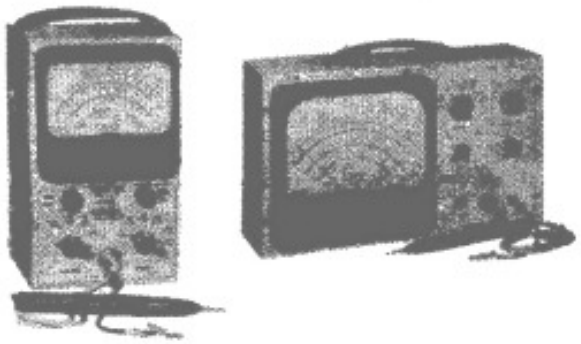
EICO

Laboratory Precision at lowest cost

SERVICE

BULLETIN



Models 232 - 249
PEAK to PEAK VTVM

ELECTRONIC INSTRUMENT CO., Inc. 84 Withers Street, Brooklyn, N. Y.

TSD FOR EICO MODELS 232 & 249

Before you start trouble shooting, check wiring carefully. In most cases, trouble will result from wrong or reversed wiring, cold or unsoldered connections, wrong parts used or transposed with others. If you have followed the instructions given with your kit, used a good soldering iron, a good grade rosin core solder, and used a heat sink on precision resistors, you should have no fear of high resistance solder joints or shorts and over-heated parts.

STEP 1

Compare the voltages in your unit with any shown on the schematics and locate the cause of any found to differ by 20%. See figures 1 and 2.

SIMPLIFIED SCHEMATIC BREAKDOWN

Fig. 1

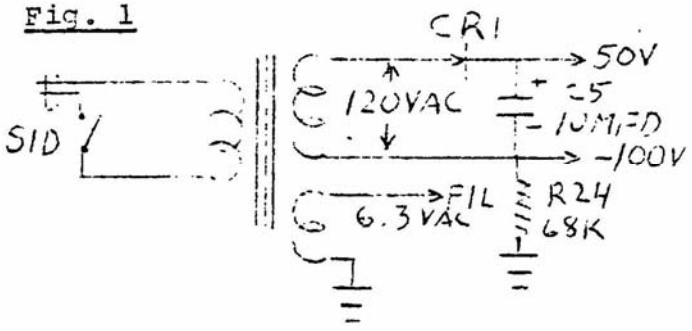
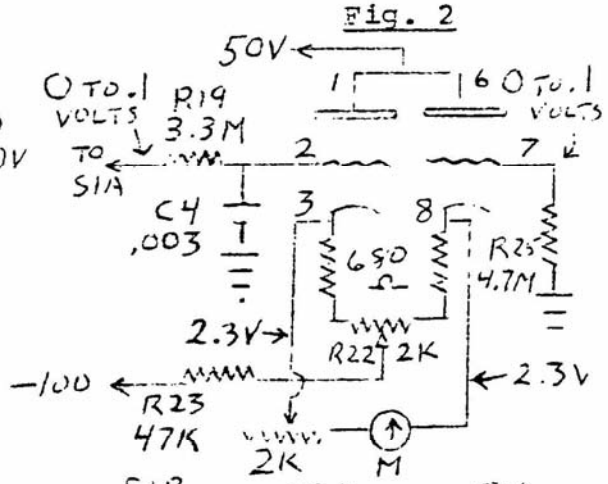


