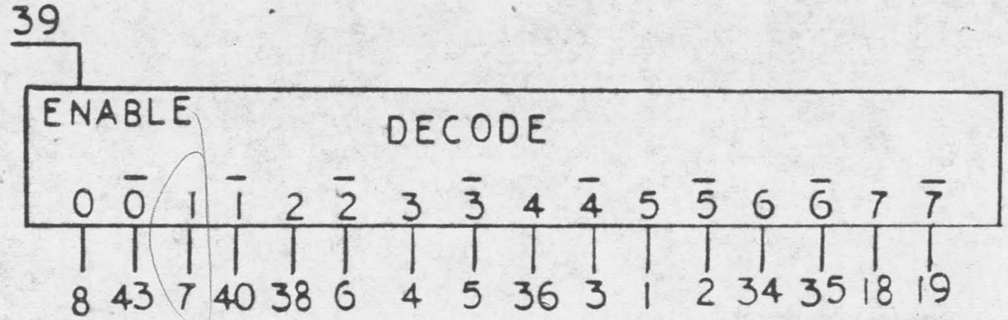
Rise time	
No load:	30 nanosecs
Full load:	40 nanosecs
Fall time	
No load:	40 nanosecs
Full load	60 nanosecs
Power required:	+12.5 15mA
	-12.5 200mA
Mechanical size:	5" x 5.4" x 0.5"
Connector type:	50 pin
Operating Temperature:	0-50°C



600160
OCTAL COUNTER AND DECODE

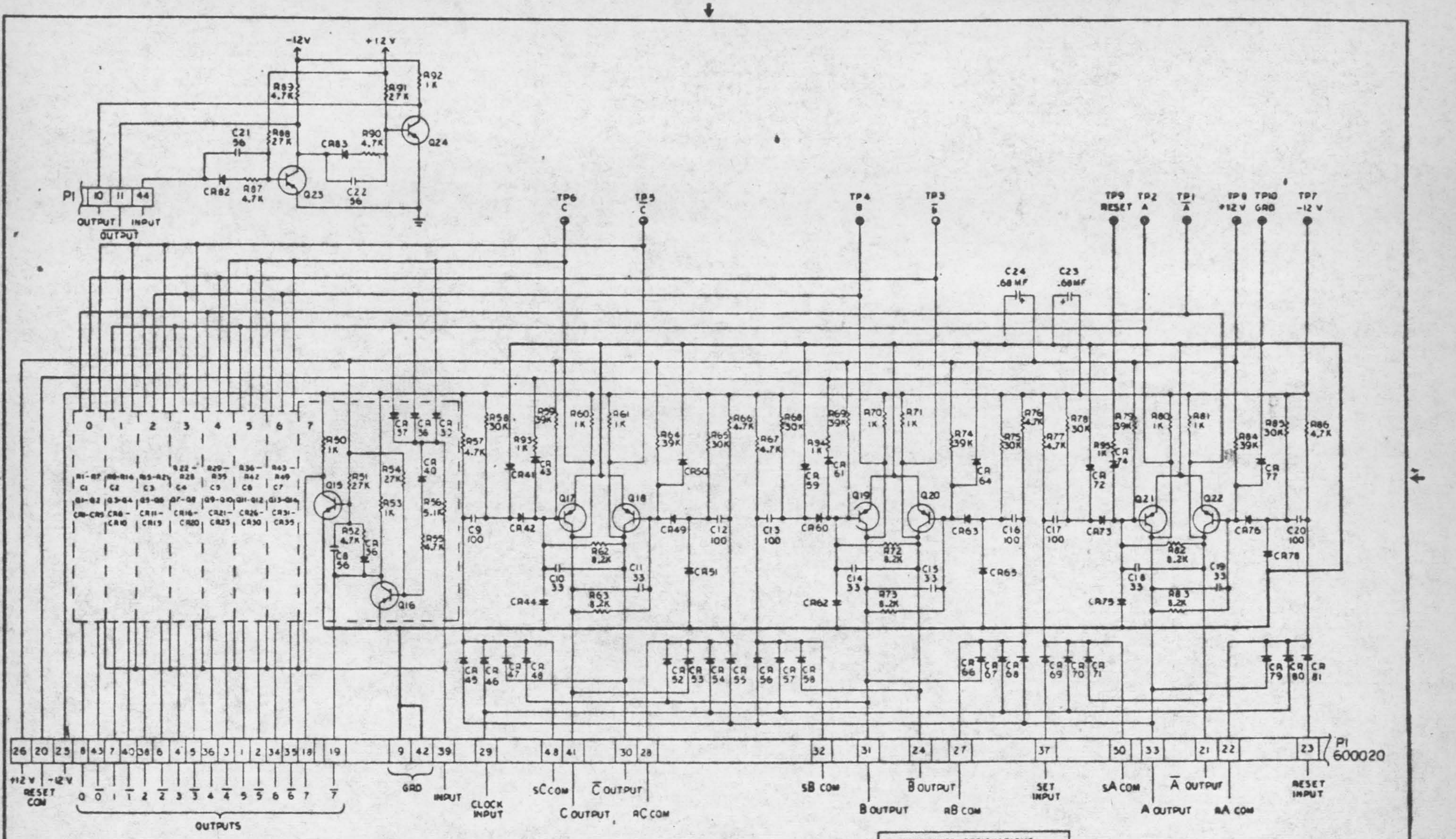
REFERENCE DWGS: SCHEMATIC NO. 600162, PARTS LIST NO. 600164





20	RESET COM	TP9
25	-12	TP7
26	+12	TP8
9,42	GRD	TP10

OCTAL COUNTER 600160



4. ALL TRANSISTORS ARE 2N2401.
3. ALL DIODES ARE REDCOR NO 100780-3.
2. ALL CAPACITOR VALUES ARE IN PICO FARADS.
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 WATT, ±5%.

REFERENCE DESIGNATIONS		
FIRST	LAST	DELETED
R1	R95	
C1	C24	
CR1	CR83	
Q1	Q24	
P1	P1	
TP1	TP10	

PARTS LIST

OCTAL COUNTER AND DECODE
PRINTED WIRING ASSEMBLY

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Mica, 56 PF, 10%	Micamold	MCM10D560K	
C2	Same as C1			
C3	Same as C1			
C4	Same as C1			
C5	Same as C1			
C6	Same as C1			
C7	Same as C1			
C8	Same as C1			
C9	Capacitor, Mica, 100PF, 10%	Micamold	MCM10D101K	
C10	Capacitor, Mica, 33 PF, 10%	Micamold	MCM10D330K	
C11	Same as C10			
C12	Same as C9			
C13	Same as C9			
C14	Same as C10			
C15	Same as C10			
C16	Same as C9			
C17	Same as C9			
C18	Same as C10			
C19	Same as C10			
C20	Same as C9			
C21	Same as C1			
C22	Same as C1			
C23	Capacitor, Tantalum, .68MF, 35V	Texas Inst.	SCM684F2P035K4	
C24	Same as C23			
CR1	Diode, Silicon,	Redcor	100780	
CR2	Same as CR1			

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Same as CR1			
CR9	Same as CR1			
CR10	Same as CR1			
CR11	Same as CR1			
CR12	Same as CR1			
CR13	Same as CR1			
CR14	Same as CR1			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR1			
CR19	Same as CR1			
CR20	Same as CR1			
CR21	Same as CR1			
CR22	Same as CR1			
CR23	Same as CR1			
CR24	Same as CR1			
CR25	Same as CR1			
CR26	Same as CR1			
CR27	Same as CR1			
CR28	Same as CR1			
CR29	Same as CR1			
CR30	Same as CR1			
CR31	Same as CR1			

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR32	Same as CR1			
CR33	Same as CR1			
CR34	Same as CR1			
CR35	Same as CR1			
CR36	Same as CR1			
CR37	Same as CR1			
CR38	Same as CR1			
CR39	Same as CR1			
CR40	Same as CR1			
CR41	Same as CR1			
CR42	Same as CR1			
CR43	Same as CR1			
CR44	Same as CR1			
CR45	Same as CR1			
CR46	Same as CR1			
CR47	Same as CR1			
CR48	Same as CR1			
CR49	Same as CR1			
CR50	Same as CR1			
CR51	Same as CR1			
CR52	Same as CR1			
CR53	Same as CR1			
CR54	Same as CR1			
CR55	Same as CR1			
CR56	Same as CR1			
CR57	Same as CR1			
CR58	Same as CR1			
CR59	Same as CR1			
CR60	Same as CR1			

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR61	Same as CR1			
CR62	Same as CR1			
CR63	Same as CR1			
CR64	Same as CR1			
CR65	Same as CR1			
CR66	Same as CR1			
CR67	Same as CR1			
CR68	Same as CR1			
CR69	Same as CR1			
CR70	Same as CR1			
CR71	Same as CR1			
CR72	Same as CR1			
CR73	Same as CR1			
CR74	Same as CR1			
CR75	Same as CR1			
CR76	Same as CR1			
CR77	Same as CR1			
CR78	Same as CR1			
CR79	Same as CR1			
CR80	Same as CR1			
CR81	Same as CR1			
CR82	Same as CR1			
CR83	Same as CR1			
Q1	Transistor, PNP	Redcor	101120	
Q2	Same as Q1			
Q3	Same as Q1			
Q4	Same as Q1			
Q5	Same as Q1			
Q6	Same as Q1			

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
Q7	Same as Q1			
Q8	Same as Q1			
Q9	Same as Q1			
Q10	Same as Q1			
Q11	Same as Q1			
Q12	Same as Q1			
Q13	Same as Q1			
Q14	Same as Q1			
Q15	Same as Q1			
Q16	Same as Q1			
Q17	Same as Q1			
Q18	Same as Q1			
Q19	Same as Q1			
Q20	Same as Q1			
Q21	Same as Q1			
Q22	Same as Q1			
Q23	Same as Q1			
Q24	Same as Q1			
R1	Resistor, Comp., 1K, 1/4W, 5%	Allen-Bradley	RC07GF102J	
R2	Resistor, Comp., 27K, 1/4W, 5%	Allen-Bradley	RC07GF273J	
R3	Resistor, Comp., 4.7K, 1/4W, 5%	Allen-Bradley	RC07GF472J	
R4	Same as R1			
R5	Same as R2			
R6	Same as R3			
R7	Resistor, Comp., 5.1K, 1/4, 5%	Allen-Bradley	RC07GF512J	
R8	Same as R1			

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R9	Same as R2			
R10	Same as R3			
R11	Same as R1			
R12	Same as R2			
R13	Same as R3			
R14	Same as R7			
R15	Same as R1			
R16	Same as R2			
R17	Same as R3			
R18	Same as R1			
R19	Same as R2			
R20	Same as R3			
R21	Same as R7			
R22	Same as R1			
R23	Same as R2			
R24	Same as R3			
R25	Same as R1			
R26	Same as R2			
R27	Same as R3			
R28	Same as R7			
R29	Same as R1			
R30	Same as R2			
R31	Same as R3			
R32	Same as R1			
R33	Same as R2			
R34	Same as R3			
R35	Same as R7			
R36	Same as R1			
R37	Same as R2			

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R38	Same as R3			
R39	Same as R1			
R40	Same as R2			
R41	Same as R3			
R42	Same as R7			
R43	Same as R1			
R44	Same as R2			
R45	Same as R3			
R46	Same as R1			
R47	Same as R2			
R48	Same as R3			
R49	Same as R7			
R50	Same as R1			
R51	Same as R2			
R52	Same as R3			
R53	Same as R1			
R54	Same as R2			
R55	Same as R3			
R56	Same as R7			
R57	Same as R3			
R58	Resistor, Comp., 30K, 1/4W, 5%	Allen-Bradley	RC07GF303J	
R59	Resistor, Comp., 39K 1/4W, 5%	Allen-Bradley	RC07GF393J	
R60	Same as R1			
R61	Same as R1			
R62	Resistor, Comp., 8.2K, 1/4W, 5%	Allen-Bradley	RC07GF882J	
R63	Same as R62			
R64	Same as R59			

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R65	Same as R58			
R66	Same as R3			
R67	Same as R3			
R68	Same asR58			
R69	Same as R59			
R70	Same as R1			
R71	Same as R1			
R72	Same as R62			
R73	Same asR62			
R74	Same as R59			
R75	Same as R58			
R76	Same as R3			
R77	Same as R3			
R78	Same as R58			
R79	Same as R59			
R80	Same as R1			
R81	Same as R1			
R82	Same asR62			
R83	Same as R62			
R84	Same as R59			
R85	Same as R58			
R86	Same as R3			
R87	Same as R3			
R88	Same as R2			
R89	Same as R3			
R90	Same as R3			
R91	Same as R2			
R92	Same as R1			
R93	Same as R1			

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R94	Same as Rl			
R95	Same as Rl			
TPl	Test Probe Receptacle-Blu	Ucinite	119437-G	
TP2	Test Probe Receptacle-Blk	Ucinite	119437-C	
TP3	Same as TPl			
TP4	Test Probe Receptacle-Brn	Ucinite	119437-D	
TP5	Same as TPl			
TP6	Same as TP2			
TP7	Test Probe Receptacle-Orn	Ucinite	119437-E	
TP8	Same as TP7			
TP9	Same as TP7			
TP10	Same as TP7			

INSTRUCTION MANUAL FOR COMPARATOR AMPLIFIER MODEL 600205

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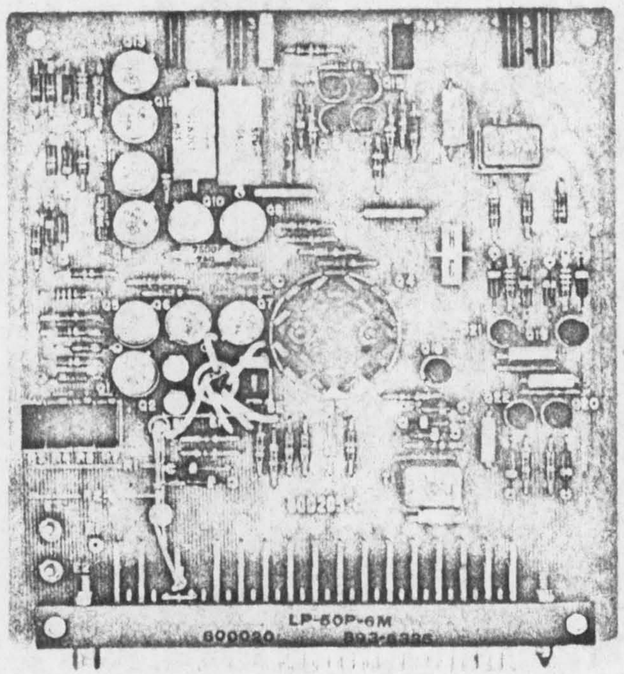

Figure 1. Model 600205 Comparator Amplifier

1. DESCRIPTION AND PURPOSE

2. Description - The Model 600205 Comparator Amplifier Trigger (see figure 1) is a printed circuit board module consisting of a resistance adder network, an amplifier, strobed amplifier, and a flip-flop. The circuit board is a standard 50-pin module card with components mounted on one side. The board assembly measures 5 x 5.4 inches and requires one standard card space. Test points are provided on the top edge of the card for waveform observation and trouble shooting during operation.

3. Purpose - The usual application of the comparator module is in analog-to-digital converters where very high speed accurate comparisons, with respect to ground, are necessary. The comparator compares the analog input against a switch matrix output. The algebraic sum of the two voltages are amplified by the amplifier and fed to the strobed amplifier. When the strobed amplifier is strobed, it sets or resets, as appropriate, the flip-flop. Setting or resetting the flip-flop causes the selection or rejection of the voltage supplied by the switch matrix.

4. CIRCUIT DESCRIPTION (See figures 2, 3, and 4)

5. Resistance Adder Network - The resistance adder network receives three inputs. The analog input is received through 1 to R3, the switch matrix output is applied to pin 20, and a +10-volt reference is applied to pin 18. The analog input is the input applied to the basic equipment. The switch matrix provides a precise voltage dependent upon its selected resistance value. The +10-volt reference is used whenever an offsetting voltage is required to provide bipolar operation. Refer to figure 2 for a simplified schematic of the resistance adder network. The amplifier input is obtained at the junction of the three resistances (R1 + R3 + R4), (R2 + R5), and (RX). Assume a balanced condition such that (R1 + R3 + R4) equals (R2 + R5) equals (RX)/2. If E_{ref} equals -10 volts, E1 is at the ground position and the amplifier input is at null,

INSTRUCTION MANUAL FOR
CLOCK OSCILLATOR MODEL 600140

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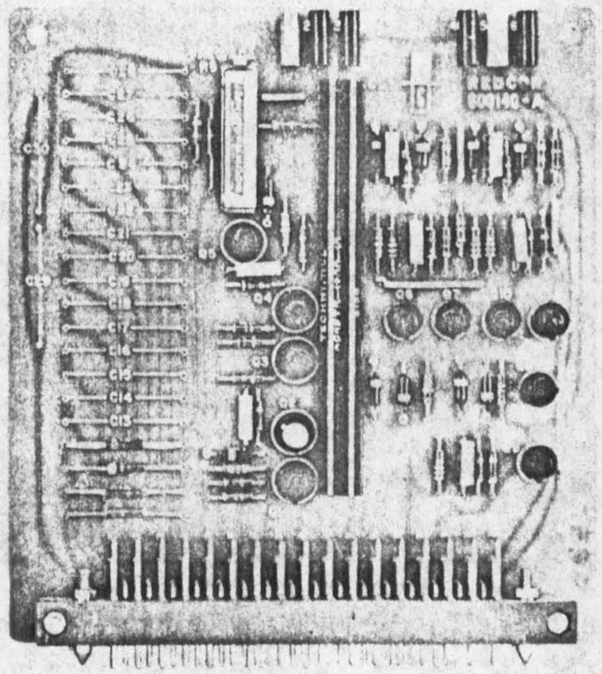

Figure 1. Clock Oscillator Model 600140

1. **DESCRIPTION AND PURPOSE**

2. Description - The Model 600140 Clock Oscillator (see Figure 1) is a printed circuit board module consisting of an oscillator and clock generator. The circuit board is a standard 50-pin module card with components mounted on one side only. The board assembly measures 5 x 5.4 inches and requires a standard one card space. Test points are provided on the top edge of the card for wave form observation and trouble shooting during operation.

3. Purpose - The Clock Oscillator is used to provide two phase output pulses required to operate DC flip-flops and A-D converters. Provisions are incorporated in the clock oscillator to allow the use of an external oscillator to operate the clock generator.

4. **CIRCUIT DESCRIPTION** (See Figures 2 and 3).

5. Oscillator - The oscillator circuit consisting of transistors Q1 and Q2 is a complementary PNP, NPN Hook oscillator. The operating frequency of the oscillator is determined by R4, R5, C9 thru C30 and the negative voltage applied to pin 39 of the connector. Coarse frequency control of the oscillator is accomplished by C9 thru C30 in 11 steps. External selection of C9 thru C30 can be accomplished by means of external switch connections between the respective connector pin of the capacitor and power ground (pin 9). Vernier frequency control of the oscillator is accomplished by potential of the negative voltage applied to pin 39 of the connector and adjustment of R5. In lieu of an external voltage control a fixed vernier adjustment may be accomplished through the use of an external capacitor connected to pin 4 of the connector. When no external voltage control is required pin 39 should be returned to -12.5 volts.

The output from the oscillator is a negative going square wave with the upper cycle referenced at +10v dc or +12.5v dc depending upon which voltage is applied to pin 5 of the connector. The output waveform may be observed at TP3.

Transistors Q3, Q4, and Q5 provide further amplification and squaring up of the oscillator output. The amplified output is square wave with the upper portion of the wave form referenced at 0v dc and the lower portion referenced at -12.5v dc. Two isolated oscillator outputs are provided, one applied to pin 45 and the other applied to pin 11 of the connector. The amplified oscillator outputs can be observed at TP1 and TP2.

6. Clock Generator - The clock generator receives the oscillator outputs (pin 45 to 46 and pin 11 to 12) and provides two separate outputs of different pulse widths. Should an external timing source be used, the input must be a low impedance square wave -12.5 volts amplitude with upper portion of the wave form referenced to 0v dc. The clock generator input applied to pin 46 of the connector is delayed 100 nanoseconds. Resistor R12 is a matching resistor to prevent delay line ringing. Transistor circuits Q6 and Q7 condition and restore the delayed square wave.

The delayed square wave clock generator input is applied to an "or" gate CR5 and CR6 along with the undelayed clock generator input applied to pin 12 of the connector. The resulting waveform is rectangular waveform with the negative going portion of the waveform being 200 nanoseconds longer in duration than the positive going portion. This rectangular waveform is amplified by transistors Q8 and Q9. Transistor Q9 also inverts the rectangular waveform so the positive going portion is 200 nanoseconds longer than the negative portion. This rectangular wave form has the positive portion at 0v dc and the negative portion at -12.5v dc, and is the C_2 output applied to pin 50 of the connector.

The undelayed clock generator input at pin 12 of the connector is applied to "and" gate CR9 and CR8 along with the delayed clock generator input coming from Q7. The resulting waveform is a square wave of the same pulse width and phase as the undelayed clock generator input at pin 12 of the connector. The waveform is amplified by transistor Q10 and Q11 and applied to pin 33 of the connector. This output is the C1 output and is a negative going squarewave with the upper portion referenced at 0v dc and the lower portion of the waveform referenced at -12.5v dc.

7. Maintenance - Standard circuit board maintenance practices apply. Replacement parts shall be those specified in the parts list.

CAUTION

When soldering and replacing electronic components on the circuit board, the circuit board and replacement components should not be overheated. Use an appropriate heatsink.

Troubleshooting is easily accomplished using test points TP1 thru TP6 and observing waveform.

8. Replacement Parts - Replacement parts for the clock oscillator are listed in the following parts list. For location and identification of parts see Figure 4.

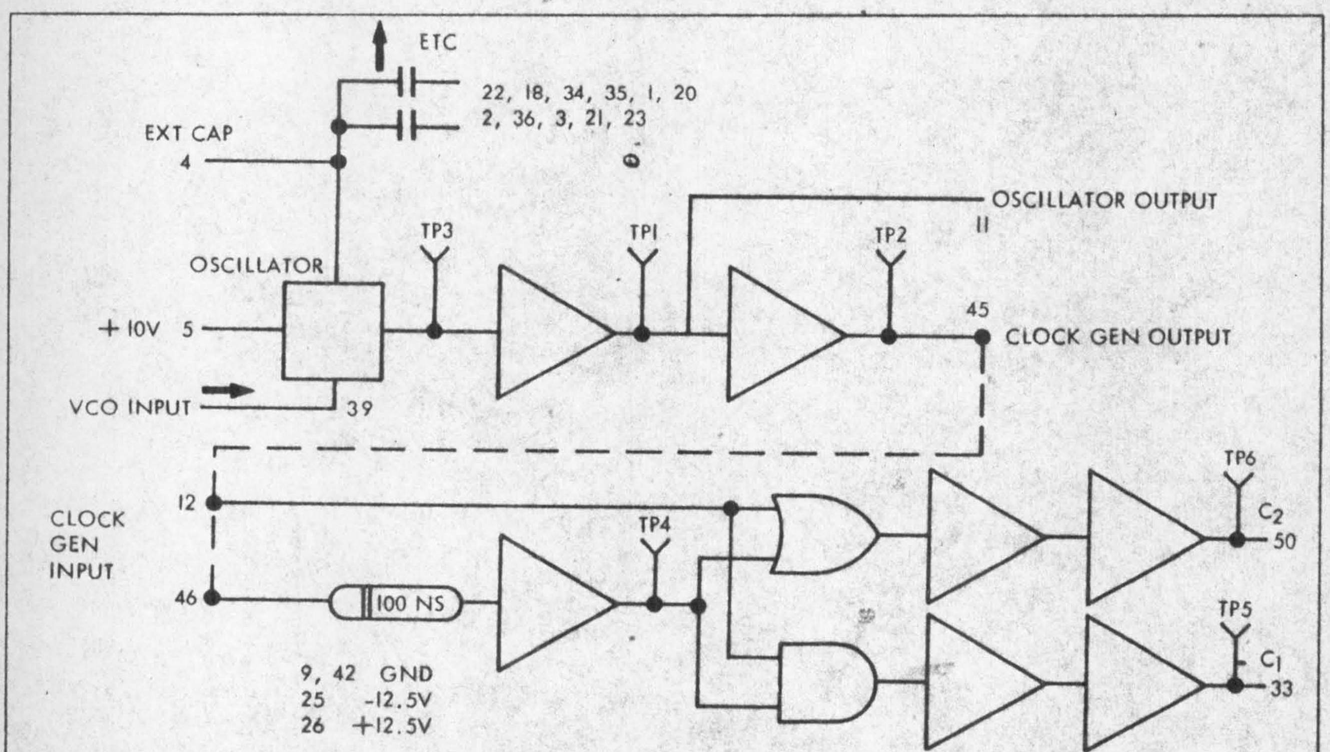

Figure 2. Clock Oscillator Model 600140, Logic Diagram

9. SPECIFICATIONS

Output Frequency:

Minimum	10 cps
Maximum	1 mc

Frequency Adjust:

Switchable	11 steps
Vernier Control	±5% external capacitor by potentiometer located at top of the card
Voltage Control	±20% external negative voltage in range of 0 to -10 volts

C1 Output Pulse Width:

Minimum	100 nsec
Maximum	Adjustable

C2 Output Pulse Width:

Minimum	300 nsec
Maximum	Adjustable

Output Loading:

C1 Output	750 ohms to ground 10 ma from -12 volts
C2 Output	750 ohms to ground 10 ma from -12 volts

C1 and C2 Output Capacity	200 pf to ground

C1 and C2 Rise Time:

No load	40 nsec
Full load	60 nsec

Fall Time:

No load	80 nsec
Full load	100 nsec

External Clock Input	Minimum rise and fall time 100 nsec between 0 and -12 volts
Loading	Internal loading to ground 1. 2K ohm
Power Requirements	-12. 5 volts 75 ma
	+12. 5 volts 15 ma
Mechanical Size	5" x 5. 4" x 0. 5"
Connector Type	50 pin
Board Type	.090 in. thick glass epoxy
Operating Temperature	0° to +50°C
Number of Test Points	6
Test Points	1, 2, 3 oscillator outputs
	4 delayed oscillator output
	5 C1 clock output
	6 C2 clock output

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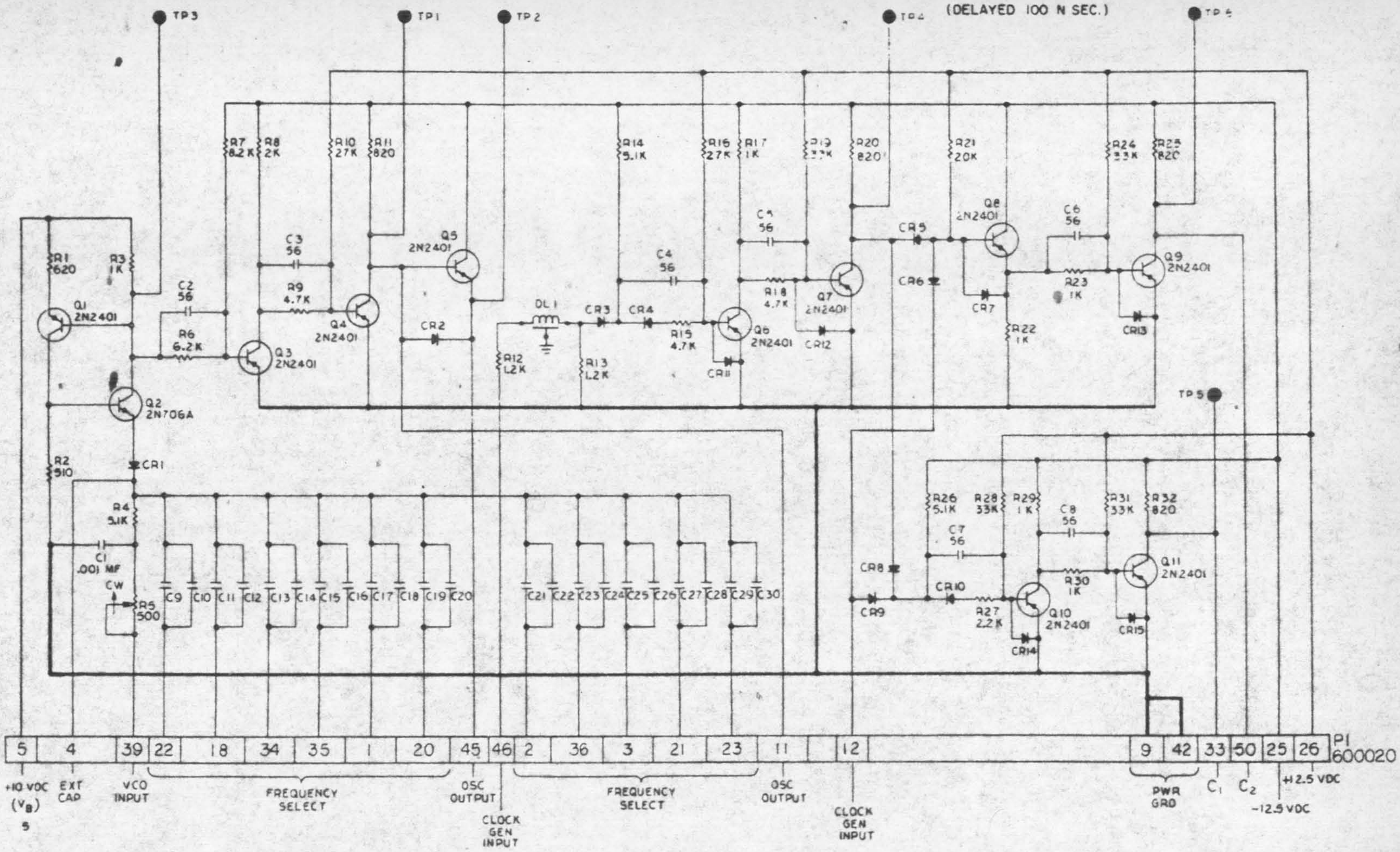

5 PIN 5 CAN BE +12.5 VDC IF NO V_B IS AVAILABLE.
4. ALL CAPACITOR VALUES FOR C9 THRU C30 ARE SELECTED FOR FREQUENCY.
3. ALL DIODES ARE REDCOR NO. 100780.
2. ALL CAPACITANCE VALUES ARE IN PICO FARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT, ±5%.
NOTE: UNLESS OTHERWISE SPECIFIED

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Figure 3. Clock Oscillator Model 600140, Schematic Diagram

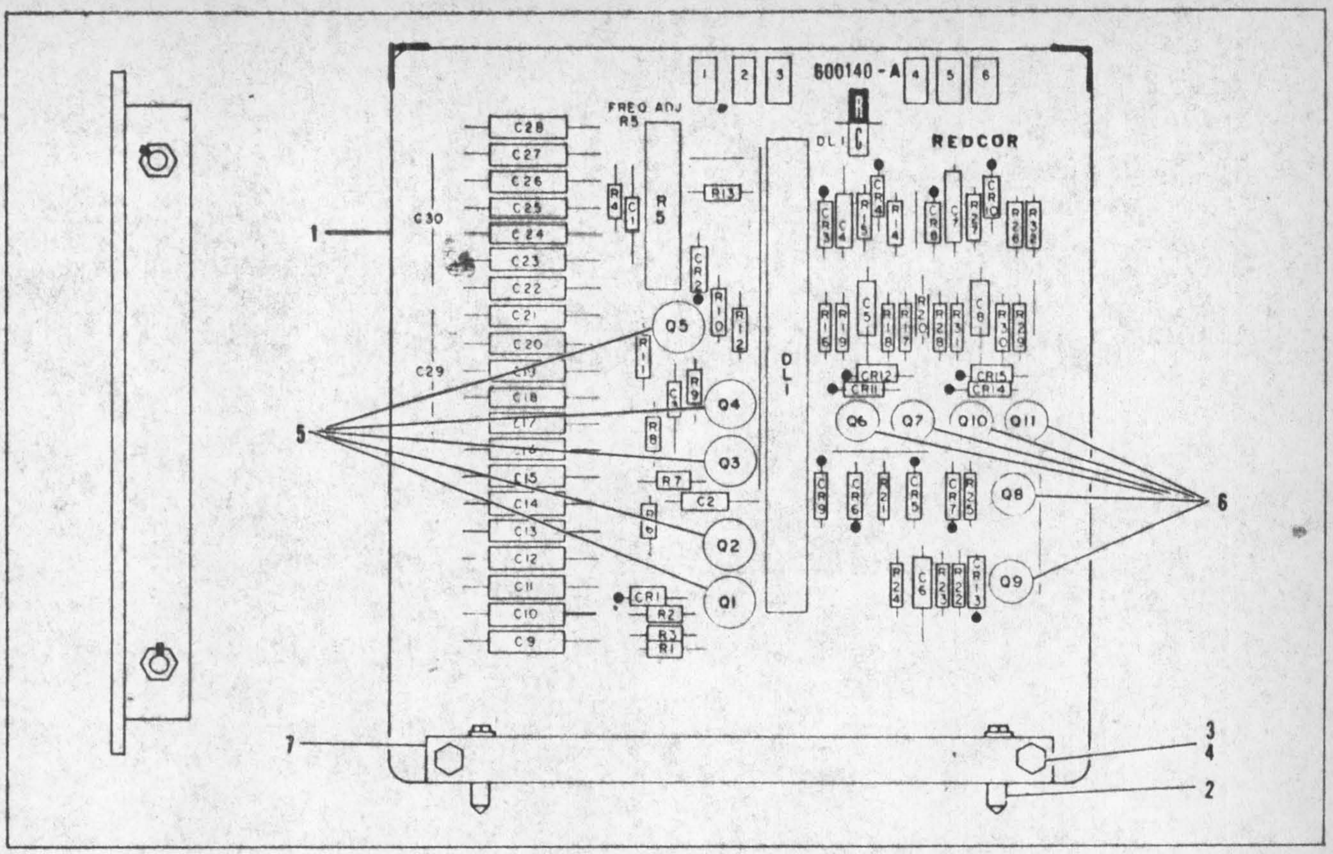

Figure 4. Clock Oscillator Model 600140, Parts Identification

PARTS LIST

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
1	Connector, 50 Pin, Male	Redcor	600020
2	Screw, Flt Hd, 100° Csk, #4-40 x 1/2 Cad. Stl.		
3	Nut, Hex, Cad. Stl., #4-40		
4	Pin, Polarizing, Male	Redcor	600021
5	Transipad	Milton Ross	A-10117
6	Transipad, TO-18	Milton Ross	10044
C1	Capacitor, Cerafil, .001 mf, 100V	Aerovox	MC80V102A-M
C2	Capacitor, Mica, 56 pf		MCM10D560K
C3	Capacitor, Mica, 56 pf		MCM10D560K
C4	Capacitor, Mica, 56 pf		MCM10D560K
C5	Capacitor, Mica, 56 pf		MCM10D560K
C6	Capacitor, Mica, 56 pf		MCM10D560K
C7	Capacitor, Mica, 56 pf		MCM10D560K
C8	Capacitor, Mica, 56 pf		MCM10D560K
*C9	Capacitor		
*C10	Capacitor		
*C11	Capacitor		
*C12	Capacitor		
*C13	Capacitor		
*C14	Capacitor		
*C15	Capacitor		
*C16	Capacitor		
*C17	Capacitor		
*C18	Capacitor		

*Selected for Frequency

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
*C19	Capacitor		
*C20	Capacitor		
*C21	Capacitor		
*C22	Capacitor		
*C23	Capacitor		
*C24	Capacitor		
*C25	Capacitor		
*C26	Capacitor		
*C27	Capacitor		
*C28	Capacitor		
*C29	Capacitor		
*C30	Capacitor		
CR1	Diode, Silicon	Redcor	100780-3
CR2	Diode, Silicon	Redcor	100780-3
CR3	Diode, Silicon	Redcor	100780-3
CR4	Diode, Silicon	Redcor	100780-3
CR5	Diode, Silicon	Redcor	100780-3
CR6	Diode, Silicon	Redcor	100780-3
CR7	Diode, Silicon	Redcor	100780-3
CR8	Diode, Silicon	Redcor	100780-3
CR9	Diode, Silicon	Redcor	100780-3
CR10	Diode, Silicon	Redcor	100780-3
CR11	Diode, Silicon	Redcor	100780-3
CR12	Diode, Silicon	Redcor	100780-3
CR13	Diode, Silicon	Redcor	100780-3
CR14	Diode, Silicon	Redcor	100780-3
CR15	Diode, Silicon	Redcor	100780-3
DL1	Delay Line	Technitrol	C25FTS-1200-10
Q1	Transistor, PNP	Philco	2N2401
Q2	Transistor, NPN	Motorola	2N706A
Q3	Transistor, PNP	Philco	2N2401
Q4	Transistor, PNP	Philco	2N2401
Q5	Transistor, PNP	Philco	2N2401
Q6	Transistor, PNP	Philco	2N2401
Q7	Transistor, PNP	Philco	2N2401
Q8	Transistor, PNP	Philco	2N2401
Q9	Transistor, PNP	Philco	2N2401
Q10	Transistor, PNP	Philco	2N2401
Q11	Transistor, PNP	Philco	2N2401
R1	Resistor, Comp., 620 ohm, 1/4W, ±5%	A. B.	RC07GF621J
R2	Resistor, Comp., 510K, 1/4W, ±5%	A. B.	RC07GF511J
R3	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R4	Resistor, Comp., 5.1K, 1/4W, ±5%	A. B.	RC07GF512J
R5	Resistor, W.W., 500 ohm, Pot	Bourns	275-1-501
R6	Resistor, Comp., 6.2K, 1/4W, ±5%	A. B.	RC07GF622J
R7	Resistor, Comp., 8.2K, 1/4W, ±5%	A. B.	RC07GF822J
R8	Resistor, Comp., 2K, 1/4W, ±5%	A. B.	RC07GF202J
R9	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R10	Resistor, Comp., 27K, 1/4W, ±5%	A. B.	RC07GF273J
R11	Resistor, Comp., 820 ohm, 1/4W, ±5%	A. B.	RC07GF821J
R12	Resistor, Comp., 1.2K, 1/4W, ±5%	A. B.	RC07GF122J
R13	Resistor, Comp., 1.2K, 1/4W, ±5%	A. B.	RC07GF122J
R14	Resistor, Comp., 5.1K, 1/4W, ±5%	A. B.	RC07GF512J
R15	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R16	Resistor, Comp., 27K, 1/4W, ±5%	A. B.	RC07GF273J
R17	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R18	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R19	Resistor, Comp., 33K, 1/4W, ±5%	A. B.	RC07GF333J
R20	Resistor, Comp., 820 ohm, 1/4W, ±5%	A. B.	RC07GF821J
R21	Resistor, Comp., 20K, 1/4W, ±5%	A. B.	RC07GF203J
R22	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R23	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J

* Selected for Frequency.

