TM 9-4933-241-14&P

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT
AND GENERAL SUPPORT MAINTENANCE
MANUAL INCLUDING REPAIR PARTS LIST
FOR

VOLTMETER, DIGITAL
MODEL 2340
(NSN 4933-01-018-9820)
GENERAL MICROWAVE CORP.

HEADQUARTERS, DEPARTMENT OF THE ARMY

AUGUST 1981

Technical Manual
No. 9-4933-241-14&P

HEADQUARTERS
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Washington, DC, *7 August 1981*

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MODEL 2340
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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual direct to: Commander, US Army Armament Materiel Readiness Command, ATTN: DRSAR-MAS, Rock Island, IL 61299. A reply will be furnished directly to you.

NOTE

This manual is published for the purpose of identifying an authorized commercial manual for the use of the personnel to whom this voltmeter is issued.

Manufactured by: General Microwave Corp.
155 Marine St.
Farmingdale, NY 11735

Procured under Contract No. DAAA09-79C-4621

This technical manual is an authentication of the manufacturers' commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

INSTRUCTIONS FOR REQUISITIONING PARTS

NOT IDENTIFIED BY NSN

When requisitioning parts not identified by National Stock Number, it is mandatory that the following information be furnished the supply officer.

1 - Manufacturer's Federal Supply Code Number - 11332

2 - Manufacturer's Part Number exactly as listed herein.

3 - Nomenclature exactly as listed herein, including dimensions, if necessary.

4 - Manufacturer's Model Number - Model 2340

5 - Manufacturer's Serial Number (End Item)

6 - Any other information such as Type, Frame Number, and Electrical Characteristics, if applicable.

7 - If DD Form 1348 is used, fill in all blocks except 4, 5, 6, and Remarks field in accordance with AR 725-50.

Complete Form as Follows:

(a) In blocks 4, 5, 6, list manufacturer's Federal Supply Code Number - 11332 followed by a colon and manufacturer's Part Number for the repair part.

(b) Complete Remarks field as follows:
Noun: (nomenclature of repair part)
For: NSN: 4933-01-018-9820
Manufacturer: General Microwave Corp.
155 Marine Street
Farmingdale, NY 11735
Model: 2340
Serial: (of end item)

Any other pertinent information such as Frame Number, Type, Dimensions, etc.

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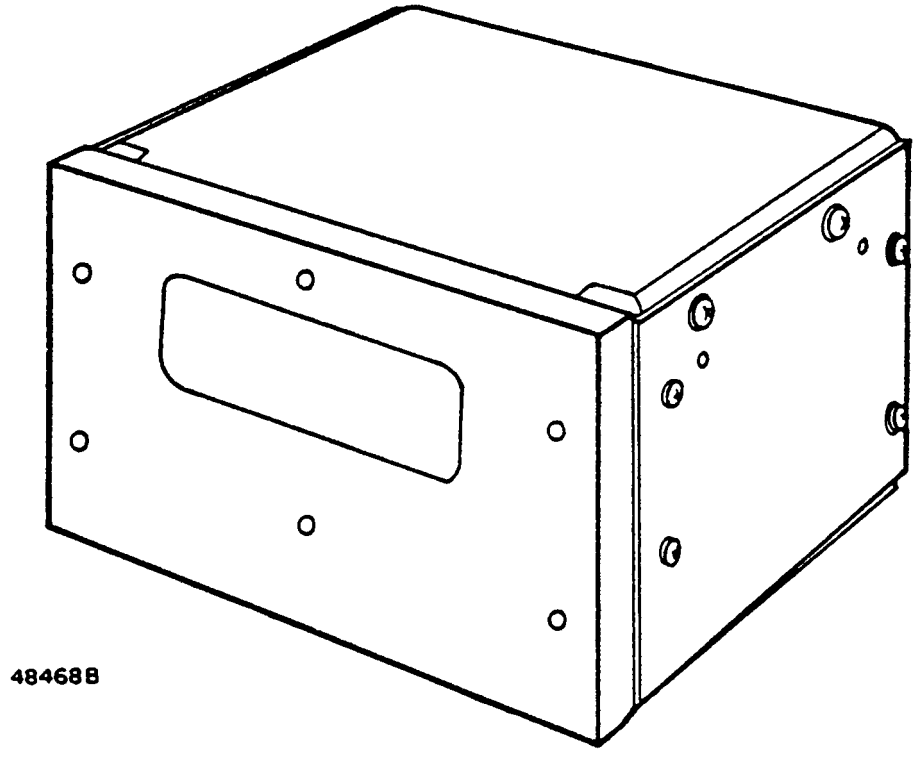

Figure 1. Digital Voltmeter Model 2340

1. DESCRIPTION

Model 2340 Digital Voltmeter is a panel mounted unit that is designed to automatically measure 0 to ±60 volts dc. The readout is shown on a 5-digit LED display. This manual contains information for operation, troubleshooting, repair, and parts list. Refer to Table 1 for a summary of the features and characteristics of the digital voltmeter. Appendix A provides the calibration procedure. This instrument does not require lubrication. Safety precautions and cleaning instructions are described in repair section 4.

2. OPERATION

Apply primary dc power and input voltage. There are no external controls. After at least a five-minute warmup period, the following operation can be observed:

The value and polarity of input voltages in the range of 0 to 60.00 volts will be automaticall y displayed.

Inputs in the 0 to ±9.999 volt range will be displayed to a resolution of .001 volt.

Inputs greater than ±10.999 volts will be displayed to a resolution of .01 volt.

Inputs in the ±10.000 to ±10.999 volts range will be displayed to a resolution of either .001 volt, or .01 volt, depending on the automatically selected range.

3. TROUBLESHOOTING

A detailed understanding of the unit block diagram (figure 3) and timing diagram (figure 4) is essential to troubleshooting the Model 2340. Study the material provided under Block Diagram Description and Timing, including the schematic (figure 5) before initiating troubleshooting procedures.

The flow diagram (figure 6) and test chart (table 2) are logical troubleshooting guides. Careful observation of the display, dc voltages, and waveforms will expedite isolation of a malfunction to a functional block. At that point, the unit schematic and the flow diagram are required to further localize and identify the cause of malfunction.

3.1 RECOMMENDED TEST EQUIPMENT

The following test equipment (or equivalent) is required to implement the troubleshooting procedure.

QTY	DESCRIPTION	
1	Power Supply, LAMBDA	LPD-422A-FM
1	DC Signal Standard, ANALOGIC	AN3100
1	Digital Multimeter, FLUKE	8000A
1	Oscilloscope, TEKTRONIX w/type W Plug-in	545A

8.2 BLOCK DIAGRAM (Figure 3)

Model 2340 circuits are contained in three major subassemblies:

1. Dc power supply module 8656-P1 which converts input, unregulated, 22-30V dc to well-regulated +15 vdc, −15 vdc and +5 vdc outputs.

2. Analog pc board assembly 8661-G1 which contains all circuitry required by the voltmeter other than the counter chain, storage latches, and the 4-1/2 digit LED readout.

3. Counters and Digital Readout pc board assembly 8659-G1 which contains the 4-1/2 digit LED readout, 4-decade counter chain, storage latches, BCD decoder drivers and LED current limiting resistor networks. (Note: This assembly interfaces with the other assemblies via a 20-pin plug-in integral connector which has its mating connector on the analog pc board assembly.)

Functionally the Model 2340 is a precision, dual-slope, A/D converter with a LED numeric readout. It includes autoranging circuits which route the signal directly to the input buffer or via a precise 10:1 voltage divider to the input buffer. Routing is determined by the reading in the counter circuits; if below 1,000, the signal goes directly to the buffer; if above 10,999, the signal is attenuated through the 10:1 divider.

The input power protection circuits prevent damage to the power supply module when a wrong polarity or a transient overvoltage is present at the dc power input.

To reduce the temperature extremes to which key thermally sensitive components are exposed, a heated enclosure is used on the analog pc board. A temperature sensor and controller applies power to several heating elements to keep the compartment from dropping below 30° C (approx).

3.3 TIMING (Figure 4)

All timing measurements are referenced to the negative going output pulse of rate control oscillator U15. (The waveforms of figure 4 are typical for a positive input voltage measurement .)

The rate control pulse sets S/R flip-flop U11 to generate the INTEGRATE SIGNAL ENABLE which in turn sets a second S/R flip-flop (also part of U11) to provide the CLK ENABLE signal. While the CLK ENABLE is high, CLOCK pulses are generated from the clock circuit consisting of three inverters of U8 and R53 and C11. The clock frequency is primarily determined by the values of R53 and C11.

To establish initial conditions in the counter chain, consisting of decade counter integrated circuits U101 through U104, the CLAMP output of timer U15 (pin 7) is differentiated and coupled to Q14 to generate a narrow RESET pulse. After 8000 negative clock pulse transitions, the 8 digit from counter U104 goes high; after 2000 additional clock pulses the 8000 signal at U104 (pin 11) goes low. At that instant the output from one-half of J-K flip-flop U13 complements and the negative going edge of U13 (pin 13) is differentiated and applied to S/R flip-flop U12. This permits the integration of either the plus or minus reference voltage depending on the output of polarity flip-flop U14. Simultaneously, the negative going edge of the U13 (pin 13) output resets INTEGRATE SIGNAL flip-flop U11 to end the signal integration phase of the measurement.

Signal polarity is determined by sampling the comparator output level (U7 pin 7) at the end of the INTEGRATE SIGNAL phase of the measurement. The sampling pulse (POLARITY STROBE) is generated by differentiating the

down going edge of U13 pin 13 and coupling into inverter U8 (pin 5). Measured signal polarity is stored in J-K flip-flop U14 by reading in the instantaneous logic levels applied to the J-K inputs during the POLARITY STROBE.

During the INTEGRATE SIGNAL period a charge is accumulated on integrator capacitor C2; during INTEGRATE REF that charge is reduced to zero by the appropriate reference voltage coupled through analog gates Q4 or Q5. When comparator U7 senses that the integrator has crossed through zero, the comparator output changes state and resets CLOCK ENABLE flip-flop U11 by generating a negative pulse at the output of U9.