Fig. 2



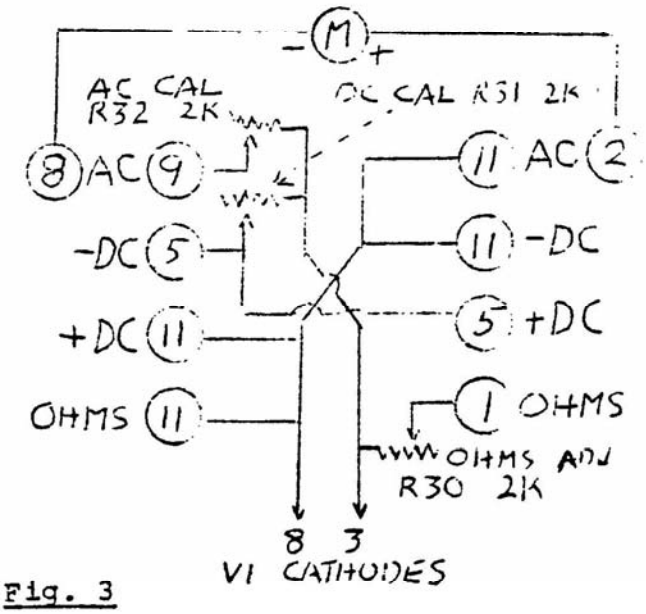


Fig. 3

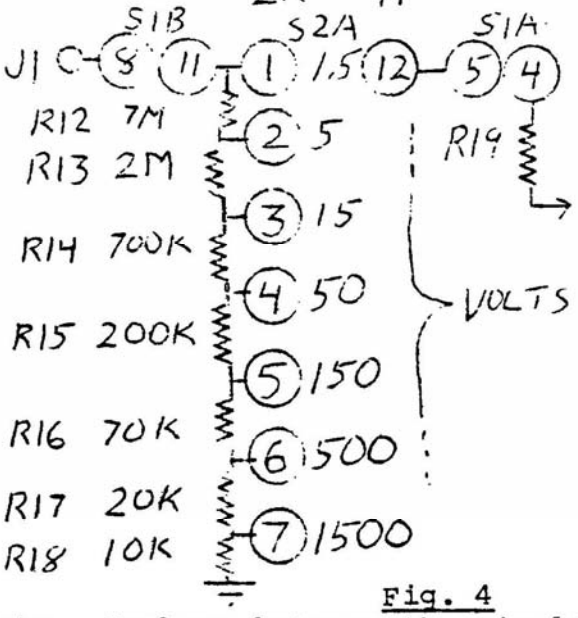


Fig. 4

NOTE

Numbers in the circles refer to contacts. Numbers between the circles indicate continuity when switch is in position identified. Numbers above the circles refer to switch wafers.

Fig 1. - Power Supply
Fig.2. - Basic Bridge Circuit
Fig 3.- SIC Function Switching
Fig 4.-- ± DC Switching Circuit

STEP 2

The next step will trace the trouble either to the basic bridge circui or the grid circuit of the 12AU7. Place the function switch into +DC volts and ground the junction of R19 and S1A-4 with a screwdriver or the common lead of your instrument. This will balance the bridge and will enable you to adjust the pointer with the zero adjust pot. If there is no adjustment, we know the trouble is in the cathode circuit. If the pointer does return to zero, we then know the trouble is in the grid circuit. See figure 2.

STEP 3

Improper or dissimilar voltages in the cathode circuit are usually indicative of a defective 12AU7, improper or open resistors, defective zero adjust pot, or leakage to ground on the socket, switch S1C or in the pot (R22). 2.3V ±20% is usually measured between cathodes and ground which will vary when the zero adjust pot is varied. Zero adjus ment should be possible in all functions. If the meter does not move continuity through S1C, or through the calibration pots, is suspected. See figure 3. Grounding one cathode or the other through a 4.7K ohm resistor should cause the meter to move up scale showing the meter movement is good.

STEP 4

Operation of the grid circuit can be checked by connecting a 3.3 meg, 1/2 watt resistor from the positive terminal of BT1 to XV1-2. The meter should move up scale and indicate about .8 to 1.3 on the 1.5 vol DC scale: the actual value will depend on the position of the DC calibration pot. Operation of the DC calibration pot R31 may be checked at this time if capacitor C4 is not shorted or leaky.

STEP 5

With the range switch in the 1500V position removal of the short installed in Step 2 should not greatly change the meter reading, but higher readings will normally be obtained when the range switch is turned towards the 1.5 volt position. If there is a change, ground terminals S1A-4, S1A-5, S2A-12 and S2A-1 (in that order) with the common lead, will pinpoint the wafer containing the poor connection or contact. See figure 4.

