



**240 | Solid State
FET • TVM**



OPERATING MANUAL

GENERAL DESCRIPTION

Designed for on the bench, and in the field use, the Model 240 Solid-State FET TVM reflects the most up-to-date use of semiconductor circuitry. While eminently suited for servicing vacuum-tube equipment, this modern TVM is especially applicable to semiconductor circuit testing. The low 1-volt d. c. full scale enables you to accurately read voltages as low as .02 volt d. c. while giving good indications down to .01 volt. Direct readings may be made to 1000 volts d. c., and with the addition of an HVP probe (not supplied), readings can be extended to 30,000 volts d. c.

The 1-volt full scale is a necessity in most semiconductor circuits, where the difference of a few millivolts -- easily read on the Model 240 -- may indicate if a transistor circuit is operating properly.

At the other end of the d. c. spectrum, the addition of the HVP probe enables accurate setting of the EHT (25,000 volts) required for best operation of a color cathode-ray tube.

The seven a. c. ranges cover the complete gamut of alternating voltage measurements from 1-volt r. m. s. (full scale) to 1000-volts r. m. s. full scale. The meter scales are calibrated in both r. m. s. and peak-to-peak to enable accurate conversions. Covering the frequency range from 25Hz to over 2 MHz, you can perform most required a. c. measurements with the a. c. portion of the 240.

Seven ohmmeter ranges are available to read up to 1000 megohms. A low voltage is used in the ohmmeter section to avoid accidental damage to semiconductors in the equipment under test. However, this voltage is high enough for use in testing both diodes and transistors.

Adding to the versatility of the 240 is the use of the EICO-exclusive Uniprobe. Here, only one probe with a fingertip control is used for all functions. Further refinements include the use of 1% tolerance resistors to insure maximum circuit accuracy, a meter scale with a zero-center for FM detector alignment, one zero adjustment for all functions, and a transformer-powered supply using a silicon rectifier and zener regulation particularly suitable for bench operation. Internal batteries can be switched in to make the Model 240 completely independent of the power line.

A modern FET-input semiconductor, differential amplifier, tight voltage regulation, and close-tolerance resistors assure stability and accuracy on all ranges. No warm up is required, the circuit does not "age", and the FET input circuit is completely protected by fast-acting semiconductor circuitry.

Besides its impressive electrical specifications, the Model 240 is extremely well-constructed and features the "professional look" that has been acclaimed by servicemen and industry.

SPECIFICATIONS

DC Voltmeter:	Range: 0 to 1, 3, 10, 30, 100, 300, 1000 volts either + or -; Input Resistance: 11 megohms; Accuracy: $\pm 3\%$; Range can be extended to 30,000 volts using EICO HVP-2 probe
AC Voltmeter:	Range: RMS - 0 to 1, 3, 10, 30, 100, 300, 1000 volts; P-P- 0 to 2.8, 8.5, 28, 85, 280, 850, 2800 volts; Input Impedance: 1 megohm; Accuracy: $\pm 5\%$ of full scale (with a sine-wave input signal); Frequency Response: ± 1 dB from 25 Hz to 2MHz. Can be extended to 250MHz using EICO RF Probe PRF-11
Ohmmeter:	0.2 ohm to 1000 megohms in seven ranges
Meter:	4-1/2", 200- μ A movement

Power Supply: Transformer isolated, silicon rectifier, zener regulated, 1.5 volt battery for ohmmeter function, three 9-volt transistor radio batteries for portable power

Power Line

Requirements: 105-132 volts a. c. , 50-60 Hz, 1.4 VA

Overall

Dimensions: Height - 8-1/2", Width - 5-3/4", Depth - 5", Weight - 6 lbs

Supplied complete with Uniprobe (combining isolating and direct probe and useful for all functions and ranges) and associated ground lead.

PRELIMINARY ADJUSTMENT

1. With the instrument standing normally on the workbench, note that the meter needle rests on the left-hand zero scale mark. If not, VERY CAREFULLY, using a fine screwdriver, adjust the meter zero screw (located within the dark, lower portion of the meter frame) until the needle does rest on the zero mark.

Note: For the mechanical adjustment detailed above, the 240 must not be plugged into the supply. The batteries should not be connected to the unit. It is preferable that the meter lugs be shorted to each other. Be sure to remove the short before proceeding to the next step.

2. Plug the Uniprobe phone jack connector into its receptacle on the front panel, then plug the ground lead into the ground jack directly under the phone jack.
3. Plug the line cord into a 3-wire source of 105-132 volts 50-60Hz power. Note that for safety sake the Model 240 is equipped with a three-wire system. If you do not have a three-wire receptacle, use a converter plug connecting the ground lead to a nearby ground. CAUTION: DO NOT USE a power source of any other voltage or frequency or the instrument will be damaged.
4. Place the FUNCTION switch in the AC position. The front-panel indicator lamp will come on and the meter needle may deflect. Operate the ZERO ADJ control to place the meter needle exactly on the zero indicators.

ELECTRICAL BALANCE

To initially check the zero ADJ control and the differential amplifier, proceed as follows:

1. Set the FUNCTION switch at +DC. Set Uniprobe to AC/OHMS. Short uniprobe to ground lead.
2. Rotate the ZERO ADJ control clockwise until the meter deflects up scale.
3. Reset the meter back to zero by turning the ZERO ADJ control (counterclockwise).
4. Place the FUNCTION switch to -DC.
5. Rotate the ZERO ADJ control counterclockwise until the meter deflects up scale.
6. Reset the meter back to zero using the ZERO ADJ control (clockwise). In either step 2 or 5 (or both) the meter must be capable of deflecting above 50% of full scale. Note also that the zero settings of the control should be almost identical in both the +DC and -DC settings of the Function switch. If the ZERO ADJ control does not perform as described, the circuit requires service. See the MAINTENANCE section. When set to battery, malfunctioning of the control may indicate worn 9 volt batteries.