The negative going edge of the CLOCK ENABLE pulse is differentiated (R54 and C10) and coupled through Q11 to generate a positive strobe pulse for loading the counter outputs into storage latches U105 through U108. This positive strobe is also coupled through Q12 and delayed by C13 to generate the DELAYED STROBE pulse which transfers the overrange signal from one-half of flip-flop U13 into the second half of U13. The U13 output drives the most significant 1 in the LED readout when greater than 9999 clock pulses have been accumulated during the INTEGRATE REF phase of the measurement.

Table 1.

ELECTRICAL CHARACTERISTICS	SPECIFICATIONS
FULL SCALE RANGE:	Auto-ranging Low scale 0-±11.000V DC High scale 0-±110.00V DC
MAXIMUM ALLOWABLE INPUT:	500 V, AC or DC
RESOLUTION:	1 mV, low scale 10 mV, high scale
INPUT IMPEDANCE:	1 Megohm
CMV: (Common Mode Voltage)	±300 V DC (600 AC, P-P)
CMR: (Common Mode Rejection)	>100 dB, DC to 60 Hz
NMR: (Normal Mode Rejection)	>30 dB at 60 Hz
INPUT BIAS CURRENT:	25 nA Maximum
ACCURACY:	±0.04% reading ± 3 counts
STABILITY:	Specified accuracy applies over the full operating temperature range.
LONG TERM STABILITY:	Calibration not required more often than every six months
SETTLING TIME:	New reading appears each conversion cycle.
SAMPLE RATE:	Two per second
WARM UP TIME:	Five minutes to specified accuracy.
DISPLAY:	7 Segment LED, .27 in.
POLARITY INDICATION:	Automatic + and — symbols.
INPUT POWER:	22 to 30 V DC 18 watts max. at 28 V DC.
INPUT POWER PROTECTION:	To 32 V max. 2 minutes duration; to 80 V max. 100 msec duration; reverse polarity.
PHYSICAL CHARACTERISTICS	
SIZE: (in inches)	3.50H x 6.30W x 5.25D (exclusive of connector) See outline drawing, figure 2.
WEIGHT:	4.2 lb. max.
MATING CONNECTOR REQUIRED:	MS3124E-10-6S
CASE MATERIAL:	Aluminum alloy, black anodize finish.

Table 1 (continued)

	SPECIFICATIONS
SERVICE CONDITIONS	
TEMPERATURE:	Per MIL-STD-810B Operating —40° C to 71° C Storage — 62° C to 85° C
HUMIDITY:	Per MIL-STD-810B, Method 507, Procedure I (to 95 percent RH)
VIBRATION:	Per MIL-STD-810B, Method 514-1, Procedure IX, Part 1.
SHOCK:	Per MIL-STD-810B, Method 516-1, Procedure I, Figure 516.1-1, Parameters b and d.
FUNGUS:	As specified in Table III of MIL-STD-810B, Method 508, Procedure I.
OPTIONAL VARIATIONS	
INPUT VOLTAGE	117V, ±10%, 60-400 Hz
FULL SCALE RANGE	SINGLE RANGE 0-9.999V OR 0-99.99V

The DELAYED STROBE pulse is used in determining the measurement range and illuminating the correct decimal point. Application of the DELAYED STROBE pulse strobes a logic signal into J-K flip-flop U14 which is derived from logic which determines whether the count stored in the latches is less than 1000 or greater than 10,999. The range outputs of U14 actuate the appropriate auto-ranging relay (SPST) K1 or K2 for routing the signal directly to the input buffer or via a precise 10:1 voltage divider to the input buffer and to illuminate the display decimal point. The delay time is required to prevent timing problems which can result in readout errors.

Between measurements, that is the time during which the CLOCK ENABLE flip-flop is reset, a FET clamp circuit across integrator capacitor C2 is enabled, to prevent charge accumulation from various leakage and bias currents.

3.4 FLOW DIAGRAM AND TEST CHART (figure 6 and table 2).

The troubleshooting flow diagram provides a logical and systematic procedure for isolating malfunctions and locating defective components. Isolation of a malfunction will initially be to one of the major subassemblies, (1) Power Supply, (2) Analog Circuits and (3) Counters and Digital Readout.

The test chart is used in conjunction with the flow diagram and details each test listed in the diagram.

4. REPAIR

To gain access to the interior of a Model 2340 remove the two screws at the rear of the unit, the four screws on each side, and then carefully withdraw the panel-chassis assembly from the housing. Standard readily available components are used whenever possible in the manufacture of the Model 2340. Special or modified parts are identified in the parts list by GMC DWG number. Observe the usual precautions and good practices associated with replacing components in precision electronic equipment, such as:

CAUTION

(1) Before using any tool, electrostatically neutralize it by touching it to a large metallic mass or a known ground

CAUTION

(2) Make resistance checks using the higher ohmmeter ranges only.

CAUTION

(3) To avoid damage to the printed circuit board, use a temperature-controlled 1/8 inch soldering iron set to 700° F whenever possible if component replacement is required. The heat of the soldering iron will permit the component to be removed through the conformal coating. After component replacement has been made, thoroughly remove all flux remains using a clean stiff brush dipped in Freon TMC™ solvent. Then permit a one-minute drying period and apply Humiseal 1B3 1™ coating using a second clean stiff brush. Allow a one hour curing period before calibrating the unit.

(4) If component replacement is required, be sure to use only the types described in the parts list.