STEP 6

With the range switch in the 1.5 volts position, the application of 1. volts through a 3.3 meg resistor to J1 should give you a reading on th meter. If not, move the resistor to S1B-8, S1B-11 and to S2A-1, and note where the first reading is obtained. An indication will pinpoint the area where continuity is lacking.

STEP 7

Any problems remaining will be limited to bad resistors, poorly soldered connections, or no continuity through the switches in the circuit preceeding R19. Figures 5 & 6 ... will be helpful when trouble shooting problems existing in OHMS and AC FUNCTIONS. It is advisable to use another ohmmeter when checking for continuity or values of resistors.

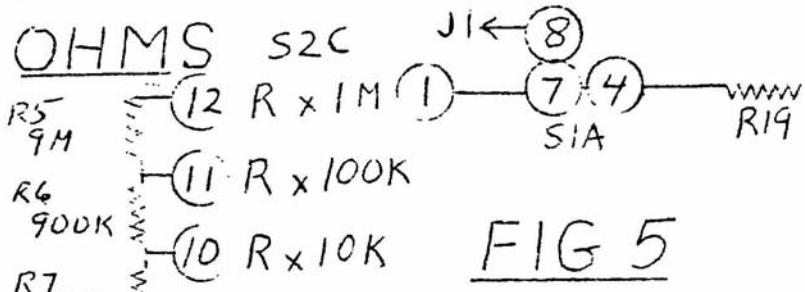
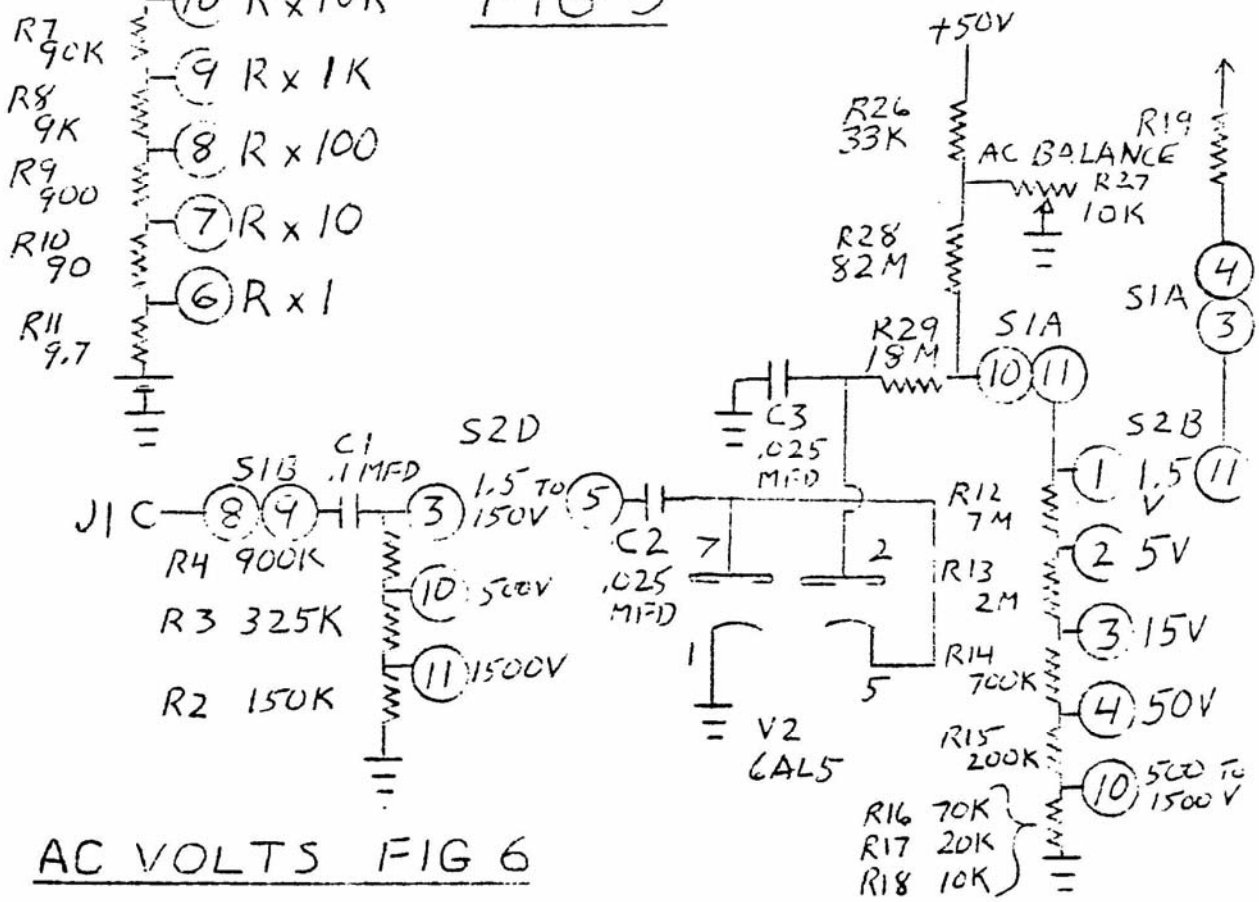