CALIBRATION

AC Voltmeter. To perform this calibration, some known level of a.c. voltage must be used. This may be either the accurately known power line, a power supply delivering some known level of a.c., or a metered audio generator such as the EICO Model 378.

1. Set the Function Switch to AC.
2. Set the Range Switch to the appropriate range. If in doubt, first switch to the higher range and then reset it to the range providing the maximum deflection.
3. Connect the Uniprobe and associated ground lead to the Model 240.
4. Connect the Uniprobe tip (set to the AC/OHMS position) to one side of the a.c. source, and the ground lead to the other side.
5. With the a.c. source operational, check that the Model 240 indicates the correct voltage. If not, adjust R23 (the lower of the two potentiometers accessible through removable hole plugs on the right-hand side of the instrument), until the meter indicates the correct value. See Fig. 1.
6. For maximum accuracy, select a voltage that is approximately full scale.

DC Voltmeter. To perform this calibration, some known level of d.c. must be used. This may be a single fresh dry cell (1.55 volts) or an accurate metered adjustable d.c. power supply.

1. Set the Uniprobe to the DC position.
2. Set the FUNCTION switch to the -DC position.
3. Set the RANGE switch to the 3V position.
4. Connect the Uniprobe tip to the negative terminal of the battery power supply and the ground lead to the positive terminal of the battery or power supply. The meter should indicate the appropriate voltage. If not, adjust R24 (the upper of the two potentiometers accessible through removable hole plugs on the right-hand side of the instrument) until the meter indicates the correct value. This one adjustment suffices for all ranges. However, if desired, an accurate metered, adjustable power supply, such as the EICO Model 1030 can be used to check all ranges. The Model 1030 can also be used to check the +DC functions.

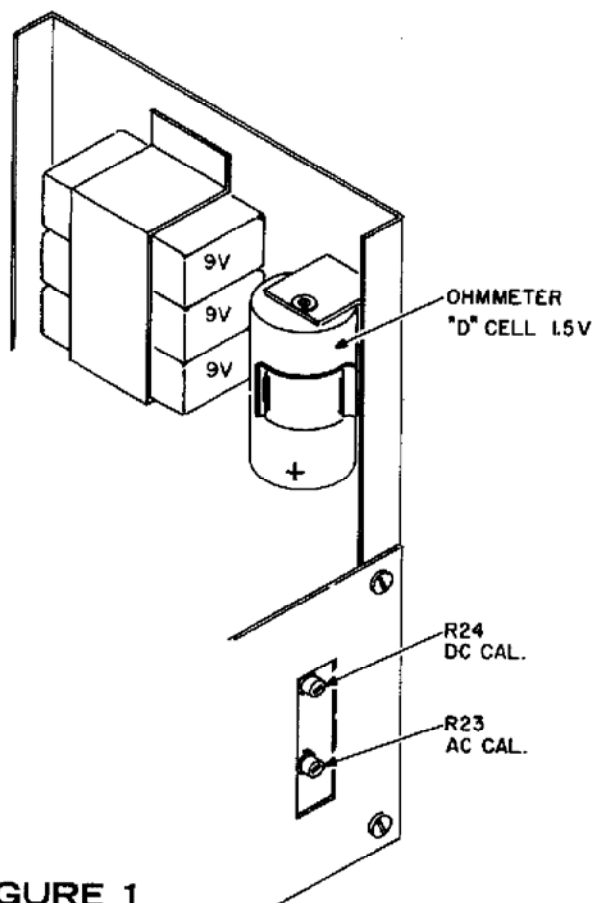


FIGURE 1

Ohmmeter Function. No separate calibration is required for the Ohms function range.

To check for ohmmeter leakage (if any), proceed as follows. This also checks the condition of the ohmmeter battery.

1. Place the FUNCTION switch at OHMS.
2. Place the RANGE switch in the R x 1 position. The meter needle should deflect to the right. Operate the OHMS ADJ control for an exact full-scale indication. If your meter does not deflect full-scale, replace the 1-1/2 volt ohmmeter battery.
3. Rotate the Uniprobe tip to the AC/OHMS position. Short the tip to the ground lead. The meter should drop to zero. Adjust the ZERO ADJ until it does. It may be necessary to repeat this procedure until the meter rests at both full scale and zero as the probe tip is grounded and ungrounded. On battery operation, the meter may not be capable of being zeroed. This indicates defective 9 volt batteries.
4. Isolate the probe tip and set the RANGE SWITCH to R x 1. The needle should indicate exactly full scale.
5. Without touching the OHMS ADJ control, place the range switch in the R x 1M position. If the meter needle drops away from the full scale position, there is excessive leakage in the ohmmeter circuit and it should be thoroughly checked.

BATTERY REPLACEMENT

To determine if the 9 volt battery is usable, set the meter to any voltage range. Set the Uniprobe to AC/OHMS. Connect the test leads to each other. Adjust the meter to zero. If this adjustment cannot be made, the 9 volt batteries need replacement. The 1-1/2 volt battery should be replaced if the meter cannot be set to zero on the lowest resistance ohmmeter range when the test leads are connected to each other.

Do not permit an exhausted battery to remain in the instrument case as the chemicals released from an exhausted battery may corrode the connectors and surrounding components.