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
R24	Resistor, Comp., 33K, 1/4W, ±5%	A. B.	RC07GF333J
R25	Resistor, Comp., 820 ohm, 1/4W, ±5%	A. B.	RC07GF821J
R26	Resistor, Comp., 5.1K, 1/4W, ±5%	A. B.	RC07GF512J
R27	Resistor, Comp., 2.2K, 1/4W, ±5%	A. B.	RC07GF222J
R28	Resistor, Comp., 33K, 1/4W, ±5%	A. B.	RC07GF333J
R29	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R30	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R31	Resistor, Comp., 33K, 1/4W, ±5%	A. B.	RC07GF333J
R32	Resistor, Comp., 820 ohm, 1/4W, ±5%	A. B.	RC07GF821J
TP1	Test Jack, Blue	Ucinite	119437-G
TP2	Test Jack, Black	Ucinite	119437-C
TP3	Test Jack, Black	Ucinite	119437-C
TP4	Test Jack, Brown	Ucinite	119437-D
TP5	Test Jack, Yellow	Ucinite	119437-H
TP6	Test Jack, Black	Ucinite	119437-C

INSTRUCTION MANUAL FOR CLOCK OSCILLATOR MODEL 600140

REDCOR 600140

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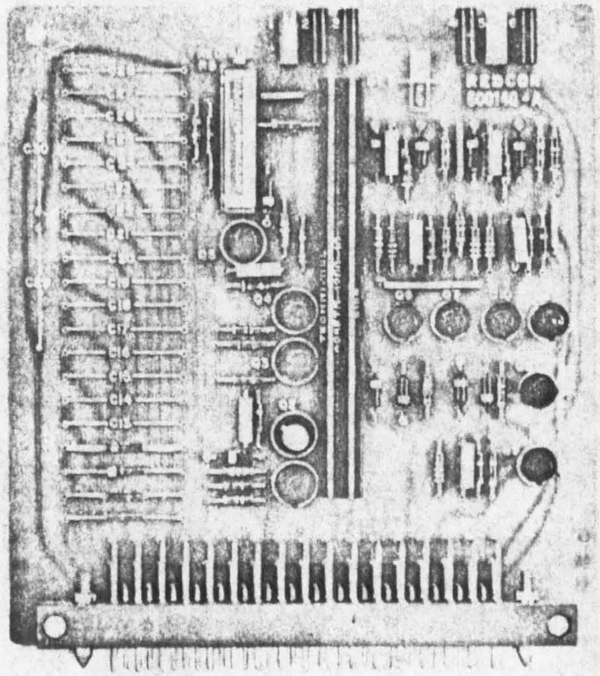

Figure 1. Clock Oscillator Model 600140

1. **DESCRIPTION AND PURPOSE**

2. Description - The Model 600140 Clock Oscillator (see Figure 1) is a printed circuit board module consisting of an oscillator and clock generator. The circuit board is a standard 50-pin module card with components mounted on one side only. The board assembly measures 5 x 5.4 inches and requires a standard one card space. Test points are provided on the top edge of the card for wave form observation and trouble shooting during operation.

3. Purpose - The Clock Oscillator is used to provide two phase output pulses required to operate DC flip-flops and A-D converters. Provisions are incorporated in the clock oscillator to allow the use of an external oscillator to operate the clock generator.

4. **CIRCUIT DESCRIPTION** (See Figures 2 and 3).

5. Oscillator - The oscillator circuit consisting of transistors Q1 and Q2 is a complementary PNP, NPN Hook oscillator. The operating frequency of the oscillator is determined by R4, R5, C9 thru C30 and the negative voltage applied to pin 39 of the connector. Coarse frequency control of the oscillator is accomplished by C9 thru C30 in 11 steps. External selection of C9 thru C30 can be accomplished by means of external switch connections between the respective connector pin of the capacitor and power ground (pin 9). Vernier frequency control of the oscillator is accomplished by potential of the negative voltage applied to pin 39 of the connector and adjustment of R5. In lieu of an external voltage control a fixed vernier adjustment may be accomplished through the use of an external capacitor connected to pin 4 of the connector. When no external voltage control is required pin 39 should be returned to -12.5 volts.

The output from the oscillator is a negative going square wave with the upper cycle referenced at +10v dc or +12.5v dc depending upon which voltage is applied to pin 5 of the connector. The output waveform may be observed at TP3.

Transistors Q3, Q4, and Q5 provide further amplification and squaring up of the oscillator output. The amplified output is square wave with the upper portion of the wave form referenced at 0v dc and the lower portion referenced at -12.5v dc. Two isolated oscillator outputs are provided, one applied to pin 45 and the other applied to pin 11 of the connector. The amplified oscillator outputs can be observed at TP1 and TP2.

6. Clock Generator - The clock generator receives the oscillator outputs (pin 45 to 46 and pin 11 to 12) and provides two separate outputs of different pulse widths. Should an external timing source be used, the input must be a low impedance square wave -12.5 volts amplitude with upper portion of the wave form referenced to 0v dc. The clock generator input applied to pin 46 of the connector is delayed 100 nanoseconds. Resistor R12 is a matching resistor to prevent delay line ringing. Transistor circuits Q6 and Q7 condition and restore the delayed square wave.

The delayed square wave clock generator input is applied to an "or" gate CR5 and CR6 along with the undelayed clock generator input applied to pin 12 of the connector. The resulting waveform is rectangular waveform with the negative going portion of the waveform being 200 nanoseconds longer in duration than the positive going portion. This rectangular waveform is amplified by transistors Q8 and Q9. Transistor Q9 also inverts the rectangular waveform so the positive going portion is 200 nanoseconds longer than the negative portion. This rectangular wave form has the positive portion at 0v dc and the negative portion at -12.5v dc, and is the C_2 output applied to pin 50 of the connector.

The undelayed clock generator input at pin 12 of the connector is applied to "and" gate CR9 and CR8 along with the delayed clock generator input coming from Q7. The resulting waveform is a square wave of the same pulse width and phase as the undelayed clock generator input at pin 12 of the connector. The waveform is amplified by transistor Q10 and Q11 and applied to pin 33 of the connector. This output is the C1 output and is a negative going squarewave with the upper portion referenced at 0v dc and the lower portion of the waveform referenced at -12.5v dc.

7. Maintenance - Standard circuit board maintenance practices apply. Replacement parts shall be those specified in the parts list.

CAUTION

When soldering and replacing electronic components on the circuit board, the circuit board and replacement components should not be overheated. Use an appropriate heatsink.

Troubleshooting is easily accomplished using test points TP1 thru TP6 and observing waveform.

8. Replacement Parts - Replacement parts for the clock oscillator are listed in the following parts list. For location and identification of parts see Figure 4.

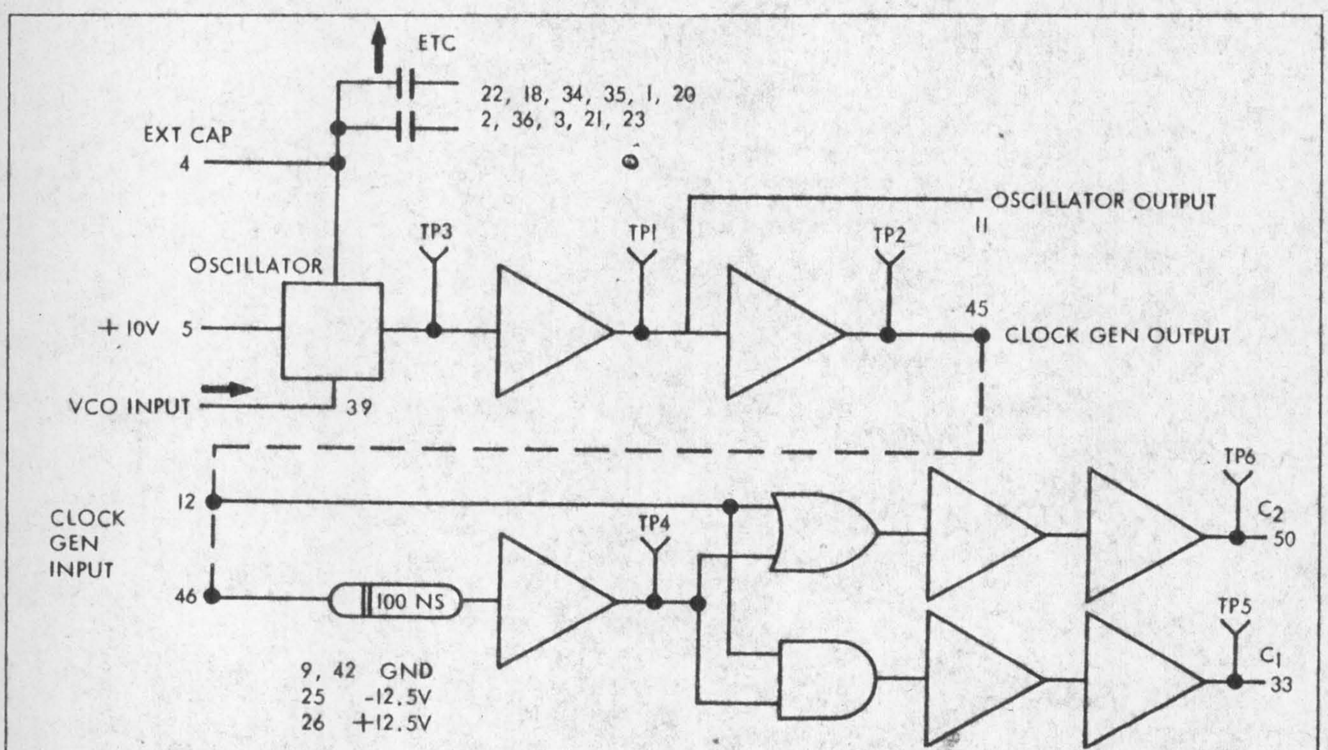

Figure 2. Clock Oscillator Model 600140, Logic Diagram

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600140

9. SPECIFICATIONS

Output Frequency:

Minimum	10 cps
Maximum	1 mc

Frequency Adjust:

Switchable	11 steps
Vernier Control	±5% external capacitor by potentiometer located at top of the card
Voltage Control	±20% external negative voltage in range of 0 to -10 volts

C1 Output Pulse Width:

Minimum	100 nsec
Maximum	Adjustable

C2 Output Pulse Width:

Minimum	300 nsec
Maximum	Adjustable

Output Loading:

C1 Output	750 ohms to ground 10 ma from -12 volts
C2 Output	750 ohms to ground 10 ma from -12 volts

C1 and C2 Output Capacity .... 200 pf to ground

C1 and C2 Rise Time:

No load	40 nsec
Full load	60 nsec

Fall Time:

No load	80 nsec
Full load	100 nsec

External Clock Input	Minimum rise and fall time 100 nsec between 0 and -12 volts
Loading	Internal loading to ground 1. 2K ohm
Power Requirements	-12. 5 volts 75 ma +12. 5 volts 15 ma
Mechanical Size	5" x 5. 4" x 0. 5"
Connector Type	50 pin
Board Type	.090 in. thick glass epoxy
Operating Temperature	0° to +50°C
Number of Test Points	6
Test Points	1, 2, 3 oscillator outputs 4 delayed oscillator output 5 C1 clock output 6 C2 clock output

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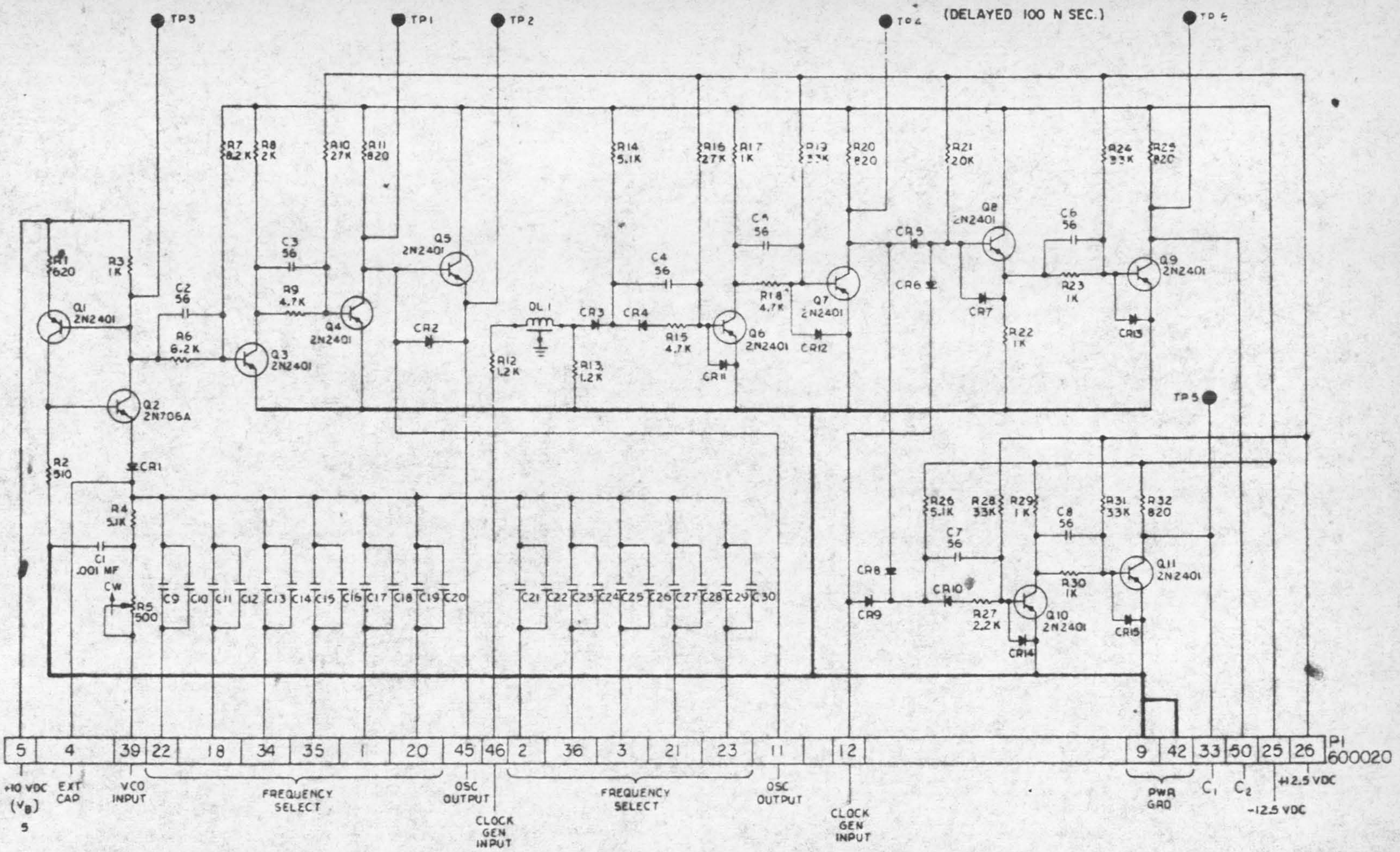

5. PIN 5 CAN BE +12.5 VDC IF NO V_B IS AVAILABLE.
4. ALL CAPACITOR VALUES FOR C9 THRU C30 ARE SELECTED FOR FREQUENCY.
3. ALL DIODES ARE REDCOR NO. 100780.
2. ALL CAPACITANCE VALUES ARE IN PICO FARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT, ±5%.
NOTE: UNLESS OTHERWISE SPECIFIED

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Figure 3. Clock Oscillator Model 600140, Schematic Diagram

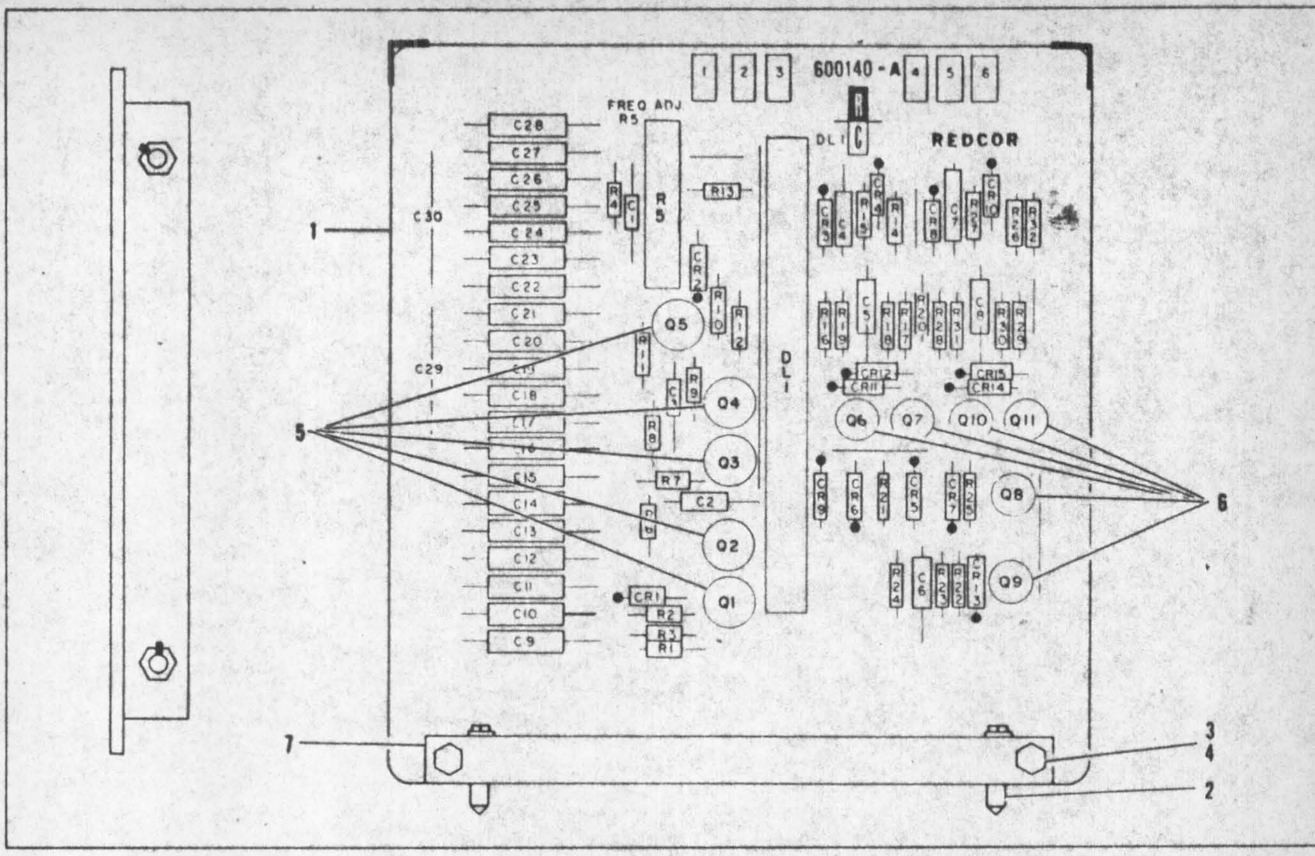

Figure 4. Clock Oscillator Model 600140, Parts Identification

PARTS LIST

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
1	Connector, 50 Pin, Male	Redcor	600020
2	Screw, Flt Hd, 100° Csk, #4-40 x 1/2 Cad. Stl.		
3	Nut, Hex, Cad. Stl., #4-40		
4	Pin, Polarizing, Male	Redcor	600021
5	Transipad	Milton Ross	A-10117
6	Transipad, TO-18	Milton Ross	10044
C1	Capacitor, Cerafil, .001 mf, 100V	Aerovox	MC80V102A-M
C2	Capacitor, Mica, 56 pf		MCM10D560K
C3	Capacitor, Mica, 56 pf		MCM10D560K
C4	Capacitor, Mica, 56 pf		MCM10D560K
C5	Capacitor, Mica, 56 pf		MCM10D560K
C6	Capacitor, Mica, 56 pf		MCM10D560K
C7	Capacitor, Mica, 56 pf		MCM10D560K
C8	Capacitor, Mica, 56 pf		MCM10D560K
*C9	Capacitor		
*C10	Capacitor		
*C11	Capacitor		
*C12	Capacitor		
*C13	Capacitor		
*C14	Capacitor		
*C15	Capacitor		
*C16	Capacitor		
*C17	Capacitor		
*C18	Capacitor		

*Selected for Frequency

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
*C19	Capacitor		
*C20	Capacitor		
*C21	Capacitor		
*C22	Capacitor		
*C23	Capacitor		
*C24	Capacitor		
*C25	Capacitor		
*C26	Capacitor		
*C27	Capacitor		
*C28	Capacitor		
*C29	Capacitor		
*C30	Capacitor		
CR1	Diode, Silicon	Redcor	100780-3
CR2	Diode, Silicon	Redcor	100780-3
CR3	Diode, Silicon	Redcor	100780-3
CR4	Diode, Silicon	Redcor	100780-3
CR5	Diode, Silicon	Redcor	100780-3
CR6	Diode, Silicon	Redcor	100780-3
CR7	Diode, Silicon	Redcor	100780-3
CR8	Diode, Silicon	Redcor	100780-3
CR9	Diode, Silicon	Redcor	100780-3
CR10	Diode, Silicon	Redcor	100780-3
CR11	Diode, Silicon	Redcor	100780-3
CR12	Diode, Silicon	Redcor	100780-3
CR13	Diode, Silicon	Redcor	100780-3
CR14	Diode, Silicon	Redcor	100780-3
CR15	Diode, Silicon	Redcor	100780-3
DL1	Delay Line	Technitrol	C25FTS-1200-10
Q1	Transistor, PNP	Philco	2N2401
Q2	Transistor, NPN	Motorola	2N706A
Q3	Transistor, PNP	Philco	2N2401
Q4	Transistor, PNP	Philco	2N2401
Q5	Transistor, PNP	Philco	2N2401
Q6	Transistor, PNP	Philco	2N2401
Q7	Transistor, PNP	Philco	2N2401
Q8	Transistor, PNP	Philco	2N2401
Q9	Transistor, PNP	Philco	2N2401
Q10	Transistor, PNP	Philco	2N2401
Q11	Transistor, PNP	Philco	2N2401
R1	Resistor, Comp., 620 ohm, 1/4W, ±5%	A. B.	RC07GF621J
R2	Resistor, Comp., 510K, 1/4W, ±5%	A. B.	RC07GF511J
R3	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R4	Resistor, Comp., 5.1K, 1/4W, ±5%	A. B.	RC07GF512J
R5	Resistor, W.W., 500 ohm, Pot	Bourns	275-1-501
R6	Resistor, Comp., 6.2K, 1/4W, ±5%	A. B.	RC07GF622J
R7	Resistor, Comp., 8.2K, 1/4W, ±5%	A. B.	RC07GF822J
R8	Resistor, Comp., 2K, 1/4W, ±5%	A. B.	RC07GF202J
R9	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R10	Resistor, Comp., 27K, 1/4W, ±5%	A. B.	RC07GF273J
R11	Resistor, Comp., 820 ohm, 1/4W, ±5%	A. B.	RC07GF821J
R12	Resistor, Comp., 1.2K, 1/4W, ±5%	A. B.	RC07GF122J
R13	Resistor, Comp., 1.2K, 1/4W, ±5%	A. B.	RC07GF122J
R14	Resistor, Comp., 5.1K, 1/4W, ±5%	A. B.	RC07GF512J
R15	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R16	Resistor, Comp., 27K, 1/4W, ±5%	A. B.	RC07GF273J
R17	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R18	Resistor, Comp., 4.7K, 1/4W, ±5%	A. B.	RC07GF472J
R19	Resistor, Comp., 33K, 1/4W, ±5%	A. B.	RC07GF333J
R20	Resistor, Comp., 820 ohm, 1/4W, ±5%	A. B.	RC07GF821J
R21	Resistor, Comp., 20K, 1/4W, ±5%	A. B.	RC07GF203J
R22	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R23	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J

*** Selected for Frequency.**

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
R24	Resistor, Comp., 33K, 1/4W, ±5%	A. B.	RC07GF333J
R25	Resistor, Comp., 820 ohm, 1/4W, ±5%	A. B.	RC07GF821J
R26	Resistor, Comp., 5.1K, 1/4W, ±5%	A. B.	RC07GF512J
R27	Resistor, Comp., 2.2K, 1/4W, ±5%	A. B.	RC07GF222J
R28	Resistor, Comp., 33K, 1/4W, ±5%	A. B.	RC07GF333J
R29	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R30	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R31	Resistor, Comp., 33K, 1/4W, ±5%	A. B.	RC07GF333J
R32	Resistor, Comp., 820 ohm, 1/4W, ±5%	A. B.	RC07GF821J
TP1	Test Jack, Blue	Ucinite	119437-G
TP2	Test Jack, Black	Ucinite	119437-C
TP3	Test Jack, Black	Ucinite	119437-C
TP4	Test Jack, Brown	Ucinite	119437-D
TP5	Test Jack, Yellow	Ucinite	119437-H
TP6	Test Jack, Black	Ucinite	119437-C

INSTRUCTION MANUAL FOR SWITCH MATRIX MODEL 600122

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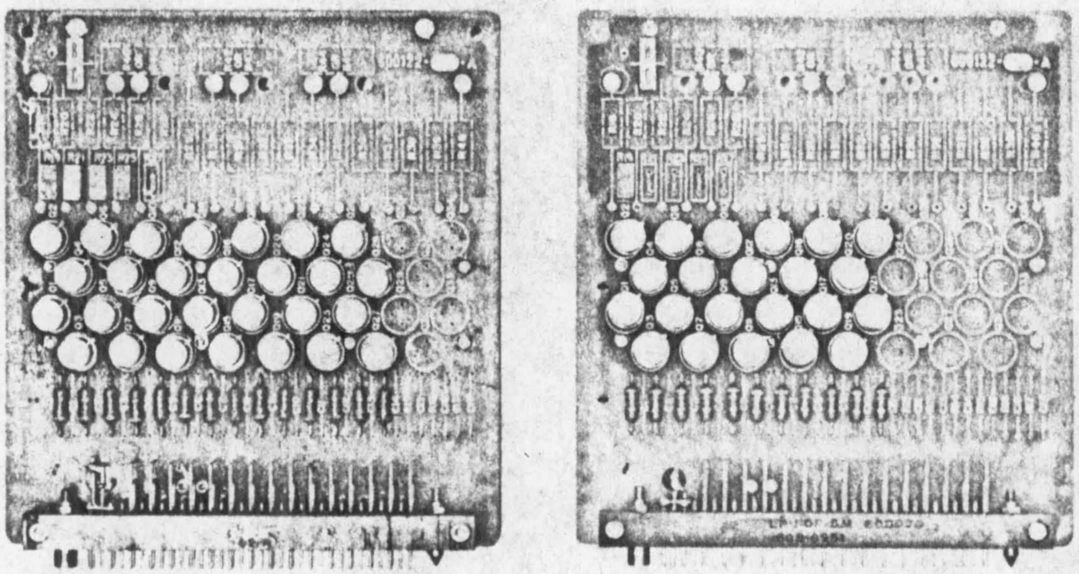

14-Bit Switch Matrix

11-Bit Switch Matrix

Figure 1. Switch Matrix Model 600122

1. DESCRIPTION AND PURPOSE

2. Description - The Model 600122 Switch Matrix (see Figure 1) is a group of printed circuit boards containing up to 17 pairs of precision transistor switches, and associated resistor networks. Each matrix module utilizes an identical basic circuit board. Selection of resistor values and bussing provides the flexibility necessary to assemble the different matrices. Either binary-coded-decimal or pure binary networks of up to 17 bits can be assembled. The circuit board is a standard 50-pin module card with components mounted on both sides. The board assembly measures 5 x 5.4 inches and requires two standard card spaces. A magnetic shield covers the resistor matrix for electrical and mechanical shielding.

3. Purpose - The Switch Matrix Module, with its transistor switches and resistors, makes up resistor ladder networks which are used in analog-to-digital or digital-to-analog converters. The switches are operated externally by providing proper voltage levels to the inputs.

4. CIRCUIT DESCRIPTION (See Figure 4)

5. Binary Coded Matrix - Figure 2A illustrates a simplified schematic of a typical 11-bit binary resistor matrix. The switches can select either the high side or low side of the reference source. The source impedance of the reference supply can, when compared with the nominal values of the resistor matrix, be ignored. This allows the source impedance of the resistor network to be constant regardless of switch positions. The source impedance of the matrix can be considered to be equivalent to figure 2B which resolves to figure 2C and thus to figure 2D. By successive reductions of this type, the circuit finally resolves to figure 2E. Thus, the source impedance of the matrix is 2.5K and switch 1 is equivalent to half scale. Switch 2 is weighted quarter scale and each successive switch weighted, in binary fashion, one-half the weight of the previous value. To continue in this fashion beyond switch 5, would however, require impractical values of resistors. To reduce the resistor values to a common group, a series parallel ladder is used. Thus, switches 6, 7, 8, and 9 contribute through a

75K resistor, voltage equivalent to switches 2, 3, 4, and 5 from a source of 5K. The voltages contributed to the output, therefore, are:

$$\frac{5K}{75K + 5K} \text{ or } \frac{1}{16}$$

Therefore, switches 6, 7, 8, and 9 have the binary relationship of 1/16 and contribute half the voltage of switches 2, 3, 4, and 5.

6. Decimal Coded Matrix - Figure 3A illustrates a simplified schematic of a typical 13-bit decimal-coded resistor matrix. The last section of the matrix is as illustrated in figure 3B and reduces to figure 3C. Therefore, the matrix reduces to figure 3D, which resolves to figure 3E. Thus, the source impedance of the matrix is 2K. Switches 1, 2, 3, 4, and 5 have a binary coded relationship of 1-2-2-4. Again, to continue in this fashion, beyond switch 5 would result in impractical resistor values. Switches 6, 7, 8, and 9 contribute through a 36K resistor voltage equivalent to switches 2, 3, 4, and 5 from a source of 4K. The voltages contributed to the output, therefore, are:

$$\frac{4K}{36K + 4K} \text{ or } \frac{1}{10}$$

Therefore, switches 6, 7, 8, and 9 have the decimal relationship of 1/10 of switches 2, 3, 4, and 5.

7. Terminations - In each of the examples described, the matrix was terminated to ensure that the ladder network ended in the proper characteristic impedance. In the 11-bit binary converter, the last two resistors are 10K and 20K. The terminating resistor must, therefore, be 20K to ensure a characteristic impedance of 5K. In the 13-bit decimal converter, the last four resistors are 10K, 20K, 20K and 40K. The characteristic impedance of 4K requires a terminating resistor of 40K.

8. 14-bit Binary Matrix and 17-bit Decimal Matrix - Simple extensions can be utilized to obtain expansion of the matrices described. In each case, the resistor matrix is expanded by extending the ladder matrix illustrated to the proper number of bits and terminating with the proper resistor value.

9. Circuit Description - The transistor switches are analogous to a double-throw, single pole switch. With -12.5 volts applied to a switch input the PNP transistor conducts and the NPN transistor is cut off. With this condition, the -10 V reference voltage is applied to the common emitters. With +3 V applied to a switch input the PNP transistor is cut off and the NPN transistor conducts. With this condition, the ground reference voltage is applied to the common emitters. The transistors are operated in an inverted configuration to obtain low voltage offset conditions and low saturation resistance.

10. MAINTENANCE

Standard circuit board maintenance practices apply. Replacement parts shall be those specified in the parts list. Non-linearity of the output usually results from defective transistors or resistors. Measurements, with an ohmmeter, should detect a faulty component. If a short circuit occurs in a reference input, a pair or more of the complementary switches should be suspected. Again, measurements with an ohmmeter should detect a faulty component. After initial set up at the factory, potentiometers R19, R21, R23, R25 and R27 should not require additional adjustment in the field. However, if resistor R18, R20, R22, R24 or R26 is replaced, its associated potentiometer may require adjustment.

11. SPECIFICATIONS

Number of Switches . . . . 17 max

Coding Available . . . . See table 1

Input Voltage Levels:

- Switch select . . . . -12.5 V
- Switch off . . . . +3 V

Input Loads:

- To -12.5 V . . . . 470 ohms
- To ground . . . . 470 ohms

Reference Source . . . . -10 V nominal

Reference Source Load . . . . 6 ma per bit

Output Level . . . . See table 1

Output Impedance . . . . See table 1

Output Settling Time . . . . . 2 usec to within 0.01%

Resistor Adjustments . . . . 1st 5 bits max

Resistor Loading:

- +3 V . . . . 6 ma per bit
- -12.5 V . . . . 6 ma per bit from -10 V

Operating Temperature . . . . 0° to 50°C

Board Type . . . . Glass epoxy

Mechanical Size . . . . 5" x 5.4" x 1"

Connector Type . . . . 50 pin

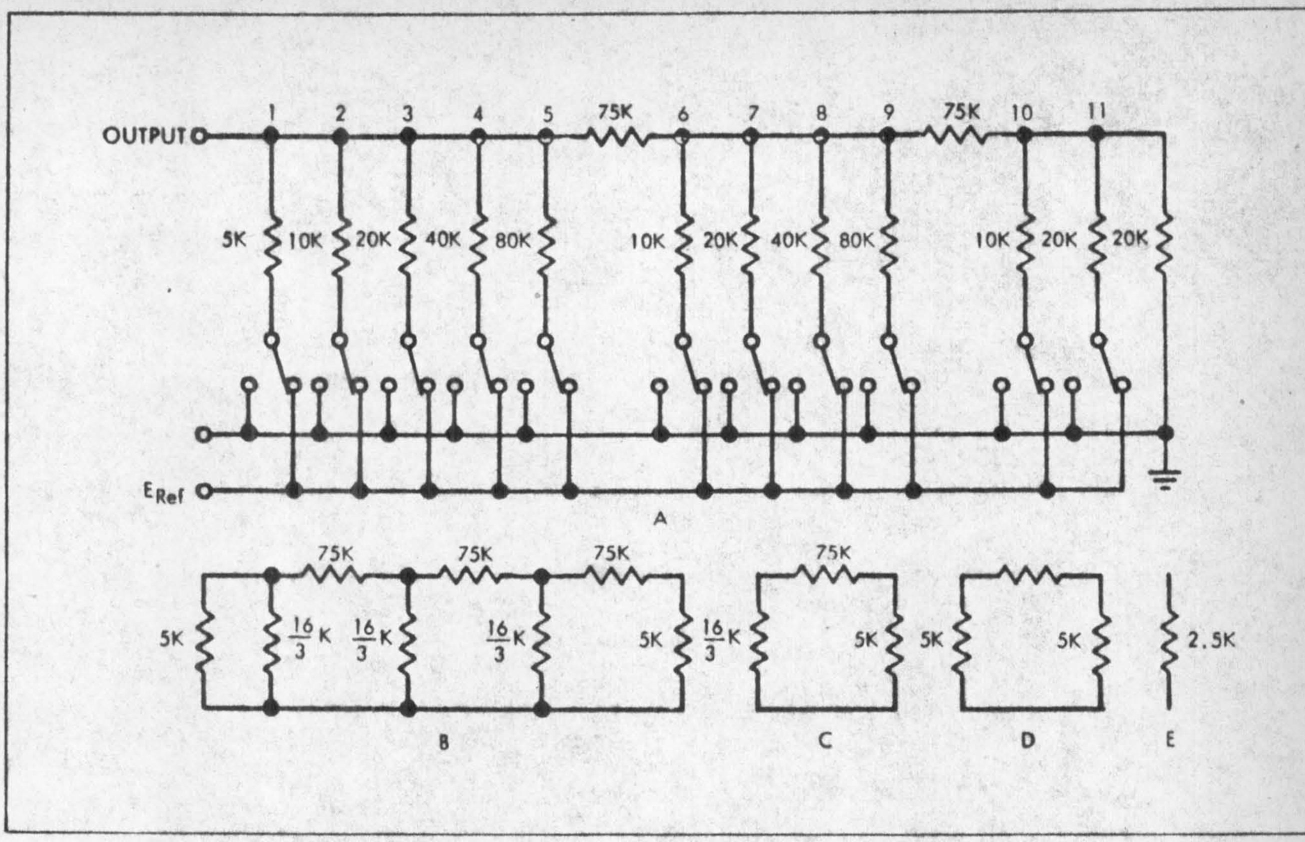

Figure 2. 11 Bit Binary Coded Matrix, Simplified Schematic

Table 1. Switch Output Coding

	Full Scale Output Voltage		Output Impedance		No Offsetting Resistor (R46, R47) Used	
Codes	Unipolar	Bipolar	Unipolar	Bipolar	Output Voltage	Output Impedance
17 BCD 422*1 (1)	-6 2/3 V	±3 1/3 V	1 1/3K	1 1/3K	-10 V	2K
13 BCD 422*1 (1)	-6 2/3 V	±3 1/3 V	1 1/3K	1 1/3K	-10 V	2K
9 BCD 422*1 (1)	-6 2/3 V	±3 1/3 V	1 1/3K	1 1/3K	-10 V	2K
17 BCD 8421 (1)	-5. 454 V	±2. 727 V	2. 1818K	2. 1818K	-6 V	3K
13 BCD 8421 (1)	-5. 454 V	±2. 727 V	2. 1818K	2. 1818K	-6 V	3K
9 BCD 8421 (1)	-5. 454 V	±2. 727 V	2. 1818K	2. 1818K	-6 V	3K
14 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2. 5K
13 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2. 5K
12 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2. 5K
11 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2. 5K
10 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2. 5K
9 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2. 5K
8 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2. 5K

(1) Used in A-D Operation.

2* Coding the same as 8.

