JACKSON *Electronic Test Equipment*

Tele-Volter

VACUUM TUBE VOLTMETER

MODEL 709

INSTRUCTION MANUAL

THE JACKSON ELECTRICAL INSTRUMENT COMPANY
DAYTON, OHIO U. S. A.

ABOUT YOUR NEW JACKSON INSTRUMENT

Your new Jackson Tele-Volter is a compact accurate and stable Electronic Volt Ohmmeter. It provides a large seven inch meter having long easy to read scales, while size and weight have been kept to a minimum making the instrument readily portable. All of the Jackson know-how and the highest quality components have been utilized in the Tele-Volter. This is another fine instrument in the line of Jackson Service Engineered Test Equipment that has long been famous in the radio and TV field.

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GENERAL DESCRIPTION

The Jackson Tele-Volter is a compact, accurate and stable electronic volt ohmmeter. The Tele-Volter provides a large 7-inch meter having long easy to read scales without sacrificing the small size and light weight necessary in a portable instrument. The case is styled with a sloping front and finished in gray Ham-R-Tex. Dials are projection type for maximum readability from all angles. The probe supplied with the Tele-Volter incorporates a two position slide action switch for changing from DC to AC or ohms. A high voltage probe which extends the DC range to 30,000 volts and a high frequency probe useful to 200 MC are available as accessory equipment.

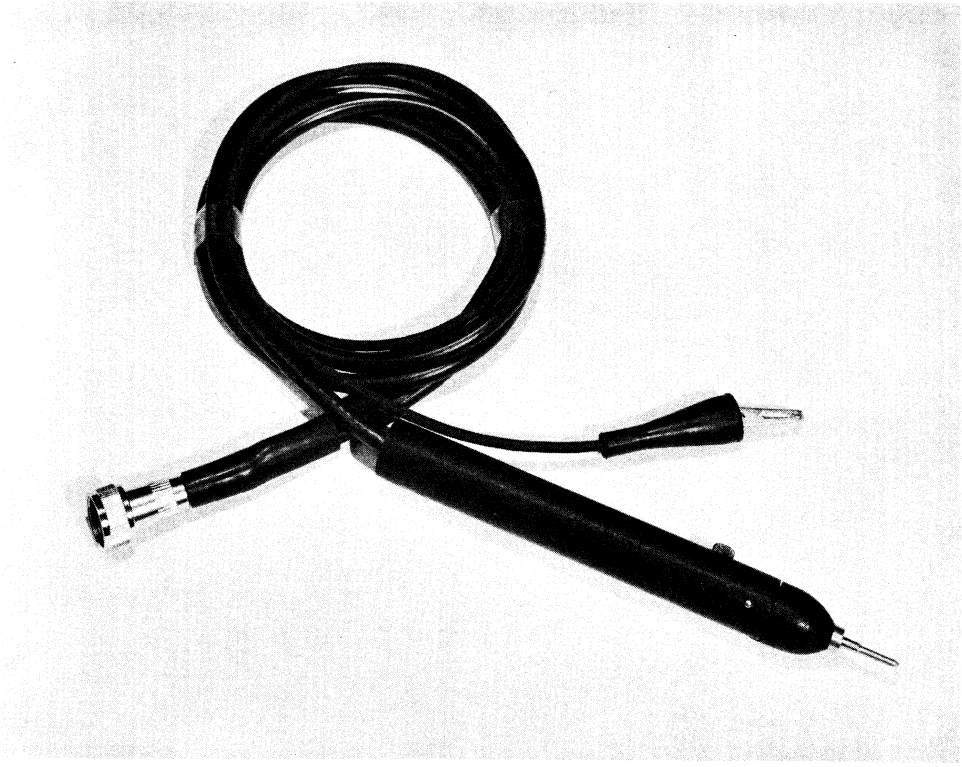

Figure 1

ELECTRICAL CIRCUITRY

The measuring circuit utilizes a 12AU7 dual-triode tube in a balanced bridge circuit. This circuit is exceptionally stable and is unaffected by normal line voltage fluctuations. The electronic circuit affords complete meter protection against overloads, and provides proper damping.

A. When used as a DC Voltmeter with the circuit switch in -DCV or +DCV position, and the probe switch in DC position, the voltage to be measured is fed through a 1 megohm isolation resistor in the probe directly to a voltage divider. This divider is tapped to give the various full scale voltage sensitivities. The proper tap for any given range is selected by means of the range switch and the voltage at the tap applied directly to the input of the balanced bridge measuring circuit.