FIG 5



AC VOLTS FIG 6

NOTE

Numbers in index refer to contacts. Numbers between the circles indicate continuity when switch is is position identified. Numbers above the circles refer to switch wafers.

INTERCONNECTION CHARTS

Function Switch S1 #60067

	OFF	AC-VOLTS	-DCV	+DCV	OHMS
A	3-4	3-4, 10-11	4-5	4-5	4-7-8
B	-----	8-9	8-11	8-11	-----
C	2-11-9	2-11, 8-9	2-11, 5-8	2-5, 8-11	1-2, 8-11
D	-----	3-4	3-4	3-4	3-4

Function Switch S2 #60024

	1.5 R x 1	5 R X 10	15 R X 100	50 R X 1K	150 R X 10K	500 R X 100K	1500 R X 1M
A	1-12	2-12	3-12	4-12	5-12	6-12	7-12
B	1-11	2-11	3-11	4-11	10-11	10-11	10-11
C	1-6	1-7	1-8	1-9	1-10	1-11	1-12
D	3-5	3-5	3-5	3-5	3-5	5-10	5-11

Below you will find a list of possible troubles and their remedies:

SYMPTOMS	PROBABLE CAUSE	SUGGESTED PROCEDURE
POWER SUPPLY		
1. Trans. operates hot	(a) In normal operation tran will get warm	(a) None
2. Trans. leaking wax	(a) Short in power supply.	(a) Remove rectifier CR1, check trans. voltage and CR1. Replace trans. or CR1.
	(b) Leaky filter condenser.	(b) Replace condenser.

DC BRIDGE CIRCUIT

1. Meter does not move.	(a) No voltage on plate of 12AU7.	(a) Check power supply (See diagram)
	(b) Short in function switch.	(b) Remove meter leads, check resistance from leads to ground to locate trouble. Trace wiring through function switch using figure 3.
	(c) Short on meter movement	(c) Remove any shorting wire on meter used for shipping purposes
2. Meter jump when you touch probe on 5V, 10V and high ohms ranges.	(a) Normal reaction due to electrostatic pickup; will read correctly if calibrated properly.	(a) Some of the pickup might be reduced by inserting a .01 mfd. from one side of the line to the ground.
3. Pointer swings off scale on all ranges.	(a) Open bridge circuit	(a) Use procedure in paragraph three.
	(b) Defective 12AU7	(b) Change 12AU7.
4. Pointer swings off scale on all voltage ranges except ohms.	(a) Poor ground on AC, DC divider network (See figure 4 & 6).	(a) Solder and secure ground two lugs on RANGE switch.
	(b) One of the res. in divider network open or not making proper contact.	(b) Check divider using ohmmeter. See fig. 4 & 6
5. Pointer swings off scale on only one range.	(a) No continuity through S2 range switch.	(a) Use ohmmeter to check continuity through inoperative position and adjust or clean the errant contact.
6. Plus and minus DC, no readings	(a) Short in Uniprobe	(a) See that shield is not touching inner conductor.
	(b) Resistor open	(b) Replace resistor.