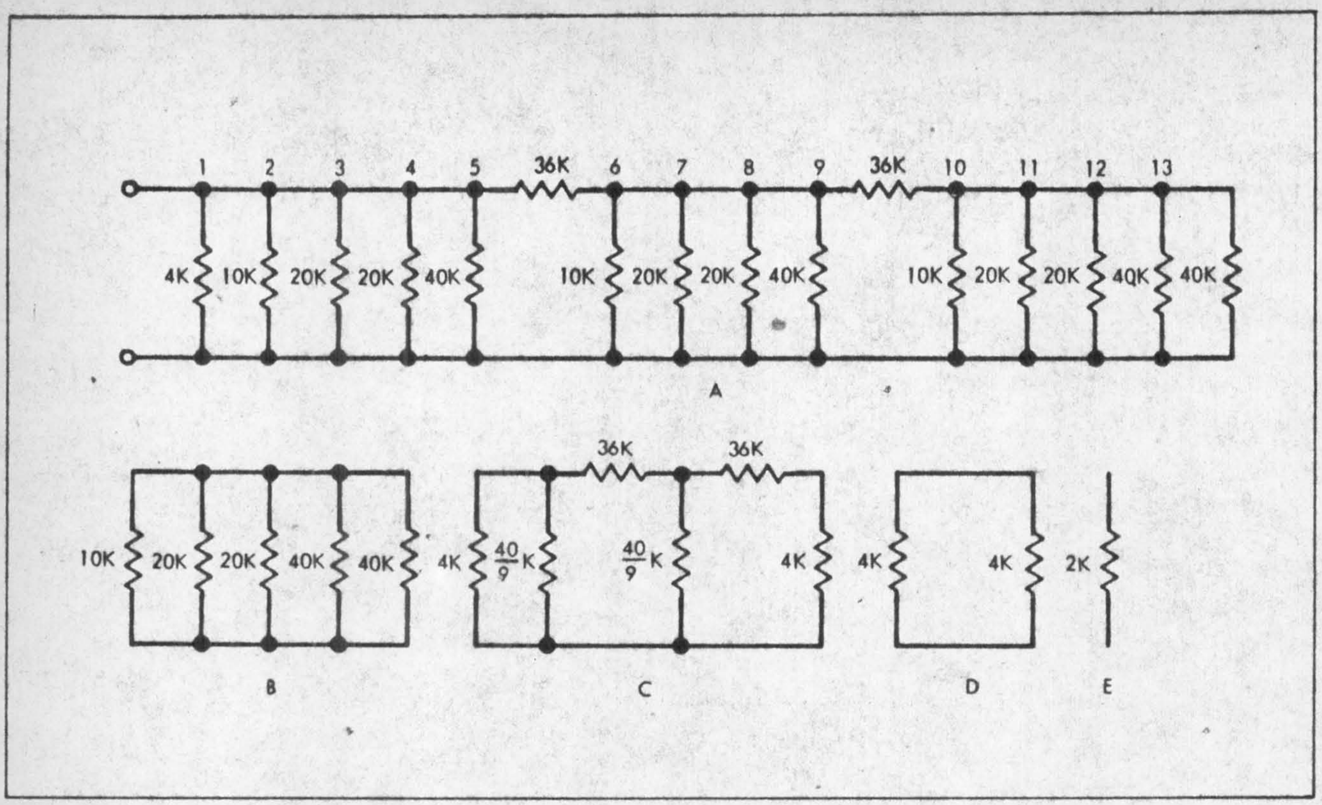

Figure 3. 13-Bit 1224 Decimal Coded Matrix, Simplified Schematic

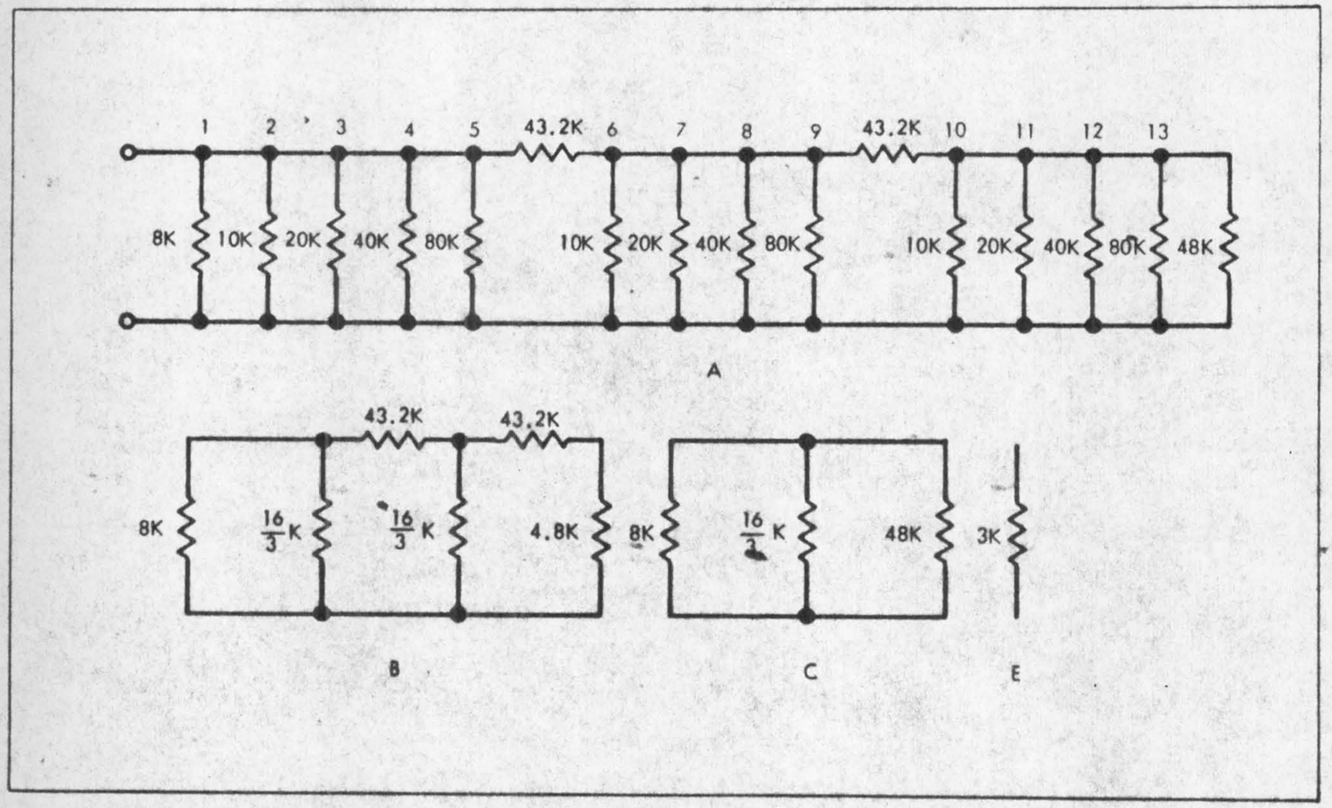

Figure 4. 13-Bit 1248 Decimal Coded Matrix, Simplified Schematic

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RESISTOR VALUES (5)

MODEL NO	DESC	R18	R20	R21	R22	R23	R24	R25	R26	R27	R28
600122-1	17 BIT BCD	3.99K	9.985K	20	19.97K	50	9.97K	50	39.95K	100	10K
-2	16 BIN	4.99K	9.985K	20	19.97K	50	39.95K	100	80K	0	10K
-3	13 BCD	3.99K	10K	0	20K	0	20K	0	[illegible]	0	10K
-4	11 BIN	4.99K	10K	0	20K	0	40K	0	80K	0	10K
-5	15 BIN	4.99K	9.985K	20	19.97K	50	40K	0	80K	0	10K
-6	9 BIN	4.99K	10K	0	20K	0	40K	0	80K	0	10K
-7	8 BIN	5K	10K	0	20K	0	40K	0	80K	0	160K
-8	10 BIN	5K	10K	0	20K	0	40K		80K	0	160K
-9											
-10											
-11	17 BCD	3.99K	9.985K	20	19.97K	50	9.97K	50	39.95K	100	10K
-12	16 BIN	4.99K	9.985K	20	19.97K	50	39.95K	100	80K	0	10K
-13	13 BCD	3.99K	10K	0	20K	0	20K		40K	0	10K
-14	11 BIN	4.99K	10K	0	20K	0	40K	0	80K	0	10K
-15	13 BIN	4.99K	9.985K	20	19.97K	50	40K	0	80K	0	10K
-16	9 BIN	4.99K	10K	0	20K	0	40K	0	80K	0	10K
-17	13 BCD	7.99K	10K	0	20K	0	40K	0	80K	0	10K
-18	17 BCD	7.99K	9.985K	20	19.97K	50	39.95K	100	79.95K	100	10K
-19											
600122-20	BIT										

MODEL NO	R29	R30	R31	R32	R33	R34	R35	R36	R37	R38	R39	R40	R41	R42	R43	R46	R47	NOT USED	APPLICATION
600122-1	20K	20K	40K	10K	20K	20K	80K	10K	20K	20K	40K	36K	36K	36K	40K				A-D
-2	20K	40K	80K	10K	20K	40K	80K	10K				75K	75K	75K	10K			SW 15,16,17	
-3	[illegible]	20K	40K	10K	20K	[illegible]	40K					36K	36K	0	40K			SW 14,15,16,17	
-4	20K	40K	80K	10K	20K							75K	75K	0	20K			SW 12 THRU 17	
-5	20K	40K	80K	10K	20K	40K	80K					75K	75K	0	80K			SW 14 THRU 17	
-6	20K	40K	80K									75K	0	0	80K			SW 10 THRU 17	
-7	320K	640K										0	0	0	640K			SW 9 THRU 17	
-8	320K	640K	[illegible]	[illegible]								0	0	0	[illegible]			SW 11 THRU 17	
-9																			
-10																			A-D
-11	20K	20K	40K	10K	20K	20K	80K	10K	20K	20K	40K	36K	36K	36K	40K	3.99K	20		D-A
-12	20K	40K	80K	10K	20K	40K	80K	10K				75K	75K	75K	10K	4.99K	20	SW 15,16,17	
-13	20K	20K	40K	10K	20K	[illegible]	40K					36K	36K	0	40K	3.99K	20	SW 14,15,16,17	
-14	20K	40K	80K	10K	20K							75K	75K	0	20K	4.99K	20	SW 12 THRU 17	
-15	20K	40K	80K	10K	20K	40K	80K					75K	75K	75K	80K	4.99K	20	SW 14 THRU 17	
-16	20K	40K	80K									75K	0	0	80K	4.99K	20	SW 10 THRU 17	
-17	20K	40K	80K	10K	20K	40K	80K					43.2K	43.2K	0	48K	7.99K	20	SW 14 THRU 17	
-18	20K	40K	80K	10K	20K	40K	80K	10K	20K	40K	80K	43.2K	43.2K	43.2K	48K	7.99K	20		
-19																			
600122-20																			D-A

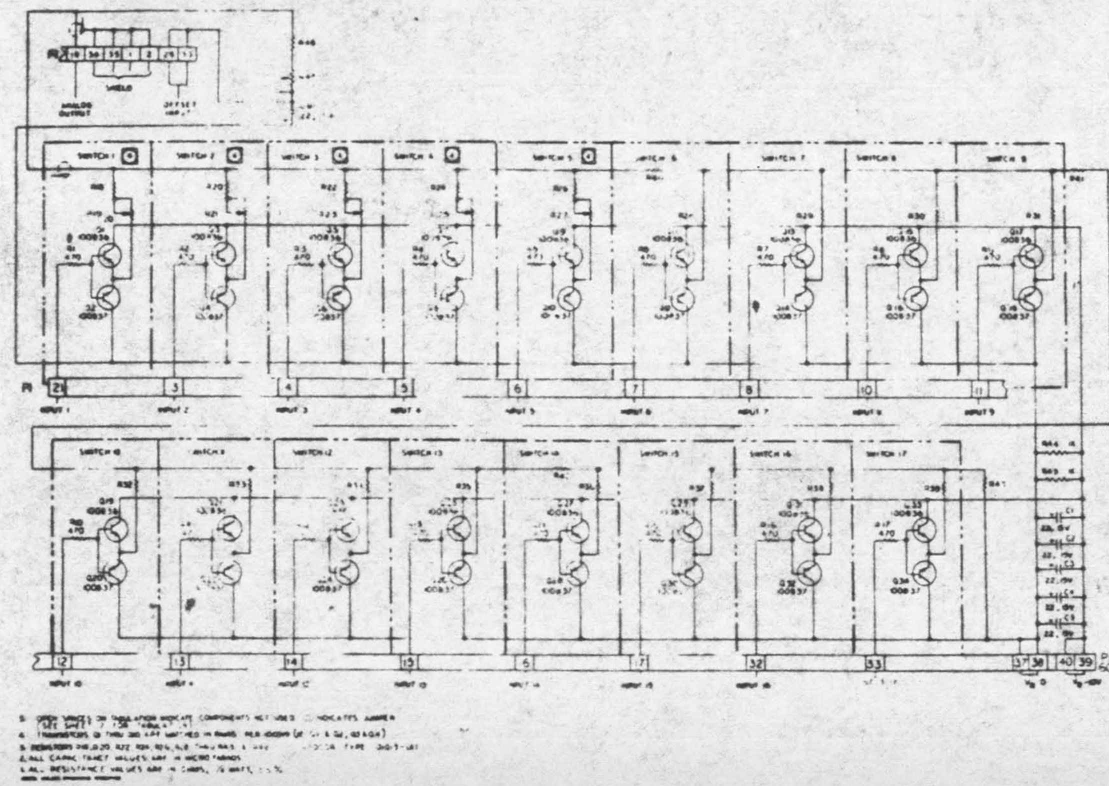

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Figure 5. Series Switch Matrix Modules Model 600122, Part Identification

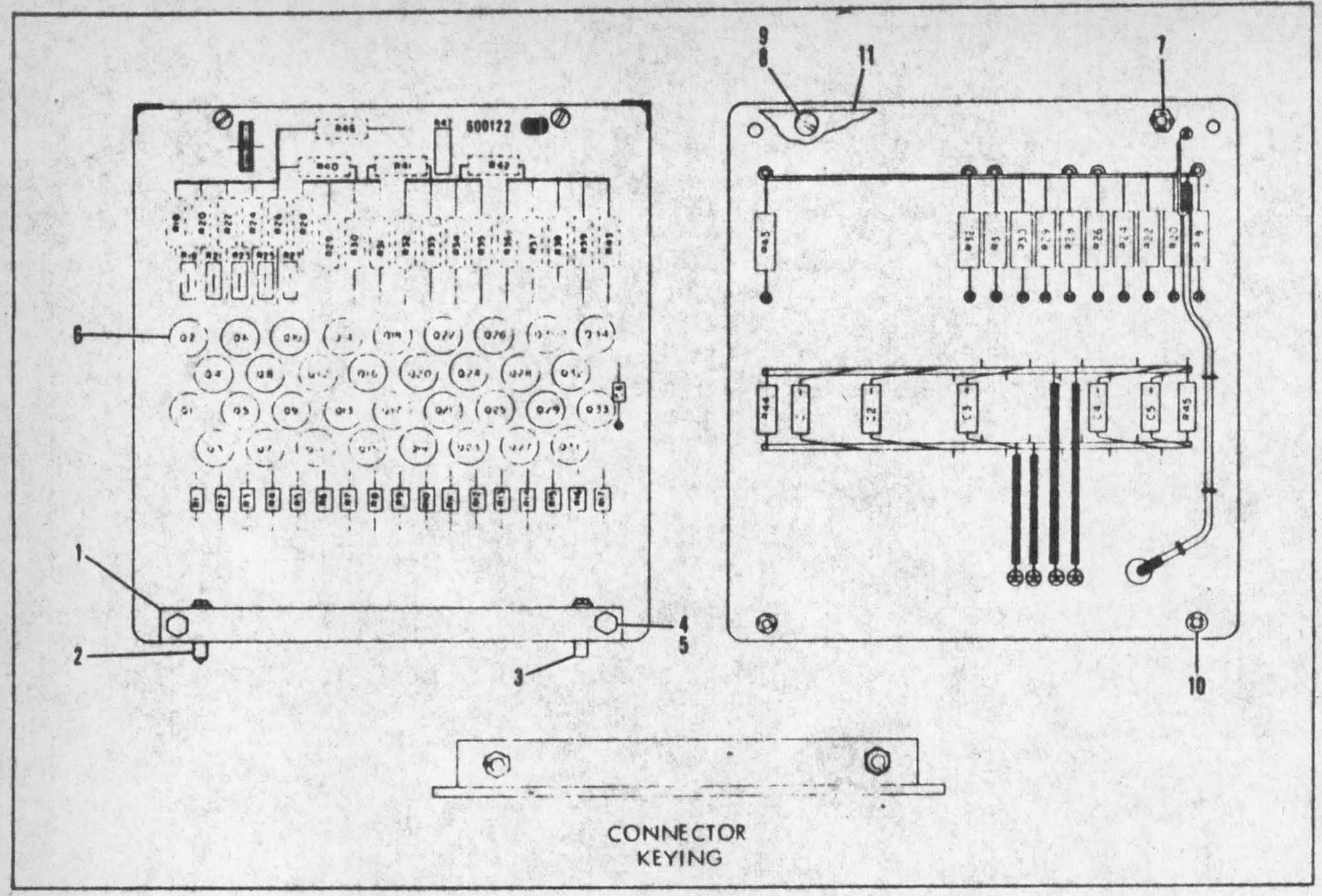

Figure 6. Switch Matrix Model 600122, Parts Location

PARTS LIST

ITEM NUMBER OR REF DESIG	PART NO.	DESCRIPTION	MANUFACTURER	QTY PER ASSY	USABLE ON CODE
1	600020	Connector, 50-Pin, Male	Redcor	1	
2	600021	Pin, Polarizing, Male	Redcor	1	
3	600022	Pin, Polarizing, Female	Redcor	1	
4		Screw, B. H., #4-40, 7/8 lg, Cad. Stl.		2	
5		Nut, Hex, #4-40, S. Pat, Cad. Stl.			
6	10123	Transipad, TO-5	Milton Ross	34	-1, -11, -18
				28	-2, -12
				26	-3, -5, -13, -15, -17
				22	-4, -14
				20	-8
				18	-6, -7, -16

REDCOR

ITEM NUMBER OR REF DESIG	PART NO.	DESCRIPTION	MANUFACTURER	QTY PER ASSY	USABLE ON CODE
7	100180-7	Spacer, Hex, #4-40, 3/8 lg.	Redcor	2	
8		Screw, B. H., #4-40, 3/16 lg., Cad. Stl.		4	
9		Washer, Lock, #4, Cad. Stl.		2	
10	2101	Spacer, Standoff #6, 3/8 lg.	H. H. Smith	2	
11	600209	Cover, 600122 Module	Redcor	1	
A	RC07GF471J	Resistor, Comp., 470 ohm, 1/4W, ±5%	Allen Bradley	17	-1, -11, -18
				14	-2, -12
				13	-3, -5, -14
(See Table 1 for Resistor Tabulation)				11	-4, -14
				10	-8
				9	-6, -7, -16
B	RC07GF102J	Resistor, Comp., 1K, 1/4W, ±5%	Allen Bradley	2	
C	101015-B-3990R0	Resistor, W. W., 3.99K, 1/4W, ±.02%	Redcor	1	-1, -3
				2	-11, -13
D	101015-B-4990R0	Resistor, W. W., 4.99K, 1/4W, ±.02%	Redcor	1	-2, -4, -5, -6
				2	-12, -14, -15 -16
E	RN60C5001F	Resistor, Metal Film, 5K, 1/8W, ±1%	Key	1	-7
F	RN60C5001B	Resistor, Metal Film, 5K, 1/8W, ±0.1%	Key	1	-8
G	101015-B-7990R0	Resistor, W. W., 7.99K, 1/4W, ±0.02%	Redcor	2	-17
H	101015-B-9985R0	Resistor, W. W., 9.985K, 1/4W, ±0.02%	Redcor	1	-1, -2, -5, -11, -12, -15, -18
I	101015-B-100000	Resistor, W. W., 10K, 1/4W, ±0.02%	Redcor	4	-2, -12
				3	-1, -3, -4, -11, -13, -14, -17, -18
				2	-5, -6, -15, -16
J	RN60C1002F	Resistor, Metal Film, 10K, 1/8W, ±1%	Key	1	-7

ITEM NUMBER OR REF DESIG	PART NO.	DESCRIPTION	MANUFACTURER	QTY PER ASSY	USABLE ON CODE
K	RN60C1002C	Resistor, Metal Film, 10K, 1/8W, ±0.25%	Key	1	-8
L	101015-B-199700	Resistor, W.W., 19.97K, 1/4W, ±0.02%	Redcor	2	-1, -11
				1	-2, -5, -12, -15, -1
M	RN60C2002D	Resistor, Metal Film, 20K, 1/8W, ±0.5%	Key	1	-8
N	101015-B-200000	Resistor, W.W., 20K, 1/4W, ±0.02%	Redcor	6	-1, -3, -13. -11
				4	-4, -14
				3	-17, -18
				2	-2, -5, -6, -12, -15, -16
O	RN70B2002F	Resistor, Carb. Film, 20K, 1/2W, ±1%	Key	1	-7
P	101015-B-3600000	Resistor, W.W., 36K, 1/4W, ±0.02%	Redcor	3	-1, -3
				2	-11, -13
Q	101015-B-399500	Resistor, W.W., 39.95K, 1/4W, ±0.02%	Redcor	1	-1, -2, -11, -12, -18
R	101015-B-400000	Resistor, W.W., 40K, 1/4W, ±0.02%	Redcor	4	-1, -3, -11, -13
				3	-5, -15, -17, -18
				2	-2, -4, -6, -12, -14, -16
S	RN70B4002F	Resistor, Carb. Film, 40K, 1/2W, ±1%	Key	1	-7, -8
T	101015-B-432000	Resistor, W.W., 43.2K, 1/4W, ±0.02%	Redcor	3	-18
				2	-4, -5, -14
				1	-6, -16
W	101015-B-799500	Resistor, W.W., 79.95K, 1/4W, ±0.02%	Redcor	1	-18
X	101015-B-800000	Resistor, W.W., 80K, 1/4W, ±0.02%	Redcor	4	-5
				3	-2, -6, -12, -15, -17, -18
				2	-14
				1	-4

600122

ITEM NUMBER OR REF DESIG	PART NO.	DESCRIPTION	MANUFACTURER	QTY PER ASSY	USABLE ON CODE
Y	RN70B8002F	Resistor, Carb. Film, 80K, 1/2W, ±1%	Key	3	-16
				1	-7, -8
Z	RN70B1603F	Resistor, Carb. Film, 160K, 1/2W, ±1%	Key	1	-7, -8
AA	RN70B3203F	Resistor, Carb. Film, 320K, 1/2W, ±1%	Key	1	-7, -8
AB	RN70B6403F	Resistor, Carb. Film, 640K, 1/2W, ±1%	Key	2	-7
				1	-8
AC	RC07GF125J	Resistor, Comp., 1.2 meg, 1/4W, ±5%	Allen Bradley	1	-8
AD	RC07GF245J	Resistor, Comp., 2.4 meg, 1/4W, ±5%	Allen Bradley	2	-8
AE	176-20 ohm	Resistor, Variable, 20 ohm	Techno	3	-11, -12, -15
				2	-1, -2, -5, -13, -14, -16
				1	-3, -4, -6
AF	361-20-2E	Resistor, Variable, 20 ohm	Teledyne	3	-18
				2	-17
AG	176-50 ohm	Resistor, Variable, 50 ohm	Techno	2	-1, -11
				1	-2, -5, -12, -15
AH	361-50-2E	Resistor, Variable, 50 ohm	Teledyne	1	-18
AI	176-100 ohm	Resistor, Variable, 100 ohm	Techno	1	-1, -11, -12
AJ	361-100-2E	Resistor, Variable, 100 ohm	Teledyne	1	-18
C1	SCM226BP015K4	Capacitor, Tant., 22 mfd, 15V	Texas Inst.	5	-1, -2, -3, -4, -5, -6, -7, -8, -11, -12, -14, -16
				6	-13, -15, -17, -18
C2	SCM226BP015K4	Capacitor, Tant., 22 mfd, 15V	Texas Inst.	Ref	
C3	SCM226BP015K4	Capacitor, Tant., 22 mfd, 15V	Texas Inst.	Ref	
C4	SCM226BP015K4	Capacitor, Tant., 22 mfd, 15V	Texas Inst.	Ref	
C5	SCM226BP015K4	Capacitor, Tant., 22 mfd, 15V	Texas Inst.	Ref	

ITEM NUMBER OR REF DESIG	PART NO.	DESCRIPTION	MANUFACTURER	QTY PER ASSY	USABLE ON CODE
C6	SCM226BP015K4	Capacitor, Tant., 22 mfd, 15V	Texas Inst.	Ref	-13, -15, -17, -18
Q1-Q2	100919	Transistor, Pair	Redcor	5 (pairs)	
Q3-Q4	100919	Transistor, Pair	Redcor	Ref	
Q5-Q6	100919	Transistor, Pair	Redcor	Ref	
Q7-Q8	100919	Transistor, Pair	Redcor	Ref	
Q9-Q10	100919	Transistor, Pair	Redcor	Ref	
Q11	100836	Transistor, PNP	Redcor	17	-1, -11, -18
				14	-2, -12
				13	-3, -5, -13, -15, -17
				11	-4, -14
				10	-8
				9	-6, -16
				8	-7
Q12	100837	Transistor, NPN	Redcor	17	-1, -11, -18
				14	-2, -12
				13	-3, -5, -13, -15, -17
				11	-4, -14
				10	-8
				9	-6, -16
				8	-7
Q13	100836	Transistor, PNP	Redcor	Ref	
Q14	100837	Transistor, NPN	Redcor	Ref	
Q15	100836	Transistor, PNP	Redcor	Ref	
Q16	100837	Transistor, NPN	Redcor	Ref	
Q17	100836	Transistor, PNP	Redcor	Ref	-1, -2, -3, -4, -5, -6, -8, -11, -12, -13, -14, -15, -16, -17, -18
Q18	100837	Transistor, NPN	Redcor	Ref	-1, -2, -3, -4, -5, -6, -8, -11, -12, -13, -14, -15, -16, -17, -18

ITEM NUMBER OR REF DESIG	PART NO.	DESCRIPTION	MANUFACTURER	QTY PER ASSY	USABLE ON CODE
Q19	100836	Transistor, PNP	Redcor	Ref	-1, -2, -3, -4, -5, -8, -11, -12, -13, -14, -15, -17, -18
Q20	100837	Transistor, NPN	Redcor	Ref	-1, -2, -3, -4, -5, -8, -11, -12, -13, -14, -15, -17, -18
Q21	100836	Transistor, PNP	Redcor	Ref	-1, -2, -3, -4, -5, -11, -12, -13, -14, -15, -17, -18
Q22	100837	Transistor, NPN	Redcor	Ref	-1, -2, -3, -4, -5, -11, -12, -13, -14, -15, -17, -18
Q23	100836	Transistor, PNP	Redcor	Ref	-1, -2, -3, -5, -11, -12, -13, -15, -17, -18
Q24	100837	Transistor, NPN	Redcor	Ref	-1, -2, -3, -5, -11, -12, -13, -15, -17, -18
Q25	100836	Transistor, PNP	Redcor	Ref	-1, -2, -3, -5, -11, -12, -13, -15, -17, -18
Q26	100837	Transistor, NPN	Redcor	Ref	-1, -2, -3, -5, -11, -12, -13, -15, -17, -18
Q27	100836	Transistor, PNP	Redcor	Ref	-1, -2, -11, -12, -18
Q28	100837	Transistor, NPN	Redcor	Ref	-1, -2, -11, -12, -18
Q29	100836	Transistor, PNP	Redcor	Ref	-1, -11, -18
Q30	100837	Transistor, NPN	Redcor	Ref	-1, -11, -18
Q31	100836	Transistor, PNP	Redcor	Ref	-1, -11, -18
Q32	100837	Transistor, NPN	Redcor	Ref	-1, -11, -18
Q33	100836	Transistor, PNP	Redcor	Ref	-1, -11, -18
Q34	100837	Transistor, NPN	Redcor	Ref	-1, -11, -18

TABLE I. RESISTOR USE TABULATION

MODEL NO.	R1 thru R17	R18	R19	R20	R21	R22	R23	R24	R25	R26	R27	R28	R29	R30	R31	R32	R33	R34	R35	R36	R37	R38	R39	R40	R41	R42	R43	R44	R45	R46	R47	NOT USED
600122-1	A R1-17	C	AE	H	AE	L	AG	L	AG	Q	AI	I	N	N	R	I	N	N	R	I	N	N	R	P	P	P	R	B	B			
600122-2	A R1-14	D	AE	H	AE	L	AG	Q	AI	X	•	I	N	R	X	I	N	R	X	I				V	V	V	I	B	B			SW15-17
600122-3	A R1-13	C	AE	I	•	N	•	N	•	R	•	I	N	N	R	I	N	N	R					P	P	•	R	B	B			SW14-17
600122-4	A R1-11	D	AE	I	•	N	•	R	•	X	•	I	N	R	X	I	N							V	V	•	N	B	B			SW12-17
600122-5	A R1-13	D	AE	H	AE	L	AG	R	•	X	•	I	N	R	X	I	N	R	X					V	V	•	X	B	B			SW14-17
600122-6	A R1-9	D	AE	I	•	N	•	R	•	X	•	I	N	R	X									V	•	•	X	B	B			SW10-17
600122-7	A R1-9	E	•	J	•	O	•	S	•	Y	•	Z	AA	AB										•	•	•	AB	B	B			SW9-17
600122-8	A R1-10	F	•	K	•	M	•	S	•	Y	•	Z	AA	AB	AC	AD								•	•	•	AD	B	B			SW1-17
600122-9																																
600122-10																																
600122-11	A R1-17	C	AE	H	AE	L	AG	L	AG	Q	AI	I	N	N	R	I	N	N	R	I	N	N	R	P	P	P	R	B	B	C	AE	
600122-12	A R1-14	D	AE	H	AE	L	AG	Q	AI	X	•	I	N	R	X	I	N	R	X	I				V	V	V	I	B	B	D	AE	SW15-17
600122-13	A R1-13	C	AE	I	•	N	•	N	•	R	•	I	N	N	R	I	N	N	R					P	P	•	R	B	B	C	AE	SW14-17
600122-14	A R1-11	D	AE	I	•	N	•	R	•	X	•	I	N	R	X	I	N							V	V	•	N	B	B	D	AE	SW12-17
600122-15	A R1-13	D	AE	H	AE	L	AG	R	•	X	•	I	N	R	X	I	N	R	X					V	V	V	X	B	B	D	AE	SW14-17
600122-16	A R1-9	D	AE	I	•	N	•	R	•	Y	•	I	N	R	Y									V	•	•	Y	B	B	D	AE	SW10-17
600122-17	A R1-13	G	AF	I	•	N	•	R	•	X	•	I	N	R	X	I	N	R	X					T	T	•	U	B	B	G	AF	SW14-17
600122-18	A R1-17	G	AF	H	AF	L	AH	Q	AJ	W	AJ	I	N	R	X	I	N	R	X	I	N	R	X	T	T	T	U	B	B	G	AF	

* Wire Shunt (0 ohms)

INSTRUCTION MANUAL FOR SWITCH MATRIX MODEL 600122

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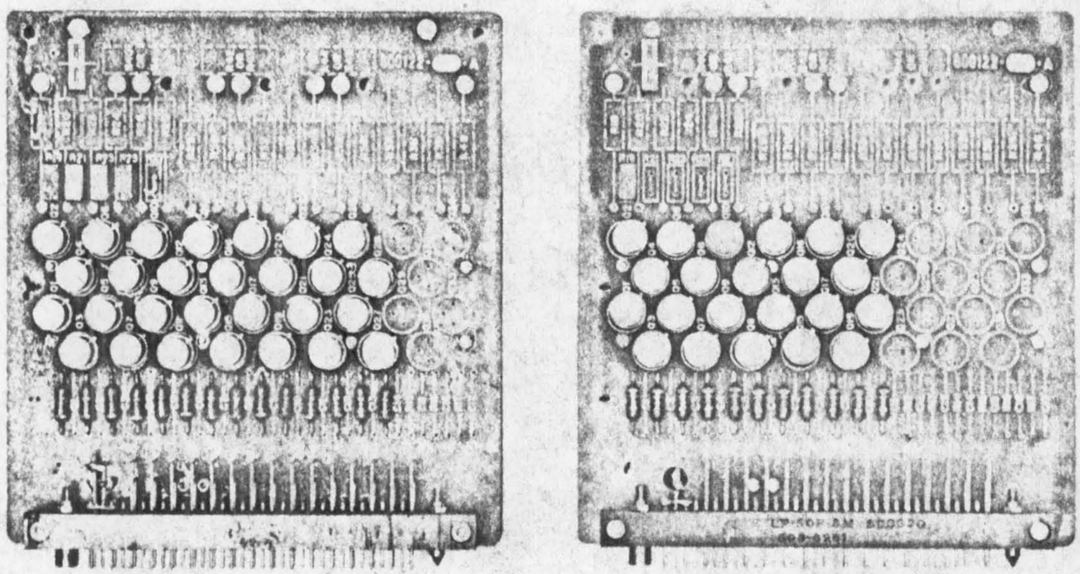


14-Bit Switch Matrix 11-Bit Switch Matrix

Figure 1. Switch Matrix Model 600122

1. DESCRIPTION AND PURPOSE

2. Description - The Model 600122 Switch Matrix (see Figure 1) is a group of printed circuit boards containing up to 17 pairs of precision transistor switches, and associated resistor networks. Each matrix module utilizes an identical basic circuit board. Selection of resistor values and bussing provides the flexibility necessary to assemble the different matrices. Either binary-coded-decimal or pure binary networks of up to 17 bits can be assembled. The circuit board is a standard 50-pin module card with components mounted on both sides. The board assembly measures 5 x 5.4 inches and requires two standard card spaces. A magnetic shield covers the resistor matrix for electrical and mechanical shielding.

3. Purpose - The Switch Matrix Module, with its transistor switches and resistors, makes up resistor ladder networks which are used in analog-to-digital or digital-to-analog converters. The switches are operated externally by providing proper voltage levels to the inputs.

4. CIRCUIT DESCRIPTION (See Figure 4)

5. Binary Coded Matrix - Figure 2A illustrates a simplified schematic of a typical 11-bit binary resistor matrix. The switches can select either the high side or low side of the reference source. The source impedance of the reference supply can, when compared with the nominal values of the resistor matrix, be ignored. This allows the source impedance of the resistor network to be constant regardless of switch positions. The source impedance of the matrix can be considered to be equivalent to figure 2B which resolves to figure 2C and thus to figure 2D. By successive reductions of this type, the circuit finally resolves to figure 2E. Thus, the source impedance of the matrix is 2.5K and switch 1 is equivalent to half scale. Switch 2 is weighted quarter scale and each successive switch weighted, in binary fashion, one-half the weight of the previous value. To continue in this fashion beyond switch 5, would however, require impractical values of resistors. To reduce the resistor values to a common group, a series parallel ladder is used. Thus, switches 6, 7, 8, and 9 contribute through a

75K resistor, voltage equivalent to switches 2, 3, 4, and 5 from a source of 5K. The voltages contributed to the output, therefore, are:

$$\frac{5K}{75K + 5K} \text{ or } \frac{1}{16}$$

Therefore, switches 6, 7, 8, and 9 have the binary relationship of 1/16 and contribute half the voltage of switches 2, 3, 4, and 5.

6. Decimal Coded Matrix - Figure 3A illustrates a simplified schematic of a typical 13-bit decimal-coded resistor matrix. The last section of the matrix is as illustrated in figure 3B and reduces to figure 3C. Therefore, the matrix reduces to figure 3D, which resolves to figure 3E. Thus, the source impedance of the matrix is 2K. Switches 1, 2, 3, 4, and 5 have a binary coded relationship of 1-2-2-4. Again, to continue in this fashion, beyond switch 5 would result in impractical resistor values. Switches 6, 7, 8, and 9 contribute through a 36K resistor voltage equivalent to switches 2, 3, 4, and 5 from a source of 4K. The voltages contributed to the output, therefore, are:

$$\frac{4K}{36K + 4K} \text{ or } \frac{1}{10}$$

Therefore, switches 6, 7, 8, and 9 have the decimal relationship of 1/10 of switches 2, 3, 4, and 5.

7. Terminations - In each of the examples described, the matrix was terminated to ensure that the ladder network ended in the proper characteristic impedance. In the 11-bit binary converter, the last two resistors are 10K and 20K. The terminating resistor must, therefore, be 20K to ensure a characteristic impedance of 5K. In the 13-bit decimal converter, the last four resistors are 10K, 20K, 20K and 40K. The characteristic impedance of 4K requires a terminating resistor of 40K.

8. 14-bit Binary Matrix and 17-bit Decimal Matrix - Simple extensions can be utilized to obtain expansion of the matrices described. In each case, the resistor matrix is expanded by extending the ladder matrix illustrated to the proper number of bits and terminating with the proper resistor value.

9. Circuit Description - The transistor switches are analogous to a double-throw, single pole switch. With -12.5 volts applied to a switch input the PNP transistor conducts and the NPN transistor is cut off. With this condition, the -10 V reference voltage is applied to the common emitters. With +3 V applied to a switch input the PNP transistor is cut off and the NPN transistor conducts. With this condition, the ground reference voltage is applied to the common emitters. The transistors are operated in an inverted configuration to obtain low voltage offset conditions and low saturation resistance.

10. MAINTENANCE

Standard circuit board maintenance practices apply. Replacement parts shall be those specified in the parts list. Non-linearity of the output usually results from defective transistors or resistors. Measurements, with an ohmmeter, should detect a faulty component. If a short circuit occurs in a reference input, a pair or more of the complementary switches should be suspected. Again, measurements with an ohmmeter should detect a faulty component. After initial set up at the factory, potentiometers R19, R21, R23, R25 and R27 should not require additional adjustment in the field. However, if resistor R18, R20, R22, R24 or R26 is replaced, its associated potentiometer may require adjustment.

11. SPECIFICATIONS

Number of Switches . . . . 17 max

Coding Available . . . . See table 1

Input Voltage Levels:

Switch select . . . . -12.5 V
Switch off . . . . +3 V

Input Loads:

To -12.5 V . . . . 470 ohms
To ground . . . . 470 ohms

Reference Source . . . . -10 V nominal

Reference Source Load . . . . 6 ma per bit

Output Level . . . . See table 1

Output Impedance . . . . See table 1

Output Settling Time . . . . . 2 usec to within 0.01%

Resistor Adjustments . . . . 1st 5 bits max

Resistor Loading:

+3 V . . . . 6 ma per bit
-12.5 V . . . . 6 ma per bit from -10 V

Operating Temperature . . . . 0° to 50°C

Board Type . . . . Glass epoxy

Mechanical Size . . . . 5" x 5.4" x 1"

Connector Type . . . . 50 pin

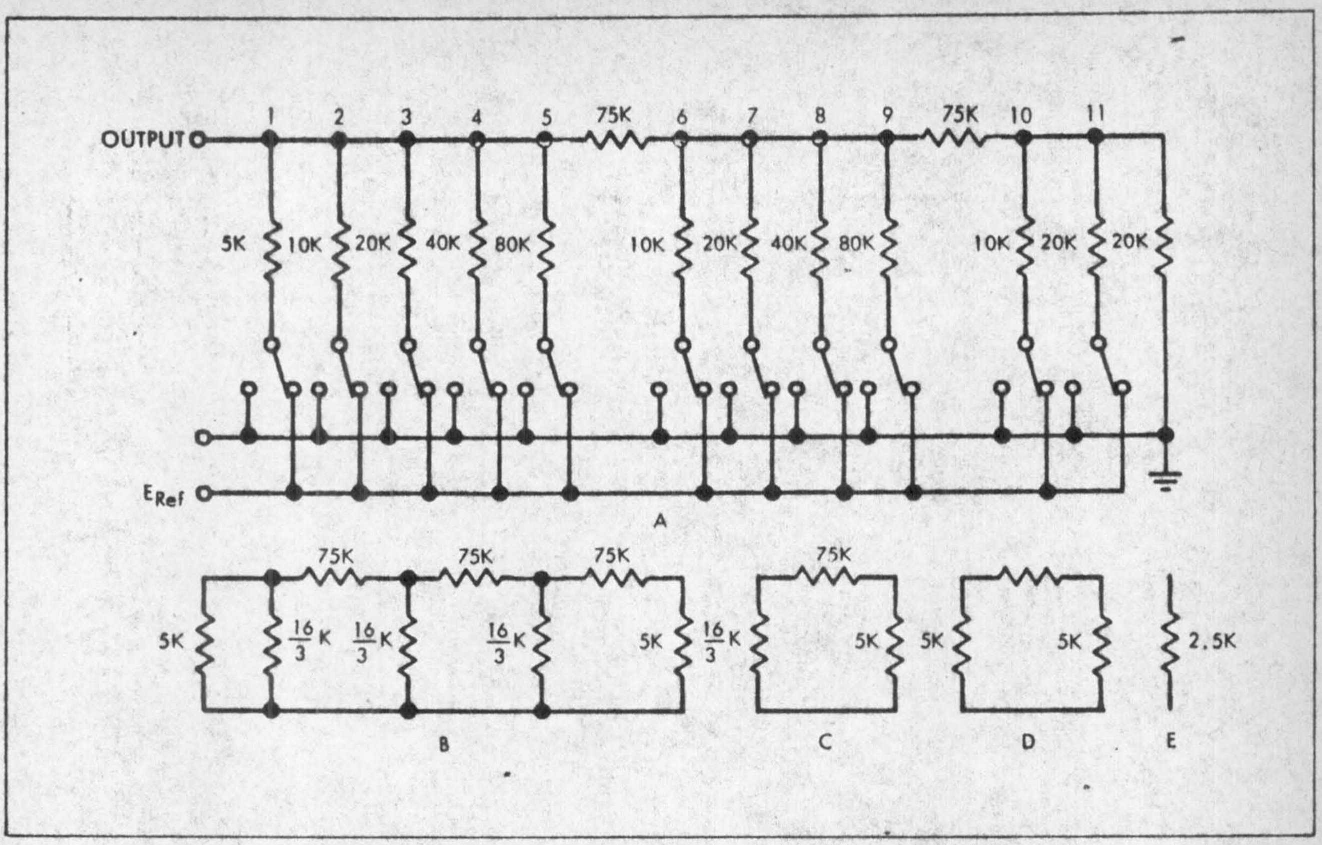


Figure 2. 11 Bit Binary Coded Matrix, Simplified Schematic

Table 1. Switch Output Coding

Codes	Full Scale Output Voltage		Output Impedance		No Offsetting Resistor (R46, R47) Used	
	Unipolar	Bipolar	Unipolar	Bipolar	Output Voltage	Output Impedance
17 BCD 422*1 ①	-6 2/3 V	±3 1/3 V	1 1/3K	1 1/3K	-10 V	2K
13 BCD 422*1 ①	-6 2/3 V	±3 1/3 V	1 1/3K	1 1/3K	-10 V	2K
9 BCD 422*1 ①	-6 2/3 V	±3 1/3 V	1 1/3K	1 1/3K	-10 V	2K
17 BCD 8421	-5.454 V	±2.727 V	2.1818K	2.1818K	-6 V	3K
13 BCD 8421	-5.454 V	±2.727 V	2.1818K	2.1818K	-6 V	3K
9 BCD 8421	-5.454 V	±2.727 V	2.1818K	2.1818K	-6 V	3K
14 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2.5K
13 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2.5K
12 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2.5K
11 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2.5K
10 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2.5K
9 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2.5K
8 Binary	-6 2/3 V	±3 1/3 V	1 2/3K	1 2/3K	-10 V	2.5K

① Used in A-D Operation.
2* Coding the same as 8.