B. When used as an AC Voltmeter with the circuit switch in ACV position and the probe switch in AC-Ohms position the voltage to be measured is fed directly through the probe to the input of a 6AL5 dual-diode tube used as a peak to peak rectifier. The resultant DC voltage at the output of this rectifier circuit is then applied to the voltage divider at the input of the measuring circuit.

C. When used as an Ohmmeter with the circuit switch in OHMS position and the probe switch in AC-Ohms position, voltage from a 1.5 volt battery is applied through a precision resistor directly to the input of the 12AU7 tube in the DC measuring circuit. The circuit sensitivity can be adjusted by means of the OHMS ADJUST control to give full scale deflection of the meter. When an unknown resistor is connected between the ground lead and the probe tip a voltage divider circuit is set up. This circuit consists of the battery voltage in series with the unknown resistor and the precision resistor. The correct precision resistor for the range being used is selected by means of the range switch. The voltage drop across the unknown resistor and thus the meter deflection is proportional to the resistance value of the unknown.

D. The power supply uses one section of a 6AL5 dual-diode tube as a half wave rectifier. The rectified voltage is then filtered by means of a resistance-capacity filter. The contact potential developed by the second section of the 6AL5 tube is used to balance out the contact potential developed by the diodes of the peak to peak rectifier.

TECHNICAL SPECIFICATIONS

(A) POWER REQUIRED

Voltage	115 Volts AC
Frequency	50 - 60 Cycles
Power Consumption	12 Watts

(Note: Other voltage and frequency inputs are available on special order.)

(B) DIMENSIONS

Height	8-1/4"
Width	7-1/4"
Depth	8-3/4"

(C) WEIGHT

Net Weight	10 lbs.
Shipping Weight	13 lbs.

(D) TUBE COMPLEMENT

1 - 12AU7	Voltmeter Tube
1 - 6AL5	Peak to Peak Rectifier
1 - 6AL5	Power Rectifier and Balance Voltage Generator

(E) DIAL LAMPS

2 - Type 51 6.3V, .25A.

(F) DC VOLTMETER

Accuracy	3% of Full Scale
Input Resistance	11 megohms
DC Ranges (Black scales)	0 - 1 - 5 - 10 - 50 - 100 - 500 - 1000
Zero Center Ranges (Blue scales)	Calibrated Positive & Negative 0 -.5 - 2.5 - 5 - 25 - 50 - 250 - 500

(G) AC VOLTMETER

Accuracy	5% of Full Scale
Input Impedance	.2 megohm shunted by 150 mmf.
Frequency	20 Cycles to 4.5 MC.
RMS Ranges (Black scales)	0 - 1 - 5 - 10 - 50 - 100 - 500 - 1000
P - P Ranges (Red scales)	0 - 2.8 - 14 - 28 - 140 - 280 - 1400 - 2800

(H) OHMMETER

Resistance Ranges (Green Scale)	0 - 1K - 10K - 100K - 1 meg - 10 meg - 100 meg - 1000 meg
Accuracy	3% of Total Scale Length

VOLTAGE AND RESISTANCE MEASUREMENT

(A) GENERAL USAGE

1. Attach cable of combination probe and ground lead assembly to input connector on front panel of Tele-Volter.

2. Before plugging line cord into AC receptacle check zero position of meter. If pointer does not indicate exactly zero, correct by means of zero adjusting screw which is located on meter front just below Jackson name plate.

3. Now insert plug on Tele-Volter line cord into 115 volt 50 - 60 cycle AC receptacle (unless instrument is equipped for other voltage or frequency) and rotate circuit switch to DCV position. Sufficient warm-up time should be allowed before proceeding with any voltage or resistance measurements.