1. Remove the four screws at the rear of the case. Two of these screws are long ones for mounting the a. c. line cord and supports. Slide the case off.
2. The 1-1/2 volt ohmmeter battery is mounted at the right side of the rear subchassis in its own holder. The battery should be replaced with a comparable cell, observing the polarity (positive side down). See Fig. 1.
3. The three 9-volt transistor radio batteries for field power (portable) are held in place with a metal bracket to the rear subchassis. Loosen the bracket screws. Remove and replace all three batteries when required. The three are in parallel and if only one is replaced, the others will drain the good one and also ruin it. Conventional polarized battery clips are used here. Tighten the batteries back in place.
4. A switch on the rear panel determines whether the Model 240 is operated on the power line or on the internal batteries. Place this switch in the appropriate position. (See Fig. 1)

CLEANING THE CASE AND METER.

A lightly soaped moist cloth can be used to clean both the case and meter face. DO NOT use detergents or an abrasive cleaner as the surfaces may be damaged.

OPERATION

Insert the Uniprobe plug into its jack and the associated ground lead plug to its banana jack. Plug the line cord into a 120 volt 50-60 Hz power source, making sure that the rear panel power-selector slide switch is in the LINE position. If battery power is used, place the selector switch in battery position. Now place the FUNCTION switch in any position other than OFF. If the set is line powered, the front panel indicator lamp will come on. This lamp does not operate when the instrument is powered by its internal batteries, unless the line cord remains plugged into a power source. With the instrument powered, adjust the ZERO ADJ control until the meter indicates zero.

DC Voltage Measurements

1. Rotate the end of the Uniprobe until the detent locks in the DC position. Note that the Uniprobe end can be rotated either way when set to the desired position. The small red extrusion will drop into a V-slot.
2. Place the FUNCTION switch in the -DC or +DC position depending on the polarity of the voltage being measured.
3. Short the ground lead to the Uniprobe tip, and adjust the ZERO ADJ control until the meter indicates zero.
4. Connect the ground lead to the ground of the circuit under test, and the probe tip to the voltage source being measured. The RANGE SWITCH SHOULD be set to a range which is greater than the voltage to be measured. If in doubt, always start at 1 kV and progress downward until a usable indication is found.

AC Voltage Measurements

1. Rotate the end section of the Uniprobe until the detent locks in the AC/OHMS position. The Uniprobe end section can be rotated either way.
2. Place the FUNCTION switch in the AC position.
3. Set the RANGE switch to a range greater than the voltage to be measured. If in doubt, always start at the 1 kV position and progress downward.
4. Short the ground lead to the probe tip, and adjust the ZERO ADJ control until the meter indicates zero.
5. Connect the ground lead and the probe tip to the circuit being measured.
Note: The AC scale arrangement in the Model 240 shows both RMS (black scale) and associated peak-to-peak (red scale) of the voltage being measured. No conversions are necessary as both scales are direct reading. Peak-to-peak indications are valid regardless of whether the waveform is complex or sine wave. The RMS indications are valid only for sine waves.

Ohmmeter Measurements.

1. Rotate the end section of the Uniprobe until the detent locks in the AC/OHMS position. Note that the probe end can be rotated in either direction.
2. Place the FUNCTION switch in the OHMS position. The meter should indicate up scale.
3. Short the ground lead to the probe tip. Set the RANGE switch to R x 100. Adjust the ZERO ADJ until the meter indicates zero. Do not change the zero adjustment for any other RANGE switch setting.
4. Remove the ground lead from the probe tip, then adjust the OHMS ADJ control until the meter indicates exactly at the extreme right-hand marker on the ohms scale.
5. Remove power from equipment under test to avoid damage to the Model 240.
6. Connect the ground lead and the probe tip across the resistance to be measured. Set the RANGE switch for a convenient deflection. Multiply the indication on the meter OHMS scale by the factor indicated on the panel at the RANGE switch.
7. When not in use, switch the FUNCTION switch away from OHMS to avoid unnecessary battery drain.

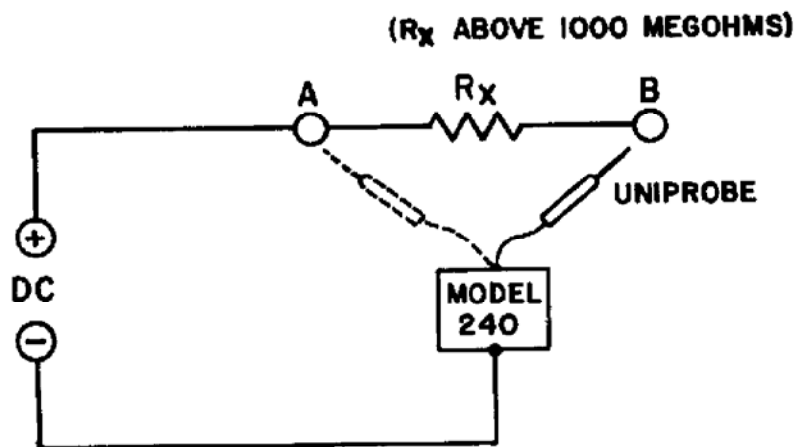


FIGURE 2

Resistance Measurements Above 1000 Megohms.

The upper limit of direct resistance measurement of this instrument is 1000 megohms. The leakage resistance of small paper and mica capacitors usually exceeds this value. To measure resistance above 1000 megohms, an external d. c. source between 20 and 500 volts can be used to obtain a measurable meter deflection. The circuit connection is shown in Fig. 2 and procedure is as follows:

1. Set the FUNCTION switch to +DC, and the Uniprobe to DC. Place the RANGE switch at a range that encompasses the voltage of the power supply used.
2. Measure and record the voltage at point A, and then the voltage at point B.
3. Compute the value of the unknown resistor from the following formula:

$$R_X \text{ (megohms)} = \frac{11 [(\text{volts at point A}) - (\text{volts at point B})]}{(\text{volts at point B})}$$

EXAMPLE: Assume that the power supply used is 300 volts, and the Model 240 measures 300 volts at point A and 1.1 volt at point B. Then

$$R_X = \frac{11 (300 - 1.1)}{1.1} = 3000 \text{ megohms (approximate)}$$

Zero Center Operation.