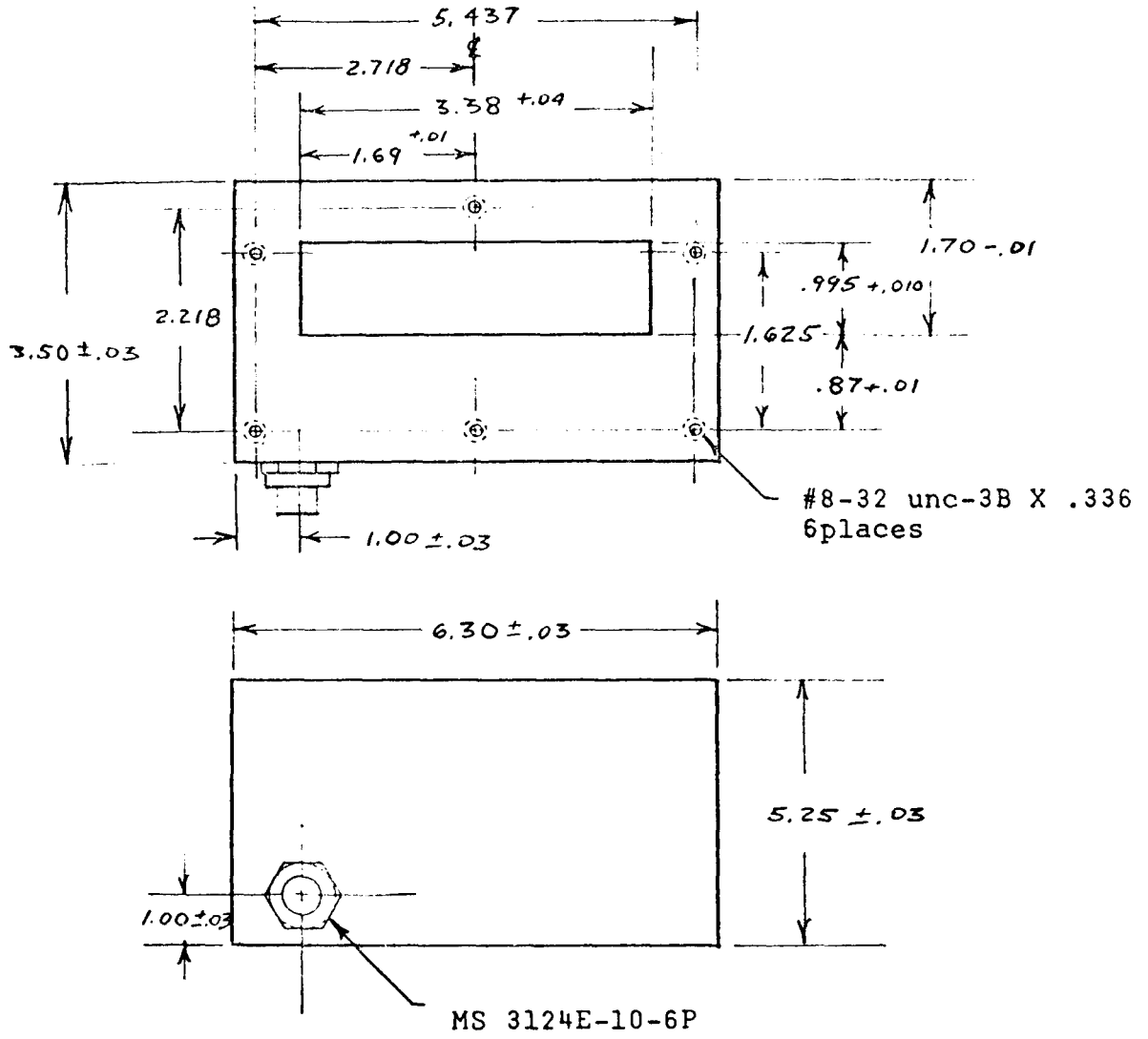

Figure 2. Outline Drawing

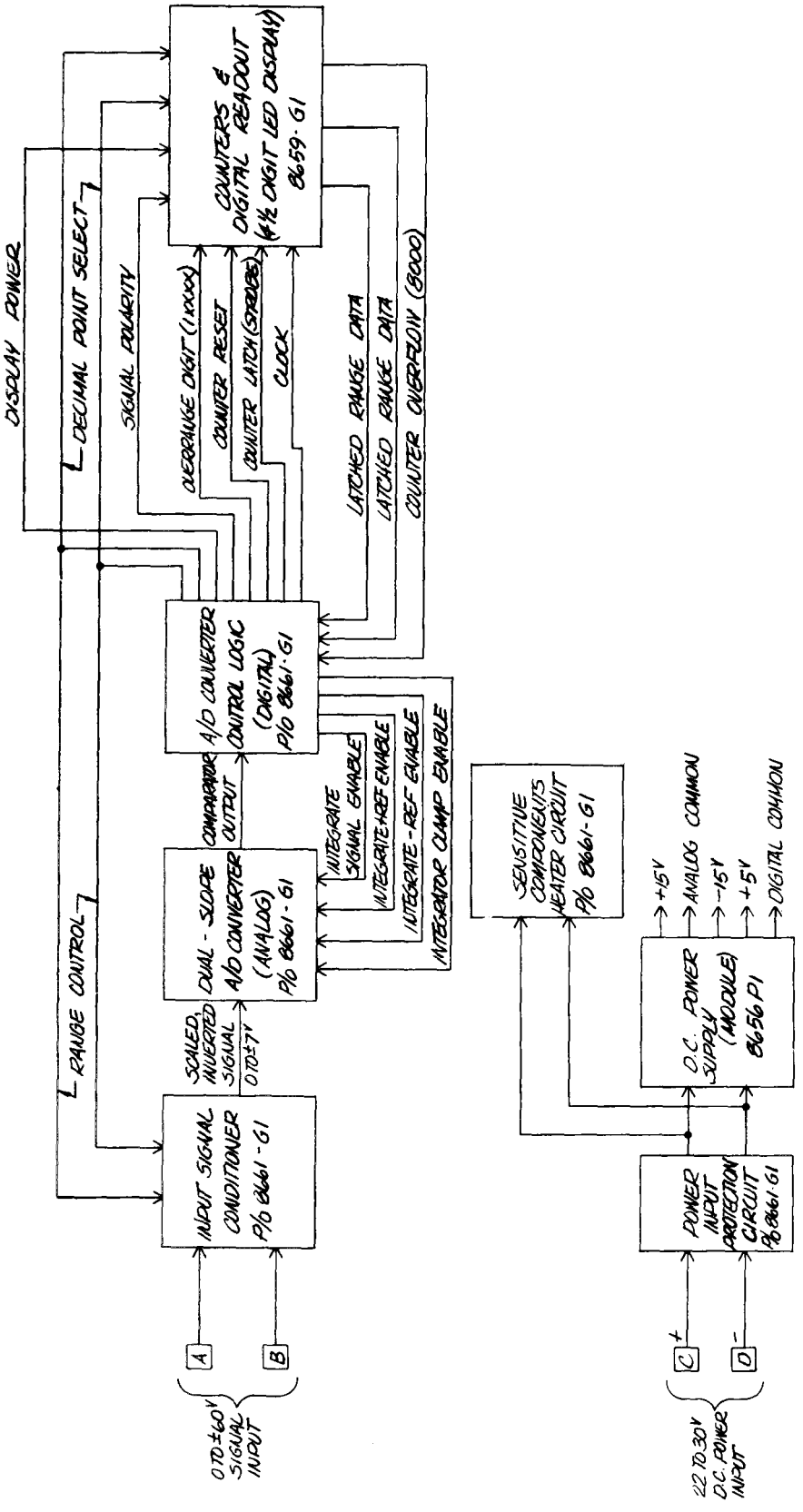

Figure 3 Block Diagram

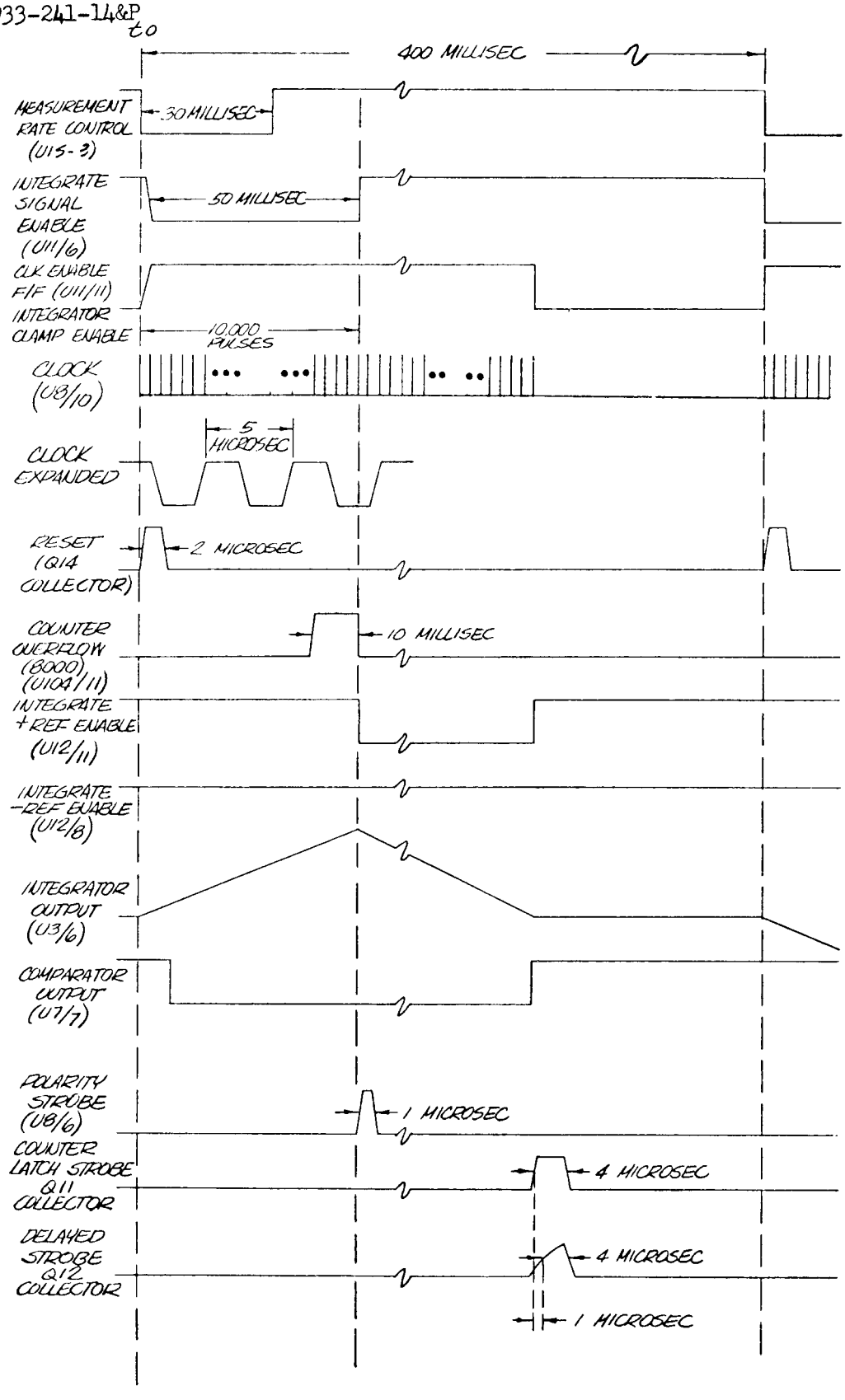

Figure 4. Timing Diagram

Figure 5. Schematic Diagram (Sheet 1 of 2). Located in back of manual.

Figure 5. Schematic Diagram (Sheet 2 of 2). Located in back of manual.