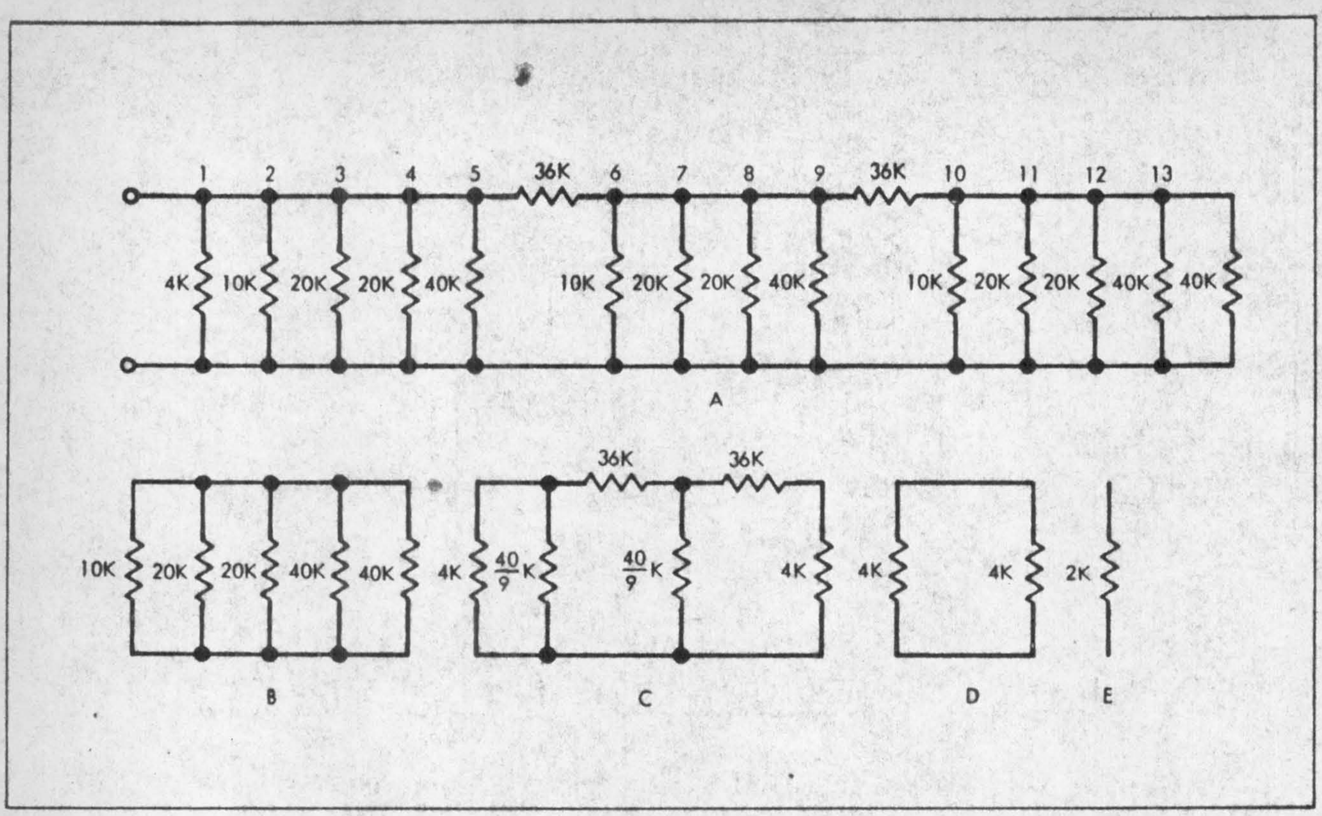


Figure 3. 13-Bit 1224 Decimal Coded Matrix, Simplified Schematic

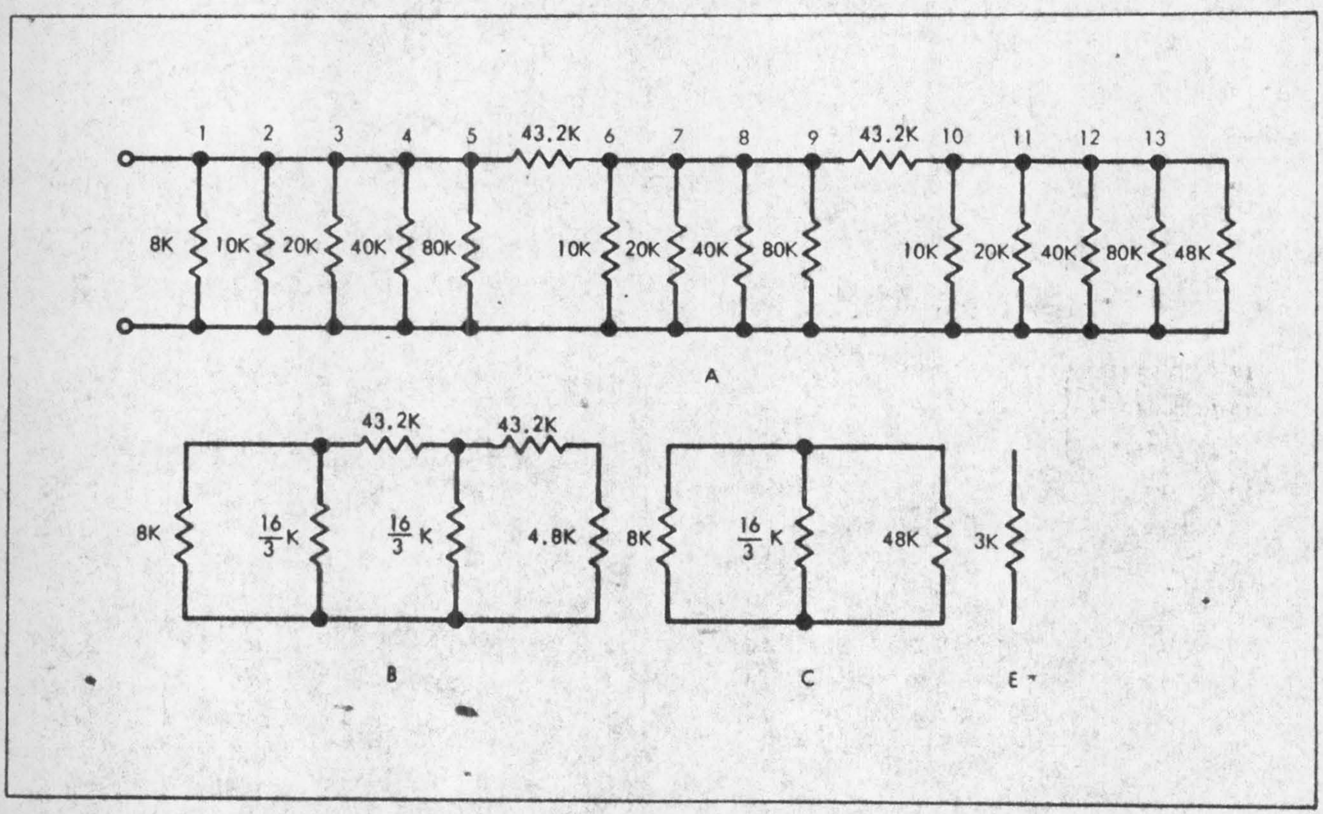
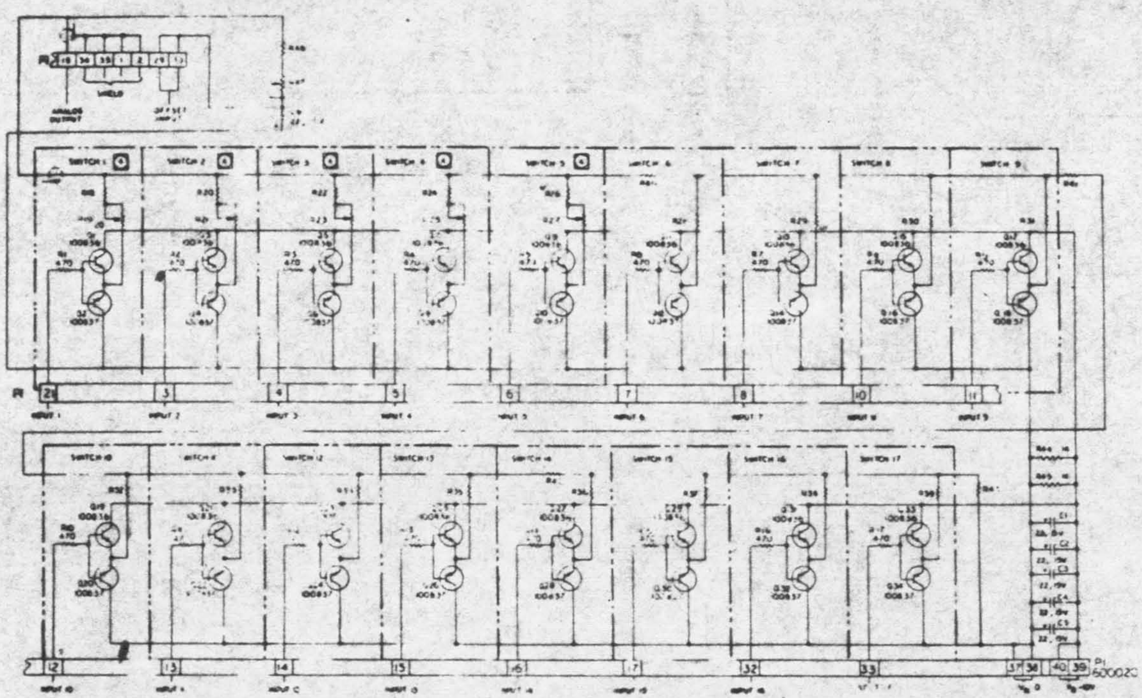


Figure 4. 13-Bit 1248 Decimal Coded Matrix, Simplified Schematic

MODEL NO		DESC		R18	R20	R21	R22	R23	R24	R25	R26	R27	R28	R29	R30	R31	R32	R33	R34	R35	R36	R37	R38	R39	R40	R41	R42	R43	R46	R47		NOT USED	APPLICATION
600122	-1	17 BIT	BCD	3.99K	9.985K	20	19.97K	50	9.97K	50	39.95K	100	10K	20K	20K	40K	10K	20K	20K	40K	[illegible]	20K	20K	40K	36K	36K	36K	40K					A-D
	-2	14	BIN	4.99K	9.985K	20	19.97K	50	39.95K	100	80K	0	10K	20K	40K	80K	10K	20K	40K	80K	[illegible]				75K	75K	75K	10K				SW 15,16,17	
	-3	13	BCD	3.99K	10K	0	20K	0	20K	0	[illegible]	0	10K	20K	20K	40K	10K	20K	[illegible]	40K					36K	36K	0	40K				SW 14,15,16,17	
	-4	11	BIN	4.99K	10K	0	20K	0	40K	0	[illegible]	0	10K	20K	40K	80K	10K	20K							75K	75K	0	20K				SW 12 THRU 17	
	-5	13	BIN	4.99K	9.985K	20	19.97K	50	40K	0	[illegible]		10K	20K	40K	80K	10K	20K	40K	80K					75K	75K	0	80K				SW 14 THRU 17	
	-6	9	BIN	4.99K	10K	0	20K	0	40K	0	80K	0	[illegible]	20K	40K	80K									75K	0	0	80K				SW 10 THRU 17	
	-7	8	BIN	5K	10K	0	20K	0	40K	0	[illegible]	0	160K	320K	640K										0	0	0	[illegible]				SW 9 THRU 17	
	-8	10	BIN	5K	10K	[illegible]	20K	0	40K		[illegible]	0	160K	320K	640K	1.2M	2.4M								0	0	0	2.4M				SW 11 THRU 17	
	-9																																
	-10																																A-D
	-11	17	BCD	3.99K	9.985K	20	19.97K	50	19.97K	50	39.95K	100	10K	20K	20K	40K	10K	20K	20K	40K	10K	20K	20K	40K	36K	36K	36K	40K	3.99K	20			D-A
	-12	14	BIN	4.99K	9.985K	20	19.97K	50	39.95K	100	80K	0	10K	20K	40K	80K	10K	20K	40K	80K	10K				75K	75K	75K	10K	4.99K	20		SW 15,16,17	
	-13	13	BCD	3.99K	10K	0	20K	0	20K		[illegible]	0	10K	20K	20K	40K	10K	20K	[illegible]	40K					36K	36K	0	40K	3.99K	20		SW 14,15,16,17	
	-14	11	BIN	4.99K	10K	0	20K	0	40K	0	80K	0	10K	20K	40K	80K	10K	20K							75K	75K	0	20K	4.99K	20		SW 12 THRU 17	
	-15	13	BIN	4.99K	9.985K	20	19.97K	50	40K	0	[illegible]		10K	20K	40K	80K	10K	20K	40K	80K					75K	75K	75K	80K	4.99K	20		SW 14 THRU 17	
	-16	9	BIN	4.99K	10K	0	20K	0	40K		[illegible]	0	10K	20K	40K	80K									75K	0	0	80K	4.99K	20		SW 10 THRU 17	
	-17	13	BCD	7.99K	10K	0	20K		40K	0	80K	0	10K	20K	40K	80K	[illegible]	20K	40K	80K					45.2K	45.2K	0	48K	7.99K	20		SW 14 THRU 17	
	-18	17	BCD	7.99K	9.985K	20	19.97K	50	39.95K	100	79.95K	100	10K	20K	40K	80K	[illegible]	20K	40K	80K	10K	20K	40K	80K	45.2K	45.2K	45.2K	48K	7.99K	20			
	-19																																
600122	-20		BIT																														D-A



5. OPEN SPACES ON TABULATION INDICATE COMPONENTS NOT USED. [illegible] INDICATES JUMPER (SEE SHEET [illegible] FOR TABULATION)
4. TRANSISTORS Q1 THRU Q30 ARE MATCHED IN PAIRS [illegible] (Q1 & Q2, Q3 & Q4)
3. RESISTORS R18, R20, R22, R24, R26 [illegible] TYPE [illegible]
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT, ±5%.
NOTES: UNLESS OTHERWISE SPECIFIED

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Figure 5. Series Switch Matrix Modules Model 600122, Part Identification

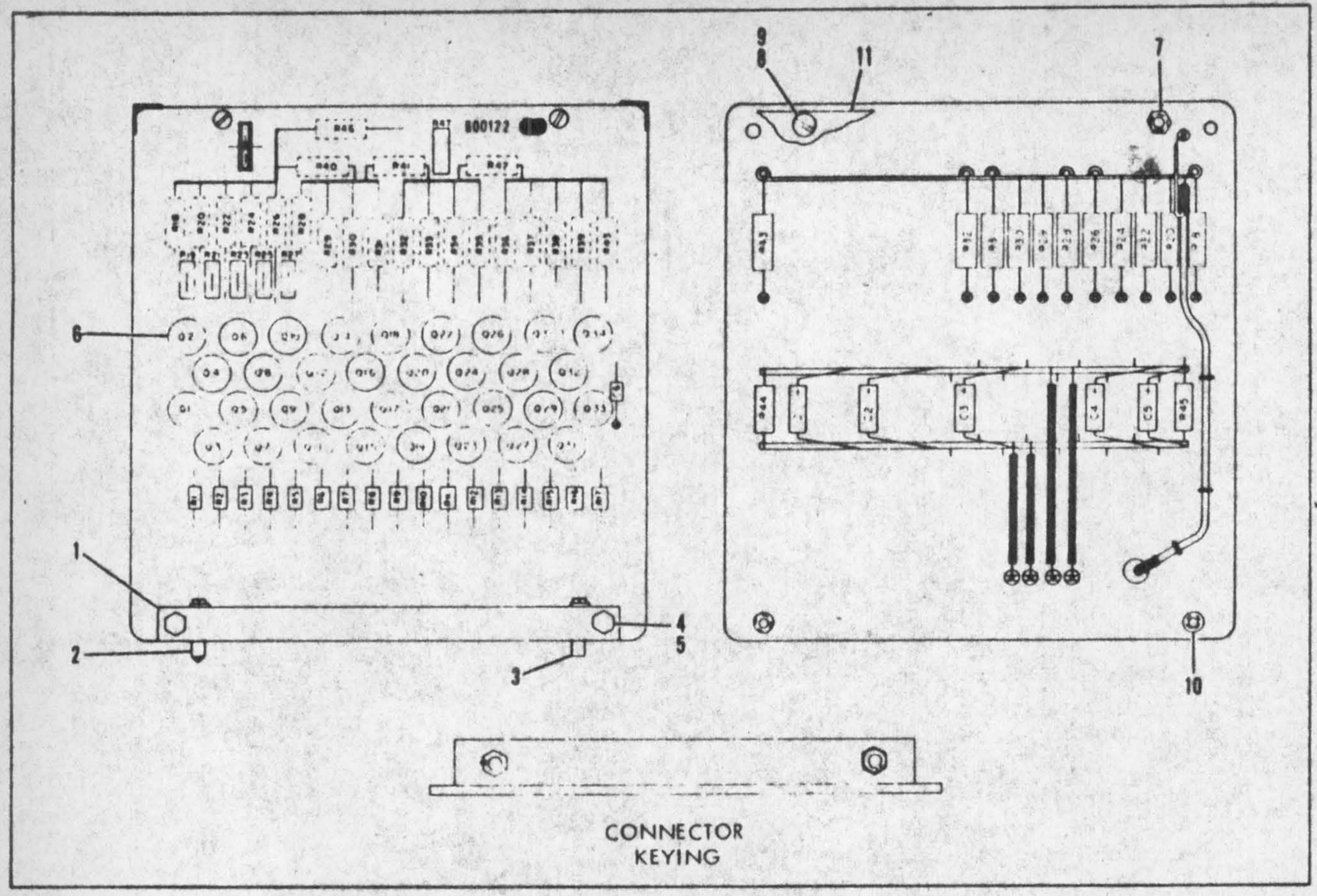

Figure 6. Switch Matrix Model 600122, Parts Location

PARTS LIST

ITEM NUMBER OR REF DESIG	PART NO.	DESCRIPTION	MANUFACTURER	QTY PER ASSY	USABLE ON CODE
1	600020	Connector, 50-Pin, Male	Redcor	1	
2	600021	Pin, Polarizing, Male	Redcor	1	
3	600022	Pin, Polarizing, Female	Redcor	1	
4		Screw, B. H., #4-40, 7/8 lg, Cad. Stl.		2	
5		Nut, Hex, #4-40, S. Pat, Cad. Stl.			
6	10123	Transipad, TO-5	Milton Ross	34	-1, -11, -18
				28	-2, -12
				26	-3, -5, -13, -15, -17
				22	-4, -14
				20	-8
				18	-6, -7, -16

REDCOR

600122

ITEM NUMBER OR REF DESIG	PART NO.	DESCRIPTION	MANUFACTURER	QTY PER ASSY	USABLE ON CODE
7	100180-7	Spacer, Hex, #4-40, 3/8 lg.	Redcor	2	
8		Screw, B.H., #4-40, 3/16 lg., Cad. Stl.		4	
9		Washer, Lock, #4, Cad. Stl.		2	
10	2101	Spacer, Standoff #6, 3/8 lg.	H. H. Smith	2	
11	600209	Cover, 600122 Module	Redcor	1	
A	RC07GF471J	Resistor, Comp., 470 ohm, 1/4W, ±5%	Allen Bradley	17	-1, -11, -18
				14	-2, -12
				13	-3, -5, -14
(See Table 1 for Resistor Tabulation)				11	-4, -14
				10	-8
				9	-6, -7, -16
B	RC07GF102J	Resistor, Comp., 1K, 1/4W, ±5%	Allen Bradley	2	
C	101015-B-3990R0	Resistor, W.W., 3.99K, 1/4W, ±.02%	Redcor	1	-1, -3
				2	-11, -13
D	101015-B-4990R0	Resistor, W.W., 4.99K, 1/4W, ±.02%	Redcor	1	-2, -4, -5, -6
				2	-12, -14, -15 -16
E	RN60C5001F	Resistor, Metal Film, 5K, 1/8W, ±1%	Key	1	-7
F	RN60C5001B	Resistor, Metal Film, 5K, 1/8W, ±0.1%	Key	1	-8
G	101015-B-7990R0	Resistor, W.W., 7.99K, 1/4W, ±0.02%	Redcor	2	-17
H	101015-B-9985R0	Resistor, W.W., 9.985K, 1/4W, ±0.02%	Redcor	1	-1, -2, -5, -11, -12, -15, -18
I	101015-B-100000	Resistor, W.W., 10K, 1/4W, ±0.02%	Redcor	4	-2, -12
				3	-1, -3, -4, -11, -13, -14, -17, -18
				2	-5, -6, -15, -16
J	RN60C1002F	Resistor, Metal Film, 10K, 1/8W, ±1%	Key	1	-7

ITEM NUMBER OR REF DESIG	PART NO.	DESCRIPTION	MANUFACTURER	QTY PER ASSY	USABLE ON CODE
K	RN60C1002C	Resistor, Metal Film, 10K, 1/8W, ±0.25%	Key	1	-8
L	101015-B-199700	Resistor, W.W., 19.97K, 1/4W, ±0.02%	Redcor	2	-1, -11
				1	-2, -5, -12, -15, -1
M	RN60C2002D	Resistor, Metal Film, 20K, 1/8W, ±0.5%	Key	1	-8
N	101015-B-200000	Resistor, W.W., 20K, 1/4W, ±0.02%	Redcor	6	-1, -3, -13. -11
				4	-4, -14
				3	-17, -18
				2	-2, -5, -6, -12, -15, -16
O	RN70B2002F	Resistor, Carb. Film, 20K, 1/2W, ±1%	Key	1	-7
P	101015-B-3600000	Resistor, W.W., 36K, 1/4W, ±0.02%	Redcor	3	-1, -3
				2	-11, -13
Q	101015-B-399500	Resistor, W.W., 39.95K, 1/4W, ±0.02%	Redcor	1	-1, -2, -11, -12, -18
R	101015-B-400000	Resistor, W.W., 40K, 1/4W, ±0.02%	Redcor	4	-1, -3, -11, -13
				3	-5, -15, -17, -18
				2	-2, -4, -6, -12, -14, -16
S	RN70B4002F	Resistor, Carb. Film, 40K, 1/2W, ±1%	Key	1	-7, -8
T	101015-B-432000	Resistor, W.W., 43.2K, 1/4W, ±0.02%	Redcor	3	-18
				2	-4, -5, -14
				1	-6, -16
W	101015-B-799500	Resistor, W.W., 79.95K, 1/4W, ±0.02%	Redcor	1	-18
X	101015-B-800000	Resistor, W.W., 80K, 1/4W, ±0.02%	Redcor	4	-5
				3	-2, -6, -12, -15, -17, -18
				2	-14
				1	-4

600122

ITEM NUMBER OR REF DESIG	PART NO.	DESCRIPTION	MANUFACTURER	QTY PER ASSY	USABLE ON CODE
Y	RN70B8002F	Resistor, Carb. Film, 80K, 1/2W, ±1%	Key	3	-16
				1	-7, -8
Z	RN70B1603F	Resistor, Carb. Film, 160K, 1/2W, ±1%	Key	1	-7, -8
AA	RN70B3203F	Resistor, Carb. Film, 320K, 1/2W, ±1%	Key	1	-7, -8
AB	RN70B6403F	Resistor, Carb. Film, 640K, 1/2W, ±1%	Key	2	-7
				1	-8
AC	RC07GF125J	Resistor, Comp., 1.2 meg, 1/4W, ±5%	Allen Bradley	1	-8
AD	RC07GF245J	Resistor, Comp., 2.4 meg, 1/4W, ±5%	Allen Bradley	2	-8
AE	176-20 ohm	Resistor, Variable, 20 ohm	Techno	3	-11, -12, -15
				2	-1, -2, -5, -13, -14, -16
				1	-3, -4, -6
AF	361-20-2E	Resistor, Variable, 20 ohm	Teledyne	3	-18
				2	-17
AG	176-50 ohm	Resistor, Variable, 50 ohm	Techno	2	-1, -11
				1	-2, -5, -12, -15
AH	361-50-2E	Resistor, Variable, 50 ohm	Teledyne	1	-18
AI	176-100 ohm	Resistor, Variable, 100 ohm	Techno	1	-1, -11, -12
AJ	361-100-2E	Resistor, Variable, 100 ohm	Teledyne	1	-18
C1	SCM226BP015K4	Capacitor, Tant., 22 mfd, 15V	Texas Inst.	5	-1, -2, -3, -4, -5, -6, -7, -8, -11, -12, -14, -16
				6	-13, -15, -17, -18
C2	SCM226BP015K4	Capacitor, Tant., 22 mfd, 15V	Texas Inst.	Ref	
C3	SCM226BP015K4	Capacitor, Tant., 22 mfd, 15V	Texas Inst.	Ref	
C4	SCM226BP015K4	Capacitor, Tant., 22 mfd, 15V	Texas Inst.	Ref	
C5	SCM226BP015K4	Capacitor, Tant., 22 mfd, 15V	Texas Inst.	Ref	

ITEM NUMBER OR REF DESIG	PART NO.	DESCRIPTION	MANUFACTURER	QTY PER ASSY	USABLE ON CODE
C6	SCM226BP015K4	Capacitor, Tant., 22 mfd, 15V	Texas Inst.	Ref	-13, -15, -17, -18
Q1-Q2	100919	Transistor, Pair	Redcor	5 (pairs)	
Q3-Q4	100919	Transistor, Pair	Redcor	Ref	
Q5-Q6	100919	Transistor, Pair	Redcor	Ref	
Q7-Q8	100919	Transistor, Pair	Redcor	Ref	
Q9-Q10	100919	Transistor, Pair	Redcor	Ref	
Q11	100836	Transistor, PNP	Redcor	17	-1, -11, -18
				14	-2, -12
				13	-3, -5, -13, -15, -17
				11	-4, -14
				10	-8
				9	-6, -16
				8	-7
Q12	100837	Transistor, NPN	Redcor	17	-1, -11, -18
				14	-2, -12
				13	-3, -5, -13, -15, -17
				11	-4, -14
				10	-8
				9	-6, -16
				8	-7
Q13	100836	Transistor, PNP	Redcor	Ref	
Q14	100837	Transistor, NPN	Redcor	Ref	
Q15	100836	Transistor, PNP	Redcor	Ref	
Q16	100837	Transistor, NPN	Redcor	Ref	
Q17	100836	Transistor, PNP	Redcor	Ref	-1, -2, -3, -4, -5, -6, -8, -11, -12, -13, -14, -15, -16, -17, -18
Q18	100837	Transistor, NPN	Redcor	Ref	-1, -2, -3, -4, -5, -6, -8, -11, -12, -13, -14, -15, -16, -17, -18

ITEM NUMBER OR REF DESIG	PART NO.	DESCRIPTION	MANUFACTURER	QTY PER ASSY	USABLE ON CODE
Q19	100836	Transistor, PNP	Redcor	Ref	-1, -2, -3, -4, -5, -8, -11, -12, -13, -14, -15, -17, -18
Q20	100837	Transistor, NPN	Redcor	Ref	-1, -2, -3, -4, -5, -8, -11, -12, -13, -14, -15, -17, -18
Q21	100836	Transistor, PNP	Redcor	Ref	-1, -2, -3, -4, -5, -11, -12, -13, -14, -15, -17, -18
Q22	100837	Transistor, NPN	Redcor	Ref	-1, -2, -3, -4, -5, -11, -12, -13, -14, -15, -17, -18
Q23	100836	Transistor, PNP	Redcor	Ref	-1, -2, -3, -5, -11, -12, -13, -15, -17, -18
Q24	100837	Transistor, NPN	Redcor	Ref	-1, -2, -3, -5, -11, -12, -13, -15, -17, -18
Q25	100836	Transistor, PNP	Redcor	Ref	-1, -2, -3, -5, -11, -12, -13, -15, -17, -18
Q26	100837	Transistor, NPN	Redcor	Ref	-1, -2, -3, -5, -11, -12, -13, -15, -17, -18
Q27	100836	Transistor, PNP	Redcor	Ref	-1, -2, -11, -12, -18
Q28	100837	Transistor, NPN	Redcor	Ref	-1, -2, -11, -12, -18
Q29	100836	Transistor, PNP	Redcor	Ref	-1, -11, -18
Q30	100837	Transistor, NPN	Redcor	Ref	-1, -11, -18
Q31	100836	Transistor, PNP	Redcor	Ref	-1, -11, -18
Q32	100837	Transistor, NPN	Redcor	Ref	-1, -11, -18
Q33	100836	Transistor, PNP	Redcor	Ref	-1, -11, -18
Q34	100837	Transistor, NPN	Redcor	Ref	-1, -11, -18

TABLE I. RESISTOR USE TABULATION

MODEL NO.	R1 thru R17	R18	R19	R20	R21	R22	R23	R24	R25	R26	R27	R28	R29	R30	R31	R32	R33	R34	R35	R36	R37	R38	R39	R40	R41	R42	R43	R44	R45	R46	R47	NOT USED
600122-1	A R1-17	C	AE	H	AE	L	AG	L	AG	Q	AI	I	N	N	R	I	N	N	R	I	N	N	R	P	P	P	R	B	B			
600122-2	A R1-14	D	AE	H	AE	L	AG	Q	AI	X	•	I	N	R	X	I	N	R	X	I				V	V	V	I	B	B			SW15-17
600122-3	A R1-13	C	AE	I	•	N	•	N	•	R	•	I	N	N	R	I	N	N	R					P	P	•	R	B	B			SW14-17
600122-4	A R1-11	D	AE	I	•	N	•	R	•	X	•	I	N	R	X	I	N							V	V	•	N	B	B			SW12-17
600122-5	A R1-13	D	AE	H	AE	L	AG	R	•	X	•	I	N	R	X	I	N	R	X					V	V	•	X	B	B			SW14-17
600122-6	A R1-9	D	AE	I	•	N	•	R	•	X	•	I	N	R	X									V	•	•	X	B	B			SW10-17
600122-7	A R1-9	E	•	J	•	O	•	S	•	Y	•	Z	AA	AB										•	•	•	AB	B	B			SW9-17
600122-8	A R1-10	F	•	K	•	M	•	S	•	Y	•	Z	AA	AB	AC	AD								•	•	•	AD	B	B			SW1-17
600122-9																																
600122-10																																
600122-11	A R1-17	C	AE	H	AE	L	AG	L	AG	Q	AI	I	N	N	R	I	N	N	R	I	N	N	R	P	P	P	R	B	B	C	AE	
600122-12	A R1-14	D	AE	H	AE	L	AG	Q	AI	X	•	I	N	R	X	I	N	R	X	I				V	V	V	I	B	B	D	AE	SW15-17
600122-13	A R1-13	C	AE	I	•	N	•	N	•	R	•	I	N	N	R	I	N	N	R					P	P	•	R	B	B	C	AE	SW14-17
600122-14	A R1-11	D	AE	I	•	N	•	R	•	X	•	I	N	R	X	I	N							V	V	•	N	B	B	D	AE	SW12-17
600122-15	A R1-13	D	AE	H	AE	L	AG	R	•	X	•	I	N	R	X	I	N	R	X					V	V	V	X	B	B	D	AE	SW14-17
600122-16	A R1-9	D	AE	I	•	N	•	R	•	Y	•	I	N	R	Y									V	•	•	Y	B	B	D	AE	SW10-17
600122-17	A R1-13	G	AF	I	•	N	•	R	•	X	•	I	N	R	X	I	N	R	X					T	T	•	U	B	B	G	AF	SW14-17
600122-18	A R1-17	G	AF	H	AF	L	AH	Q	AJ	W	AJ	I	N	R	X	I	N	R	X	I	N	R	X	T	T	T	U	B	B	G	AF	

* Wire Shunt (0 ohms)

INSTRUCTION MANUAL

FOR

AC FLIP FLOP 600107

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Canoga Park, California

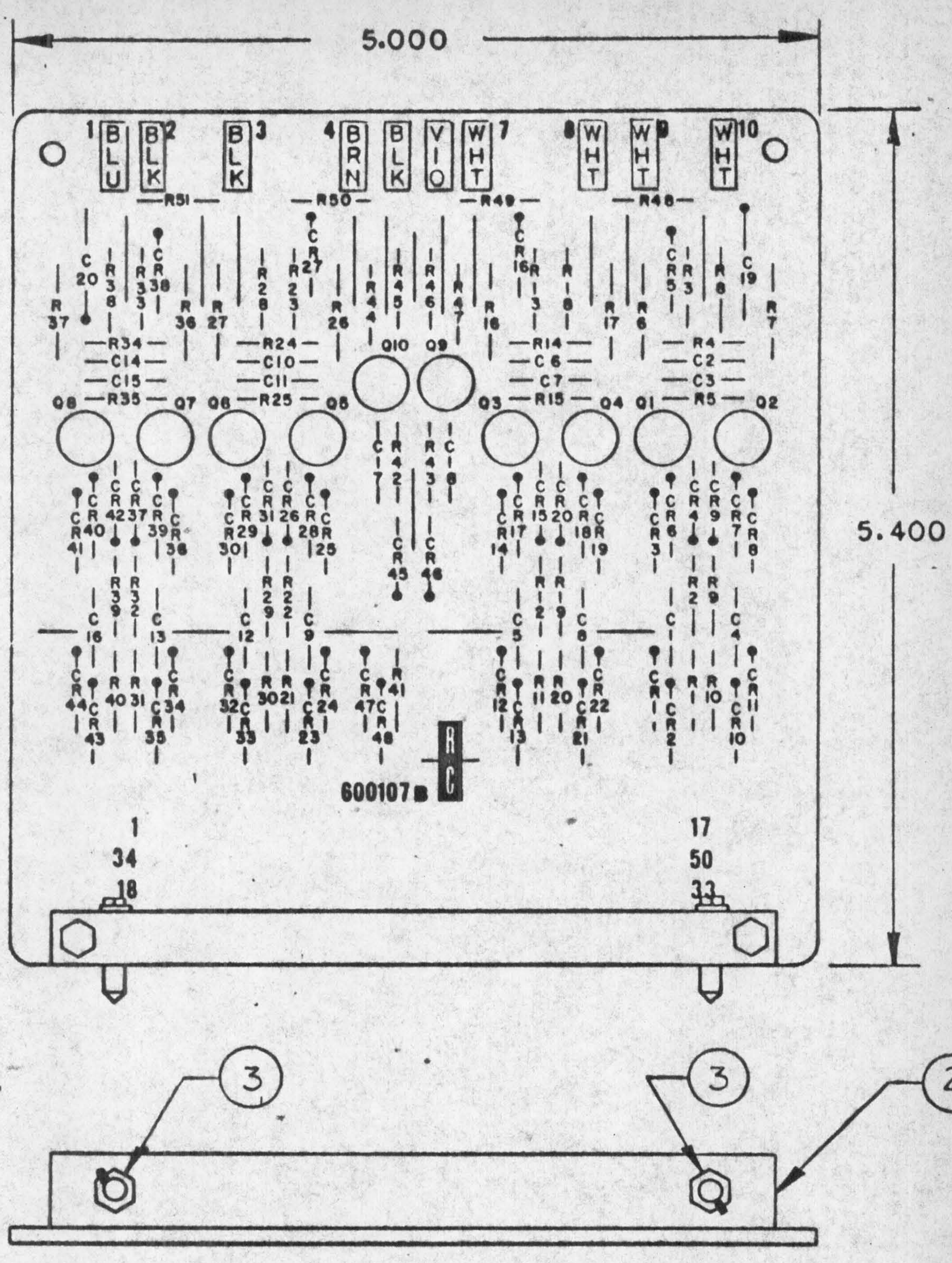
AC FLIP FLOP 600107

This card contains 4 independent AC coupled flip flops and one dual inverter amplifier. The set and reset inputs of the flip flops are two term "AND" gates with the common term available for expansion. The dual inverter input is a two term "AND" gate with the common term available for expansion.