Zero center indications allows observation of either positive or negative voltage excursions without resetting the FUNCTION switch. To prepare the instrument for such operation, place the FUNCTION switch in the +DC position and adjust the ZERO ADJ control (with the ground lead connected to the probe tip) clockwise until the meter needle rests on the -0+ mark at the bottom of the meter scale. If the meter does not deflect to midscale, use the -DC position for your tests. Set the RANGE switch to a position at least twice the voltage being measured, and then to the lowest range that permits the meter needle to remain on scale with the voltage applied. The value of positive voltage indicated (meter deflection to the right) is obtained by subtracting half the RANGE selector value from the DC voltage reading on the appropriate scale. The value of the negative voltage (meter deflection to the left) is obtained by subtracting the DC voltage reading on the appropriate scale from half the RANGE setting. (The polarities are reversed if the -DC function position is used.)

CAUTION: Although the Model 240 is protected against meter burn-out under normal operating conditions, repeated overloads may impair the accuracy of the meter movement that results from slamming the needle against the limit stops. For this reason, on either AC or DC, always start with a RANGE SETTING greater than the voltage you expect to measure. Always pay attention to polarities when measuring DC voltage.

DB Measurements

To avoid overcrowding of the meter scales, there is no DB scale on the meter. Another reason for the absence of a DB scale is that there are many different reference levels in use, and each reference level results in a different scale. Figure 3 is a graph for one accepted level--namely 0.775 volt across 600 ohms resistive load (1 milliwatt). Using this graph will allow you to conveniently convert RMS AC voltages to DB readings. These readings are also referred to as DBM.

The DB values read on Figure 3 are correct only when the voltage indication is taken across a 600-ohm load. If the readings have not been taken across a 600-ohm load, the DB values read from the chart must be corrected by adding algebraically to it, the correction increment specified in Table 1 for the particular resistive load. If the resistor you are measuring is not found in this table, the correction increment can be found as follows:

correction increment = $10 \log (600/R)$, where R is the resistive load used.

All DB measurements must be made on a sine wave to avoid waveform error.

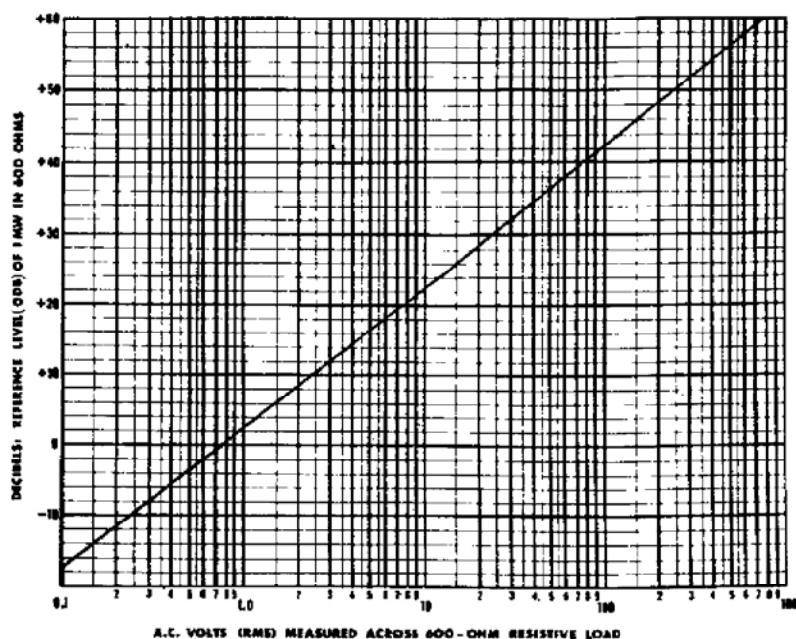


FIGURE 3

TABLE 1. Correction Increment for Various Loads

Load Res.	DB Added	Load Res.	DB Added
600	0	150	+ 6.0
500	+0.8	50	+10.8
300	+3.0	15	+16.0
250	+3.8	8	+18.8
		3.2	+22.7

HOW IT WORKS

The circuit, shown in basic form in Figure 4 consists of a differential amplifier formed by npn silicon transistors Q2 and Q3. If both transistors are matched, and the same base bias is applied to each, there will be the same voltage developed at the emitters of both transistors. In this case, the meter will indicate zero. Note that the base current of Q3 is kept constant by the voltage divider consisting of R20, R21, and the resistance reflected into the base at Q3. Transistor Q2 however, uses a field-effect transistor (FET) as a voltage-variable resistor. In its base bias network, it forms a voltage divider in conjunction with R17.