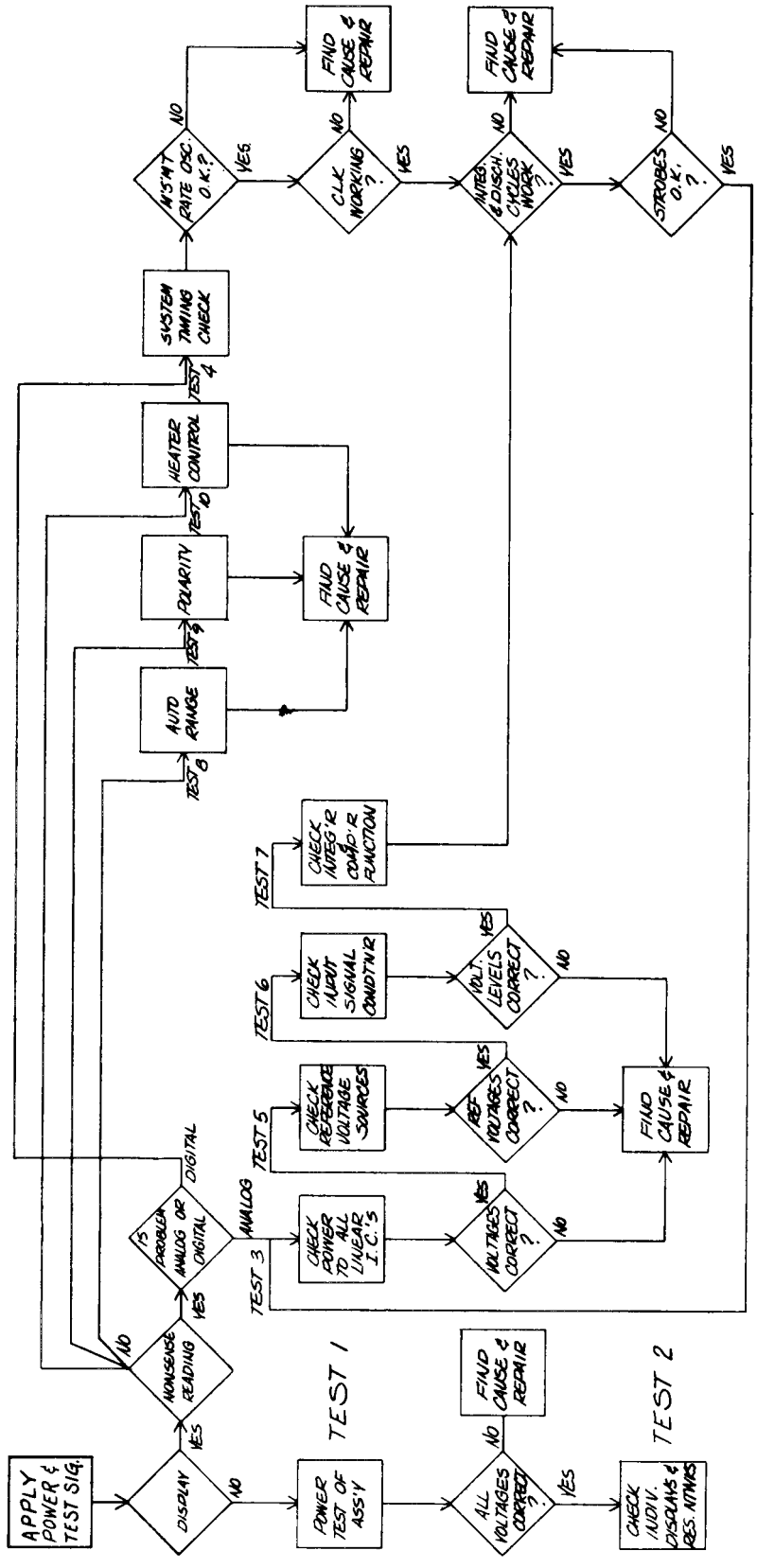

Figure 6 Flow Diagram

Table 2. TROUBLESHOOTING TEST CHART

TEST NO.	OPER. CONDI-TIONS	SYMPTOI	MEASURE	TEST POINTS	VALUE NOM	VALUE LIM	IF NOT CORREC REFER TI	IF CORREC	COMMENTS
1	Apply Correct Power to Unit	No Dis-play Illu or Dim o Intermit. Illum.	DC Power Supply Voltage At Display Subass'y	See Program Table On DWG 8660/ Sht. 2 (figure 5)	+5.0V	4.80 tc 5.10	DWG 8656-P1		Quick Test: Replace Entire Display Board Subassy 0659-G1 With Known Good Unit
			Display Volts	DS101/3, 9, 14	+3.9V	3.60 tc 4.20	DWG 8660/ Sht. 1 Q10, CR11		
2	Power Off	Display Illum. Malfunct	Z101 thru Z104	Indiv. Pins On Z101 Thru Z104 Per Dwg 8660/Sht. 2	39 OHMS Each	35 to 43 OHMS	DWG 8660/ Sht. 2		Each Display Element should Test Like a Diode with 5V Max. Diode Reverse Break-down
			DS101 Thru DS105	Pins On Dis-play Elements	Diode Test		DWG 8660/ Sht. 2		
3	Power On	Erron-eous Readout	DC Power Supplies	+V	+15V	14.7 tc 16.3	DWG 8660/ Sht. 1	Power Supply 8656-P1 OK	
				−V	−15V	−14.7 to −15.3			
				+5.0V	+5.0V	+4.8 to 5.2			
				On U1 thru U7 Per Dwg 8660/ Sht. 1					
4	Power On +1.000V Signal nput	Erron-eous Readout	System Timing	See Figure 4	Wave-forms as Shown In Fig. 2		DWG 8660/ Sht. 1	Digital Control Section OK	
5	Power On 1.0V Signal nput	Erron-eous Readout	$+V_{REF}$	CR-5 Cathode	+5.20V	+6.0V to +6.45V	DWG 8660/ Sht. 1		Loading Effects May Be Isolated By Unsoldering Bridges At Q4/ Source, and Q5/ Source on PC Board 8661. See DWG 8660/Sht. 1
			$-V_{REF}$	CR-6 Anode	−6.20V	−6.0V to −6.45V			
			Zero Set Control Wiper	C7(+)	0V	−13 to −13mV			
6	Power On 1.0V Signal nput	Erron-eous Readout	nput Buffer	J1/6	0V	−2.0 to −2.0mV	DWG 8660/ Sht. 1		
			nverting Scaler	J2/6	0V	−3.0 to −3.0mV			
			Range Relay Select	Q7/Collect	0V	300mV Max.			
				Q8/Collect	−15V	+14V Min.			

Table 2. TROUBLESHOOTING TEST CHART (continued)

EST NO.	OPER. CONDI-TIONS	SYMPTOM	MEASURE	TEST POINTS	VALUE NOM	VALUE LIM	IF NOT CORRECT REFER TO	IF CORRECT	COMMENTS
6 cont	+20V Signal		Input Buffer	U1/6	+2.0V	+1.99 to +2.01V		Input Atten R1/R2 OK	
			Inverting Scaler	U2/6	-1.24V	-1.18 to -1.30V			Depends On Value of Sat Resistor, R13 Which Depends on Value Of V_{RET}
			Range Relay	Q7/Collect	+15V	+14V Min			Decimal Point XX.XX Illuminated
			Select	Q8/Collect	0V	+300mV Max			
	Power On -10.00V Signal Input	Erroneous Readout	Input Buffer	U1/6	10.00V	-9.90 to -10.02	DWG 8660/ Sht. 1		
			Inverting Scaler	U2/6	+6.2V	+6.0 to +6.45V			
			Range Relay	Q7/Collect	0V	+300mV Max			Decimal Point XX.XXX Illuminated
			Select	Q8/Collect	+15V	+14V Min			
7	Power On +10.00V Signal Input	Erroneous Readout	Integrator Waveform	U3/6	Wave Form As Shown In Fig. 2	Posit. Peak <10V	DWG 8660/ Sht. 1		
			Comparator Waveform	U7/7	Wave Form As Shown In Fig. 2	Pos. Levels <5V Neg Levels >0V			0 to "1" Transition Time 20 microsec
8	Power On 0.0V Input	Wrong Decim. Point Displ.	Range	U14/8	Logic "1"	+2.4 to +5.0V	DWG 8660/ Sht. 1		Dec. Points Illuminated Through R63, R64 Current Limit Resistors
			Flip-Flop Output	U14/9	Logic "0"	≤400 mV			
			Delayed Strobe	U14/5	Wave Form As Shown In Fig. 2				
	+20V Input	Wrong Decim. Point Displ.	Range Flip-Flop	U14/8	Logic "0"	≤400 mV			
				U14/9	Logic "1"	+2.4 to 5.0V			

Table 2. TROUBLESHOOTING TEST CHART (continued)

EST NO.	OPER. CONDI-TIONS	SYMPTOM	MEASURE	TEST POINTS	VALUE NOM	VALUE LIM	IF NOT CORRECT REFER TO	IF CORRECT	COMMENTS
9	Power O +100mV	Polarity Display Incorrect	Poly Flip/ Flop Outputs	U14/12	Logic 0		DWG 3660/ Sht. 1		
				U14/13	Logic 1				
			Polarity Strobe	U14/1	Wave Forms As Shown In Fig. 2	1.5 us Max Pulse Width			Polarity Strobe At End of Integrate Cycle
	-100mV	Polarity Display Incorrect	Poly Flip/ Flop Outputs	U14/12	Logic 1				
				U14/13	Logic 0				
10	Power O R37 Full CW	Heater Always On or Always Off	Heater Control Inputs/ Outputs	U16/9	>15V				Heater Resistors R42, R43, R65, R66 Should Be HOT To Touch
				Q9/Collect	200mV	>600 mV			
				U16/4	+3.6V				
				U16/5	+3.6V	U16/4			
				U16/6	+7.15V	6.9V to 7.3V			
	Power O R37 Full CCW		Heater Control Inputs/ Outputs	U16/9	<2V				
				Q9/Collect	>22V				
				U16/4	+3.6V				When Voltage On U16/5 Exceeds Voltage on U16/4, Heater Switches On .
				U16/5	+3.5V	<U 16/4			
				U16/6	+7.15V	6.9 to 7.3V			When Voltage On U16/5 Drops Below Voltage On U16/4, Heater Switches Off

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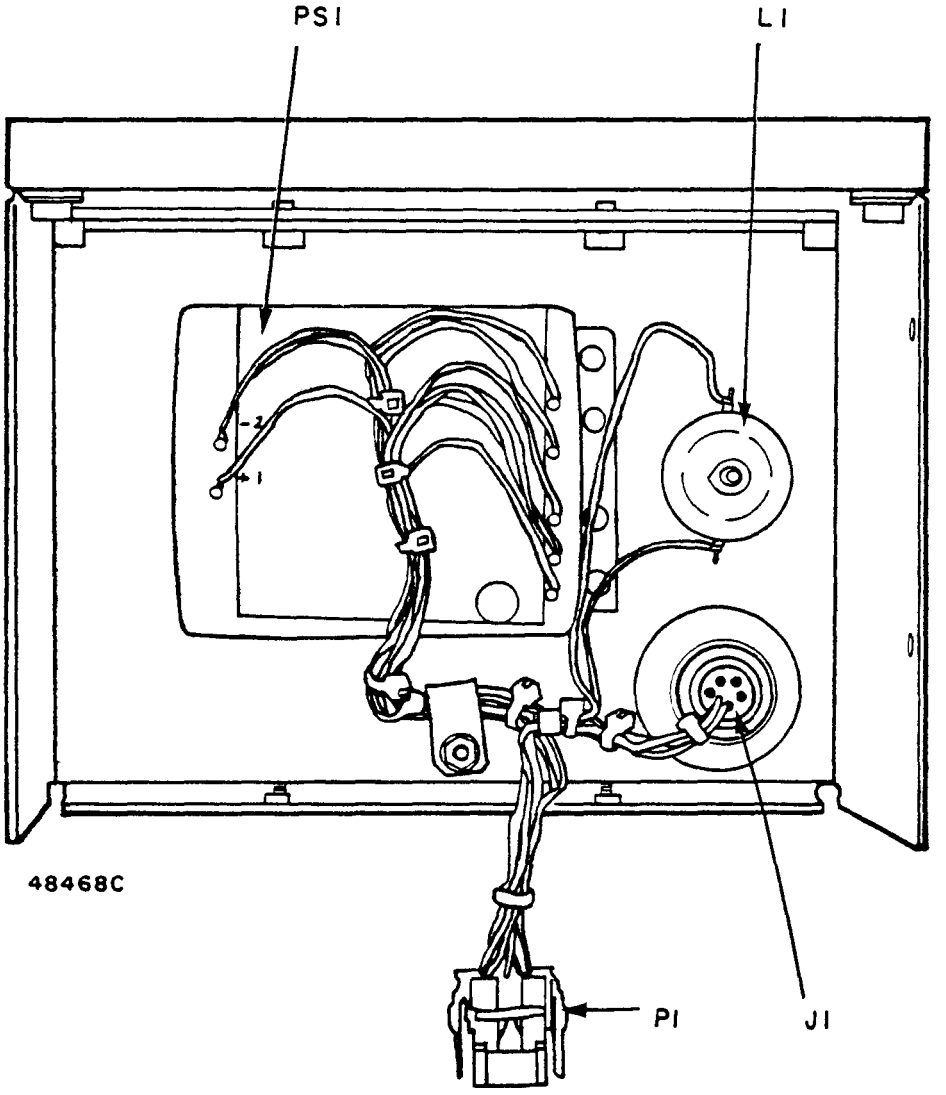