Module Type:	Flip Flop RS type
No. of Circuits:	4 Flip Flop and 1 Dual Inverter
Type of Logic:	Negative true
Logical Levels	
True:	-9 ±3 volts
False:	0 -0.5 volts
Input Gate Structure - 4 Flip Flops	
Gating Provided	
Set:	2 Term "AND" RS type
Reset:	2 Term "AND" RS type
Common:	DC reset to all stages 40mA from -12 volts
Minimum Input:	6 volts transition
Trigger Point:	Positive edge from negative voltage
Trigger Rise Time:	200 Nanosec. minimum
Noise Rejection:	1.5 volts

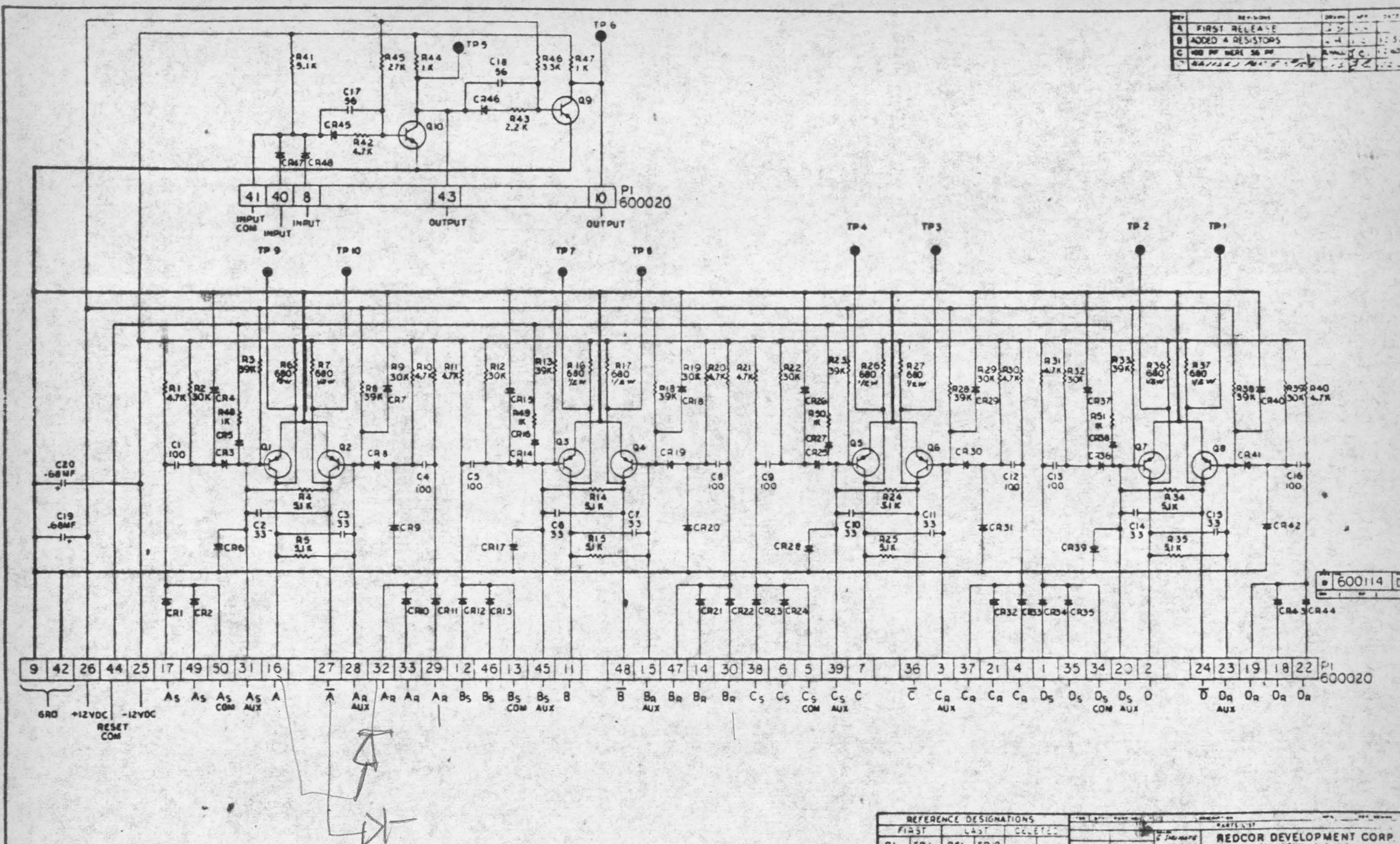
<u>Output Loading</u>:	
To ground:	1500 ohms
To negative voltage:	15mA
Capacitance:	100 PF maximum
<u>Time Relationships</u>:	
Maximum repetition rate:	1 Megacycle
Delay to last moving point:	100nSecs
<u>Rise Time</u>	
No Load:	40 nanoseconds
Full Load:	60 nanoseconds
<u>Fall Time</u>	
No Load:	60 nanoseconds
Full Load:	100 nanoseconds
<u>Dual Inverter Section</u>	
<u>Output Loading</u>:	
True:	1.5K to ground
False:	20mA to negative voltage
Capacitance:	400pf maximum
<u>Gating Structure</u>:	
Minimum:	"AND" OR
Maximum:	"AND", "AND" "AND" "OR"
Gating Provided:	Expandable 2 term "AND" "OR"
Noise Rejection:	2 volts
Trigger Level:	-6 volts
Trigger Point:	Negative falling edge

Trigger Transition:	None, but to maintain delay rise and fall times 300nS
Delay Time:	100nS
Output:	
Fall Time:	100nS no load, 200nS full load
Rise Time:	40nS no load, 150nS full load
Maximum Repetition Rate:	1 Megacycle
Power Required	
+12 volts:	4mA
-12 volts:	125mA
Operating Temperature:	0-50°C
Mechanical Size:	5" x 5.4" x .5"
Connector Type:	50 Pin
Test Points:	Each Collector Output



600107
A.C. FLIP-FLOP

REFERENCE DWGS: SCHEMATIC NO. 600114 PARTS LIST NO. 600107



4. ALL CAPACITANCE VALUES ARE IN PICO FARADS.
3. ALL RESISTANCE VALUES ARE IN OHMS. 1/4 WATT, ± 5%
2. ALL TRANSISTORS ARE REDCOR NO 1011?.
1. ALL DIODES ARE REDCOR NO. 100780.
NOTE: UNLESS OTHERWISE SPECIFIED

REFERENCE DESIGNATIONS					
FIRST		LAST		DELETED	
R1	TP1	R51	TP10		
C1		C20			
CR1		CR48			
Q1		Q10			
P1	-	P1			

600107 600107
NEXT ASSY
APPLICATION

PARTS LIST
REDCOR DEVELOPMENT CORP.
600107
NONE
600107
4 AC. [illegible]
SCHEMATIC DIAG.
600114 D

PARTS LIST

AC FLIP FLOP 600107

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Mica, 100 PF	Arco	CM15E101J	
C2	Capacitor, Mica, 33 PF	Mica Mold	MCM10D330K	
C3	Same as C2			
C4	Same as C1			
C5	Same as C1			
C6	Same as C2			
C7	Same as C2			
C8	Same as C1			
C9	Same as C1			
C10	Same as C2			
C11	Same as C2			
C12	Same as C1			
C13	Same as C1			
C14	Same as C2			
C15	Same as C2			
C16	Same as C1			
C17	Capacitor, Mica, 56 PF	Mica Mold	MCM10D560K	
C18	Same as C17			
C19	Capacitor, Tantalum, .68MF, 35V	Texas Inst.	SCM684F$_2$P035K4	
C20	Same as C19			
CR1	Diode, Silicon	Redcor	100780	
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Same as CR1			

PARTS LIST

AC FLIP FLOP 600107

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR9	Same as CR1			
CR10	Same as CR1			
CR11	Same as CR1			
CR12	Same as CR1			
CR13	Same as CR1			
CR14	Same as CR1			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR1			
CR19	Same as CR1			
CR20	Same as CR1			
CR21	Same as CR1			
CR22	Same as CR1			
CR23	Same as CR1			
CR24	Same as CR1			
CR25	Same as CR1			
CR26	Same as CR1			
CR27	Same as CR1			
CR28	Same as CR1			
CR29	Same as CR1			
CR30	Same as CR1			
CR31	Same as CR1			
CR32	Same as CR1			
CR33	Same as CR1			
CR34	Same as CR1			
CR35	Same as CR1			
CR36	Same as CR1			
CR37	Same as CR1			

PARTS LIST

AC FLIP FLOP 600107

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR38	Same as CR1			
CR39	Same as CR1			
CR40	Same as CR1			
CR41	Same as CR1			
CR42	Same as CR1			
CR43	Same as CR1			
CR44	Same as CR1			
CR45	Same as CR1			
CR46	Same as CR1			
CR47	Same as CR1			
CR48	Same as CR1			
Q1	Transistor	Redcor	101120	
Q2	Same as Q1			
Q3	Same as Q1			
Q4	Same as Q1			
Q5	Same as Q1			
Q6	Same as Q1			
Q7	Same as Q1			
Q8	Same as Q1			
Q9	Same as Q1			
Q10	Same as Q1			
Q11	Same as Q1			
Q12	Same as Q1			
R1	Resistor, Comp., 4.7K, 1/4W, ±5%	Allen-Bradley	RC07GF472J	
R2	Resistor, Comp., 30K, 1/4W, ±5%	Allen-Bradley	RC07GF303J	
R3	Resistor, Comp., 39K, 1/4W, ±5%	Allen-Bradley	RC07GF393J	

PARTS LIST

AC FLIP FLOP 600107

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R4	Resistor, Comp., 5.1K, 1/4W, ±5%	Allen-Bradley	RC07GF512J	
R5	Same as R4			
R6	Resistor, Comp., 680 Ohms, 1/2W, ±5%	Allen-Bradley	RC20GF680J	
R7	Same as R6			
R8	Same as R3			
R9	Same as R2			
R10	Same as R1			
R11	Same as R1			
R12	Same as R2			
R13	Same as R3			
R14	Same as R4			
R15	Same as R4			
R16	Same as R6			
R17	Same as R6			
R18	Same as R3			
R19	Same as R2			
R20	Same as R1			
R21	Same as R1			
R22	Same as R2			
R23	Same as R3			
R24	Same as R4			
R25	Same as R4			
R26	Same as R6			
R27	Same as R6			
R28	Same as R3			
R29	Same as R2			
R30	Same as R1			
R31	Same as R1			

PARTS LIST

AC FLIP FLOP 600107

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R32	Same as R2			
R33	Same as R3			
R34	Same as R4			
R35	Same as R4			
R36	Same as R6			
R37	Same as R6			
R38	Same as R3			
R39	Same as R2			
R40	Same as R1			
R41	Same as R4			
R42	Same as R1			
R43	Resistor, Comp., 2.2K, 1/4W, ±5%	Allen-Bradley	RC07GF222J	
R44	Resistor, Comp., 1K, 1/4W, ±5%	Allen-Bradley	RC07GF103J	
R45	Resistor, Comp., 27K, 1/4W,±5%	Allen-Bradley	RC07GF273J	
R46	Resistor, Comp., 33K, 1/4W,±5%	Allen-Bradley	RC07GF333J	
R47	Same as R44			
R48	Same as R44			
R49	Same as R44			
R50	Same as R44			
R51	Same as R44			
TP1	Test Jack, Blue	Ucinite	119437-G	
TP2	Test Jack, Black	Ucinite	119437-C	
TP3	Same as TP2			
TP4	Test Jack, Brown	Ucinite	119437-D	
TP5	Same as TP2			
TP6	Test Jack, Violet	Ucinite	119437-K	

PARTS LIST

AC FLIP FLOP 600107

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
TP7	Test Jack, White	Ucinite	119437-A	
TP8	Same as TP7			
TP9	Same as TP7			
TP10	Same as TP7			

REDCOR 600101

INSTRUCTION MANUAL FOR DC FLIP-FLOP MODEL 600101

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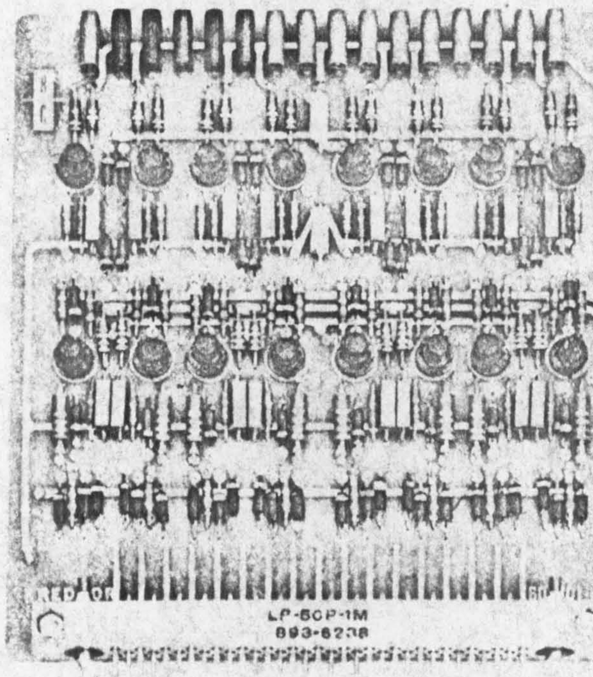


Figure 1. DC Flip-Flop Model 600101

1. DESCRIPTION AND PURPOSE

2. Description - The Model 600101 DC Flip-Flop (see Figure 1) is a printed circuit board module consisting of four independent DC flip-flop circuits. The circuit board is a standard 50-pin module card with components mounted on one side. The board assembly measures 5 x 5.4 inches (see Figure 4) and requires one standard card space. Test points are provided on the top edge of the card for waveform observation and trouble shooting during operation.

3. Purpose - The DC Flip-Flop is used as binary counter, digital register, etc. Each flip-flop circuit counts clock pulses as controlled by externally supplied gating pulses.

4. CIRCUIT DESCRIPTION (See Figures 2 and 3)

5. General - The DC Flip-Flop consists of 4 independent DC toggle pairs. These toggle pairs are two DC flip-flops intercoupled permanently with appropriate clock signals to provide the correct phase and timing relationships such that counting and sequencing functions can be performed. Each input flip-flop counts C1 clock pulses as directed by external gating commands. Each output flip-flop counts C2 clock pulses as directed by the state of its associated input flip-flop. The timing relationship of C1 and C2 clock pulses are such that the output flip-flop is held for a 100 nanosecond delay before it follows the state of its input flip-flop. This relationship allows the input flip-flop to settle down so that operation of the output flip-flop cannot trigger it into the wrong state. Since the flip-flop utilizes DC logic they are insensitive to the input rise time. Because of the DC toggle structure utilized, output loads also have no effect on triggering. Even if the output were shorted, the input flip-flop would hold its conduction state. Thus, the flip-flop can be triggered in accordance with the input gating structure.

6. MAINTENANCE

Standard circuit board maintenance practices apply. Test points are provided on the top edge of the card for waveform observation and trouble shooting during operation. Figure 4 is the Model 600101 DC Flip-Flop, parts location. Replacement parts shall be those specified in the parts list.

CAUTION

When soldering and replacing electronic components on the circuit board, the circuit board and replacement components should not be overheated. Use a 10 watt iron and appropriate heatsink.

7. SPECIFICATIONS

Module Type . . . . **Flip-Flop, JK type**

Number of Circuits 4

Logic . . . . **Negative True**

Logical Levels:

True . . . . -9 V ±3 V
False . . . . 0 V -0.5 V

Input Gate Structure:

Minimum . . . . "AND", "OR"
Maximum . . . . . "AND", "AND", "AND", "OR"

Gating Provided:

Set . . . . . . Clocked 2 "AND" "OR" JK type
Reset . . . . Clocked 2 "AND" "OR" JK type
Auxiliary . . . . DC "OR" set and "OR" reset JK Type (requires external "OR")
Common . . . . DC reset to all stages 12 ma from -12 V
Minimum Input . . . . -6 V
Trigger Point . . . . . . Negative falling edge
Fall Time Requirements . . . . None, or as determined by C1 input clock width and maximum repetition rate

Noise Rejection:

Input Structure . . . . 2.0 V

Output Loading:

To ground . . . . 1500 ohms
To negative voltage . . . . 35 ma
Capacitance . . . . 400 pf no resistance to -12 V
600 pf 400 ohms to -12 V

Time Relationships:

Maximum repetition rate . . . . 1 mc
Delay to last moving point . . . . C1 clock width +100 nsec

Rise Time:

No load . . . . 40 nsec
Full load . . . . 80 nsec

Fall Time:

No load . . . . 100 nsec
Full load . . . . 200 nsec

Clock inputs:

C1 width minimum . . . . 400 nsec
C2 width minimum . . . . 600 nsec

Clock Loads:

C1 to ground . . . . 750 ohms
C2 to ground . . . . 400 ohms

Power Required:

+12 V . . . . 8 ma
-12 V . . . . 125 ma

Board Type . . . . Glass Epoxy

Operating Temperature . . . . 0° - 50°C

Mechanical Size . . . . 5" x 5.4" x .5"

Connector Type . . . . 50 pin

Test Points:

Number 16
Data provided . . . . Each C1 gate set and reset output. Each input flip-flop true and false output

Designation	Color	Data
1	Blue	D Reset
2	Black	D True
3	Black	D Set
4	Brown	D False
5	Black	C Reset
6	Brown	C True
7	Gray	C False
8	Gray	C Set
9	Gray	B Set
10	Gray	B False
11	Gray	B True
12	Gray	B Reset
13	Gray	A False
14	Gray	A Set
15	Gray	A True
16	Gray	A Reset

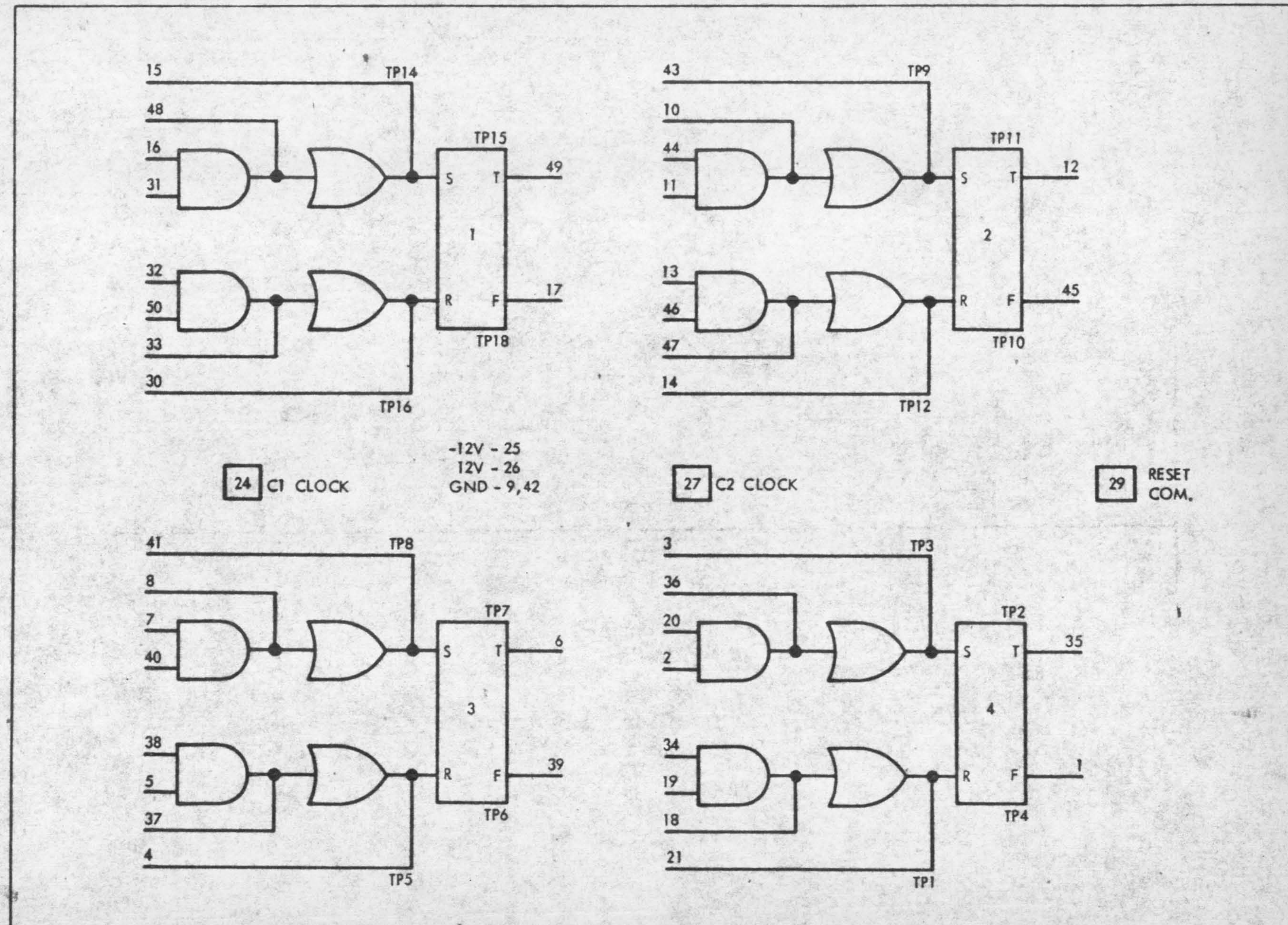
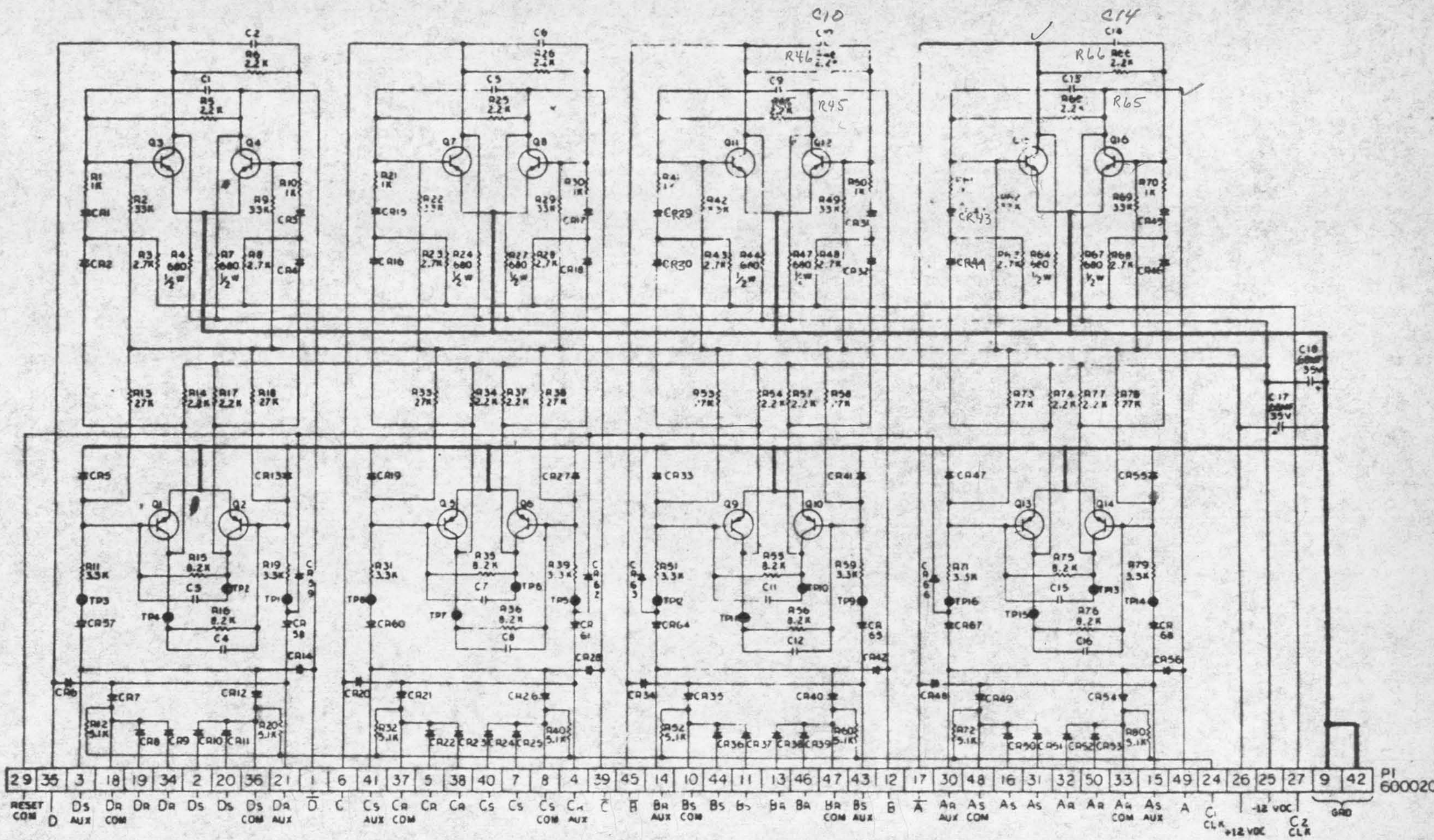


Figure 2. DC Flip-Flop Model 600101, Logic Diagram

REDCOR



4. ALL DIODES ARE REDCOR NO. 100780
3. ALL TRANSISTORS ARE TYPE 101130.
2. ALL CAPACITOR VALUES ARE 27 PF. ±5 %.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT, ±5 %.

This drawing contains information proprietary to the Redcor Corporation and may not be reproduced or used for other than maintenance purposes without prior written permission from an officer of the above firm.

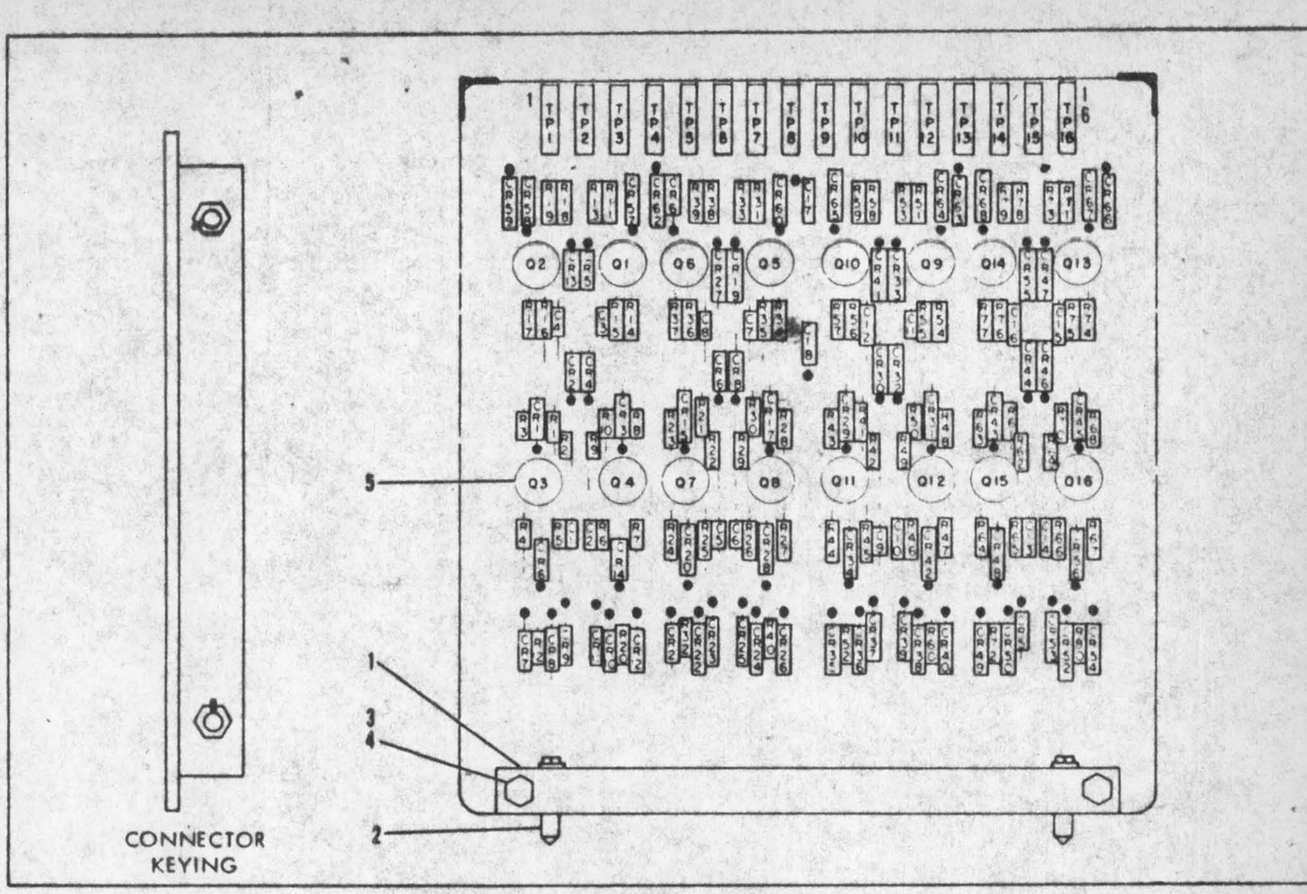


Figure 4. DC Flip-Flop Model 600101, Parts Location

PARTS LIST

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
1	Connector, 50 Pin, Male	Redcor	600020
2	Pin, Polarizing, Male	Redcor	600021
3	Nut, Hex, 4-40, Sm. Pattern, Cad. Stl.		
4	Screw, 100° Flt. Hd., 4-40 x 1/2, Cad. Stl.		
5	Transipad	Milton Ross	10044
C1	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C2	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C3	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C4	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C5	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C6	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C7	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C8	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C9	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C10	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C11	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C12	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C13	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C14	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C15	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C16	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C17	Capacitor, Tant., .68 mf, 35 V	T. I.	SCM684F2PO35K4
C18	Capacitor, Tant., .68 mf, 35 V	T. I.	SCM684F2PO35K4
CR1	Diode, Silicon	Redcor	100780

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
CR2	Diode, Silicon	Redcor	100780
CR3	Diode, Silicon	Redcor	100780
CR4	Diode, Silicon	Redcor	100780
CR5	Diode, Silicon	Redcor	100780
CR6	Diode, Silicon	Redcor	100780
CR7	Diode, Silicon	Redcor	100780
CR8	Diode, Silicon	Redcor	100780
CR9	Diode, Silicon	Redcor	100780
CR10	Diode, Silicon	Redcor	100780
CR11	Diode, Silicon	Redcor	100780
CR12	Diode, Silicon	Redcor	100780
CR13	Diode, Silicon	Redcor	100780
CR14	Diode, Silicon	Redcor	100780
CR15	Diode, Silicon	Redcor	100780
CR16	Diode, Silicon	Redcor	100780
CR17	Diode, Silicon	Redcor	100780
CR18	Diode, Silicon	Redcor	100780
CR19	Diode, Silicon	Redcor	100780
CR20	Diode, Silicon	Redcor	100780
CR21	Diode, Silicon	Redcor	100780
CR22	Diode, Silicon	Redcor	100780
CR23	Diode, Silicon	Redcor	100780
CR24	Diode, Silicon	Redcor	100780
CR25	Diode, Silicon	Redcor	100780
CR26	Diode, Silicon	Redcor	100780
CR27	Diode, Silicon	Redcor	100780
CR28	Diode, Silicon	Redcor	100780
CR29	Diode, Silicon	Redcor	100780
CR30	Diode, Silicon	Redcor	100780
CR31	Diode, Silicon	Redcor	100780
CR32	Diode, Silicon	Redcor	100780
CR33	Diode, Silicon	Redcor	100780
CR34	Diode, Silicon	Redcor	100780
CR35	Diode, Silicon	Redcor	100780
CR36	Diode, Silicon	Redcor	100780
CR37	Diode, Silicon	Redcor	100780
CR38	Diode, Silicon	Redcor	100780
CR39	Diode, Silicon	Redcor	100780
CR40	Diode, Silicon	Redcor	100780
CR41	Diode, Silicon	Redcor	100780
CR42	Diode, Silicon	Redcor	100780
CR43	Diode, Silicon	Redcor	100780
CR44	Diode, Silicon	Redcor	100780
CR45	Diode, Silicon	Redcor	100780
CR46	Diode, Silicon	Redcor	100780
CR47	Diode, Silicon	Redcor	100780
CR48	Diode, Silicon	Redcor	100780
CR49	Diode, Silicon	Redcor	100780
CR50	Diode, Silicon	Redcor	100780
CR51	Diode, Silicon	Redcor	100780
CR52	Diode, Silicon	Redcor	100780
CR53	Diode, Silicon	Redcor	100780
CR54	Diode, Silicon	Redcor	100780
CR55	Diode, Silicon	Redcor	100780
CR56	Diode, Silicon	Redcor	100780
CR57	Diode, Silicon	Redcor	100780
CR58	Diode, Silicon	Redcor	100780
CR59	Diode, Silicon	Redcor	100780
CR60	Diode, Silicon	Redcor	100780
CR61	Diode, Silicon	Redcor	100780
CR62	Diode, Silicon	Redcor	100780
CR63	Diode, Silicon	Redcor	100780
CR64	Diode, Silicon	Redcor	100780
CR65	Diode, Silicon	Redcor	100780

REDCOR

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
CR66	Diode, Silicon	Redcor	100780
CR67	Diode, Silicon	Redcor	100780
CR68	Diode, Silicon	Redcor	100780
Q1	Transistor, PNP	Redcor	101120
Q2	Transistor, PNP	Redcor	101120
Q3	Transistor, PNP	Redcor	101120
Q4	Transistor, PNP	Redcor	101120
Q5	Transistor, PNP	Redcor	101120
Q6	Transistor, PNP	Redcor	101120
Q7	Transistor, PNP 2N3251	Redcor	101120
Q8	Transistor, PNP	Redcor	101120
Q9	Transistor, PNP	Redcor	101120
Q10	Transistor, PNP	Redcor	101120
Q11	Transistor, PNP	Redcor	101120
Q12	Transistor, PNP	Redcor	101120
Q13	Transistor, PNP	Redcor	101120
Q14	Transistor, PNP	Redcor	101120
Q15	Transistor, PNP	Redcor	101120
Q16	Transistor, PNP	Redcor	101120
R1	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
R2	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R3	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R4	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J
R5	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R6	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R7	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J
R8	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R9	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R10	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
R11	Resistor, Comp., 3.3K ohm, 1/4W, ±5%	A. B.	RC07GF332J
R12	Resistor, Comp., 5.1K ohm, 1/4W, ±5%	A. B.	RC07GF512J
R13	Resistor, Comp., 27K ohm, 1/4W, ±5%	A. B.	RC07GF273J
R14	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R15	Resistor, Comp., 8.2K ohm, 1/4W, ±5%	A. B.	RC07GF822J
R16	Resistor, Comp., 8.2K ohm, 1/4W, ±5%	A. B.	RC07GF822J
R17	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R18	Resistor, Comp., 27K ohm, 1/4W, ±5%	A. B.	RC07GF273J
R19	Resistor, Comp., 3.3K ohm, 1/4W, ±5%	A. B.	RC07GF332J
R20	Resistor, Comp., 5.1K ohm, 1/4W, ±5%	A. B.	RC07GF512J
R21	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
R22	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R23	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R24	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J
R25	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R26	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R27	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J
R28	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R29	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R30	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
R31	Resistor, Comp., 3.3K ohm, 1/4W, ±5%	A. B.	RC07GF332J
R32	Resistor, Comp., 5.1K ohm, 1/4W, ±5%	A. B.	RC07GF512J
R33	Resistor, Comp., 27K ohm, 1/4W, ±5%	A. B.	RC07GF273J
R34	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R35	Resistor, Comp., 8.2K ohm, 1/4W, ±5%	A. B.	RC07GF822J
R36	Resistor, Comp., 8.2K ohm, 1/4W, ±5%	A. B.	RC07GF822J
R37	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R38	Resistor, Comp., 27K ohm, 1/4W, ±5%	A. B.	RC07GF273J
R39	Resistor, Comp., 3.3K ohm, 1/4W, ±5%	A. B.	RC07GF332J
R40	Resistor, Comp., 5.1K ohm, 1/4W, ±5%	A. B.	RC07GF512J
R41	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
R42	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R43	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R44	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J

REDCOR 600101

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
R45	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R46	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R47	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J
R48	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R49	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R50	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
R51	Resistor, Comp., 3.3K ohm, 1/4W, ±5%	A. B.	RC07GF332J
R52	Resistor, Comp., 5.1K ohm, 1/4W, ±5%	A. B.	RC07GF512J
R53	Resistor, Comp., 27K ohm, 1/4W, ±5%	A. B.	RC07GF273J
R54	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R55	Resistor, Comp., 8.2K ohm, 1/4W, ±5%	A. B.	RC07GF822J
R56	Resistor, Comp., 8.2K ohm, 1/4W, ±5%	A. B.	RC07GF822J
R57	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R58	Resistor, Comp., 27K ohm, 1/4W, ±5%	A. B.	RC07GF273J
R59	Resistor, Comp., 3.3K ohm, 1/4W, ±5%	A. B.	RC07GF332J
R60	Resistor, Comp., 5.1K ohm, 1/4W, ±5%	A. B.	RC07GF512J
R61	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
R62	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R63	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R64	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J
R65	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R66	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R67	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J
R68	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R69	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R70	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
R71	Resistor, Comp., 3.3K ohm, 1/4W, ±5%	A. B.	RC07GF332J
R72	Resistor, Comp., 5.1K ohm, 1/4W, ±5%	A. B.	RC07GF512J
R73	Resistor, Comp., 27K ohm, 1/4W, ±5%	A. B.	RC07GF273J
R74	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R75	Resistor, Comp., 8.2K ohm, 1/4W, ±5%	A. B.	RC07GF822J
R76	Resistor, Comp., 8.2K ohm, 1/4W, ±5%	A. B.	RC07GF822J
R77	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R78	Resistor, Comp., 27K ohm, 1/4W, ±5%	A. B.	RC07GF273J
R79	Resistor, Comp., 3.3K ohm, 1/4W, ±5%	A. B.	RC07GF332J
R80	Resistor, Comp., 5.1K ohm, 1/4W, ±5%	A. B.	RC07GF512J
TP1	Test Probe, Receptacle, Blue	Ucinite	119437-G
TP2	Test Probe, Receptacle, Black	Ucinite	119437-C
TP3	Test Probe, Receptacle, Black	Ucinite	119437-C
TP4	Test Probe, Receptacle, Brown	Ucinite	119437-D
TP5	Test Probe, Receptacle, Black	Ucinite	119437-C
TP6	Test Probe, Receptacle, Brown	Ucinite	119437-D
TP7	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP8	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP9	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP10	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP11	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP12	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP13	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP14	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP15	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP16	Test Probe, Receptacle, Gray	Ucinite	119437-J

INSTRUCTION MANUAL FOR DC FLIP-FLOP MODEL 600101

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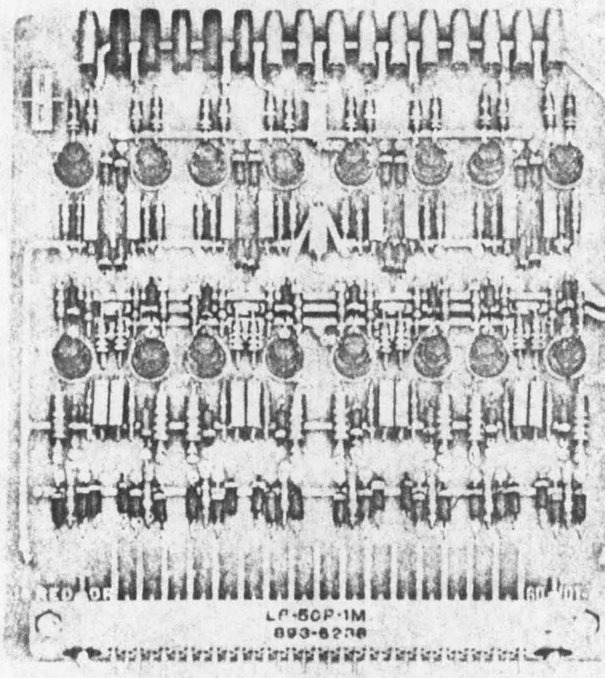

Figure 1. DC Flip-Flop Model 600101

1. DESCRIPTION AND PURPOSE

2. Description - The Model 600101 DC Flip-Flop (see Figure 1) is a printed circuit board module consisting of four independent DC flip-flop circuits. The circuit board is a standard 50-pin module card with components mounted on one side. The board assembly measures 5 x 5.4 inches (see Figure 4) and requires one standard card space. Test points are provided on the top edge of the card for waveform observation and trouble shooting during operation.