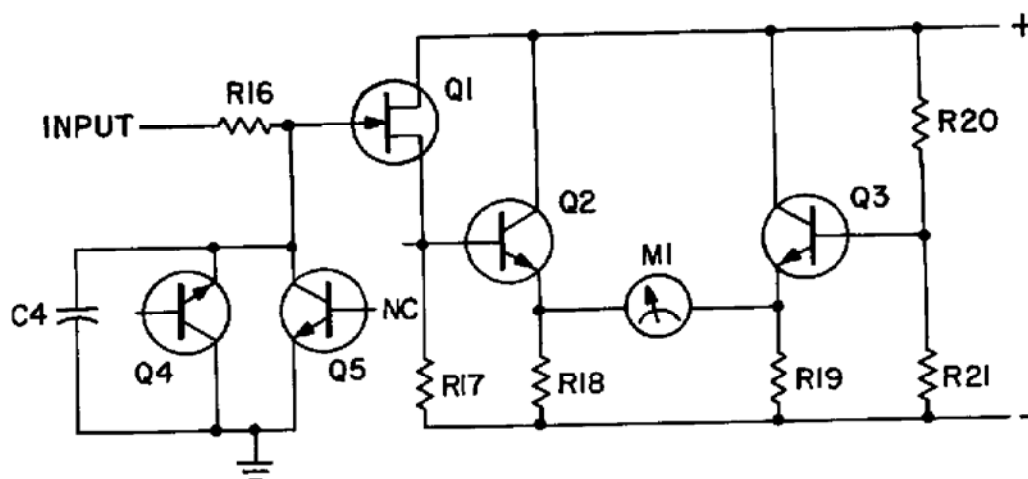


FIGURE 4

When a d.c. voltage is applied to the gate of the FET, its channel resistance, acting as the base bias resistor for Q2, varies, thus affecting the base bias of Q2. A change in the base bias of a transistor produces a change in the current flowing through it. This, in turn, causes the voltage drop across R18 to vary with the gate voltage of the FET. The meter will then indicate the voltage difference between the emitters of fixed Q3 and variable Q2.

Because too great a voltage swing at the gate of the FET can cause its junction to burn out, some form of voltage limiting is required at the gate. This is the function of silicon transistors Q4 and Q5. Note that the bases of these transistors are not used, and they act as high-quality temperature compensated zener diodes. When the voltage at the gate of the FET exceeds the base-emitter breakdown voltage of the transistors (about 9 volts) in either direction, the transistors clamp the gate voltage to 9 volts.

The remainder of the circuit is a conventional high-quality TVM. The resistor divider networks are calculated to permit the proper voltages to be fed to the FET for the various ranges. A pair of silicon diodes in a peak-to-peak doubler circuit, act as rectifiers to convert input AC voltages to the required DC to operate the FET.

One interesting development is the use of a ten-turn ball-bearing potentiometer for the ZERO ADJ control (R30). This type of control permits a far finer adjustment than the conventional one-turn control.

A zener voltage regulator is used to keep the instrument accurate if and when either the a.c. power line or the batteries change voltage during operation.

MAINTENANCE

To gain access to the interior, remove the four screws at the rear of the case -- the two lower ones mount the a. c. line cord support. Gently slide the case off the instrument.

The rear apron of the instrument chassis can be swung out by removing the two upper screws that secure the rear panel (one on each side). Once these are removed, the rear panel can be swung out and down to expose the interior of the instrument.

To get to the FUNCTION switch, remove the four screws securing the left panel (nearest the FUNCTION switch) and gently move the panel aside. This panel supports the small power transformer. Do not break any leads or the printed circuit board while removing this panel.

To gain access to the RANGE switch, remove the four screws that secure the right panel in place (nearest the RANGE switch), and gently move the panel aside. The two calibration potentiometers are mounted to this panel. Do not break any leads while removing this panel.

The electronics circuit is on a printed-circuit board that mounts to the meter lugs. The board can be removed by swinging the rear panel back out of the way, then unfastening the two meter nuts. Each component is clearly identified by printed designations on the component side of the board. If any components are replaced, carefully unsolder the leads from the foil side of the board, and replace the component making sure that you do not create any solder bridges, nor apply so much heat that the copper foil lifts from the board.

When replacing semiconductors, use the types tabulated in the parts list. Each lead of the transistor is printed on the board as a guide for re-installation.

Voltage Measurements: Table 2 specifies the various voltages to be found in the circuit.

Remove one lead of each resistor from the board and check it for correct value. Use an in-circuit capacitance checker to test the capacitors.

TABLE 2. Voltage Measurements

Q1	Q2	Q3
gate - 1.0	base - 4.5	base - 4.5
drain - 6.8	collector - 6.8	collector - 6.8
source - 4.5	emitter - 3.7	emitter - 3.7

Above voltages are measured with respect to negative (-) lead on C5
Set front panel controls: FUNCTION +DC, RANGE 100V

Voltage at common Q4 emitter and Q5 collector should rise to a maximum of 10 volt d. c. (preferably less) and remain there as the input voltage is increased (measured with respect to common lead).

D3 cathode - 22 volts $\pm 3\%$ with respect to negative (-) lead on C5

D4 cathode - 6.8 volts $\pm 10\%$ with respect to negative (-) lead on C5

PARTS

PRICE EA.	STOCK NO.	SYM. NO.	DESCRIPTION	QTY
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RESISTORS

.08	10400	R18,19	car., 10K, 1/2W, 10%	2
.08	10407	R1	car., 1M, 1/2W, 10%	1
.08	10413	R27	car., 2.7K, 1/2W, 10%	1
.09	10422	R26	car., 68K, 1/2W, 10%	1
.11	10424	R17,20	car., 22K, 1/2W, 10%	2
.08	10426	R21	car., 33K, 1/2W, 10%	1
.09	10433	R29	car., 560Ω, 1/2W, 10%	1
.08	10452	R28	car., 8.2K, 1/2W, 10%	1
.09	10457	R14,16	car., 3.3M, 1/2W, 10%	2
.41	11027	R4	car., dep., 250K, 1/4W, 1%	1
.41	11037	R6	car., dep., 900Ω, 1/4W, 1%	1
.44	11038	R7	car., dep., 9K, 1/4W, 1%	1
.41	11044	R5	car., dep., 90Ω, 1/4W, 1%	1
.39	11133	R8	car., dep., 6.838M, 1/2W, 1%	1
.39	11134	R9	car., dep., 2.162M, 1/2W, 1%	1
.39	11135	R10	car., dep., 683.8K, 1/2W, 1%	1
.39	11136	R11	car., dep., 216.2K, 1/2W, 1%	1
.39	11137	R12	car., dep., 68.38K, 1/2W, 1%	1
.39	11138	R13	car., dep., 21.62K, 1/2W, 1%	1
.39	11153	R3	car., dep., 673K, 1/2W, 1%	1
.64	11723	R2	car., dep., 1.227M, 1W, 1%	1
1.48	13008	R22	w.w., 10Ω, 1/2W, 1%	1
2.40	13105	R15	w.w., 9.1Ω, 1W, 1%	1