SYMPTOMS	PROBABLE CAUSE	SUGGESTED PROCEDURE
6.	(c) Shorted jack	(c) Replace jack or look for solder inside of jack.
	(d) Defective DC calibration pot.	(d) Replace pot.
7. Meter moves immediately after unit is turned on	(a) Leakage to ground in pots.	(a) Replace or clean inside of pots R22, R30, R31 or R32.
	(b) Short or leakage on S1C function switch.	(b) Replace switch, clean with alcohol or spray. Examine for shorts caused by wire or solder.
8. Shift on 5V and 10V ranges.	(a) This should only happen on DC. AC has a balancing pot.	(a) Normal shift; DC very slight. Try changing 12AU7.
9. Meter seems sluggish; needle moves across scale slowly	(a) C4 condenser bad or leaky.	(a) Replace same.
	(b) Condenser marked incorrectly.	(b) Replace same.
	(c) Meter movement sticks. OK when topped with finger.	(c) Replace same.
10. With leads shorted touch the probe tips. Needle jumps.	(a) Ground jack on panel not grounded	(a) Fibre washer left on banana jack. Remove fibre washer and make sure it is grounded to panel
11. Needle jumps when you touch cabinet or panel.	(a) A.C. leakage in transformer.	(a) Put .01 condenser from side one to ground.
12. DC voltage reads high; can not be calibrated.	(a) Resistor in DC probe left out or wrong value	(a) Insert resistor (1meg) in probe. (b) Replace transformer. (c) Reverse A.C. plug.
	(b) Plate voltage on 12AU7 too high.	(b) Check power supply and resistance in the cathode circuit of 12AU7.
		(c) Try other 12AU7's.

SYMPTOMS	PROBABLE CAUSE	SUGGESTED PROCEDURE
13. DC reads low	(a) Break down in probe	(a) Check insulation in panel mounted connector.
	(b) Break down on function switch	(b) Remove leads from function switch. See paragraph on leakage.
14. Not enough swing, unable to obtain zero center.	(a) Plate voltage on 12AU7 too low.	(a) Check power supply. (See section on power supply troubles)
	(b) Insufficient gain in 12AU7.	(b) Try replacing 12AU7
OHMMETER SECTION		
1. Not enough swing on ohms scale	(a) Battery bad.	(a) Replace battery.
	(b) Voltage on plate of 12AU7 too high.	(b) Check power supply and also zero adj. pot.
	(c) Voltage on plates of 12AU7 too low.	(c) Check power supply (replace filter condenser paralleling it will not show leakage.
	(d) 12AU7 has low gain.	(d) Replace tube.
	(e) Zero adj. pot changes value	(e) Check value and replace if necessary.
2. Ohms does not read but has enough swing	(a) Uniprobe open	(a) Adjust contacts in Uniprobe.
	(b) No continuity through S1A.	(b) Adjust or clean contacts. See figure 5.
	(c) Banana jack not grounded properly.	(c) Check and remove shoulder washer if necessary.
	(d) Test leads open	(d) Check and repair.
3. Pointer swings off scale to the right and ohms adjust has little or no affect at all.	(a) Battery left out or wired in incorrectly.	(a) Install battery or rewire correctly.
	(b) Battery wires broken.	(b) Replace battery wires