3. Purpose - The DC Flip-Flop is used as binary counter, digital register, etc. Each flip-flop circuit counts clock pulses as controlled by externally supplied gating pulses.

4. CIRCUIT DESCRIPTION (See Figures 2 and 3)

5. General - The DC Flip-Flop consists of 4 independent DC toggle pairs. These toggle pairs are two DC flip-flops intercoupled permanently with appropriate clock signals to provide the correct phase and timing relationships such that counting and sequencing functions can be performed. Each input flip-flop counts C1 clock pulses as directed by external gating commands. Each output flip-flop counts C2 clock pulses as directed by the state of its associated input flip-flop. The timing relationship of C1 and C2 clock pulses are such that the output flip-flop is held for a 100 nanosecond delay before it follows the state of its input flip-flop. This relationship allows the input flip-flop to settle down so that operation of the output flip-flop cannot trigger it into the wrong state. Since the flip-flop utilizes DC logic they are insensitive to the input rise time. Because of the DC toggle structure utilized, output loads also have no effect on triggering. Even if the output were shorted, the input flip-flop would hold its conduction state. Thus, the flip-flop can be triggered in accordance with the input gating structure.

6. MAINTENANCE

Standard circuit board maintenance practices apply. Test points are provided on the top edge of the card for waveform observation and trouble shooting during operation. Figure 4 is the Model 600101 DC Flip-Flop, parts location. Replacement parts shall be those specified in the parts list.

CAUTION

When soldering and replacing electronic components on the circuit board, the circuit board and replacement components should not be overheated. Use a 10 watt iron and appropriate heatsink.

7. SPECIFICATIONS.

Module Type . . . . Flip-Flop, JK type

Number of Circuits 4

Logic . . . . Negative True

Logical Levels:

True . . . . -9 V ±3 V
False . . . . 0 V -0.5 V.

Input Gate Structure:

Minimum . . . . "AND", "OR"
Maximum . . . . . "AND", "AND", "AND", "OR"

Gating Provided:

Set . . . . . . Clocked 2 "AND" "OR" JK type
Reset . . . . Clocked 2 "AND" "OR" JK type
Auxiliary . . . . DC "OR" set and "OR" reset JK Type (requires external "OR")
Common . . . . DC reset to all stages 12 ma from -12 V
Minimum Input . . . . -6 V
Trigger Point . . . . . . Negative falling edge
Fall Time Requirements . . . . None, or as determined by C1 input clock width and maximum repetition rate

Noise Rejection:

Input Structure . . . . 2.0 V

Output Loading:

To ground . . . . 1500 ohms
To negative voltage . . . . 35 ma
Capacitance . . . . 400 pf no resistance to -12 V
600 pf 400 ohms to -12 V

Time Relationships:

Maximum repetition rate . . . . 1 mc
Delay to last moving point . . . . C1 clock width +100 nsec

Rise Time:

No load . . . . 40 nsec
Full load . . . . 80 nsec

Fall Time:

No load . . . . 100 nsec
Full load . . . . 200 nsec

Clock inputs:

C1 width minimum . . . . 400 nsec
C2 width minimum . . . . 600 nsec

Clock Loads:

C1 to ground . . . . 750 ohms
C2 to ground . . . . 400 ohms

Power Required:

+12 V . . . . 8 ma
-12 V . . . . 125 ma

Board Type . . . . Glass Epoxy

Operating Temperature . . . . 0° - 50°C

Mechanical Size . . . . 5" x 5.4" x .5"

Connector Type . . . . 50 pin

Test Points:

Number 16
Data provided . . . . Each C1 gate set and reset output. Each input flip-flop true and false output

Designation	Color	Data
1	Blue	D Reset
2	Black	D True
3	Black	D Set
4	Brown	D False
5	Black	C Reset
6	Brown	C True
7	Gray	C False
8	Gray	C Set
9	Gray	B Set
10	Gray	B False
11	Gray	B True
12	Gray	B Reset
13	Gray	A False
14	Gray	A Set
15	Gray	A True
16	Gray	A Reset

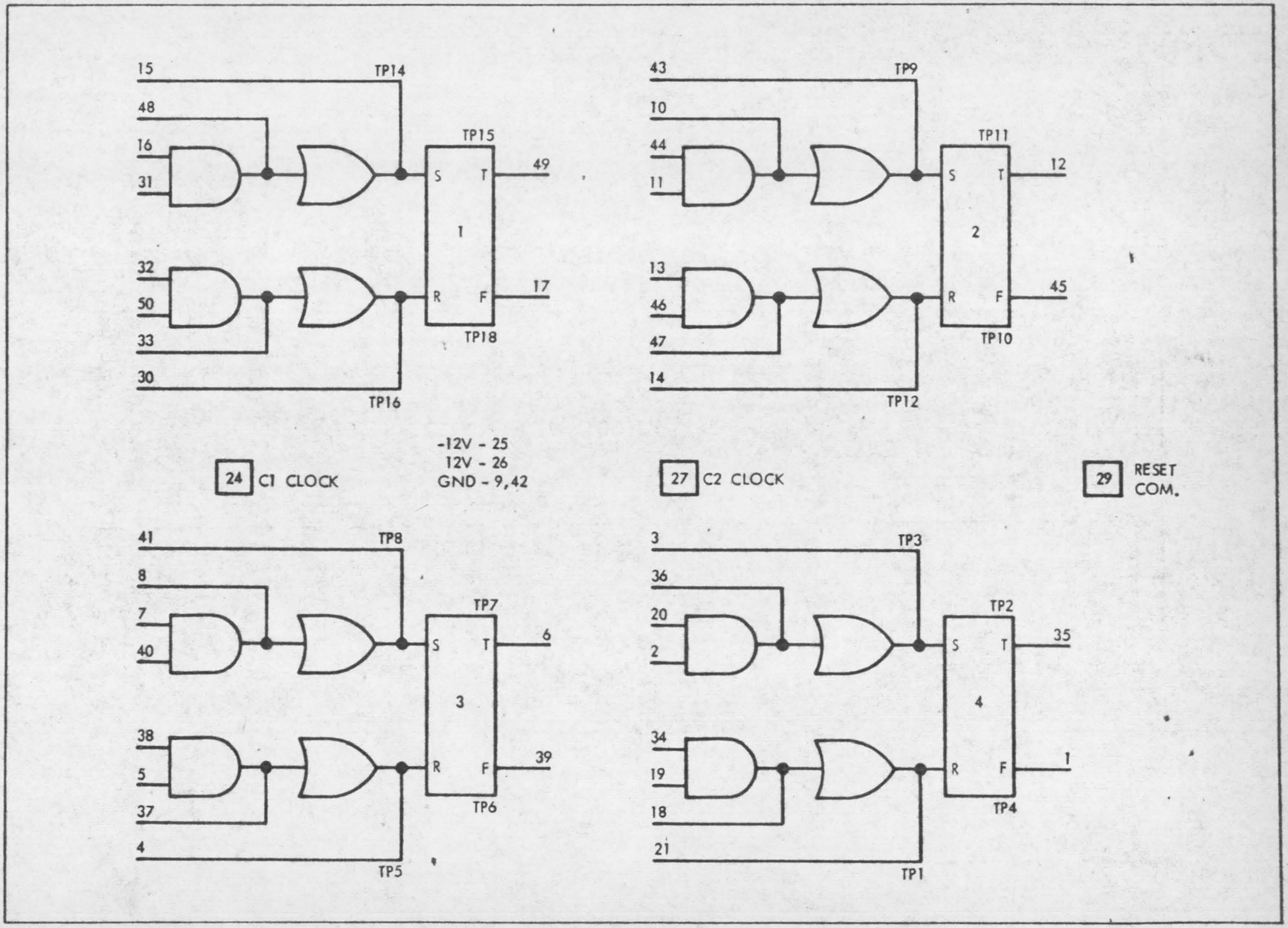

Figure 2. DC Flip-Flop Model 600101, Logic Diagram

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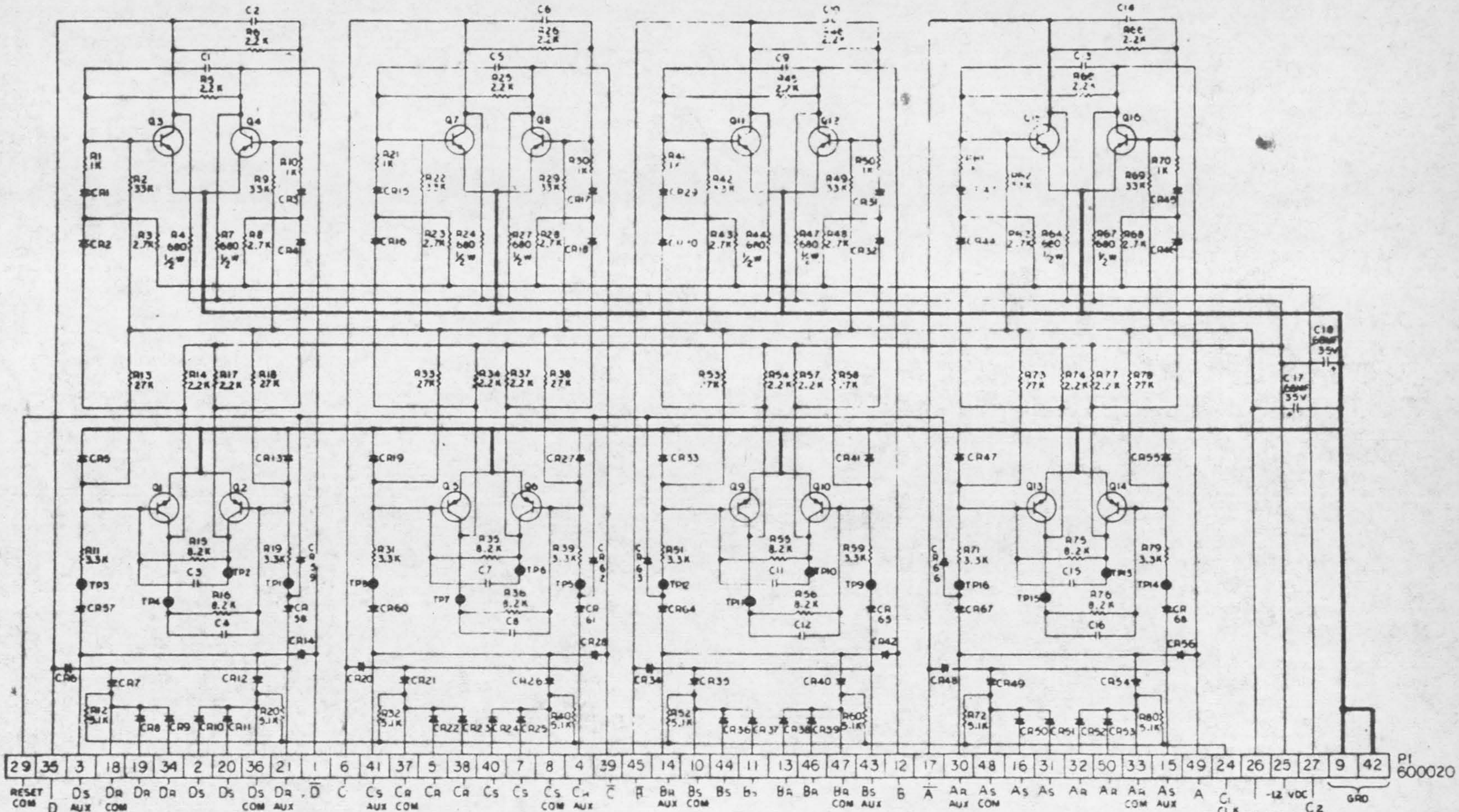

4. ALL DIODES ARE REDCOR NO. 100780
3. ALL TRANSISTORS ARE TYPE 101130 .
2. ALL CAPACITOR VALUES ARE 27 PF, ±5 %.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT, ±5 %.
NOTE: UNLESS OTHERWISE SPECIFIED

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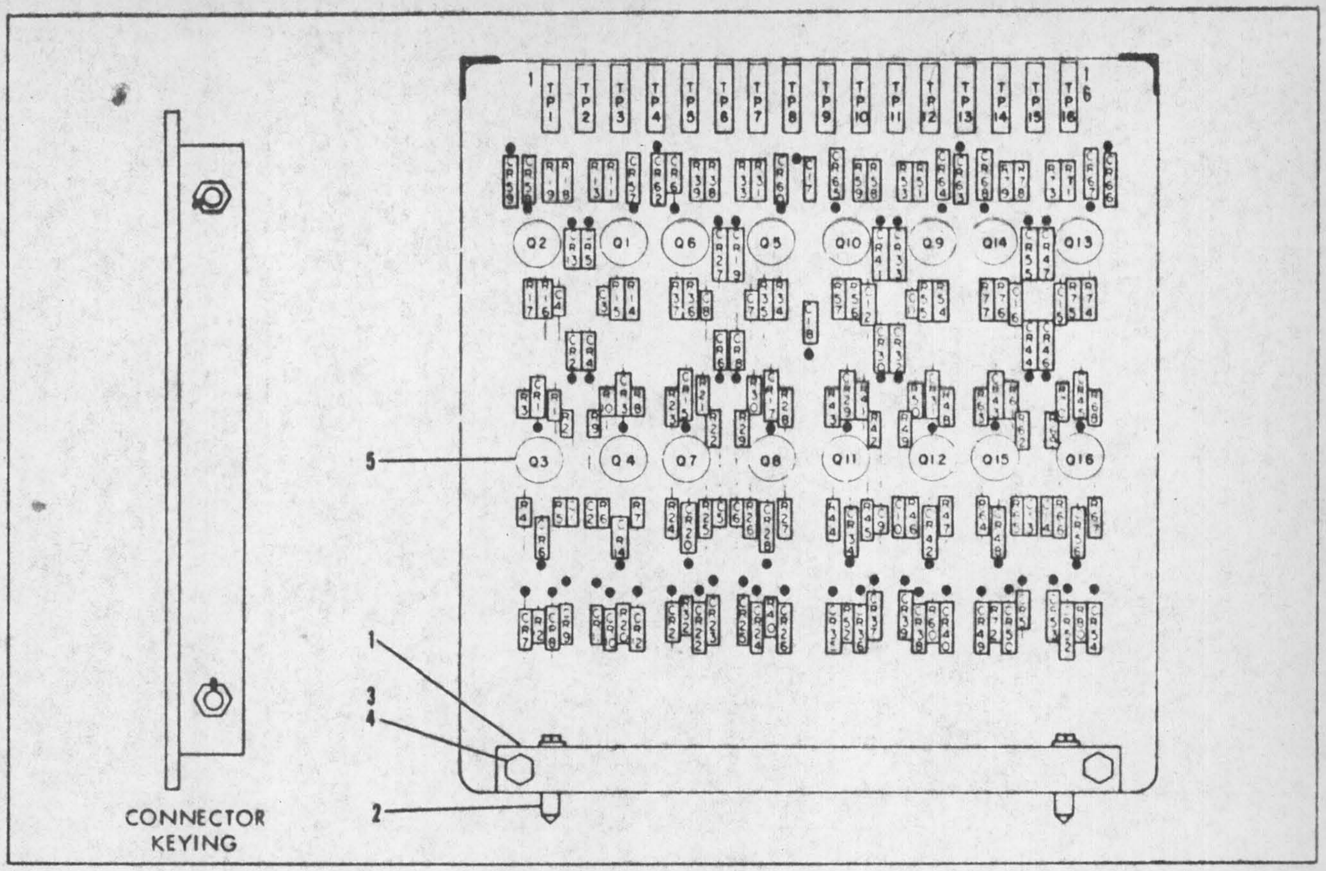

Figure 4. DC Flip-Flop Model 600101, Parts Location

PARTS LIST

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
1	Connector, 50 Pin, Male	Redcor	600020
2	Pin, Polarizing, Male	Redcor	600021
3	Nut, Hex, 4-40, Sm. Pattern, Cad. Stl.		
4	Screw, 100° Flt. Hd., 4-40 x 1/2, Cad. Stl.		
5	Transipad	Milton Ross	10044
C1	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C2	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C3	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C4	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C5	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C6	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C7	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C8	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C9	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C10	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C11	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C12	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C13	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C14	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C15	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C16	Capacitor, Mica, 27 pf, 300 V	Micamold	MCM10D270K
C17	Capacitor, Tant., .68 mf, 35 V	T. I.	SCM684F2PO35K4
C18	Capacitor, Tant., .68 mf, 35 V	T. I.	SCM684F2PO35K4
CR1	Diode, Silicon	Redcor	100780

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
CR2	Diode, Silicon	Redcor	100780
CR3	Diode, Silicon	Redcor	100780
CR4	Diode, Silicon	Redcor	100780
CR5	Diode, Silicon	Redcor	100780
CR6	Diode, Silicon	Redcor	100780
CR7	Diode, Silicon	Redcor	100780
CR8	Diode, Silicon	Redcor	100780
CR9	Diode, Silicon	Redcor	100780
CR10	Diode, Silicon	Redcor	100780
CR11	Diode, Silicon	Redcor	100780
CR12	Diode, Silicon	Redcor	100780
CR13	Diode, Silicon	Redcor	100780
CR14	Diode, Silicon	Redcor	100780
CR15	Diode, Silicon	Redcor	100780
CR16	Diode, Silicon	Redcor	100780
CR17	Diode, Silicon	Redcor	100780
CR18	Diode, Silicon	Redcor	100780
CR19	Diode, Silicon	Redcor	100780
CR20	Diode, Silicon	Redcor	100780
CR21	Diode, Silicon	Redcor	100780
CR22	Diode, Silicon	Redcor	100780
CR23	Diode, Silicon	Redcor	100780
CR24	Diode, Silicon	Redcor	100780
CR25	Diode, Silicon	Redcor	100780
CR26	Diode, Silicon	Redcor	100780
CR27	Diode, Silicon	Redcor	100780
CR28	Diode, Silicon	Redcor	100780
CR29	Diode, Silicon	Redcor	100780
CR30	Diode, Silicon	Redcor	100780
CR31	Diode, Silicon	Redcor	100780
CR32	Diode, Silicon	Redcor	100780
CR33	Diode, Silicon	Redcor	100780
CR34	Diode, Silicon	Redcor	100780
CR35	Diode, Silicon	Redcor	100780
CR36	Diode, Silicon	Redcor	100780
CR37	Diode, Silicon	Redcor	100780
CR38	Diode, Silicon	Redcor	100780
CR39	Diode, Silicon	Redcor	100780
CR40	Diode, Silicon	Redcor	100780
CR41	Diode, Silicon	Redcor	100780
CR42	Diode, Silicon	Redcor	100780
CR43	Diode, Silicon	Redcor	100780
CR44	Diode, Silicon	Redcor	100780
CR45	Diode, Silicon	Redcor	100780
CR46	Diode, Silicon	Redcor	100780
CR47	Diode, Silicon	Redcor	100780
CR48	Diode, Silicon	Redcor	100780
CR49	Diode, Silicon	Redcor	100780
CR50	Diode, Silicon	Redcor	100780
CR51	Diode, Silicon	Redcor	100780
CR52	Diode, Silicon	Redcor	100780
CR53	Diode, Silicon	Redcor	100780
CR54	Diode, Silicon	Redcor	100780
CR55	Diode, Silicon	Redcor	100780
CR56	Diode, Silicon	Redcor	100780
CR57	Diode, Silicon	Redcor	100780
CR58	Diode, Silicon	Redcor	100780
CR59	Diode, Silicon	Redcor	100780
CR60	Diode, Silicon	Redcor	100780
CR61	Diode, Silicon	Redcor	100780
CR62	Diode, Silicon	Redcor	100780
CR63	Diode, Silicon	Redcor	100780
CR64	Diode, Silicon	Redcor	100780
CR65	Diode, Silicon	Redcor	100780

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
CR66	Diode, Silicon	Redcor	100780
CR67	Diode, Silicon	Redcor	100780
CR68	Diode, Silicon	Redcor	100780
Q1	Transistor, PNP	Redcor	1[illegible]120
Q2	Transistor, PNP	Redcor	101120
Q3	Transistor, PNP	Redcor	101120
Q4	Transistor, PNP	Redcor	101120
Q5	Transistor, PNP	Redcor	101120
Q6	Transistor, PNP	Redcor	101120
Q7	Transistor, PNP	Redcor	101120
Q8	Transistor, PNP	Redcor	101120
Q9	Transistor, PNP	Redcor	101120
Q10	Transistor, PNP	Redcor	101120
Q11	Transistor, PNP	Redcor	101120
Q12	Transistor, PNP	Redcor	101120
Q13	Transistor, PNP	Redcor	101120
Q14	Transistor, PNP	Redcor	101120
Q15	Transistor, PNP	Redcor	101120
Q16	Transistor, PNP	Redcor	101120
R1	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
R2	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R3	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R4	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J
R5	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R6	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R7	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J
R8	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R9	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R10	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
R11	Resistor, Comp., 3.3K ohm, 1/4W, ±5%	A. B.	RC07GF332J
R12	Resistor, Comp., 5.1K ohm, 1/4W, ±5%	A. B.	RC07GF512J
R13	Resistor, Comp., 27K ohm, 1/4W, ±5%	A. B.	RC07GF273J
R14	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R15	Resistor, Comp., 8.2K ohm, 1/4W, ±5%	A. B.	RC07GF822J
R16	Resistor, Comp., 8.2K ohm, 1/4W, ±5%	A. B.	RC07GF822J
R17	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R18	Resistor, Comp., 27K ohm, 1/4W, ±5%	A. B.	RC07GF273J
R19	Resistor, Comp., 3.3K ohm, 1/4W, ±5%	A. B.	RC07GF332J
R20	Resistor, Comp., 5.1K ohm, 1/4W, ±5%	A. B.	RC07GF512J
R21	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
R22	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R23	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R24	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J
R25	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R26	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R27	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J
R28	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R29	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R30	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
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R41	Resistor, Comp., 1K ohm, 1/4W, ±5%	A. B.	RC07GF102J
R42	Resistor, Comp., 33K ohm, 1/4W, ±5%	A. B.	RC07GF333J
R43	Resistor, Comp., 2.7K ohm, 1/4W, ±5%	A. B.	RC07GF272J
R44	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
R45	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R46	Resistor, Comp., 2.2K ohm, 1/4W, ±5%	A. B.	RC07GF222J
R47	Resistor, Comp., 680 ohm, 1/2W, ±5%	A. B.	RC20GF681J
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R78	Resistor, Comp., 27K ohm, 1/4W, ±5%	A. B.	RC07GF273J
R79	Resistor, Comp., 3.3K ohm, 1/4W, ±5%	A. B.	RC07GF332J
R80	Resistor, Comp., 5.1K ohm, 1/4W, ±5%	A. B.	RC07GF512J
TP1	Test Probe, Receptacle, Blue	Ucinite	119437-G
TP2	Test Probe, Receptacle, Black	Ucinite	119437-C
TP3	Test Probe, Receptacle, Black	Ucinite	119437-C
TP4	Test Probe, Receptacle, Brown	Ucinite	119437-D
TP5	Test Probe, Receptacle, Black	Ucinite	119437-C
TP6	Test Probe, Receptacle, Brown	Ucinite	119437-D
TP7	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP8	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP9	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP10	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP11	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP12	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP13	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP14	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP15	Test Probe, Receptacle, Gray	Ucinite	119437-J
TP16	Test Probe, Receptacle, Gray	Ucinite	119437-J

INSTRUCTION MANUAL

FOR

POWER DRIVER & GATE

600098 CARDS

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Canoga Park, Calif.

POWER DRIVER & GATE 600098 CARDS

This module contains 2 identical independent DC power driver circuits suitable for driving both heavy loads to ground and to -12 volts. In addition to the power drivers, 18 two diode gates are provided for single and gate "AND" OR entry to standard Flip Flops. The primary use for this driver is to provide clock inputs to the 600101 module and for clock drivers in general. Also to provide additional gates for entering the 600101 module. Input gating is included on the card to facilitate gating of clock lines for function select operations.

Module type:	Power driver and gate
No. of circuits:	2 power drivers and 18 two term "AND" gates
Type of logic:	Negative true

Power Driver Section

Voltage outputs:	
True:	-9 ±3 volts
False:	0 -0.5 volts
Input gating structure:	
Minimum:	"AND" OR
Maximum:	"AND" "AND" "AND", "OR"
Gating provided:	2 term "AND" single "OR"
Noise Rejection:	1.5 volts
Minimum input level:	-6 volts
Trigger point:	Negative falling edge

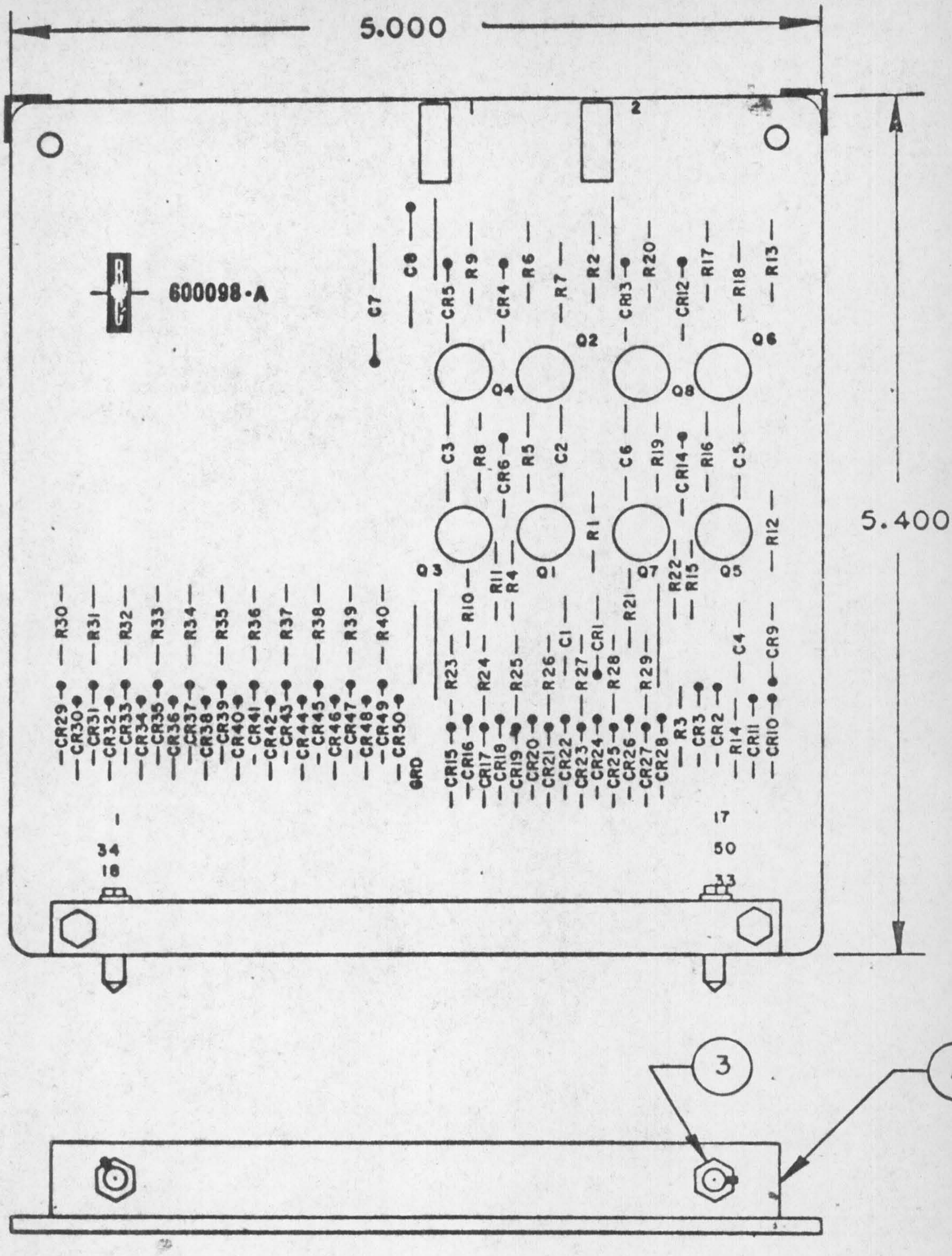
600098 Power Driver Section - (continued)

Fall time requirements:	To maintain output rise and fall times min. 300 nanosecs. Otherwise none.
Output loading:	
To ground:	300 ohms
To -12 volts:	65mA
Output Capacitive loading:	800pf with full resistive load to ground
Maximum repetition rate:	1 Megacycle
Delay to last moving point:	100 nanosecs. full load
Output rise time:	
No load	30 nanosecs
Full load	60 nanosecs
Output fall time:	
No load	30 nanosecs
Full load	70 nanosecs

Output short circuit proof with respect to ground.

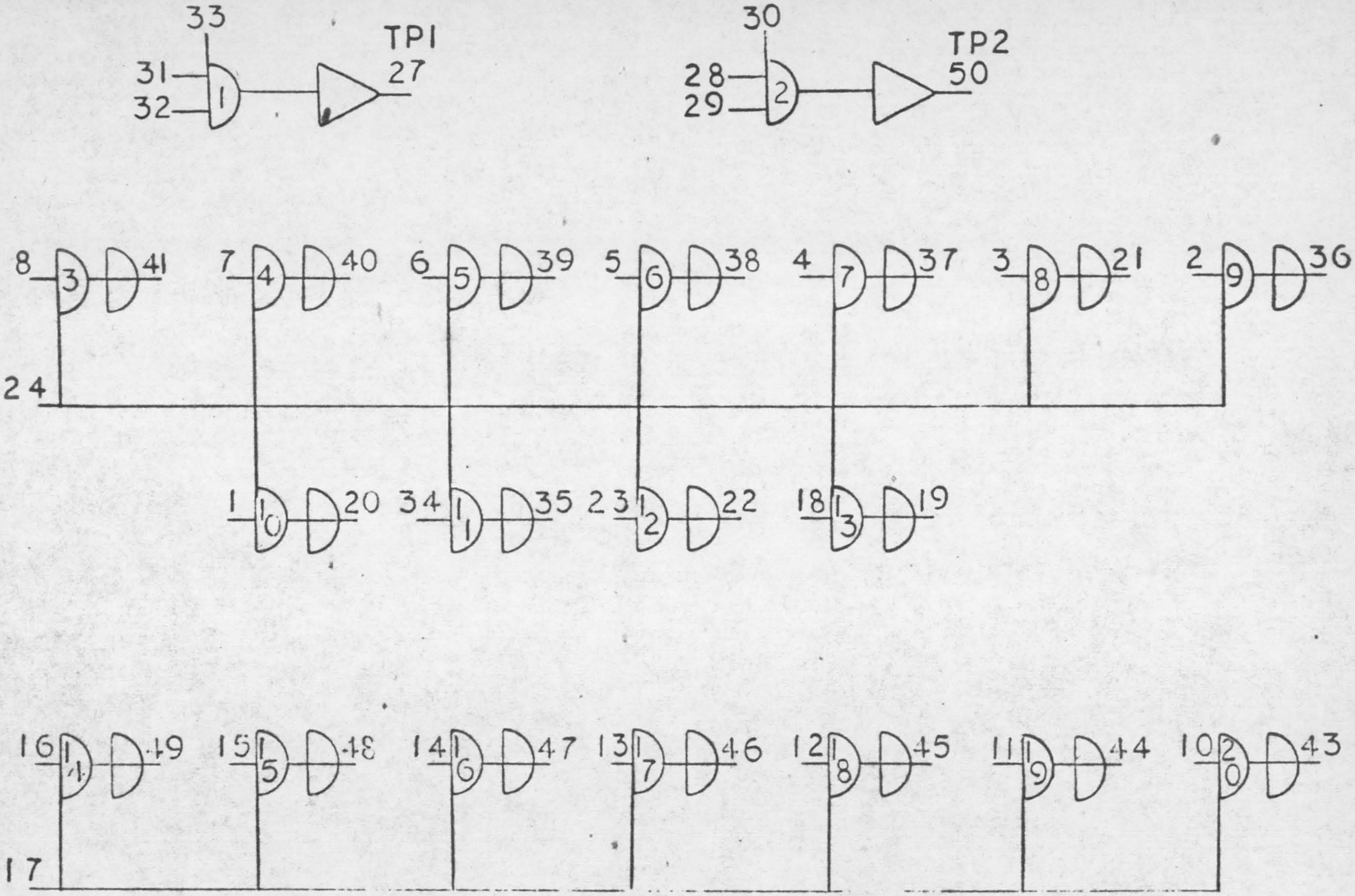
<u>Gate Circuits</u>

Recovery time:	150 nanosecs to -9 volts
Reversed bias leakage:	10µA at 25°C 35µA at 50°C
Power requirements:	+12.5 15mA
Worst case:	-12.5 75mA
Operating Temperature:	0-50°C
Mechanical Size:	5" x 5.4" x 0.5"
Connector Type:	50 pin



600098
RESET DRIVERS AND GATES

REFERENCE DWGS: SCHEMATIC NO. 600108, PARTS LIST NO. 600142



RESET DRIVER 600098

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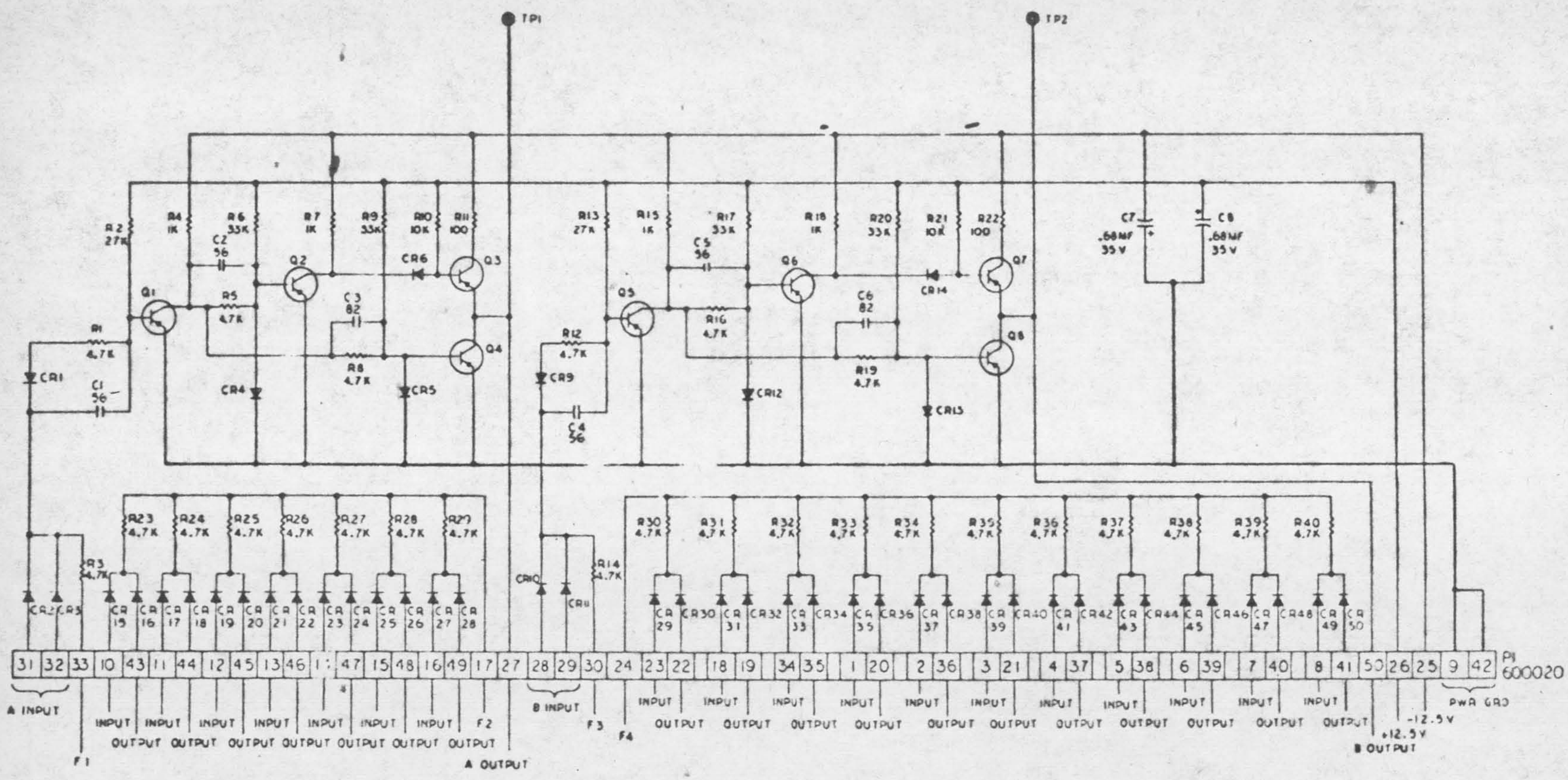

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4. ALL TRANSISTORS ARE 2N2401.
3. ALL DIODES ARE REDCOR 100780-3.
2. ALL CAPACITANCE VALUES ARE IN PICO-FARADS
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 WATT, ±5%.
NOTE UNLESS OTHERWISE SPECIFIED

REFERENCE DESIGNATIONS					
FIRST		LAST		DELETED	
R1		R40			
C1		C8			
CR1		CR50		CR7	CR8
Q1		Q8			
TP1		TP2			
P1		P1			

REDCOR CORPORATION

600098

RESET DRIVER, SCHEMATIC DIAG

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NONE

(600098)

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PARTS LIST

600098 RESET DRIVER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Disc, 56PF	Arco	CCD-560	
C2	Same as C1			
C3	Capacitor, Disc, 82PF	Arco	CCD-820	
C4	Same as C1			
C5	Same as C1			
C6	Same as C3			
C7	Capacitor, Tantalum, .68MF, 35V	Texas Inst.	SCM684F$_2$P035K4	
C8	Same as C7			
CR1	Diode, Silicon	Redcor	100780-3	
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Not Used			
CR8	Not Used			
CR9	Same as CR1			
CR10	Same as CR1			
CR11	Same as CR1			
CR12	Same as CR1			
CR13	Same as CR1			
CR14	Same as CR1			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR1			
CR19	Same as CR1			
CR20	Same as CR1			

PARTS LIST

600098 RESET DRIVER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR50	Same as CR1			
P1	Connector,50 Pin, Male	Redcor	600020	
Q1	Transistor, PNP	Philco	2N2401	
Q2	Same as Q1			
Q3	Same as Q1			
Q4	Same as Q1			
Q5	Same as Q1			
Q6	Same as Q1			
Q7	Same as Q1			
Q8	Same as Q1			
R1	Resistor, Comp., 4.7K, 1/4W, ±5%	Allen-Bradley	RC07GF472J	
R2	Resistor, Comp., 27K, 1/4W, ±5%	Allen-Bradley	RC07GF273J	
R3	Same as R1			
R4	Resistor, Comp., 1K, 1/4W, ±5%	Allen-Bradley	RC07GF102J	
R5	Same as R1			
R6	Resistor, Comp., 33K, 1/4W, ±5%	Allen-Bradley	RC07GF333J	
R7	Same as R4			
R8	Same as R1			
R9	Same as R6			
R10	Resistor, Comp., 10K, 1/4W, ±5%	Allen-Bradley	RC07GF103J	
R11	Resistor, Comp., 100 Ohm, 1/4W, ±5%	Allen-Bradley	RC07GF101J	
R12	Same as R1			
R13	Same as R2			
R14	Same as R1			
R15	Same as R4			

PARTS LIST

600098 RESET DRIVER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR21	Same as CR1			
CR22	Same as CR1			
CR23	Same as CR1			
CR24	Same as CR1			
CR25	Same as CR1			
CR26	Same as CR1			
CR27	Same as CR1			
CR28	Same as CR1			
CR29	Same as CR1			
CR30	Same as CR1			
CR31	Same as CR1			
CR32	Same as CR1			
CR33	Same as CR1			
CR34	Same as CR1			
CR35	Same as CR1			
CR36	Same as CR1			
CR37	Same as CR1			
CR38	Same as CR1			
CR39	Same as CR1			
CR40	Same as CR1			
CR41	Same as CR1			
CR42	Same as CR1			
CR43	Same as CR1			
CR44	Same as CR1			
CR45	Same as CR1			
CR46	Same as CR1			
CR47	Same as CR1			
CR48	Same as CR1			
CR49	Same as CR1			

PARTS LIST

600098 RESET DRIVER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R16	Same as R1			
R17	Same as R6			
R18	Same as R4			
R19	Same as R1			
R20	Same as R6			
R21	Same as R10			
R22	Same as R11			
R23	Same as R1			
R24	Same as R1			
R25	Same as R1			
R26	Same as R1			
R27	Same as R1			
R28	Same as R1			
R29	Same as R1			
R30	Same as R1			
R31	Same as R1			
R32	Same as R1			
R33	Same as R1			
R34	Same as R1			
R35	Same as R1			
R36	Same as R1			
R37	Same as R1			
R38	Same as R1			
R39	Same as R1			
R40	Same as R1			
TP1	Test Probe Receptacle,Wht	Ucinite	119437-A	
TP2	Test Probe Receptacle,Gry	Ucinite	119437-J	

INSTRUCTION MANUAL

FOR

POWER DRIVER & GATE

600098 CARDS

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Canoga Park, Calif.