POTENTIOMETERS

.73	18015	R23,24	10K, linear	2
.90	18187	R25	15K, linear	1
3.11	18188	R30	15K, linear, 10 turns	1

TRANSFORMER

2.96	30099	T1	power	1
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PRICE EA.	STOCK NO.	SYM. NO.	DESCRIPTION	QTY
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CAPACITORS

1.12	20090	C3	mylar, .1 mfd, 1600V, 10%	1
.24	20107	C1,2	mylar, .027 mfd, 400V, 10%	2
.16	22511	C4	disc, cer., 5000pf, 500V, 20%, Z5P	1
.78	23033	C6	elec., 10 mfd, 15V	1
.78	23057	C5	elec., 300 mfd, 30V	1

HARDWARE

.01	40000		nut, hex, #6-32 x 1/4	2
.02	40001		nut, hex, 3/8-32 x 1/2	4
.01	40004		nut, hex, #2-56 x 3/16	1
.01	40007		nut, hex, #4-40 x 1/4	4
.04	40034		nut, tinnerman, #4	4
.04	40035		nut, hex, #6-32 x 3/16	1
.02	41022		screw, #2-56 x 3/8, f.h.	1
.05	41024		screw, set, #8-32 x 1/4	1
.01	41035		screw, #6 x 1/4, P. K., b.h.	8
.03	41061		screw, set, #8-32 x 3/16	1
.01	41073		screw, #6 x 1/4, P. K., b.h., black oxide	2
.01	41086		screw, #6-32 x 5/16, b.h.	2
.01	41091		screw, #4-40 x 1/4, f.h.	6
.01	41140		screw, #6-32 x 1/4, r.h., phillips, type F	10
.01	41143		screw, #4-40 x 3/8, f.h.	2
.01	41191		screw, #6 x 1", P. K., b.h., black oxide	2
.01	42001		washer, flat, 3/8	4
.01	42002		washer, lock, #6	2
.01	42007		washer, lock, #4	3
.02	42012		washer, star	1

SWITCHES

6.18	60211	S1	rotary, function	1
5.40	60212	S2	rotary, range	1
.26	62002	S3	slide, spdt	1

METER

13.30	72020	M1	200 ua, 1000Ω, w/hdwr.	1
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LIST

PRICE EA.	STOCK NO.	SYM. NO.	DESCRIPTION	QTY
<u>HARDWARE (cont)</u>				
.01	42020		washer, fiber, special	1
.01	42021		washer, fiber, special	1
.01	42024		washer, split, #6	1
.02	42030		washer, flat, fiber, 3/8	1
.03	42031		washer, shoulder, fiber, 3/8	1
.02	42063		washer, lock, #2, ext. tooth	1
.04	42084		washer, flat, #6, 1-3/32 o. d., black	2
.02	43003		lug, solder, 1/4	1
.10	44002		spacer, fiber, special	1
.08	44003		spacer, fiber, special	1
.24	44011		spacer, #6, .565 long, black	2