Figure 7. Interior View, Cover and Boards Removed

5. **PARTS LIST** (see figure 7)

REF DES	DESCRIPTION	MFR CODE	GMC DWG
—	Digital Voltmeter	11332	8663-G1
J1	Conn, Recp, Elec MS3124E-10-6P	81349	
L1	Filter	11332	8845-P1
PS1	Power Supply	11332	8656-P1
P1	Conn, Plug 1-350243-9	00779	

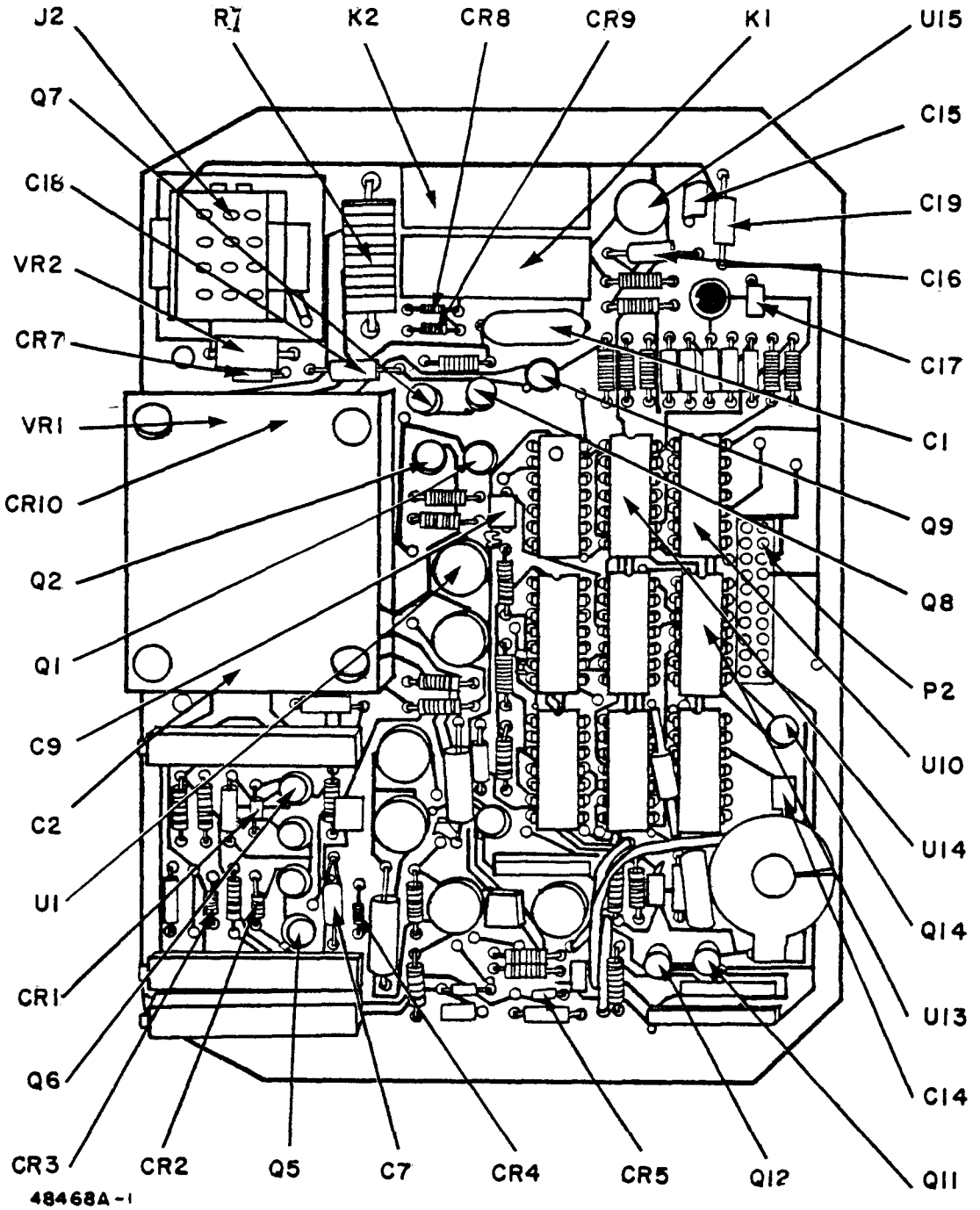

Figure 8. Analog Board A1 (sheet 1 of 3)

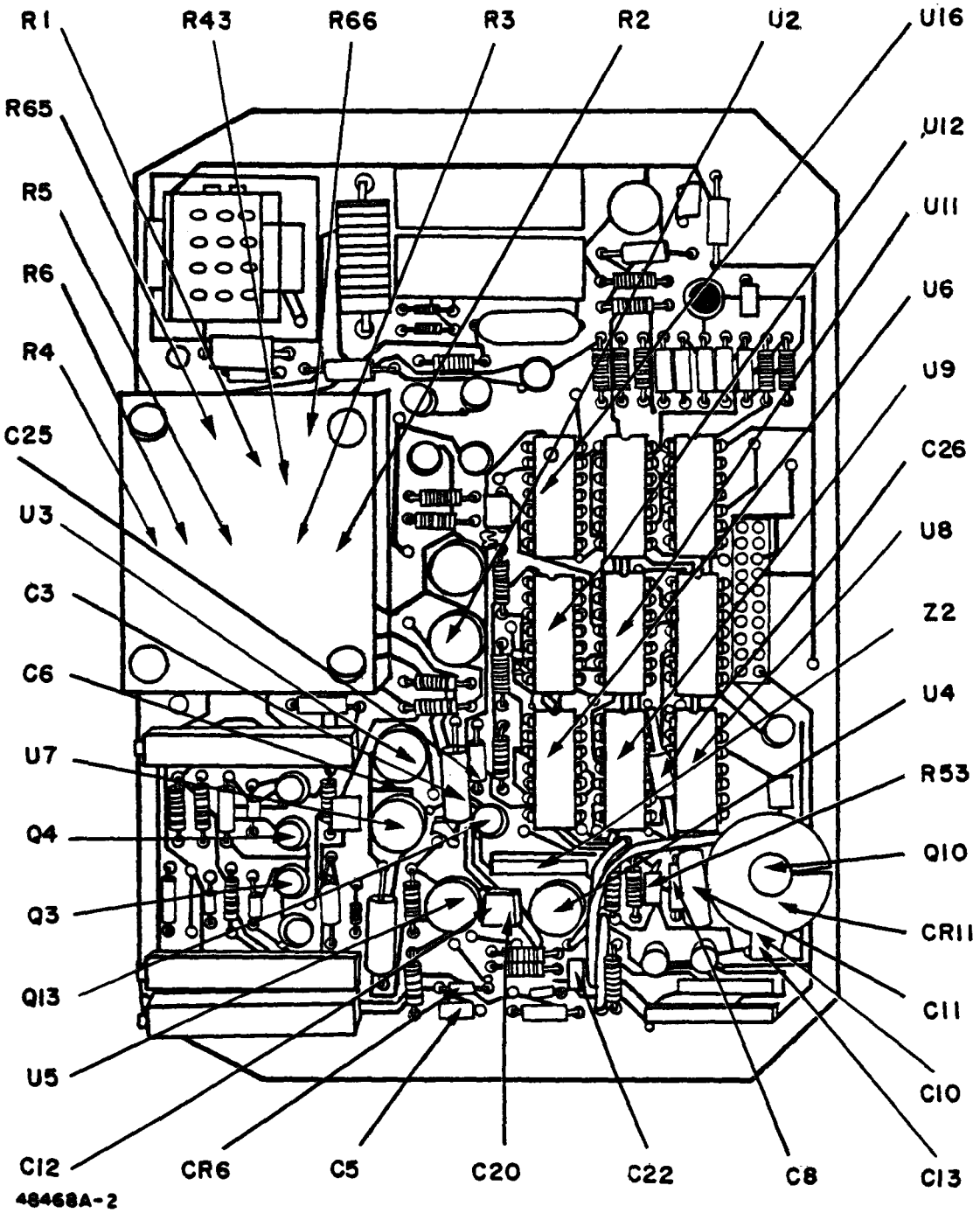

Figure 8. Analog Board A1 (sheet 2 of 3)