POWER DRIVER & GATE 600098 CARDS

This module contains 2 identical independent DC power driver circuits suitable for driving both heavy loads to ground and to -12 volts. In addition to the power drivers, 18 two diode gates are provided for single and gate "AND" OR entry to standard Flip Flops. The primary use for this driver is to provide clock inputs to the 600101 module and for clock drivers in general. Also to provide additional gates for entering the 600101 module. Input gating is included on the card to facilitate gating of clock lines for function select operations.

Module type:	Power driver and gate
No. of circuits:	2 power drivers and 18 two term "AND" gates
Type of logic:	Negative true

Power Driver Section

Voltage outputs:	
True:	-9 ±3 volts
False:	0 -0.5 volts
Input gating structure:	
Minimum:	"AND" OR
Maximum:	"AND" "AND" "AND", "OR"
Gating provided:	2 term "AND" single "OR"
Noise Rejection:	1.5 volts
Minimum input level:	-6 volts
Trigger point:	Negative falling edge

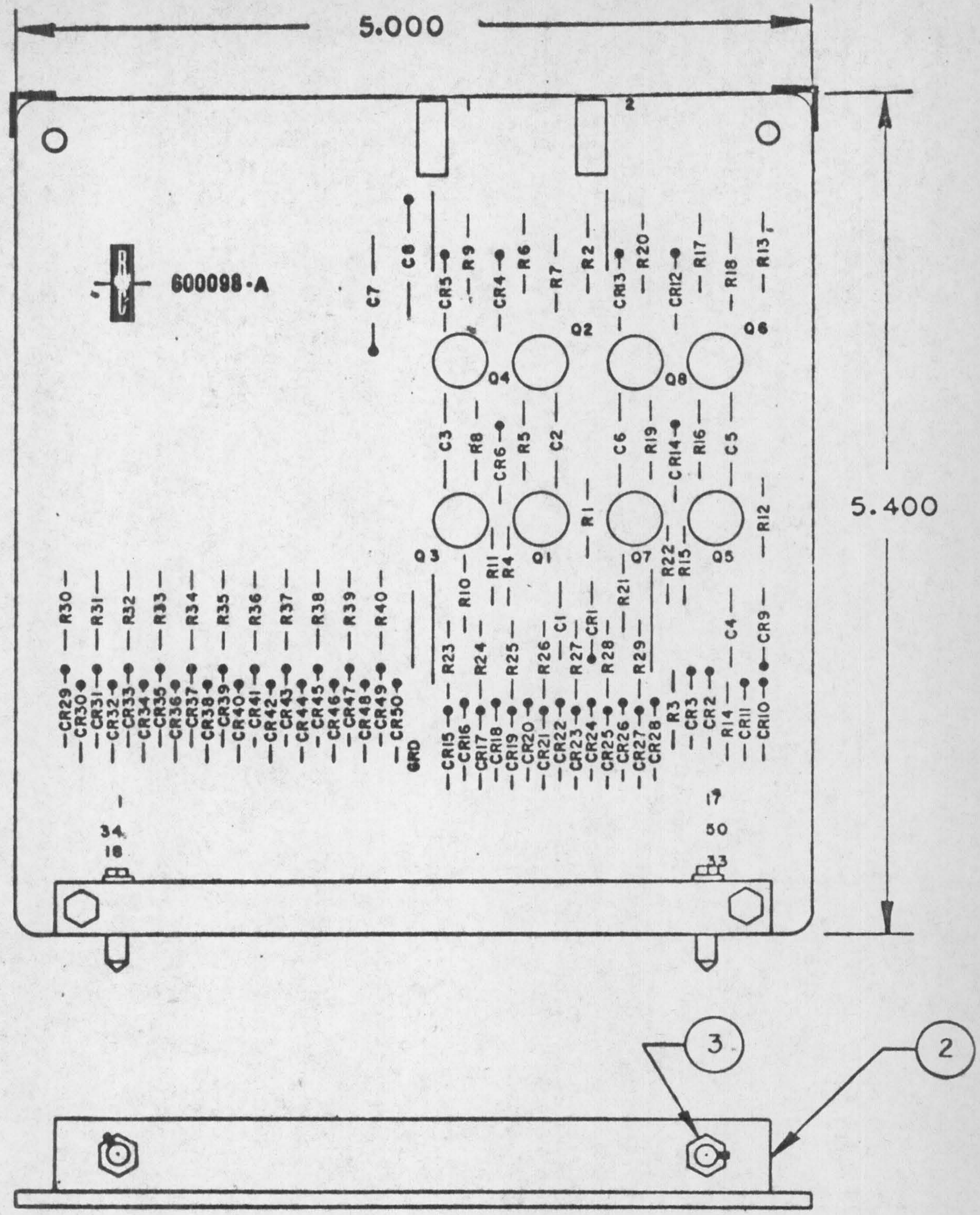
600098 Power Driver Section - (continued)

Fall time requirements:	To maintain output rise and fall times min. 300 nanosecs. Otherwise none.
Output loading:	
To ground:	300 ohms
To -12 volts:	65mA
Output Capacitive loading:	800pf with full resistive load to ground
Maximum repetition rate:	1 Megacycle
Delay to last moving point:	100 nanosecs. full load
Output rise time:	
No load	30 nanosecs
Full load	60 nanosecs
Output fall time:	
No load	30 nanosecs
Full load	70 nanosecs

Output short circuit proof with respect to ground.

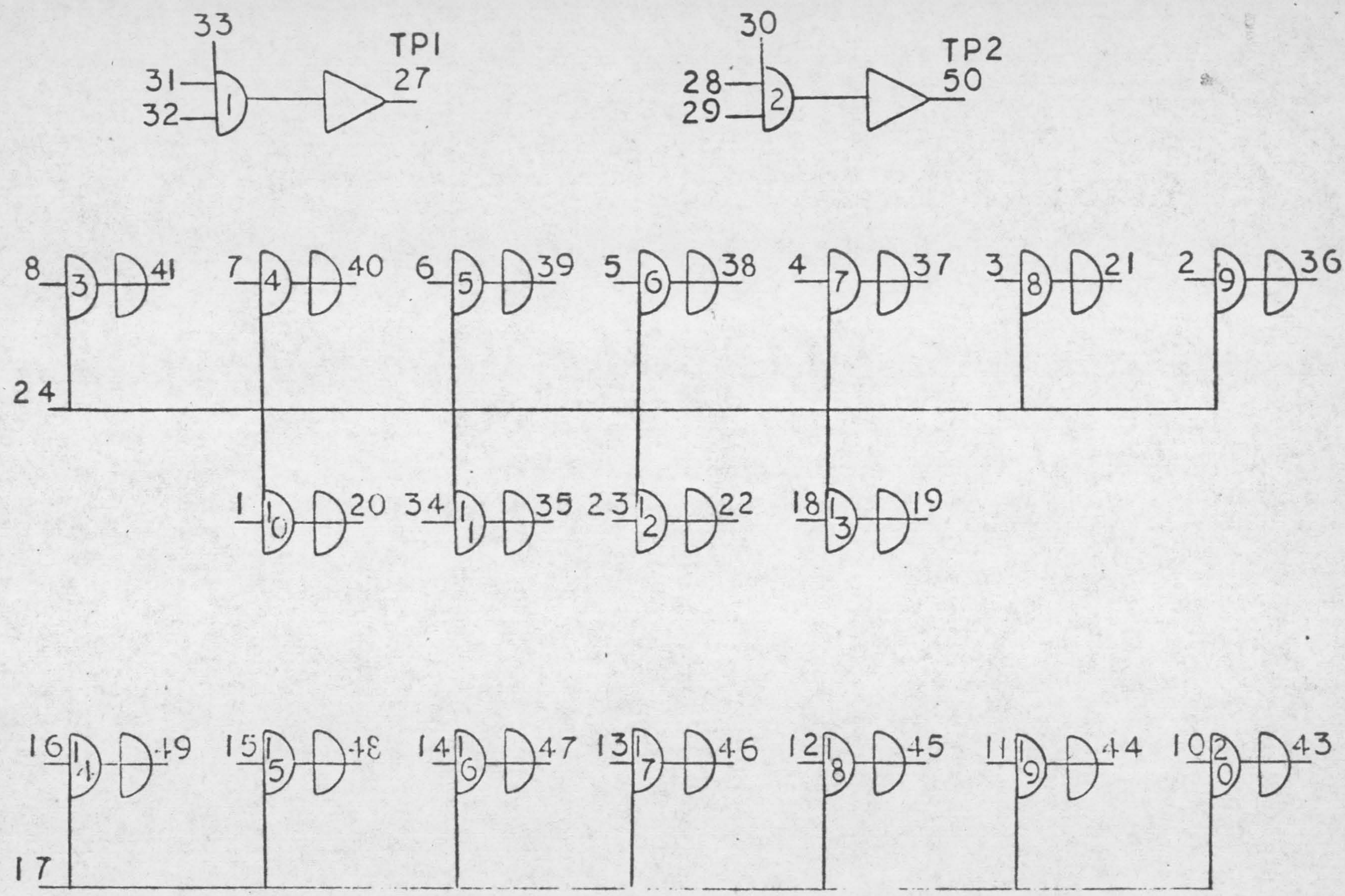
Gate Circuits

Recovery time:	150 nanosecs to -9 volts
Reversed bias leakage:	10μA at 25°C 35μA at 50°C
Power requirements:	+12.5 15mA
Worst case:	-12.5 75mA
Operating Temperature:	0-50°C
Mechanical Size:	5" x 5.4" x 0.5"
Connector Type:	50 pin



600098
RESET DRIVERS AND GATES

REFERENCE DWGS: SCHEMATIC NO. 600108, PARTS LIST NO. 600142



RESET DRIVER 600098

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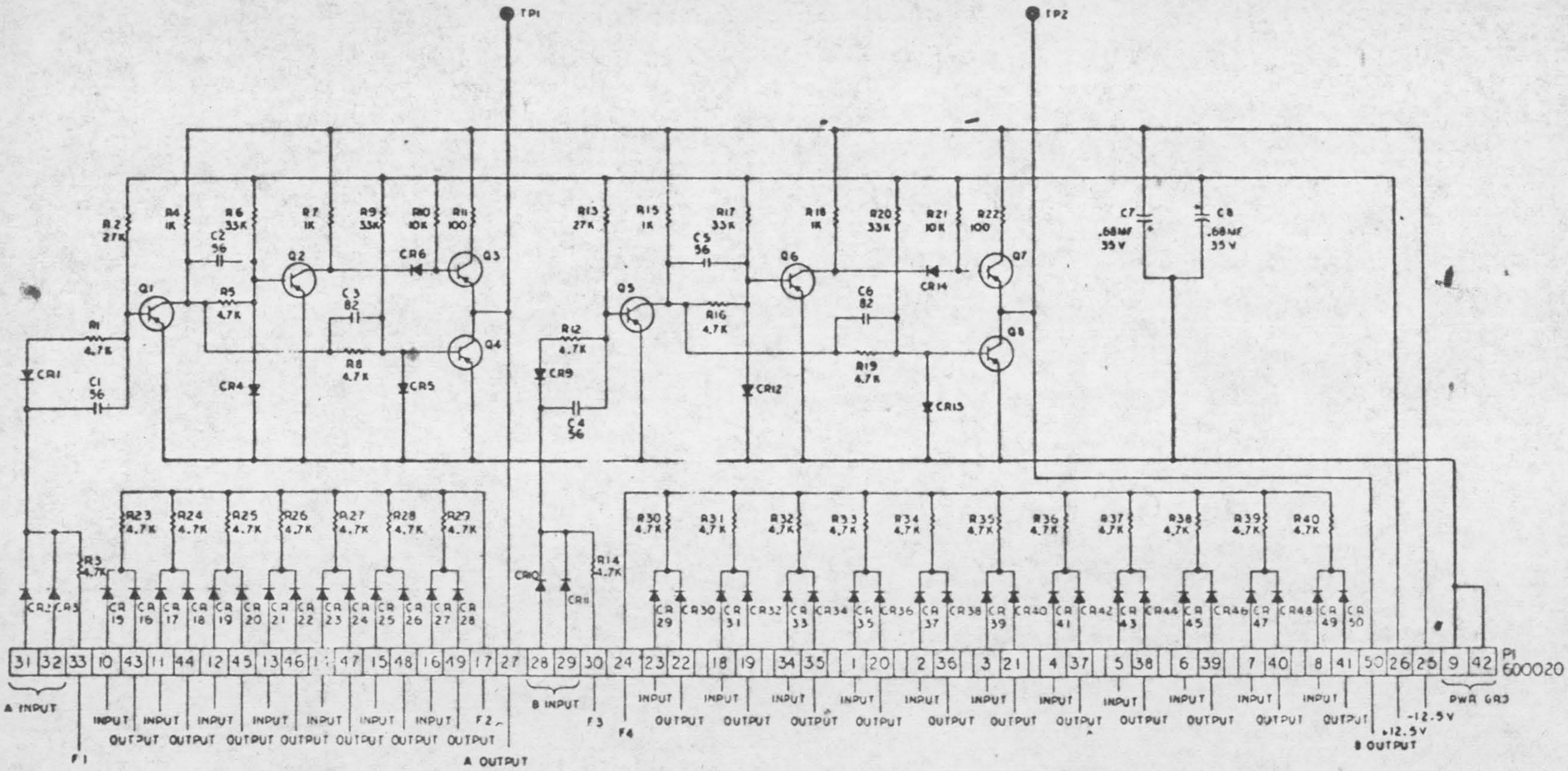

4. ALL TRANSISTORS ARE 2N2401.
3. ALL DIODES ARE REDCOR 100780-3.
2. ALL CAPACITANCE VALUES ARE IN PICO-FARADS
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 WATT, ±5%.
NOTE: UNLESS OTHERWISE SPECIFIED

REFERENCE DESIGNATIONS

FIRST	LAST	DELETED	
R1	R40		
C1	C8		
CR1	CR50	CR7	CR8
Q1	Q8		
TP1	TP2		
P1	P1		

REDCOR CORPORATION

600095
RESET DRIVER, SCHEMATIC DIAG

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(600098)

PARTS LIST

600098 RESET DRIVER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Disc, 56PF	Arco	CCD-560	
C2	Same as C1			
C3	Capacitor, Disc, 82PF	Arco	CCD-820	
C4	Same as C1			
C5	Same as C1			
C6	Same as C3			
C7	Capacitor, Tantalum, .68MF, 35V	Texas Inst.	$SCM684F_2P035K4$	
C8	Same as C7			
CR1	Diode, Silicon	Redcor	100780-3	
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Not Used			
CR8	Not Used			
CR9	Same as CR1			
CR10	Same as CR1			
CR11	Same as CR1			
CR12	Same as CR1			
CR13	Same as CR1			
CR14	Same as CR1			
CR15	Same as CR1			
CR16	Same as CR1			
CR17	Same as CR1			
CR18	Same as CR1			
CR19	Same as CR1			
CR20	Same as CR1			

PARTS LIST

600098 RESET DRIVER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR50	Same as CR1			
P1	Connector,50 Pin, Male	Redcor	600020	
Q1	Transistor, PNP	Philco	2N2401	
Q2	Same as Q1			
Q3	Same as Q1			
Q4	Same as Q1			
Q5	Same as Q1			
Q6	Same as Q1			
Q7	Same as Q1			
Q8	Same as Q1			
R1	Resistor, Comp., 4.7K, 1/4W, ±5%	Allen-Bradley	RC07GF472J	
R2	Resistor, Comp., 27K, 1/4W, ±5%	Allen-Bradley	RC07GF273J	
R3	Same as R1			
R4	Resistor, Comp., 1K, 1/4W, ±5%	Allen-Bradley	RC07GF102J	
R5	Same as R1			
R6	Resistor, Comp., 33K, 1/4W, ±5%	Allen-Bradley	RC07GF333J	
R7	Same as R4			
R8	Same as R1			
R9	Same as R6			
R10	Resistor, Comp., 10K, 1/4W, ±5%	Allen-Bradley	RC07GF103J	
R11	Resistor, Comp., 100 Ohm, 1/4W, ±5%	Allen-Bradley	RC07GF101J	
R12	Same as R1			
R13	Same as R2			
R14	Same as R1			
R15	Same as R4			

PARTS LIST

600098 RESET DRIVER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
CR21	Same as CR1			
CR22	Same as CR1			
CR23	Same as CR1			
CR24	Same as CR1			
CR25	Same as CR1			
CR26	Same as CR1			
CR27	Same as CR1			
CR28	Same as CR1			
CR29	Same as CR1			
CR30	Same as CR1			
CR31	Same as CR1			
CR32	Same as CR1			
CR33	Same as CR1			
CR34	Same as CR1			
CR35	Same as CR1			
CR36	Same as CR1			
CR37	Same as CR1			
CR38	Same as CR1			
CR39	Same as CR1			
CR40	Same as CR1			
CR41	Same as CR1			
CR42	Same as CR1			
CR43	Same as CR1			
CR44	Same as CR1			
CR45	Same as CR1			
CR46	Same as CR1			
CR47	Same as CR1			
CR48	Same as CR1			
CR49	Same as CR1			

PARTS LIST

600098 RESET DRIVER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R16	Same as R1			
R17	Same as R6			
R18	Same as R4			
R19	Same as R1			
R20	Same as R6			
R21	Same as R10			
R22	Same as R11			
R23	Same as R1			
R24	Same as R1			
R25	Same as R1			
R26	Same as R1			
R27	Same as R1			
R28	Same as R1			
R29	Same as R1			
R30	Same as R1			
R31	Same as R1			
R32	Same as R1			
R33	Same as R1			
R34	Same as R1			
R35	Same as R1			
R36	Same as R1			
R37	Same as R1			
R38	Same as R1			
R39	Same as R1			
R40	Same as R1			
TP1	Test Probe Receptacle,Wht	Ucinite	119437-A	
TP2	Test Probe Receptacle,Gry	Ucinite	119437-J	

INSTRUCTION MANUAL FOR REFERENCE POWER SUPPLY MODEL 600085

600085

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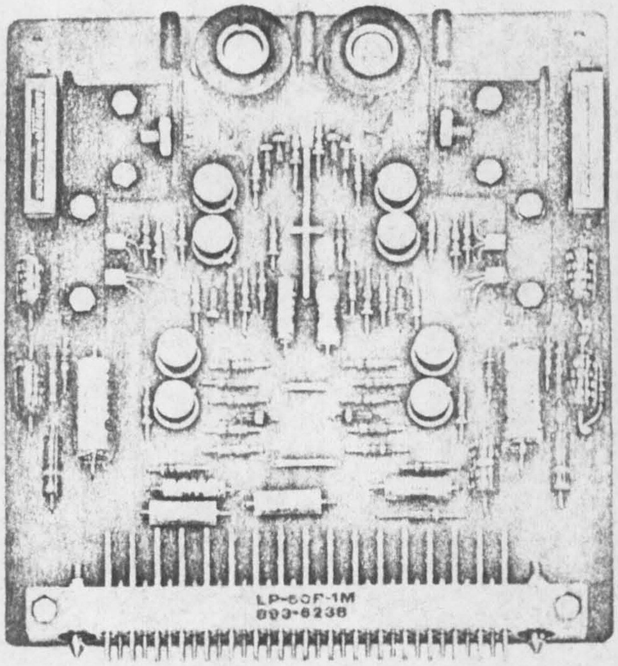

Figure 1. Reference Power Supply Model 600085

1. DESCRIPTION AND PURPOSE

2. Description - The Model 600085 Reference Power Supply (see figure 1) is a printed circuit board module consisting of two essentially identical regulated power supply circuits. One circuit provides a -10 V regulated output, and the second provides a +10 V regulated output. The circuit board is a standard 50-pin module card with components mounted on one side. The board assembly measures 5 x 5. 4 inches and requires one standard card space. Test points are provided on the top edge of the card for checking regulated voltages and trouble shooting during operation.

3. Purpose - The Reference Power Supply is used to provide an absolute internal reference from which all the weighted references are generated within digital-to analog or analog-to-digital converters. A precision -10 volts is required for the main reference. A precision +10 volts is required to offset the converter's comparator when polarity determination is required.

4. CIRCUIT DESCRIPTION (See figure 2)

5. -10-Volt Regulator - The -10-volt regulator consists of differential-amplifier Q9-Q10, differential-amplifier Q11-Q12, amplifier Q13-Q14, and power amplifier Q15-Q16. The base of Q10 is referenced to a fixed voltage by zener diode CR5. The -10-volt line is connected from a remote point and is impressed across input network R22, R46, C6, R21, R40, and R42. This remote sensing point is at the circuit where an exact -10 volts is required. Potentiometer R21 is adjusted so that when the remote point is at exactly -10 volts, the base of Q9 is at the same potential as the base of Q10. If the potential at the remote point differs from -10 volts, the voltage at the base of Q9 varies from the referenced voltage at the base of Q10. This variation is amplified and fed to differential-amplifier Q11-Q12, where it is further amplified and fed to amplifier Q13-Q14. Amplifier Q13-Q14 provides voltage amplification and feeds power amplifier Q15-Q16. Power amplifier Q15-Q16 is a dual emitter-follower utilized to provide current gain. Any deviation from the desired -10 volts at the remote point

would be amplified and a corresponding voltage, equivalent to the change in voltage but opposite in polarity, would be provided at the -10-volt output, thus returning the -10-volt line to exactly -10 volts.

6. +10-Volt Regulator - The +10-volt regulator consists of differential-amplifier Q7-Q8, differential-amplifier Q5-Q6, amplifier Q3-Q4 and power amplifier Q1-Q2. The +10-volt regulator operates in an identical manner as the -10-volt regulator, except that differential-amplifier Q7-Q8 is referenced to the -10-volt line rather than a zener diode.

7. SPECIFICATIONS

Voltage outputs	-10 V +10 V
Voltage adjustment (both channels)	±50 mv
Current output:	
-10 V	0 - 100 ma
+10 V	0 - 10 ma
Noise output (both channels)	Less than 50 uV rms
Current regulation no load to full load (both channels)	Less than 0. 005%
Voltage regulation with ±5% input voltage (both channels)	Less than 0. 005%
Temperature regulation 25°C 25°C (both channels)	Less than 0. 0005% per degree C
Transient response no load to full load (both channels)	Less than 0. 005% in 2 usec
Input power requirement:	
+12. 5 V	50 ma
-12. 5 V	150 ma
Operating temperature	0 - 50°C
Board type	0. 90" thick glass epoxy
Mechanical size	5" x 5. 4" x 0. 5"
Connector type	50-pin
Test points:	
Number	3
Data provided	ground and voltage output

Designation	Color	Data
1	Black	ground
2	Grey	+10 V output
3	Green	-10 V output

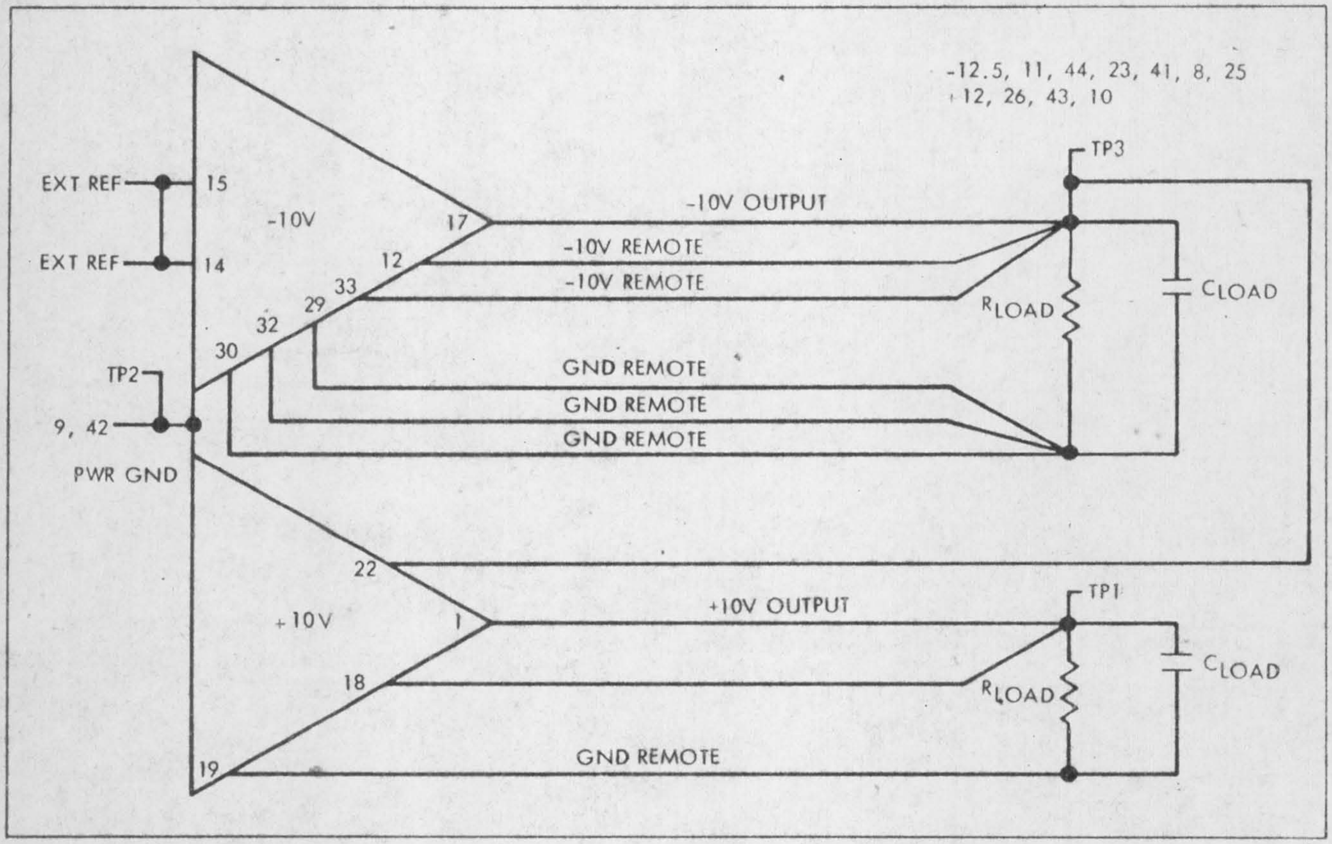

Figure 2. Reference Power Supply Model 600085, Logic Diagram

REDCOR

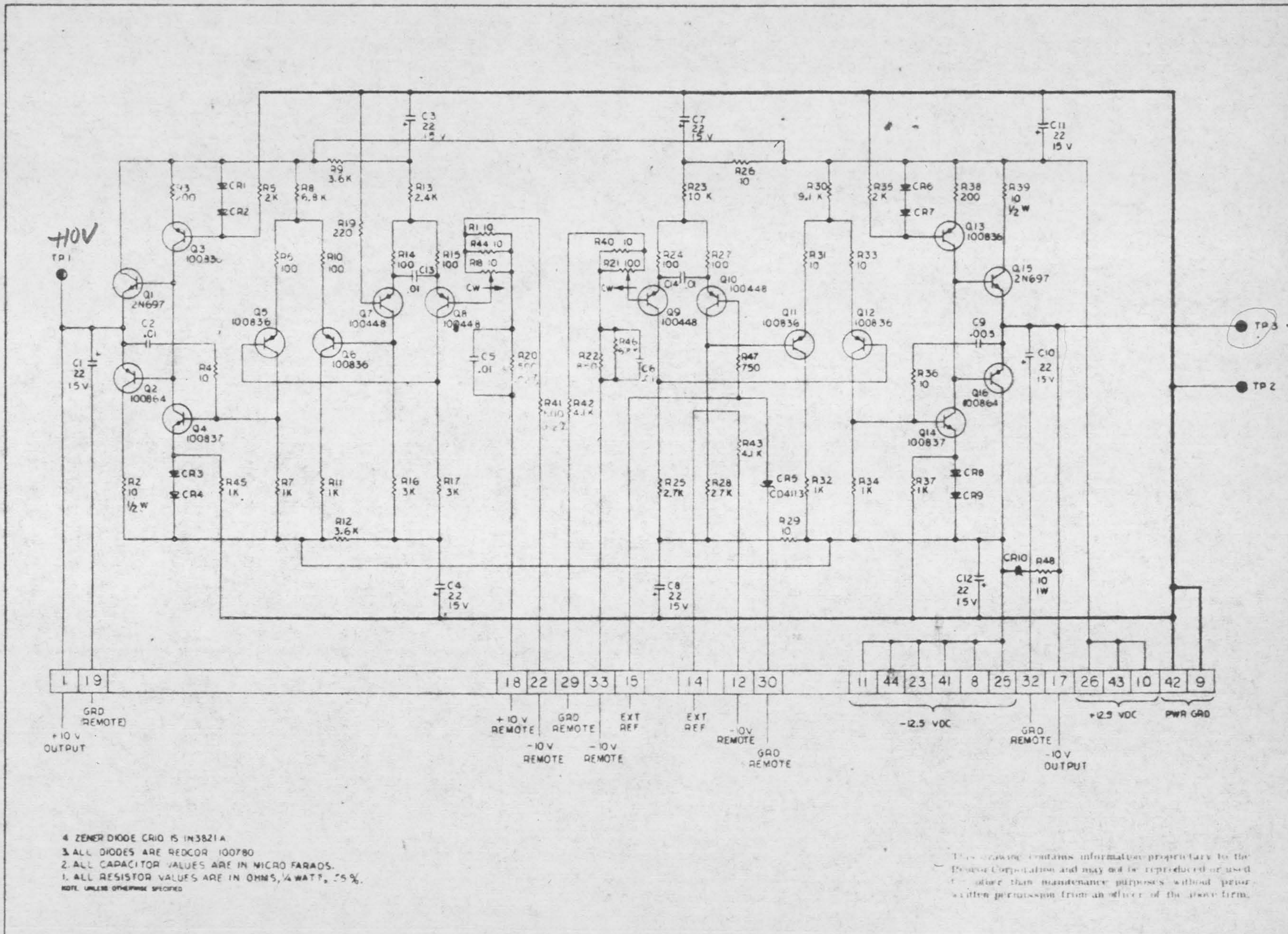

Figure 3. Reference Power Supply Model 600085, Schematic Diagram

8. MAINTENANCE

Standard circuit board maintenance practices apply. Replacement parts shall be those specified in the parts list.

CAUTION

When soldering and replacing electronic components on the circuit board, the circuit board and replacement components should not be overheated. Use an appropriate heatsink.

Trouble shooting is easily accomplished using test points TP1, TP2, and TP3 and observing voltages with a precision meter or oscilloscope.

9. REPLACEMENT PARTS

Replacement parts for the Reference Power Supply are listed in the following parts lists. For location and identification of parts see figure 3.