JACKS, KNOBS & TERMINAL STRIPS

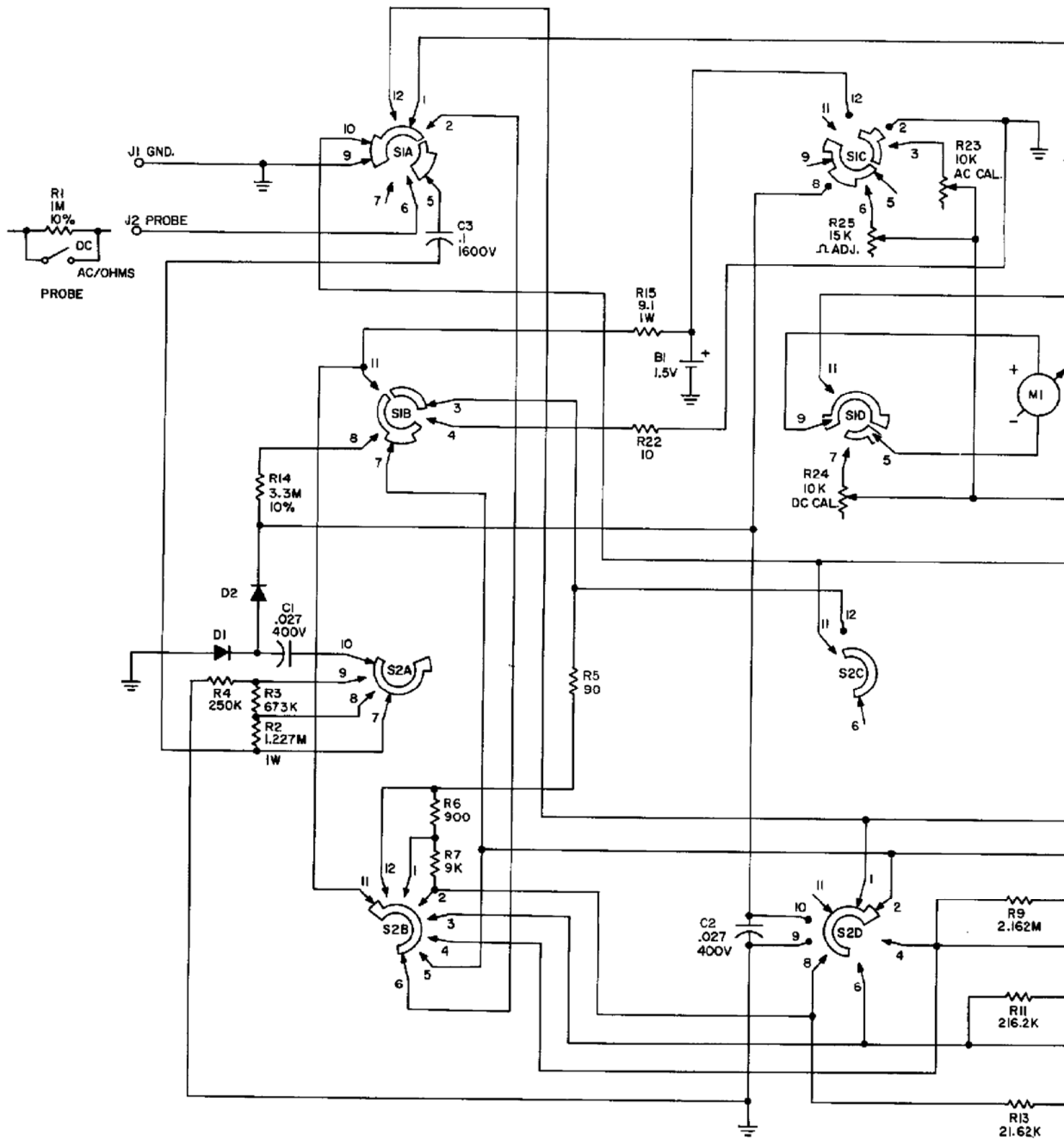
.65	50003		phone jack	1
.39	50044		jack, banana, black, insulated	1
.96	51001		phone plug	1
.62	51005		plug, banana	1
.17	51502		clip, alligator	1
.79	53108		knob, 3/4" dia.	2
.85	53109		knob, bar	2
.10	54000		terminal strip, 1 post, left	1
.06	54004		terminal strip, 2 post, w/gnd.	1