SYMPTOMS	PROBABLE CAUSE	SUGGESTED PROCEDURE
3.	(c) If this occurs only on one range, the resistors for that range or switch is making poor contact.	(c) Replace defective resistors, clean switch wafer with carbon tetrachloride, resolder to lug. See figure 5.
4. Pointer swing to the left when range switch is rotated to the high ohms ranges	(a) Gassy tubes	(a) Replace 12AU7
5. Pointer swings to the right of scale only on RX1 meg range.	(a) Due to insufficiently aged 12AU7.	(a) Allow 12AU7 to age longer. If it still does not help replace tube.
	(b) Pickup	(b) Add a .01 condenser from one side of the line to ground. Reverse the plug.
6. With leads shorted all ohms ranges zero except RX1 range.	(a) High resistance connection in unit.	(a) Resolder female coaxial connector and banana plug. Resolder all connection in ohmmeter section or unit. Adj. uniprobe contacts. 1/10 or 2/10 residual reading is normal.
7. Readings on all ranges either high or low.	(a) Internal resistance of battery has changed although voltage readings of battery is correct.	(a) Replace battery.
	(b) 12AU7 not up to par.	(b) Try other brand new tubes. Select one for best accuracy ± 10% is acceptable.
8. No movement in ohms	(a) Cup washer or battery clip grounded	(a) Install fiber shoulder washers. Check for shorts See fig. 2 in Construction manual.

SYMPTOMS	PROBABLE CAUSE	SUGGESTED PROCEDURE
AC Section		
1. No voltage when AC is applied.	(a) Blocking condenser in AC network open, missing or wired improperly.	(a) Replace condenser or rewire to proper contact. (c1 or C2).
	(b) Leaky bypass conderser on 6AL5.	(b) Replace condenser C3
	(c) 6AL5 tube defective.	(c) Replace 6AL5 tube.
	(d) TB3 grounded by solder	(d) Remove excess solder Do not mistake TB3 for ground lug on XV2. See fig. 3 in instruction manual.
2 AC will not calibrate, reads too high or too low.	(a) 6AL5 tube defective.	(a) Replace tube.
	(b) Bypass cond. on the 6AL5 leaky.	(b) Check and replace cond. C3 if necessary.
	(c) AC compensating resistors changed value.	(c) Check and replace if necessary with correct value.
	(d) Leakage in switches.	(d) See section on leakage.
3. AC will not zero balance.	(a) Tubes not balanced properly.	(a) First replace 6AL5. If this does not help, then replace 12AU7.
	(b) Res. in balancing network wrong value. (R26, R28, R27)	(b) Check values of balancing resistors.
	(c) Balancing resistors left out.	(c) Insert resistors R26 and R28.
	(d) 12AU7 tube not grounded properly.	(d) Resolder all connections.

SYMPTOMS	PROBABLE CAUSE	SUGGETED PROCEDURE
4. AC non-linear does not read same voltage on any two ranges. EX: 100V input should read 100 volts on 100V, 500V and 1000 volt range.	(a) Unbalanced tube.	(a) Replace 6AL5 tube Also try replacing 12AU7 tube.
	(b) Break down of connector.	(b) Replace panel mounted connector.
	(c) Leakage in function switch.	(c) See section devoted to leakage.

LEAKAGE

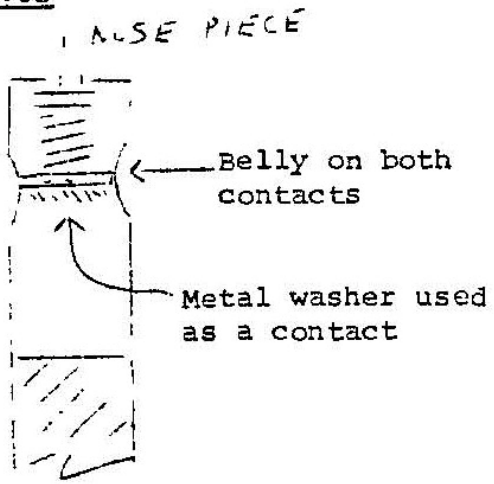
One of the most common troubles in sensitive equipment is leakage and it is one of the most difficult troubles to locate. In order to determine whether or not leakage is present in your unit, the following procedures may be used:

1. Apply a known voltage (somewhere around 100V) to the input (probe) of the VTVM. Set range switch to desired range, check reading, then move the range switch to the next range (without changing the input voltage). The reading should be the same. In other words, if 100 volts is being used as a standard, the VTVM should read 100V on the 100V range and when switched to 500 or 1000V ranges, it should also read 100 volts.