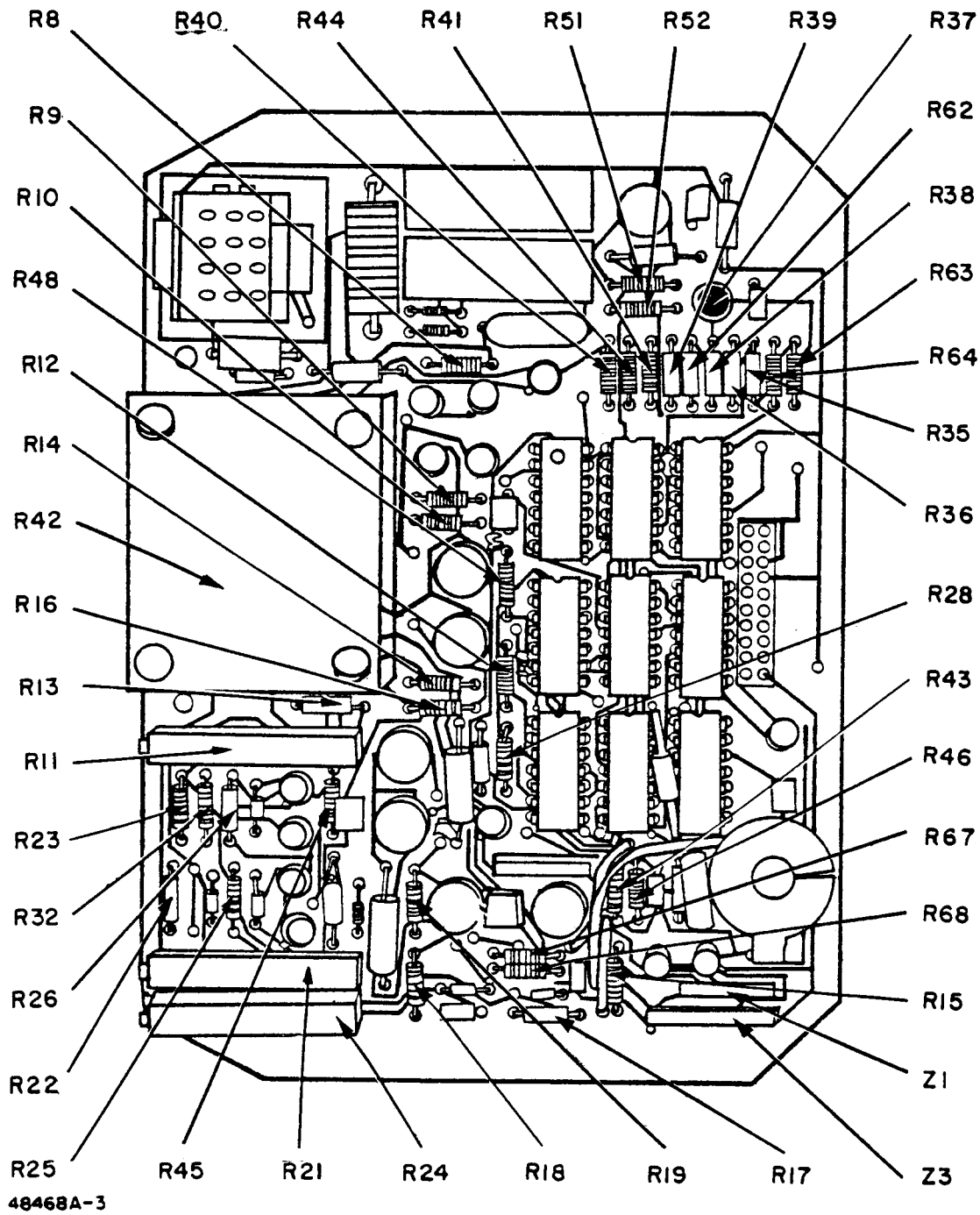

Figure 8. Analog Board A1 (sheet 3 of 3)

5. PARTS LIST (CONT) (see figure 8)

REF DES	DESCRIPTION	MFR CODE	GMC DWG
A1	Analog Board Assy	11332	8661-G1
C1	CAP, FXD, PLSTC .22uF, 100V P/N C280AE/A220KSR	80031	
C2	CAP, FXD, PLSTC 2uF, 50V ACF50-2.0-10	50369	
C3, C4	CAP, FXD, TA 6.8uF, 35V M39003/01-2305	81349	
C5	CAP, FXD, CER .01uF, 100V M39014/01-1415	81349	
C6	CAP, FXD, CER 4700pF, 100V M39014/01-1409	81349	
C7	CAP, FXD, TA 1.0uF, 50V M39014/01-2356	81349	
C8	CAP, FXD, CER 2200pF, 100V M39014/01-1403	81349	
C9	CAP, FXD, CER 470pF, 200V M39014/01-1231	81349	
C10	Same as C6		
C11	CAP, FXD, PLSTC 8200pF, 400V C350AF/A8K2CF	80031	
C12	CAP, FXD, CER 1000pF, 200V M39014/01-1397	81349	
C13	Same as C8		
C14	Same as C12		
C15	Same as C5		
C16	Same as C7		
C17	Same as C9		
C18	Same as C7		
C19	CAP, FXD, TA 4.7uF, 10V M39014/01-2255	81349	
C20	Same as C12		
C21	Not used		
C22	Same as C9		
C23, C24	Not used		
C25	CAP, FXD, CER .047uF, 50V M39014/05-2474	81349	
C26	Same as C7		

REF DES	DESCRIPTION	MFR CODE	GMC DWG
CR1-CR6	Diode, Switching JAN 1N4148	81349	
CR7	Diode, Rectifier IN4002	81349	
CR8-CR10	Same as CR1		
CR11	Diode, Shottky, 5082-2800	28480	
J1	Not used		
J2	Conn, Recep 9-350266-2	00779	
K1, K2	Relay	11332	8657-P1
P2	Connector, Plug, Electrical 1-87230-0	00779	
Q1-Q6	Transistor, FET, 'N' CHNL 2N4093	81349	
Q7-Q9	Transistor, NPN JAN 2N2222A	81349	
Q10	Transistor, NPN 2N4237	81349	
Q11, Q12	Same as Q7		
Q13	Same as Q7		
Q14	Transistor, NPN JAN 2N2369A	81349	
Q15	Not used		
Q16	Not used		
R1, R2	RES, Matched Pair	11332	8633-P1
R3, R4	RES, Matched Pair	11332	8633-P2
R5, R6	RES, Matched Pair	11332	8633-P3
R7	RES, FXD, COMP 91K OHMS, RCR42G913JS	81349	
R8	RES, FXD, COMP 120 OHMS, RCR07G121JS	81349	
R9	RES, FXD, COMP 1000 OHMS, RCR07G102JS	81349	
R10	RES, FXD, COMP 91K OHMS, RCR07G913JS	81349	
R11	RES, VAR., CER 20 OHMS, 3059Y-1-20	80294	
R12	RES, FXD, COMP 3900 OHMS, RCR07G392JS	81349	
R13	S.A.T. (selected at test) RN55C Type	11332	8681
R14	RES, FXD, COMP 100K OHMS, RCR07G104JS	81349	

PARTS LIST (CONT)

REF DES	DESCRIPTION	MFR CODE	GMC DWG
R15	RES, FXD, COMP 4700 OHMS, RCR07G472JS	81349	
R16	RES, FXD, COMP 10K OHMS, RCR07G103JS	81349	
R17	RES, FXD, FILM 825 OHMS, RNR55H8250FM	81349	
R18	Same as R15		
R19	Same as R16		
R20	S.A.T.		
R21	RES, VAR, CER 50 OHMS, 3059Y-1-50	80294	
R22	Same as R20		
R23	Same as R14		
R24	Same as R21		
R25	Same as R14		
R26	RES, FXD, FILM 24.9K OHMS, RNR55C2492FR	81349	
R27	P/O Z2		
R28	RES, FXD, COMP 22K OHMS RCR07G223JS	81349	
R29-R31	P/O Z2		
R32	Same as R14		
R33	P/O Z1		
R34	Same as R15		
R35, R36	RES, FXD, FILM 3480 OHMS, RNR55H3481M	81349	
R37	RES, VAR, CER 100 OHMS, ET-50P-101	80031	
R38	Same as R35		
R39	RES, FXD, FILM 3010 OHMS, RNR55H3011M	81349	
R40	RES, FXD, COMP 1500 OHMS, RCR07G152JS	81349	
R41	RES, FXD, COMP 33K OHMS RCR07G333JS	81349	
R42, R43	RES, FXD, WW 200 OHMS RS-5V	91637	
R44	RES, FXD, COMP 2.2 MEGOHM, RCR07G225JS	81349	
R45	Not used		
R46	Same as R12		
R47	P/O Z3		
R48	RES, FXD, COMP 15K OHMS RCR07G153JS	81349	
R49, R50	P/O Z3		
R51	RES, FXD, COMP 390K OHMS, RCR07G394JS	81349	
R52	RES, FXD, COMP 47K OHMS, RCR07G473JS	81349	
R53	RES, FXD, COMP 215 OHMS, RNR55H2150M	81349	
R54	Same as R33		
R55, R56	P/O Z3		
R57	P/O Z1		
R58, R59	Not used		
R60	Same as R33		
R61	P/O Z3		
R62	Same as R20		
R63, R64	RES, FXD, COMP 180 OHMS RCR07G181JS	81349	
R65, R66	RES, FXD, FILM 1000 OHMS, RLR20C102GR	81349	
R67, R68	RES, FXD, COMP 3300 OHMS, RCR07G332JS	81349	
U1, U2	IC, LINEAR LH0044C	12040	
U3	IC, LINEAR 741EHC	07263	
U4, U5	Same as U1		
U6	IC, QUAD COMP LM239D	12040	
U7	IC, COMP LM211H	12040	
U8	IC, DIGITAL, HEX INV SN5404J	01295	
U9	IC, DIGITAL, QUAD 2-INPUT NAND SN5403J	01295	
U10-U12	IC, DIGITAL, QUAD NAND SN54L00J	01295	
U13	IC, DIGITAL SN54L73J	01295	
U14	IC, DIGITAL SN5473J	01295	
U15	IC, TIMER SN72555L	01295	
U16	IC, VOLTAGE REG. LM723D	12040	

PARTS LIST (CONT)

REF DES	DESCRIPTION	MFR CODE	GMC DWG
VR1	DIODE, ZENER JAN 1N829	81349	
VR2	DIODE, SUPPRESSOR 1.5KE39	24444	
Z1	RES, NETWK, SIP 5-10K OHMS 4306R-101-103	80294	
Z2	RES, NETWK, SIP 5-33K OHMS 4306R-101-333	80294	
Z3	RES, NETWK, SIP 7-10K OHMS 4308-101-103	80294	