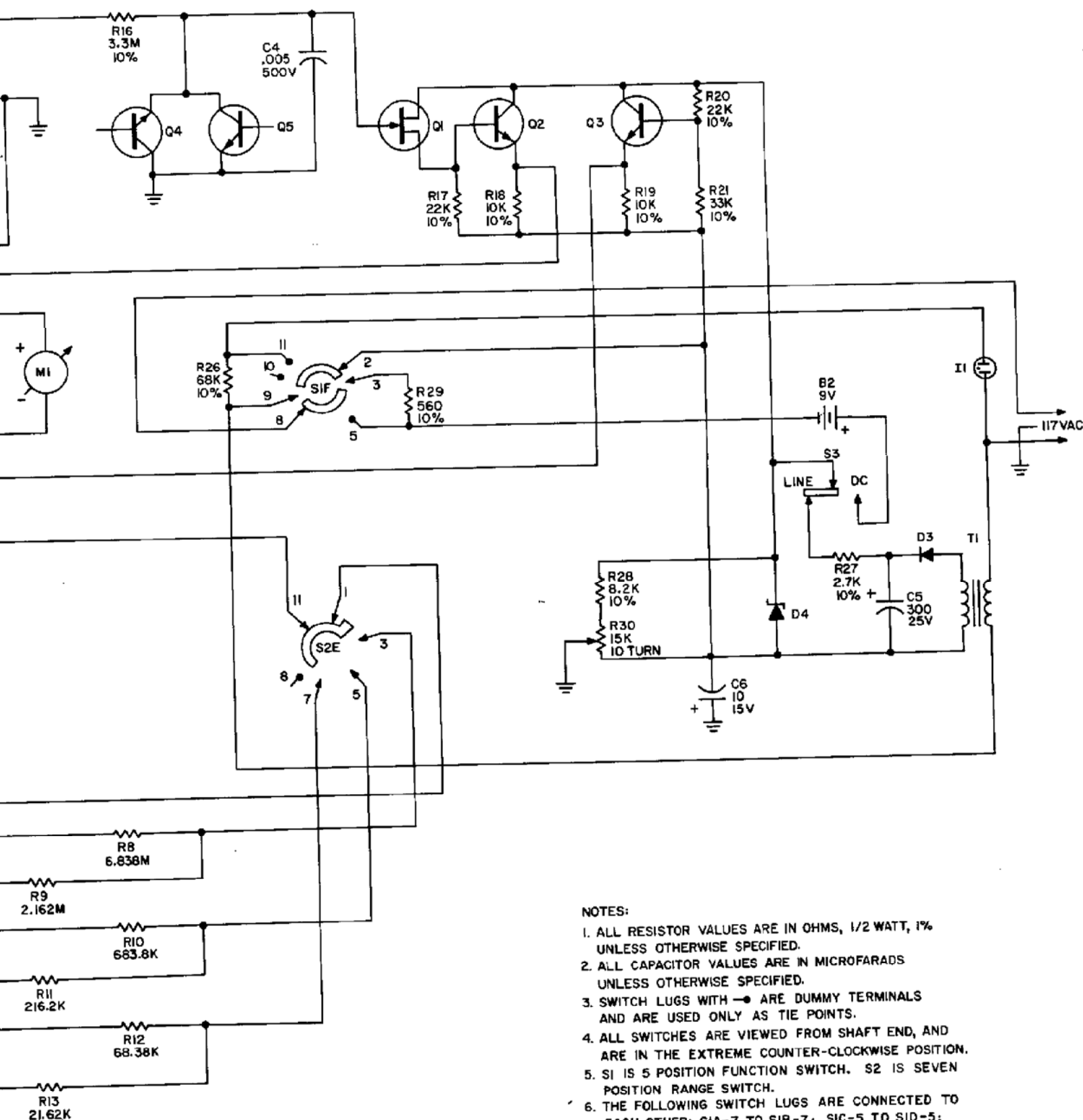
DIODES & TRANSISTORS

2.24	93019	D3	diode, 2a, 100 PIV	1
1.80	93041	D4	diode, zener, 250 mw, 6.8V, 10%	1
.76	93042	D1	diode, 25 ma, 400 PIV	1
1.44	93047	D2	diode, 25 ma, 800 PIV	1
2.40	94057	Q1	transistor, 2N4304	1
.51	94058	Q2,3	transistor, 2N3393	2
.33	94078	Q4,5	transistor, 2N5172	2

PRICE EA.	STOCK NO.	SYM. NO.	DESCRIPTION	QTY
<u>SHEET METAL & MISCELLANEOUS</u>				
.09	46016		foot, rubber	4
.12	47002		spring	1
.07	48005		3/8 plug button, black oxide	2
.02	51300		solder lug, p. c. board	11
1.08	56523		battery bracket	1
.12	56537		battery connector	3
2.10	57009		line cord, 3-conductor	1
.09/ft	58300		tubing, 1-1/2 ft.	
.07/ft	58403		single-conductor shielded cable, 4 ft.	
.05/ft	58408		black single-conductor cable, 4 ft.	
1.50	66204		manual, operating	1
2.00	66466		manual, assembly	1
2.87	80230		front panel	1
3.65	81585		subpanel, front	1
2.82	81586		subpanel, rear	1
2.40	81587		bracket, right	1
1.14	81588		bracket, left	1
.66	81589		bracket, battery	1
.12	82105		line cord, clamp	1
1.86	82578		p. c. board	1
1.80	86015		frame	1
.78	87020		handle, black plastic	1
7.20	88173		cabinet	1
.32	89418		label, nomenclature	1
.14	89422		label, line-battery	1
.02	89517		rotor contact	1
.15	89518		long contact	1
.15	89519		long contact	1
.93	89520		fiber contact holder	1
.40	89521		metal tip	1
2.00	89658		nosepiece w/red indicator	1
2.40	89659		probe body	1
--	89858		handle hardware	2
.72	97736	11	neon bulb assembly, 7" leads	1

Prices and specifications subject to change without notice. To order replacement parts, remit with order; specify part number and descriptions. Add \$1.00 for mailing and handling; if a power transformer is included in the order, add instead \$1.50 for mailing and handling.





NOTES:

1. ALL RESISTOR VALUES ARE IN OHMS, 1/2 WATT, 1% UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
3. SWITCH LUGS WITH \bullet ARE DUMMY TERMINALS AND ARE USED ONLY AS TIE POINTS.
4. ALL SWITCHES ARE VIEWED FROM SHAFT END, AND ARE IN THE EXTREME COUNTER-CLOCKWISE POSITION.
5. S1 IS 5 POSITION FUNCTION SWITCH. S2 IS SEVEN POSITION RANGE SWITCH.
6. THE FOLLOWING SWITCH LUGS ARE CONNECTED TO EACH OTHER: S1A-7 TO S1B-7; S1C-5 TO S1D-5; S1C-9 TO S1D-9; S1C-11 TO S1D-11; S2C-6 TO S2D-6; S2C-11 TO S2D-11.

SCHEMATIC DIAGRAM

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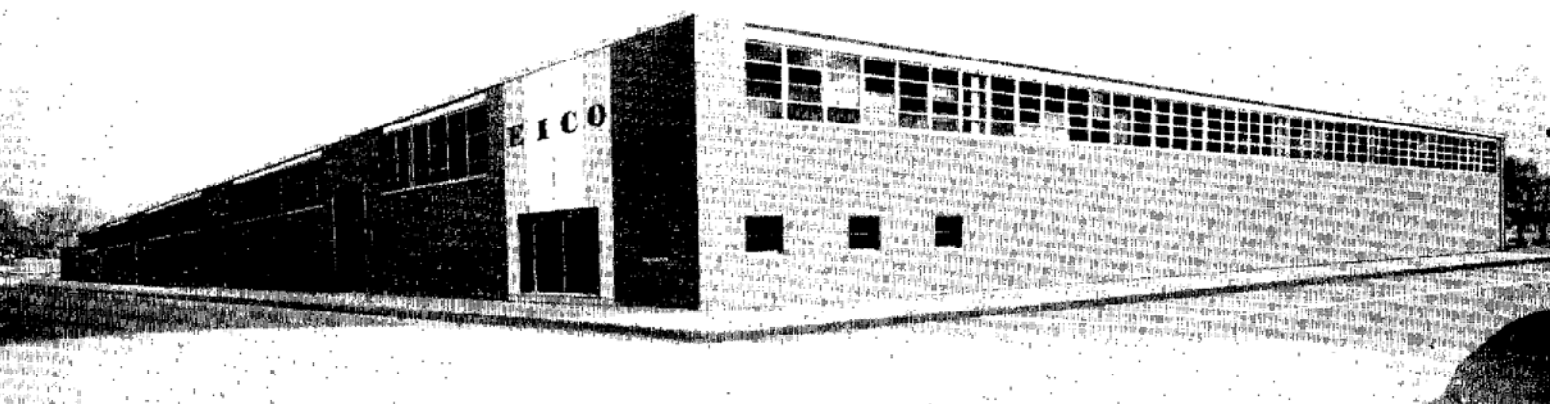
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