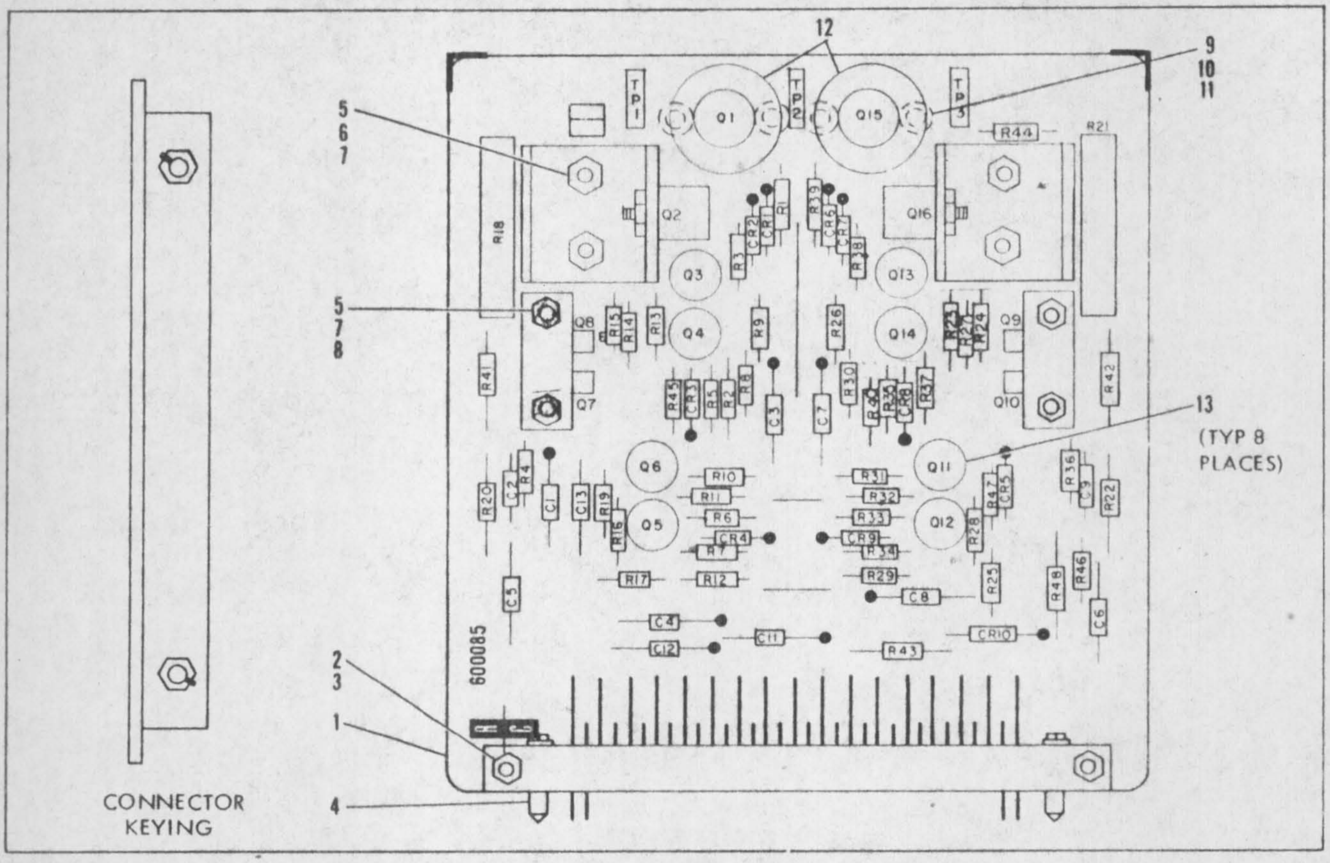

Figure 4. Reference Power Supply Model 600085, Parts Location

PARTS LIST

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
1	Connector, 50 Pin, Male	Redcor	600020
2	Nut, Hex, S.P., #4-40, Cad. Stl.		
3	Screw, 100° FH, #4-40 x 1/2 lg, Cad. Stl.		
4	Pin, Polarizing, Male	Redcor	600021
5	Nut, Hex, #2-56, Cad. Stl.		
6	Screw, Bd. Hd., #2-56 x 5/16 lg, Cad. Stl.		
7	Washer, Lock, Internal Tooth, #2		
8	Screw, 100° FH, #2-56 x 1/2 lg, Cad. Stl.		
9	Screw, Bd. Hd., #4-40 x 3/16 lg, Cad. Stl.		
10	Washer, Lock, Internal Tooth, #4		

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
11	Washer, Flt., #4, Nylon		
12	Heat Sink	PSI	PR11
13	Transipad, TO-5	Milton Ross	10123
C1	Capacitor, Tant., 22 mfd, 15V	T. I.	SCM226BP015K4
C2	Capacitor, Cerafil, .01 mfd	Aerovox	MC80V103A-M
C3	Capacitor, Tant., 22 mfd, 15V	T. I.	SCM226BP015K4
C4	Capacitor, Tant., 22 mfd, 15V	T. I.	SCM226BP015K4
C5	Capacitor, Cerafil, .01 mfd	Aerovox	MC80V103A-M
C6	Capacitor, Cerafil, .01 mfd	Aerovox	MC80V103A-M
C7	Capacitor, Tant., 22 mfd, 15V	T. I.	SCM226BP015K4
C8	Capacitor, Tant., 22 mfd, 15V	T. I.	SCM226BP015K4
C9	Capacitor, Cerafil, .005 mfd	Aerovox	MC80V502A-M
C10	Capacitor, Tant., 22 mfd, 15V	T. I.	SCM226BP015K4
C11	Capacitor, Tant., 22 mfd, 15V	T. I.	SCM226BP015K4
C12	Capacitor, Tant., 22 mfd, 15V	T. I.	SCM226BP015K4
C13	Capacitor, Cerafil, .01 mfd	Aerovox	MC80V103A-M
C14	Capacitor, Cerafil, .01 mfd	Aerovox	MC80V103A-M
CR1	Diode, Silicon	Redcor	100780
CR2	Diode, Silicon	Redcor	100780
CR3	Diode, Silicon	Redcor	100780
CR4	Diode, Silicon	Redcor	100780
CR5	Diode, Zener	C. D. (Redcor)	CD4113 (100073)*
CR6	Diode, Silicon	Redcor	100780
CR7	Diode, Silicon	Redcor	100780
CR8	Diode, Silicon	Redcor	100780
CR9	Diode, Silicon	Redcor	100780
CR10	Diode, Zener	Motorola	1N3821A
Q1	Transistor, NPN	C. D.	2N697
Q2	Transistor, PNP	Redcor	100864
Q3	Transistor, PNP	Redcor	100836
Q4	Transistor, NPN	Redcor	100837
Q5	Transistor, PNP	Redcor	100836
Q6	Transistor, PNP	Redcor	100836
Q7	Transistor, PNP	Redcor	100448
Q8	Transistor, PNP	Redcor	100448
Q9	Transistor, PNP	Redcor	100448
Q10	Transistor, PNP	Redcor	100448
Q11	Transistor, PNP	Redcor	100836
Q12	Transistor, PNP	Redcor	100836
Q13	Transistor, PNP	Redcor	100836
Q14	Transistor, NPN	Redcor	100837
Q15	Transistor, NPN	C. D.	2N697
Q16	Transistor, PNP	Redcor	100864
R1	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R2	Resistor, Comp., 10 ohm, 1/2W, ±5%	A. B.	RC20GF100J
R3	Resistor, Comp., 200 ohm, 1/4W, ±5%	A. B.	RC07GF201J
R4	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R5	Resistor, Comp., 2K, 1/4W, ±5%	A. B.	RC07GF202J
R6	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R7	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R8	Resistor, Comp., 6.8K, 1/4W, ±5%	A. B.	RC07GF682J
R9	Resistor, Comp., 3.6K, 1/4W, ±5%	A. B.	RC07GF362J
R10	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R11	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R12	Resistor, Comp., 3.6K, 1/4W, ±5%	A. B.	RC07GF362J
R13	Resistor, Comp., 2.4K, 1/4W, ±5%	A. B.	RC07GF242J
R14	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R15	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R16	Resistor, Comp., 3K, 1/4W, ±5%	A. B.	RC07GF302J
R17	Resistor, Comp., 3K, 1/4W, ±5%	A. B.	RC07GF302J
R18	Resistor, W. W., 10 ohm, Pot	Bourns	275-1-100
R19	Resistor, Comp., 220 ohm, 1/4W, ±5%	A. B.	RC07GF221J
R20	Resistor, W. W., 500 ohm, 1/4W, ±.02%	Redcor	101012-B-500R00-A

ITEM NUMBER OR REF DESIG	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER
R21	Resistor, W. W., 100 ohm, Pot	Bourns	275-1-100
R22	Resistor, W. W., Approx. 850 ohm, 1/4W	Redcor	100073*
R23	Resistor, Comp., 10K, 1/4W, ±5%	A. B.	RC07GF103J
R24	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R25	Resistor, Comp., 2.7K, 1/4W, ±5%	A. B.	RC07GF272J
R26	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R27	Resistor, Comp., 100 ohm, 1/4W, ±5%	A. B.	RC07GF101J
R28	Resistor, Comp., 2.7K, 1/4W, ±5%	A. B.	RC07GF272J
R29	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R30	Resistor, Comp., 9.1K, 1/4W, ±5%	A. B.	RC07GF912J
R31	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R32	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R33	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R34	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R35	Resistor, Comp., 2K, 1/4W, ±5%	A. B.	RC07GF202J
R36	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R37	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R38	Resistor, Comp., 200 ohm, 1/4W, ±5%	A. B.	RC07GF201J
R39	Resistor, Comp., 10 ohm, 1/2W, ±5%	A. B.	RC07GF100J
R40	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R41	Resistor, W. W., 500 ohm, 1/4W, ±.02%	Redcor	101012-B-500R00-A
R42	Resistor, W. W., Approx. 4.1K	Redcor	100073*
R43	Resistor, W. W., Approx. 150 ohm, 1/4W, ±1%	Redcor	100071*
R44	Resistor, Comp., 10 ohm, 1/4W, ±5%	A. B.	RC07GF100J
R45	Resistor, Comp., 1K, 1/4W, ±5%	A. B.	RC07GF102J
R46	Resistor, Comp., 6.8K, 1/4W, ±5%	A. B.	RC07GF682J
R47	Resistor, Comp., 750 ohm, 1/4W, ±5%	A. B.	RC07GF751J
R48	Resistor, Comp., 10 ohm, 1W, ±10%	A. B.	RC32GF100K
TP1	Test Jack, Black	Ucinite	119437-C
TP2	Test Jack, Gray	Ucinite	119437-J
TP3	Test Jack, Green	Ucinite	119437-F

*Denotes matched set

INSTRUCTION MANUAL FOR
MULTIVIBRATOR DRIVER MODEL 600050

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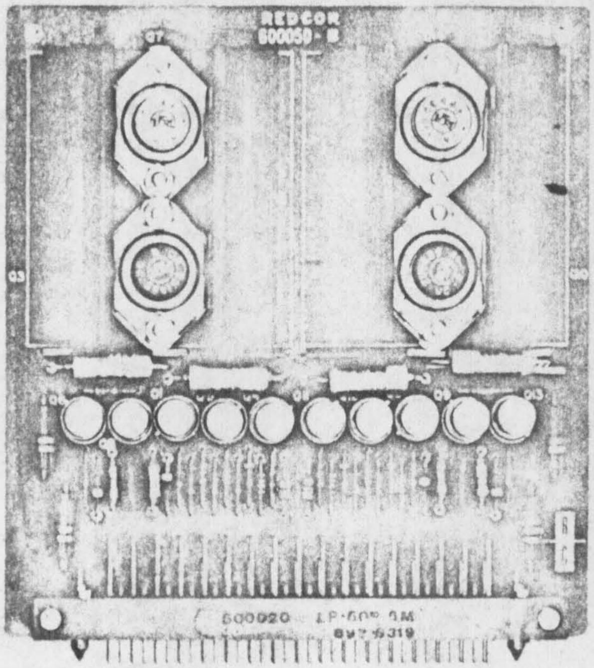


FIGURE 1 - Multivibrator Driver Model 600050

1. DESCRIPTION AND PURPOSE

2. Description - The Model 600050 Multi Driver (see Figure 1) is a printed circuit board module consisting of two identical independent driver circuits. The circuit board is a standard 50-pin module with components mounted on one side. The board assembly measures 5 x 5.4 inches and requires two standard spaces.

3. Purpose - The multivibrator power driver circuits are used for driving a trapezoidal waveform at approximately ±12V amplitude and 6Kc repetition rate. The basic oscillator is not included on the card. The primary use of the card is to provide a power source for driving the isolation transformers used in multiplexers and amplifiers.

4. CIRCUIT DESCRIPTION (see Figure 2)

5. General - Two identical circuits are contained on the module and only one will be discussed. The circuit depends for its operation upon a square wave oscillator input having a repetitive frequency of approximately 6Kc ±1Kc with voltage excursions of 0 volts and -12 volts. Installation would normally occur in a Redcor Corporation module case which contains a power supply and also the required oscillator waveform. The operation of the circuit is such that the input waveform repetitively turns on and off grounded emitter stage Q4. Q1 and Q5 are a complementary symmetric gain stage with Q1 operating as a constant current stage for Q5. The common collector output drives the complementary darlington stages consisting of Q2 and Q3 supplying the negative output and Q6 and Q7 supplying the positive half of a ±12V output waveform. The drive to the input

stages Q2 and Q6 is AC coupled via C1 and C2. The output from Q3 and Q7 is a trapezoidal waveform as shown in Figure 3. The period of the output waveform is determined by the input square wave. Capacitor C3 controls the rate of change of the waveform from the saturated ±12 volt conditions and produces the trapezoidal characteristic.

6. MAINTENANCE

Standard circuit board maintenance practices apply. Replacement parts shall be those specified in the parts list.

WARNING

Because of the AC nature of the coupling to the output transistors Q2, Q3, Q6 and Q7, it is necessary to always apply the input square wave; otherwise the transistors will tend to turn on and draw excessive current through the ±12 volts.

7. SPECIFICATIONS

Input:

Periodicity . . . . 180µSecs ±20µSecs
Rise and fall time . . . . 5µSec maximum
Voltage off condition . . . 0 volts ±0.5 volts
Voltage on condition . . . -10 volts ±1 volt

Output:

Voltage swing . . . . ±12 volts ±0.5 volts
Periodicity . . . . Determined by input
Rise and fall time . . . . 20µSecs ±2µSecs
Resistive load . . . . 10 ohms maximum
Peak load current
-12.5 V . . . . 1.2 amps
+12.5 V . . . . 1.2 amps
Average load current
-12.5 V . . . . 500 mA
+12.5 V . . . . 500 mA

Input Power Requirements:

Quiescent no load
-12.5 V . . . . 40 mA
+12.5 V . . . . 40 mA
Full load
±12.5 V average . . . . 550 mA
±12.5 V peak . . . . 1.25 amps

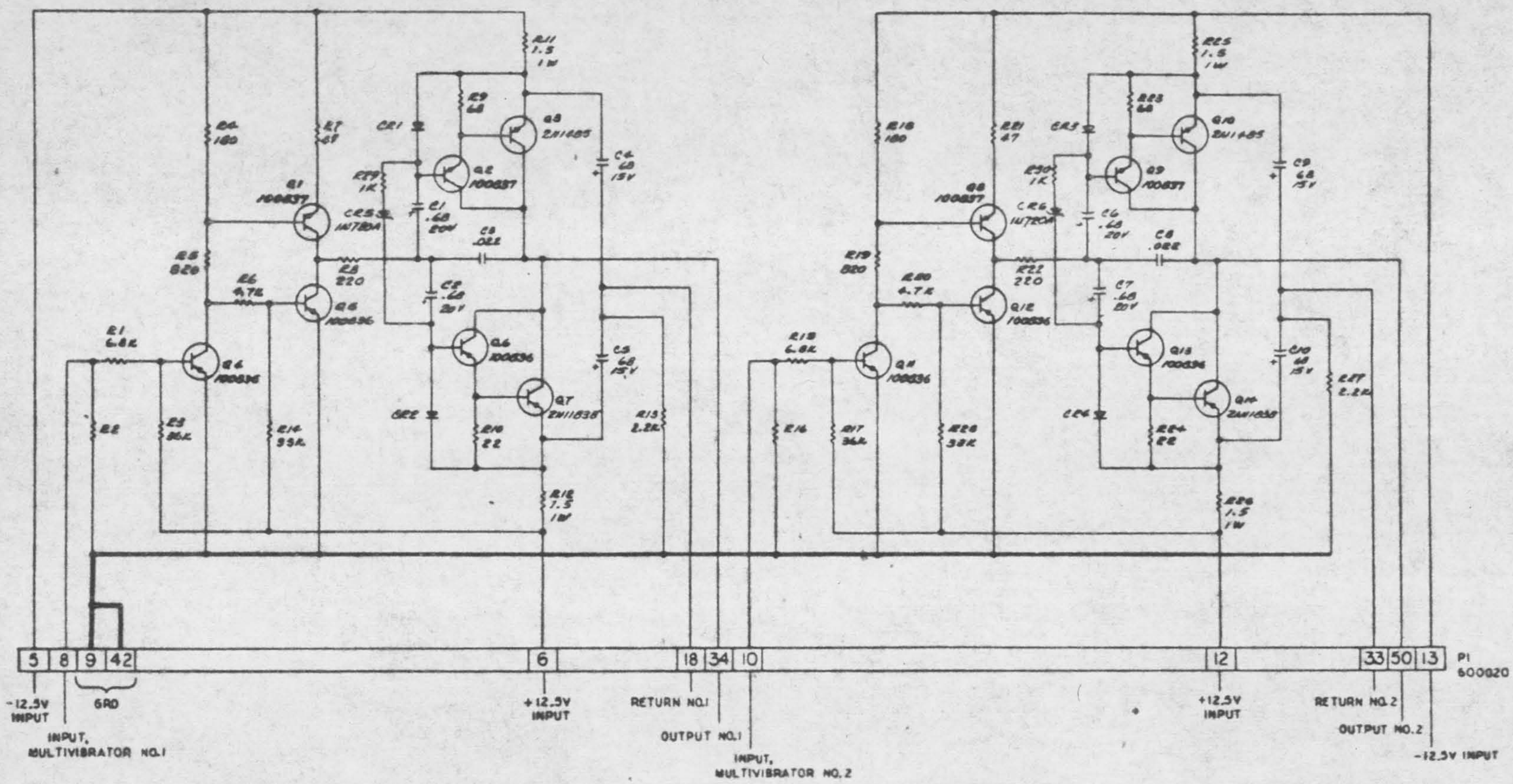
Operating temperature . . . . 0-50°C

Board type . . . . 0.90" thick glass epoxy

Mechanical size . . . . 5" x 5.4" x 0.8"

Connector type . . . . 50 pin

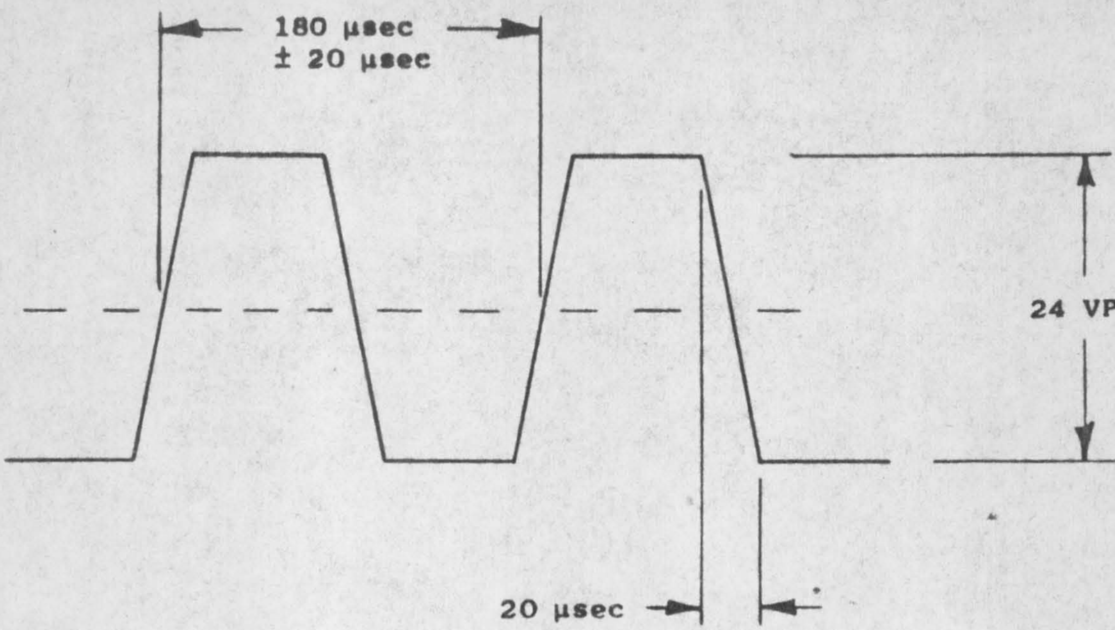
Test points. . . . . None



3. ALL DIODES ARE REDCOR NO. 100780.
2. ALL CAPACITANCE VALUES ARE IN MICRO-FARADS
1. ALL RESISTANCE VALUES ARE IN OHMS, ±5%, 1/4 WATT.
NOTE: UNLESS OTHERWISE SPECIFIED

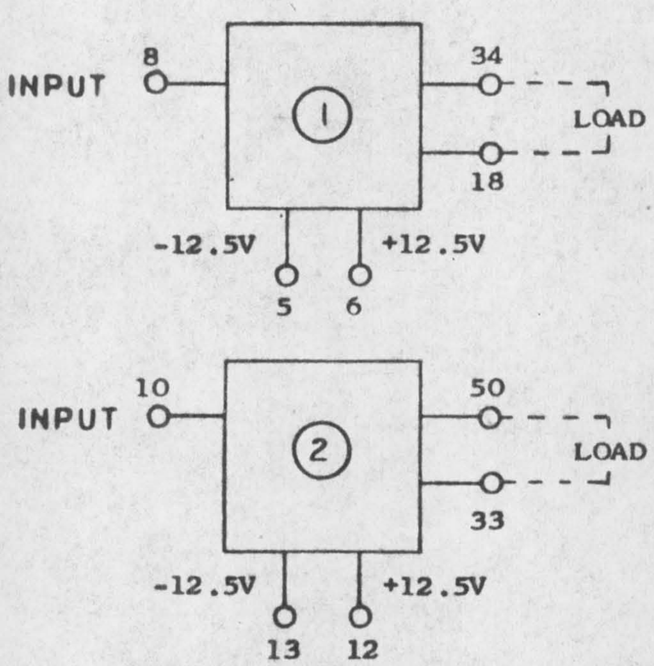
REFERENCE DESIGNATIONS		
FIRST	LAST	DELETED
R1	R30	
C1	C10	
CR1	CR6	
Q1	Q14	
P1	P1	

FIGURE 2



Multivibrator Power Waveform

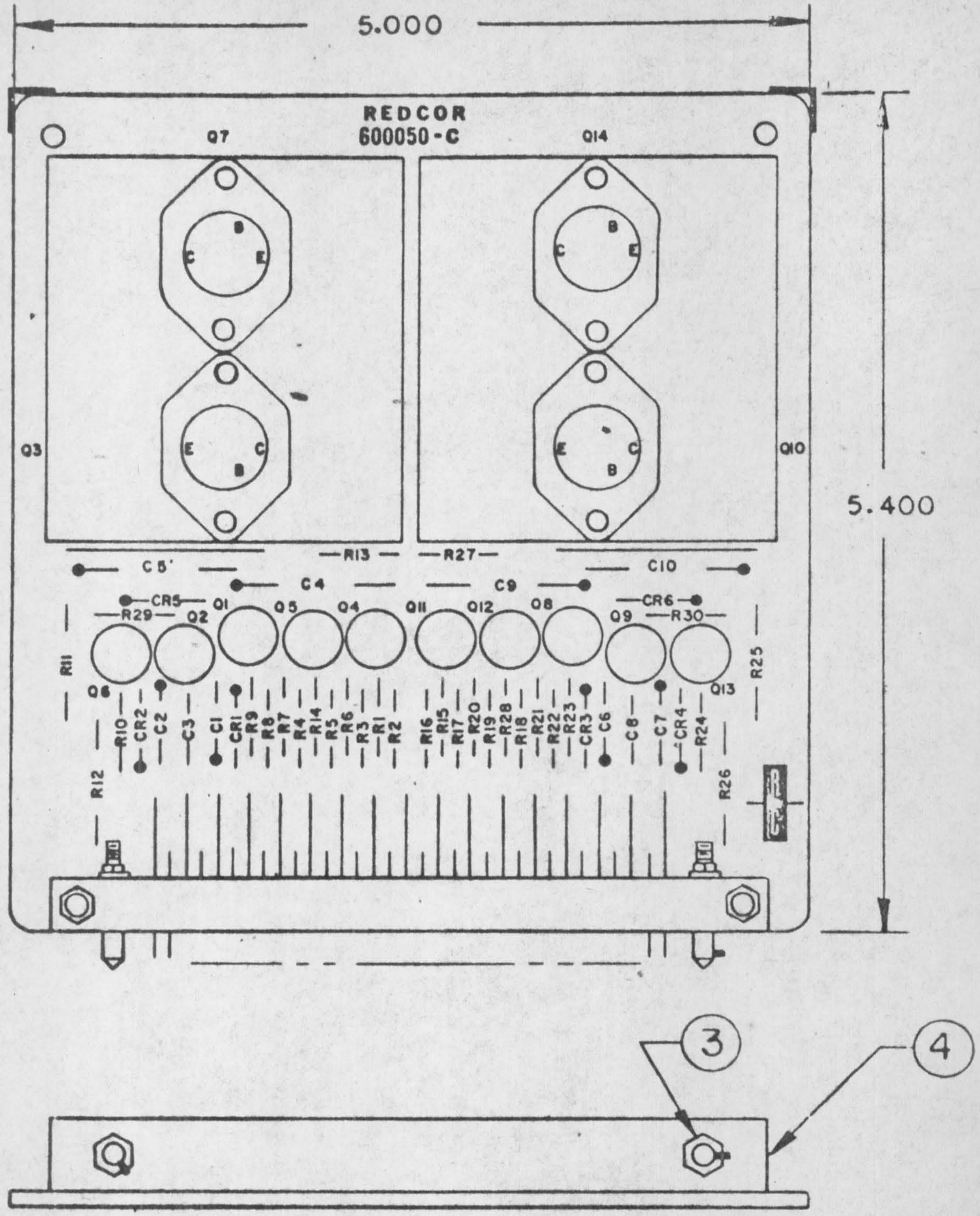
FIGURE 3



NOTE: GND 9, 42

600050 Multivibrator Driver - Logic Diagram -

FIGURE 4



600050
MULTIVIBRATOR DRIVERS

FIGURE. 5

REFERENCE DWGS: SCHEMATIC NO. 600052 PARTS LIST NO. 600050

A D D E N D U M

MODEL 600050 INSTRUCTION MANUAL

Engineering Order No. 1199

Replace R29 and R30 (3.3K, 1/4W, ±5% - Part No. RC07GF332J) with a 1K OHM, 1/4W, ±5% Allen Bradley Resistor, Part No. RC07GF102J, in series with a 1N720A Hughes Zener Diode, Reference Designations CR5 and CR6. The cathode of the Zener Diode shall be connected to the base of Q6 or Q13, as the case may be.

PARTS LIST

600050 MULTIVIBRATOR DRIVER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Tantalum, .68 MF, 20 V	Texas Inst.	$SCM684F_2P020K4$	
C2	Same as C1			
C3	Capacitor, .440 Lead Space, .022MF, 50V	Good-All	602 Series	
C4	Capacitor, Tantalum, .68 MF, 15 V	Texas Inst.	SCM686GP015K4	
C5	Same as C4			
C6	Same as C1			
C7	Same as C1			
C8	Same as C3			
C9	Same as C4			
C10	Same as C4			
CR1	Diode, Silicon	Redcor	100780	
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Diode, Zener	Hughes	1N720A	
CR6	Same as CR5			
Q1	Transistor	Redcor	100837	
Q2	Same as Q1			
Q3	Transistor, TO-8	RCA	2N1485	
Q4	Transistor	Redcor	100836	
Q5	Same as Q4			
Q6	Same as Q4			
Q7	Transistor, TO-8	RCA	2N1183B	
Q8	Same as Q1			
Q9	Same as Q1			
Q10	Same as Q3			
Q11	Same as Q4			

PARTS LIST

600050 MULTIVIBRATOR DRIVER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
Q12	Same as Q4			
Q13	Same as Q4			
Q14	Same as Q7			
R1	Resistor, Comp., 6.8K, 1/4W, ±5%	Allen-Bradley	RC07GF682J	
R2	Resistor, Comp., 1/4W, ±5%	Allen-Bradley	Selected	
R3	Resistor, Comp., 36K, 1/4W, ±5%	Allen-Bradley	RC07GF363J	
R4	Resistor, Comp., 180 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF181J	
R5	Resistor, Comp., 820 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF821J	
R6	Resistor, Comp., 4.7K, 1/4W, ±5%	Allen-Bradley	RC07GF472J	
R7	Resistor, Comp., 47 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF470J	
R8	Resistor, Comp., 220 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF221J	
R9	Resistor, Comp., 68 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF680J	
R10	Resistor, Comp., 22 ohm, 1/4W, ±5%	Allen-Bradley	RC07GF220J	
R11	Resistor, W.W., 1.5 ohm, 1W, ±5%	IRC	Type BWH	
R12	Same as R11			
R13	Resistor, Comp., 2.2K, 1/4W, ±5%	Allen-Bradley	RC07GF222J	
R14	Resistor, Comp., 33K, 1/4W, ±5%	Allen-Bradley	RC07GF333J	
R15	Same as R1			
R16	Same as R2			
R17	Same as R3			

PARTS LIST

600050 MULTIVIBRATOR DRIVER

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R18	Same as R4			
R19	Same as R5			
R20	Same as R6			
R21	Same as R7			
R22	Same as R8			
R23	Same as R9			
R24	Same as R10			
R25	Same as R11			
R26	Same as R11			
R27	Same as R13			
R28	Same as R14			
R29	Resistor, Comp., 1K, 1/4W, ±5%	Allen-Bradley	RC07GF102J	
R30	Same as R29			

INSTRUCTION MANUAL

FOR

POWER SUPPLY 600035

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Canoga Park, Calif.

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List of Illustrations

POWER SUPPLY 600035

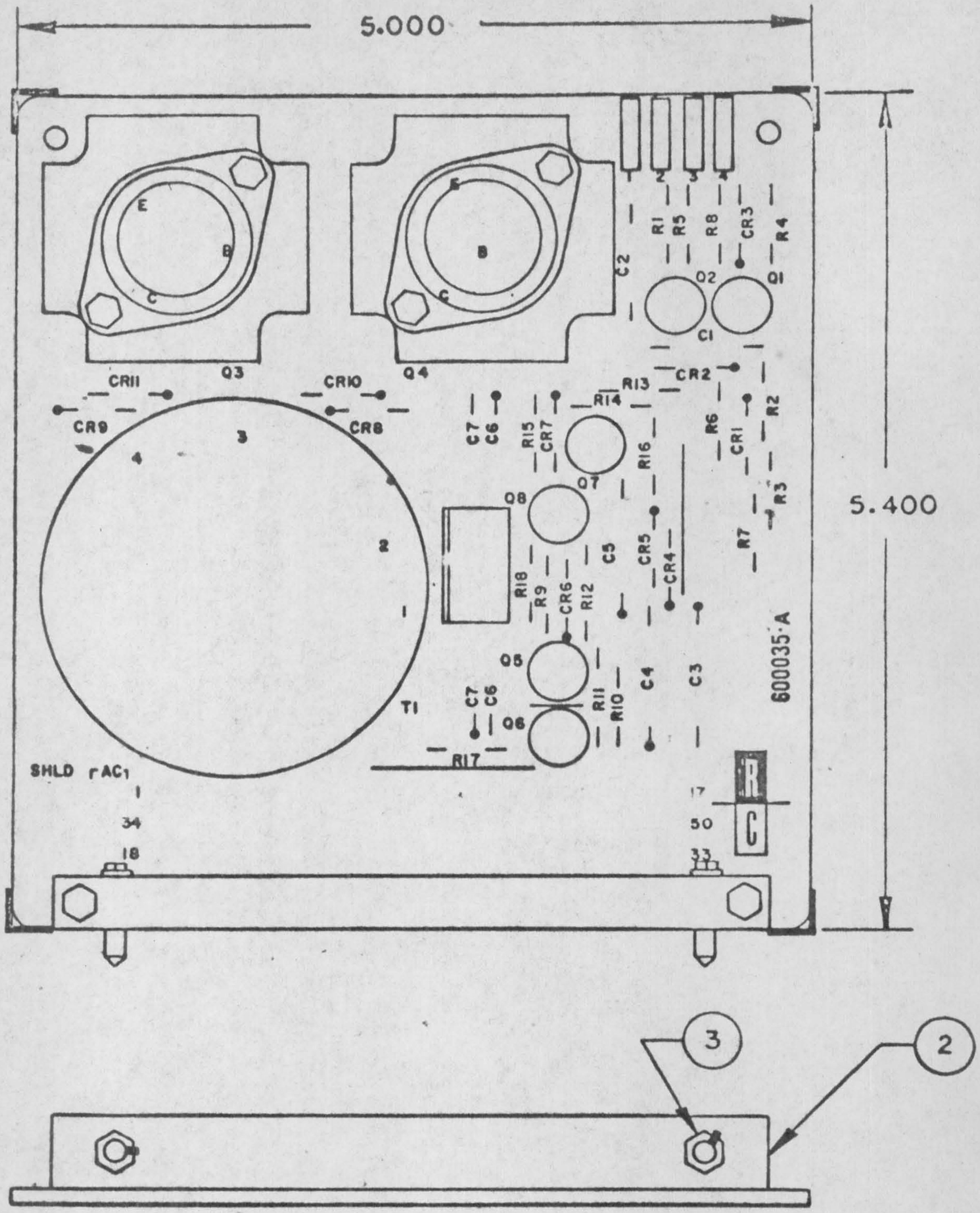
1.0 General Description

1.1 Mechanical - (See Figure 1.1) The power supply card is constructed on a 5" x 5.4" x .090 glass epoxy printed circuit board. All input output connections are made via a 50 pin connector mounted integrally with the printed circuit board. The completed assembly requires 2 card spaces in the Redcor Corporation 100775 and 100925 Module Cases.

1.2 Electrical - The power supply card derives power from a 60 cps 115VAC input and provides ±12.5VDC regulated power for general use in modular component construction. The power supply has, in addition a bistable multivibrator which serves as a frequency source for operating multivibrator power drivers.

1.3 Specifications -

Output voltages:	+12.5 volts -12.5 volts
Output loading:	150mA
Output ripple (120cps)	
No load:	5mV peak/peak
Full load:	10mV peak/peak
Regulation:	
No load/full load:	100mV



600035
POWER SUPPLY

Figure 1.1

REFERENCE DWGS: SCHEMATIC NO. 600036, PARTS LIST NO. 600034

1.3 (continued)

Line regulation	
103 - 126 AC	±100mV
Multivibrator output	
Voltage:	0 to -12.5 volts
Frequency:	5 - 7 Kc/s
Loading:	To gnd 1000 ohms
Input power:	115VAC 50-500cps
Isolation:	20μμfd
Mechanical size:	5" x 5.4" x 1"
Operating Temperature:	0 - 50°C
Connector type:	50 pin

1.4 <u>Principle of Operation</u> - The circuit diagram is as shown in Figure 1.2. The power supply consists of two parts, the regulated power supplies and multivibrator. The multivibrator is powered from the ±12.5 regulated power supply contained on the same circuit board.

1.5 Regulated Power Supply - The 115V AC (±10%) 50-600 cps power input is applied between pins 19 and 35 to the primary of the power transformer T, Pin 18 of the connector provides a shield ground for the input voltage. The center tapped secondary winding between pins 2 and 3 is connected across a fullwave bridge rectifier circuit consisting of diodes CR8, CR9, CR10 and CR11, with the center-tap forming the power ground reference point.

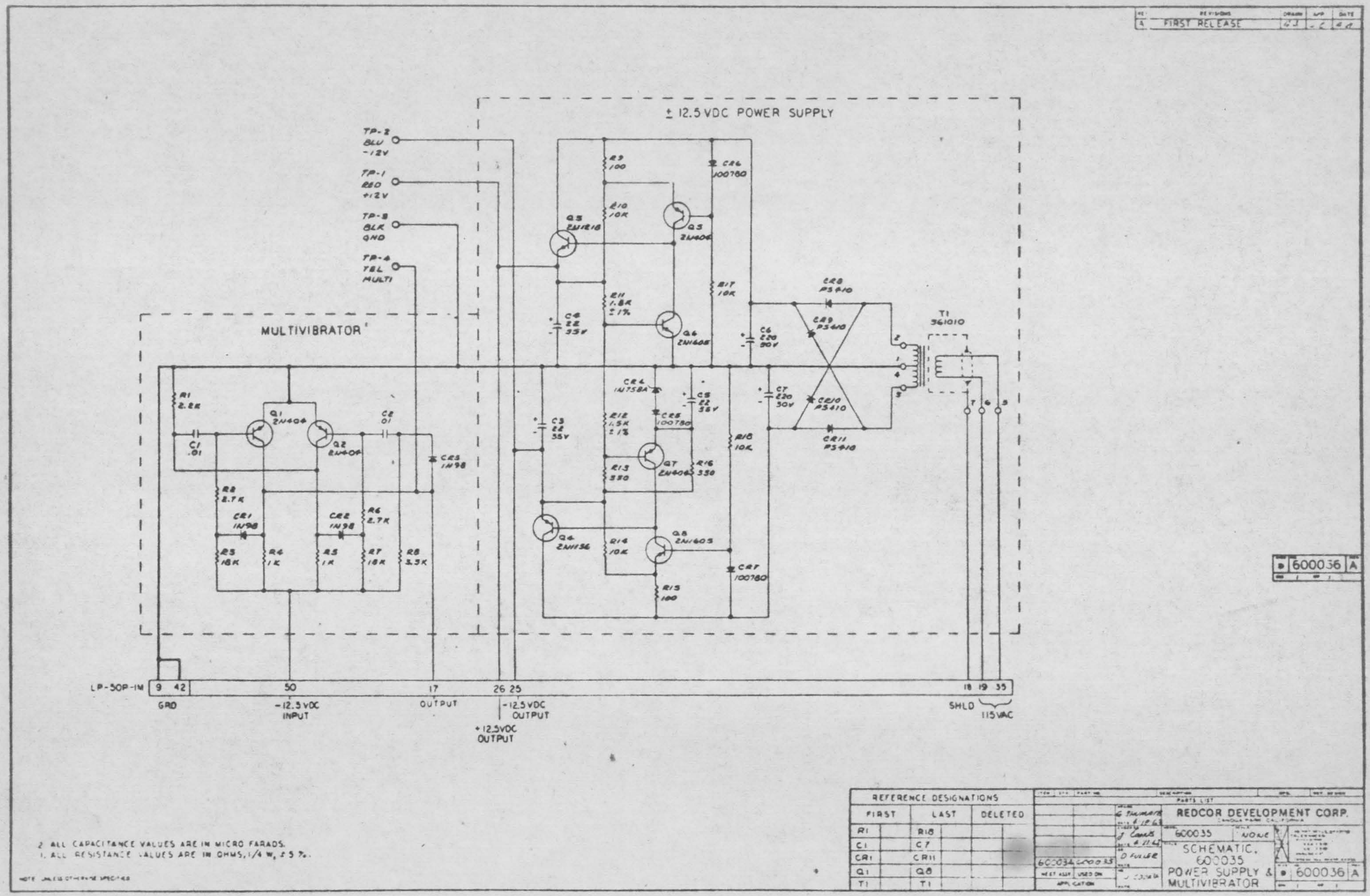

± 12.5 VDC POWER SUPPLY
MULTIVIBRATOR
FIRST RELEASE
LP-50P-1M
GRD
-12.5 VDC INPUT
OUTPUT
-12.5 VDC OUTPUT
+12.5VDC OUTPUT
SHLD
115VAC
REFERENCE DESIGNATIONS
REDCOR DEVELOPMENT CORP.
SCHEMATIC, 600035 POWER SUPPLY & MULTIVIBRATOR
600036 A
2. ALL CAPACITANCE VALUES ARE IN MICRO FARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4 W, ± 5 %.

Figure 1.2

1.5 (continued)

the +12.5 DC output is taken from cathode junction of diodes CR8 and CR9 and filtered by capacitor C4 to remove the ripple component. Similarly the -12.5V DC output is taken from the anode junction of diodes CR10 and CR11, filtering being accomplished by capacitor C7.

The output voltages are series regulated by transistors Q3 and Q4 for the +12.5 and -12.5 volt DC outputs respectively. Transistors Q7 and Q8 function as the control amplifier with zener CR5 as the reference to the emitter of Q7.

Transistors Q3 and Q4 function as the control amplifier for the +12.5 power supply. The two power supplies are made to track each other by means of resistors R11, R12 and R13, overall feedback to both regulators also being provided by there resistors.

1.6 Multivibrator - Transistors Q1 and Q2 operate as a bistable multivibrator. The frequency of repetition is established by resistors R2 and R6 and capacitors C1 and C2 respectively. No power is normally connected to this circuit to reduce power drain; pin 50 must be connected to the -12.5 volts output at pin 25 in order to derive an output at pin 17.

1.7 Maintenance - One important note is that the two power supplies are referenced together such that any fault in the -12.5 supply will affect the +12.5.

The unregulated voltages may be measured at the common cathodes of CR 8 and CR9 and the common anode of CR10 and CR11, and should be ±15 volts ±1 volt.

1.8 Test Points

No of test points: 4

Test point 1	Red	+12.5 volts
Test point 2	Blue	-12.5 volts
Test point 3	Black	Ground
Test point 4	Yellow	Multivibrator

PARTS LIST

600035 POWER SUPPLY

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
C1	Capacitor, Disc .01 µF	Sprague	40C-387	
C2	Same as C1			
C3	Capacitor, Tantalum 22µF, 35V	Texas Inst.	SCM226GP035K4	
C4	Same as C3			
C5	Same as C3			
C6	Capacitor, 220 µF, 30V	Sprague	112D227C7030M1	
C7	Same as C6			
CR1	Diode, Germanium	Redcor	100941	
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Diode, Zener	Western Semiconductor	1N758A	
CR5	Diode, Silicon	Redcor	100780	
CR6	Same as CR5			
CR7	Same as CR5			
CR8	Diode, Rectifier, Ceramit	Redcor	101449	
CR9	Same as CR8			
CR10	Same as CR8			
CR11	Same as CR8			
P1	Connector, 50 Pin, Male	Redcor	600020	
Q1	Transistor	Redcor	100836	
Q2	Same as Q1			
Q3	Transistor	Sylvania	2N1218	
Q4	Transistor	Bendix	2N1136	
Q5	Same as Q1			
Q6	Transistor	Redcor	100837	
Q7	Same as Q1			
Q8	Same as Q6			

PARTS LIST

600035 POWER SUPPLY

REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER	MANUFACTURER'S NUMBER	USABLE ON CODE
R1	Resistor, Comp., 2.2K 1/4W, 5%	Allen-Bradley	RC07GF222J	
R2	Resistor, Comp., 2.7K 1/4, 5%	Allen-Bradley	RC07GF272J	
R3	Resistor, Comp., 18K 1/4, 5%	Allen-Bradley	RC07GF183J	
R4	Resistor, Comp., 1K 1/4W, 5%	Allen-Bradley	RC07GF102J	
R5	Same as R4			
R6	Same as R2			
R7	Same as R3			
R8	Resistor, Comp., 3.3K 1/4W, 5%	Allen-Bradley	RC07GF332J	
R9	Resistor, Comp., 100ohm 1/4W, 5%	Allen-Bradley	RC07GF101J	
R10	Resistor, Comp., 10K 1/4W, 5%	Allen-Bradley	RC07GF103J	
R11	Resistor, M Film, W.W., 1.78K, ±1%	Redcor	101211-17800-A	
R12	Resistor, M Film, W.W., 1.5K, 1%	Redcor	101211-15000-A	
R13	Resistor, Comp., 330 OHM 1/4, 5%	Allen-Bradley	RC07GF331J	
R14	Same as R10			
R15	Same as R9			
R16	Same as R13			
R17	Same as R10			
R18	Same as R10			