2. Leakage can occur on wafer B of S1 (See figure 4 & 6) or wafers A of S1, B of S2 or D of S2, (See figure 6). In order to locate the exact point at which the leakage is taking place, you must remove the leads from the function switch and make direct contact, thus eliminating the switch from the circuit.

UNIPROBE CONTACTS

In cases where meter readings are errotic or not constant the contacts in the Uniprobe are suspect. These contacts should be bent so that a belly is formed in the vicinity of the metal washer on the nose piece.



NOTES ON 232 AND 249

There appears to be some confusion between the range and function switches. The switch illustrated in both Figure #4 and #5 is marked #60024 on the detent plate. This is the range switch.

The function switch is marked #60067 and should not have any of the precision resistors wired on to it. It is not illustrated separately but may be found in Figure #7, marked S1.

Page 4, Figure 3, 2nd Column - 6th instruction:
"Connect the 4.7 megohm resistor....."Change lug "C" (C) to lug "D" (C)".

On Figure 3 TB3-1 looks like a ground lug on XV2. Care should be taken not to ground the terminal strip.

Page 8, Figure 7. Meter terminal No.1 is the positive (+) terminal; terminal No. 2 is the negative (-) terminal.

Page 12, Step 3. Insert battery with positive terminal into the cup washer.

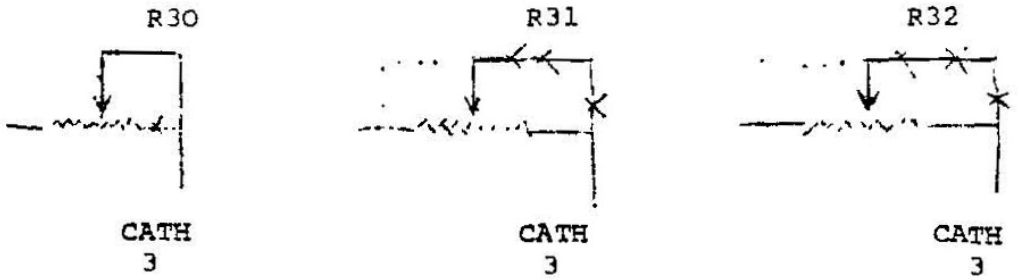
Page 12, Step 5. (Third line): Change 50,000 ohms to 40,000 ohms.

Page 9, Fig. 8. E13 should be shown pointing downward.

Page 14, Operating Instructions. Schematic diagram is incorrect. Use corrected schematic diagram in the Construction Manual.