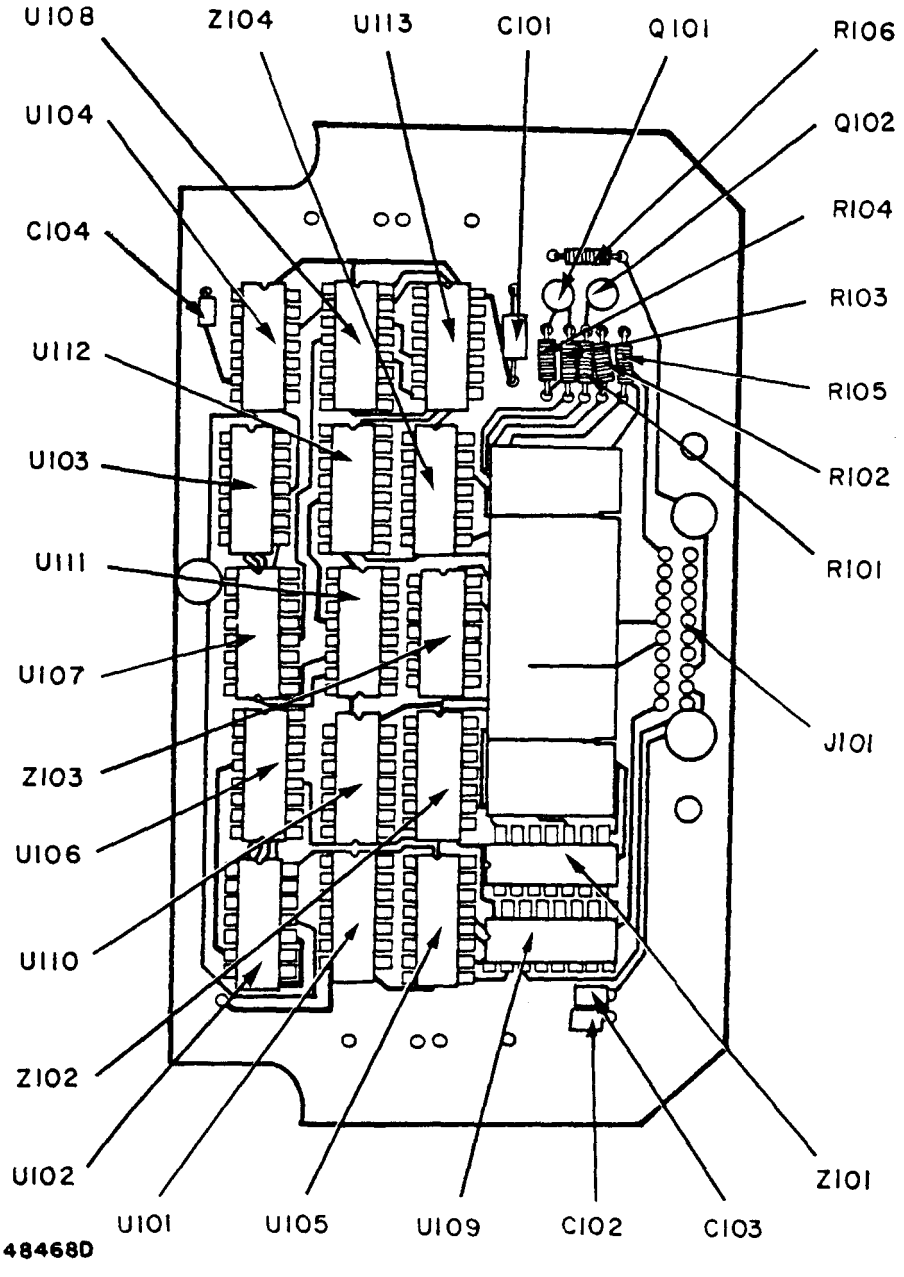

Figure 9. Display Board A2

PARTS LIST (CONT)

REF DES	DESCRIPTION	MFR CODE	GMC DWG
A2	DISPLAY BOARD ASSY	11332	8659-G1
C101	CAP, FXD, TA 4.7uF, 10V M39003/01-2255	81349	
C102	CAP, FXD, CER 470pF, 200V M39014/01-1391	81349	
C103	CAP, FXD, CER 100pF, 200V M39014/01-1219	81349	
C104	CAP, FXD, CER 100pF, 200V M39014/05-2419	81349	
DS101-DS104	LED, DISPLAY, MAN 10A	29083	
DS105	LED, DISPLAY, MAN 101A	29083	
J101	CONN, RECP, ELEC 86418-1	02660	
Q101, Q102	TRANSISTOR, NPN JAN 2N2222A	81349	
R101-R103	RES, FXD, COMP 39 OHMS, RCR07G390JS	81349	
R104	RES, FXD, COMP 3300 OHMS, RCR07G332JS	81349	
R105	Same as R101		
R106	Same as R104		
U101-U104	IC, DIGITAL SN54L90J	01295	
U105-U108	IC, DIGITAL SN54L90J	01295	
U109-U112	IC, DIGITAL SN54L47J	01295	
U113	IC, DIGITAL SN54L20J	01295	
Z101-Z104	RES, NETWK DIP 7-39 OHMS	80294	

Table 3. LIST OF MANUFACTURER'S CODES

CODE	MANUFACTURER	ADDRESS
00779	AMP, INC.	HARRISBURG, PENNSYLVANIA
01295	TEXAS INSTRUMENT	DALLAS, TEXAS
07263	FAIRCHILD	MOUNTAIN VIEW, CALIF.
11332	GENERAL MICROWAVE CORP.	FARMINGDALE, NEW YORK
12040	NATIONAL SEMICONDUCTOR	DANBURY, CONN.
24444	GENERAL SEMICONDUCTOR	TEMPE, ARIZONA
28480	HEWLETT PACKARD	PALO ALTO, CALIF.
29083	MONSANTO	SANTA CLARA, CALIF.
50369	ACTIVE & PASSIVE COMP.	PLAINVIEW, NEW YORK
80031	MEPCO, INC.	MORRISTOWN, NEW JERSEY
80294	BOURNS	RIVERSIDE, CALIF.
81349	GOVERNMENT SPECIFICATION	—
91637	DALE ELECTRONICS INC.	COLUMBUS, NEBRASKA

APPENDIX A

MODEL 2340
DIGITAL VOLTMETER
CALIBRATION PROCEDURE

SECTION I

IDENTIFICATION AND DESCRIPTION

1.1 IDENTIFICATION

Model 2340 Digital Voltmeter.

1.2 CALIBRATION DESCRIPTION

TEST INSTRUMENT PARAMETERS	PERFORMANCE SPECIFICATIONS
Accuracy	±0.04% reading ±3 counts

1.3 FORMS AND RECORDS

Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

SECTION 2

EQUIPMENT REQUIREMENTS

NOTE

Minimum use specifications are the principal parameters required for performance of the calibration, and are included to assist in the selection of alternate equipment, which may be used at the discretion of the calibrating activity. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence of current calibration.

ITEM	MINIMUM USE SPECIFICATIONS	CALIBRATION EQUIPMENT[1]
Voltage Standard	0 to 11.11110 volts Accuracy ±.01% of reading	ANALOGIC AN3100
DC Power Supply	18 to 32 volts @ 700mA (max)	LAMBDA LPD-422A-FM

[1]The calibration equipment utilized in this procedure was selected from those known to be available at Department of Defense facilities, and the listing by make or model number carries no implication of preference, recommendation, or approval by the Department of Defense for use by other agencies. It is recognized that equivalent equipment produced by other manufacturers may be capable of equally satisfactory performance in the procedure.

SECTION III

PRELIMINARY OPERATION

Refer to Model 2340 DVM Technical Manual for familiarization with general operating procedures before beginning calibration.

SECTION IV

CALIBRATION PROCESS

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met, before proceeding.

4.1 INTERCONNECTION

Connections for the calibration process are described at the appropriate point in the procedure. Connector pin assignments are:

PIN	PURPOSE
A	Signal Input High
B	Signal Input Low
C	+28V DC, 620mA max
D	+28V Return (chassis)
E	Spare
F	Spare

4.2 ACCURACY CHECKS

4.2.1. Apply DC voltage input within the range of 22 to 30 volts between pins J1-C(+) and J1-D(-). Allow a 5 minute warmup.

4.2.2. Apply calibrated input signals between pins J1-A(high) and J1-B(ground) in accordance with Table 4-1 Column (3) and check that display readout is within the calibration tolerances of column (7).

4.3 CALIBRATION ADJUSTMENT

NOTE

Do not take corrective action until step 4.3.5 has been performed.

4.3.1. Apply a DC signal of +4.5 mV between pins J1-A(+) and J1-B(-). Adjust R24 as required for a +0.005 display reading.

4.3.2. Adjust DC signal for -4.5 mV and adjust R24 as required for a -0.005 display reading.

4.3.3. Adjust DC signal for -10.0005 volts and note absolute value of display reading.

4.3.4. Adjust DC signal for +10.0005 volts and adjust R21 as required to obtain exact value noted in step 4.3.3.

4.3.5. Repeat steps 4.3.1. through 4.3.4. until no further adjustments are required.

4.3.6. Adjust DC signal input for +10.0005 volts and adjust R11 as required for a display indication of +10.001.

4.3.7. Apply glyptal tc R11, R21 and R24 adjustment screws.

Table 4-1. TEST INSTRUMENT: DIGITAL VOLTMETER

PROC. NO.		MODEL 2340 SER. NO. _____				
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEAS. RUN 1 (4)	VALUES RUN 2 (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.2	Accuracy Measurement					
4.2.2		0 V	ck ( )			-0.003 to +0.003
		+1000.0mV	ck ( )			+0.996 to +1.004
		-1000.0mV	ck ( )			-0.996 to -1.004
		+10.000V	ck ( )			+9.992 to +10.008
		-10.000V	ck ( )			-9.992 to -10.008
		+20.000V	ck ( )			+19.96 to +20.04
		-20.000V	ck ( )			-19.96 to - 20.04
		+60.000V	ck ( )			+59.94 to +60.06
		-60.000V	ck ( )			-59.94 to - 60.06
		+10.500V	ck ( )			+10.46 to +10.54
		+ 9.990V	ck ( )			+9.983 to +9.997

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

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PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.
25	4-2		