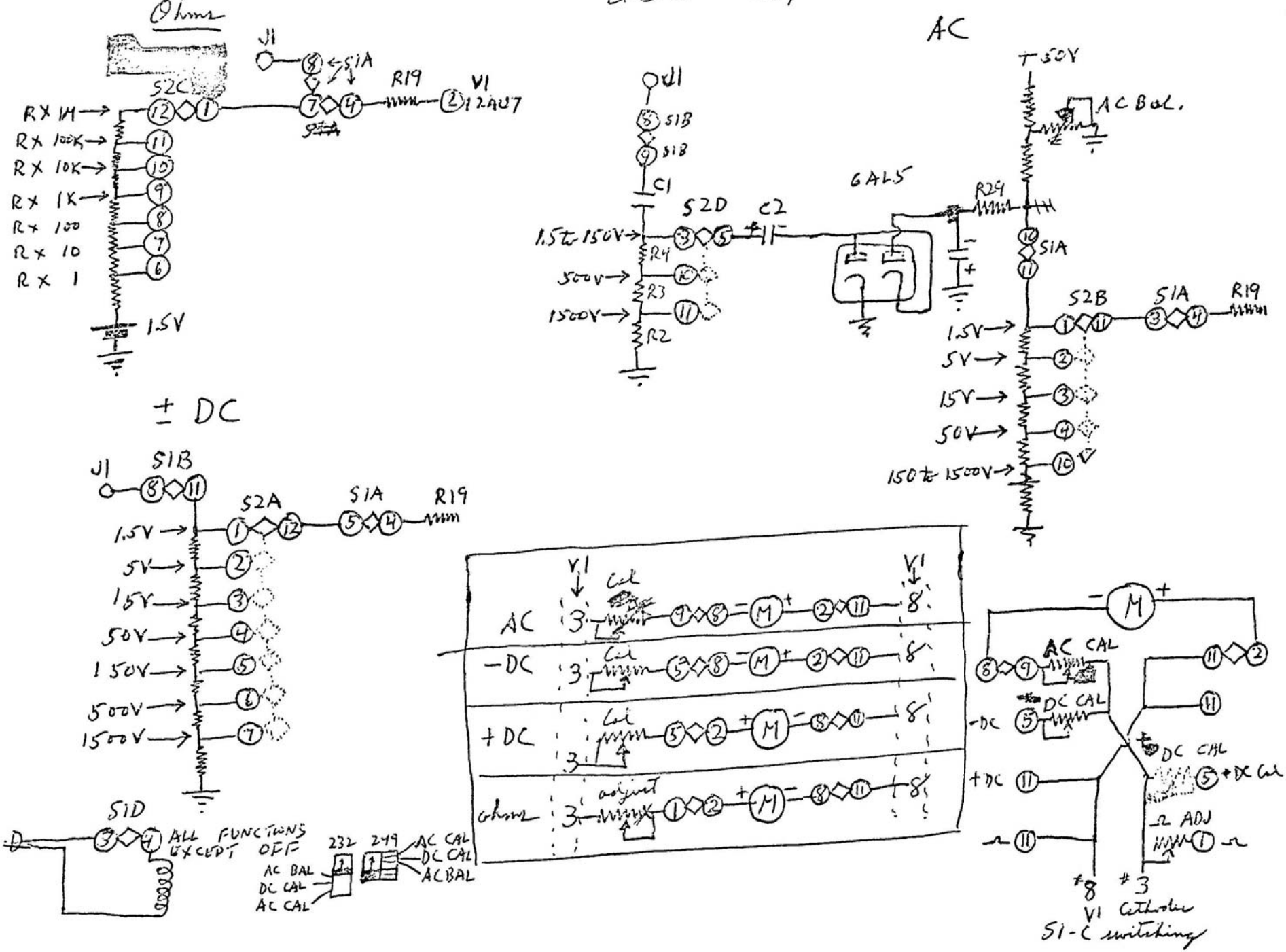
An apparent discrepancy exists in the wiring of R30,R31 and R32 when figures 3 and 7 are compared with the schematic. However the 232 will work wired either way.

The schematic may be corrected as follows: Wires marked with an X are to be eliminated - wires indicated by dots are to be added.



From a cold start, the meter should not move when the unit is turned on until the 12AU7 reaches operating temperature. Leakage paths to ground in R22, R30, R31, R32 or S1C causing such operation can be cleared (removed) by using a contact cleaner spray. Application directions will be found on the container.

232 - 249


Ohms
J1
S1A
S2C
R19
V1
12AU7
RX 1M
RX 100K
RX 10K
RX 1K
RX 100
RX 10
RX 1
1.5V
AC
J1
S1B
C1
S2D
C2
GALS
1.5 to 150V
500V
1500V
R4
R3
R2
+150V
AC Bal.
R29
S1A
S2B
S1A
R19
1.5V
5V
15V
50V
150 to 1500V
± DC
J1
S1B
S2A
S1A
R19
1.5V
5V
15V
50V
150V
500V
1500V
S1D
ALL FUNCTIONS EXCEPT OFF
232
249
AC CAL
DC CAL
AC BAL
AC BAL
DC CAL
AC CAL
V1
Cal
adjust
AC
-DC
+DC
ohms
M
AC CAL
DC CAL
-DC
+DC
DC CAL
+DC Cal
Ω ADJ
#8
#3
V1 Cathodes
S1-C switching