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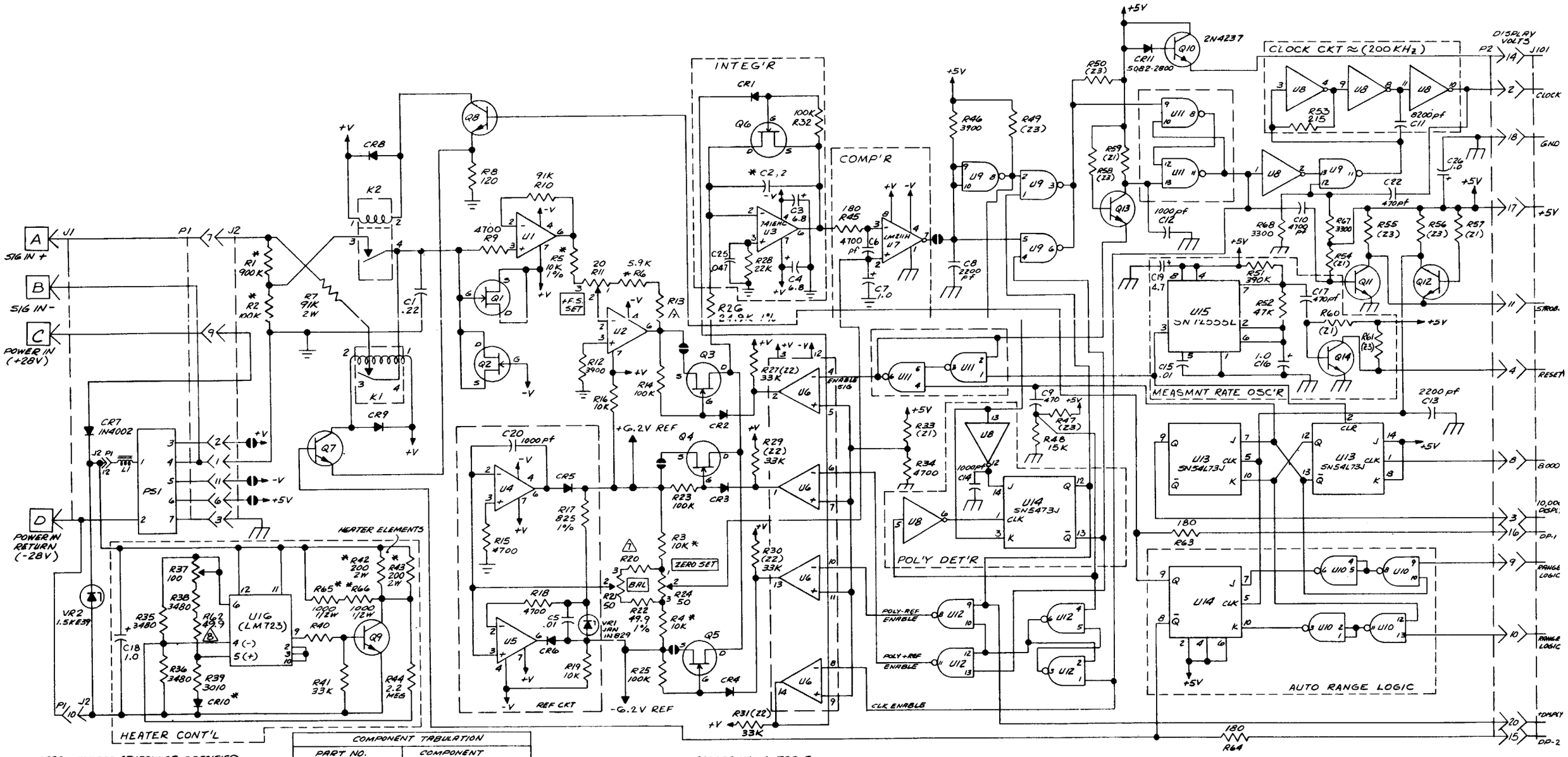


NOTES: UNLESS OTHERWISE SPECIFIED

1. RESISTANCES ARE GIVEN IN OHMS CAPACITANCES ARE GIVEN IN MICROFARADS
2. K1 SHOWN ENERGIZED
3. K2 SHOWN UNENERGIZED
4. * DENOTES HEATED AREA
5. ● DENOTES BRIDGE AT TEST
6. →← DENOTES CONNECTIONS TO DISPLAY BD
7. SELECT VALUE AT TEST
8. MFG INITIALLY TO INSTALL A 49.9 OHM RESISTOR; SELECT AT TEST IF REQD.

COMPONENT TABULATION

PART NO.	COMPONENT
AD3636 OR OP07DJ	U1, U2, U4, U5
SN54L00J	U10, U11, U12
JAN2N2369A	Q11, Q12, Q14
SN5404J	U8
SN5403J	U9
JAN1N4148	CR1-CR6, CR8-CR10
2N4093	Q1, Q2, Q3, Q4, Q5, Q6
JAN2N2222A	Q7-Q9, Q13, Q101, Q102
Z1 (5-10K)	R33, R54, R57, R59
Z2 (5-33K)	R27, R29, R30, R31
Z3 (7-10K)	R47, R49, R50, R55, R56, R58, R61
8633-P1	R1, R2
8633-P2	R3, R4
8633-P3	R5, R6
SG339J	U6

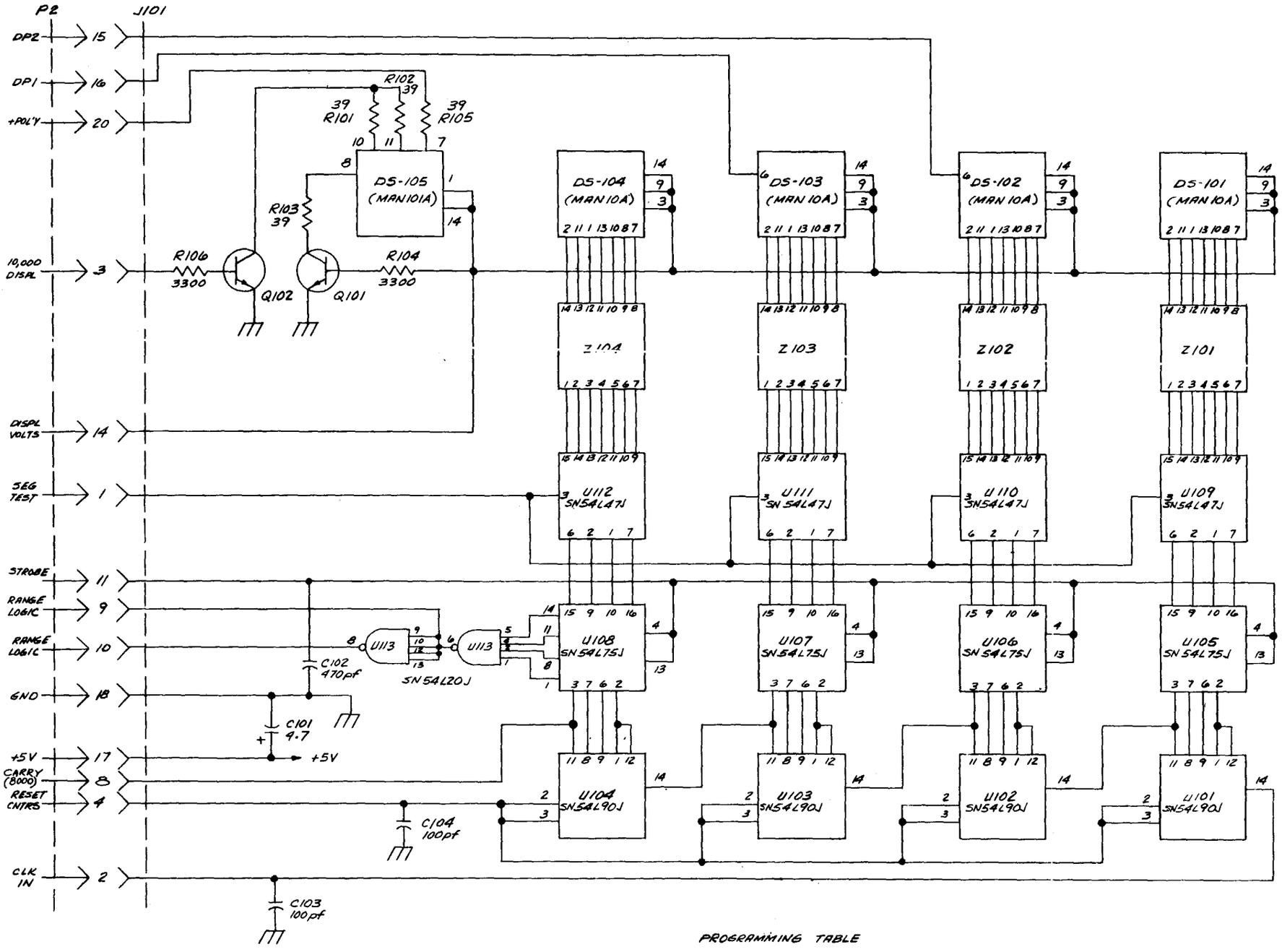
PROGRAMMING TABLE

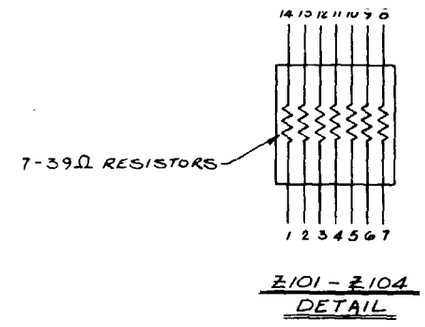
ITEM	+5V	GND	+15V	-15V	+28V	+28V RTRN
U1, U2, U3, U4, U5	—	—	7	4	—	—
U6	—	—	3	12	—	—
U7	—	—	1	8	—	—
U8, U9, U10, U11, U12	14	7	—	—	—	—
U13	3,4,6,14	—	—	—	—	—
U14	2,4,6	—	—	—	—	—
U15	4,8	—	—	—	—	—
U16	—	—	—	—	11,12	7

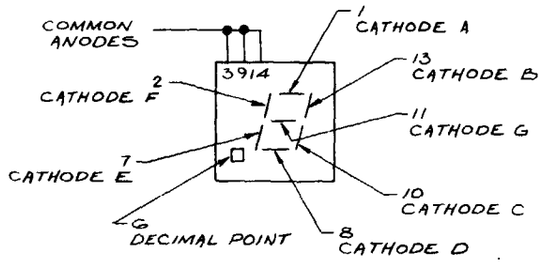
REVISION STATUS OF SHEETS

SHEET	1	2
REVISION	C	—

Figure 5. Schematic Diagram (sheet 1 of 2)







PROGRAMMING TABLE

ITEM	+5V	GND
U101 THRU U104	5	6, 7, 10
U105 THRU U108	5	12
U109 THRU U112	4, 5, 16	8
U113	14	7

Figure 5. Schematic Diagram (sheet 2 of 2)

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