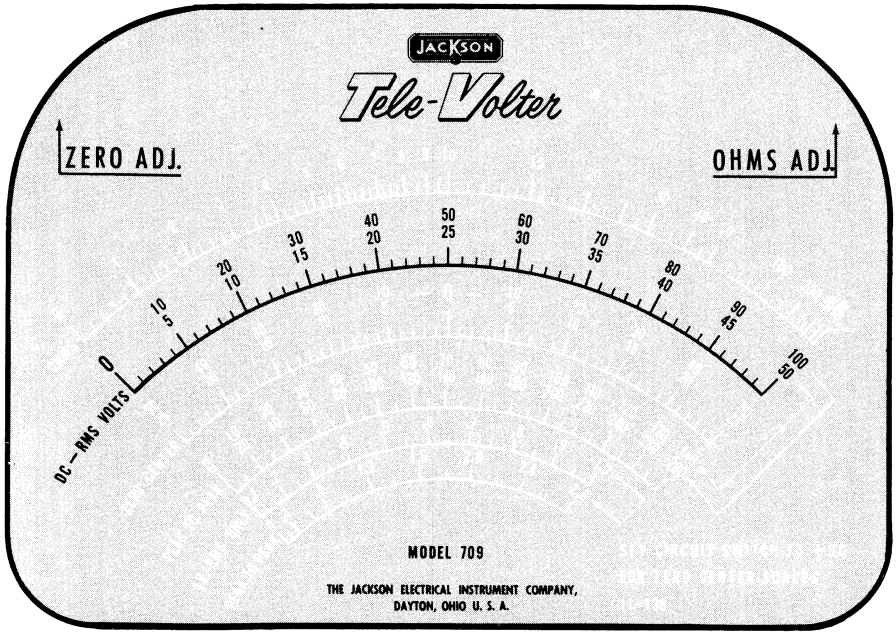

Figure 2

(B) DC VOLTAGE MEASUREMENTS

1. Set circuit switch to either -DCV or +DCV position depending on whether the voltage to be measured is negative or positive with respect to ground.

2. Set probe switch to DC position.

3. Set range switch to range position which will cover voltages to be measured.

4. Connect ground lead to ground or low side of voltage to be measured.

5. Adjust meter pointer to exactly zero by means of ZERO ADJUST control.

6. Place probe tip at point of voltage to be measured and read directly on DC (Black) scales of meter.

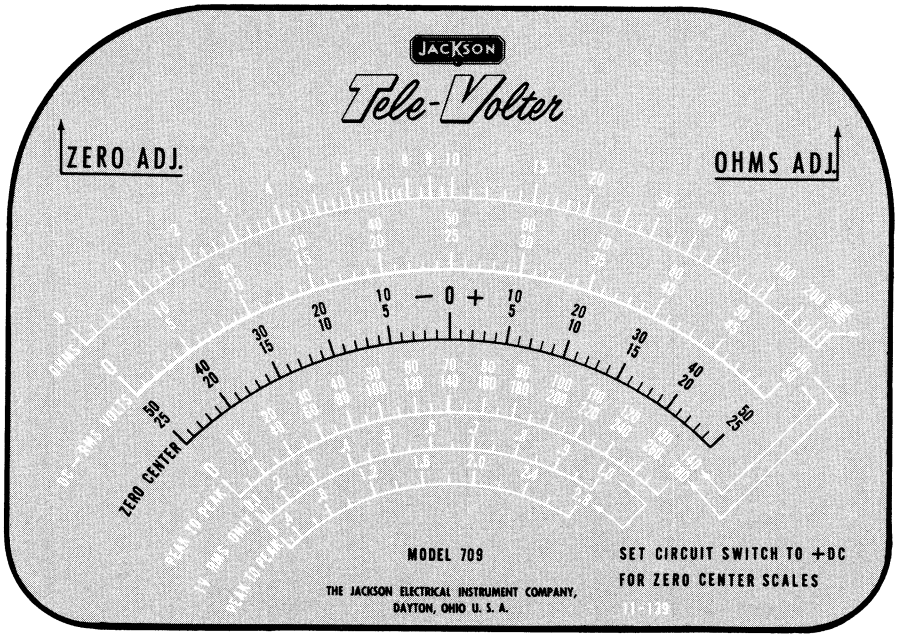

Figure 3

(C) ZERO CENTER DC VOLTAGE MEASUREMENTS

1. Set circuit switch to +DCV position.

2. Rotate ZERO ADJUST knob clockwise to move meter pointer upscale until it reads exactly zero on Zero Center (Blue) scale.

3. Set probe switch to DC position.

4. Set range switch to voltage position corresponding to the total positive and negative voltage of the Zero Center range to be used.
   Example: To use -50V · 0 · +50V range, set range switch to 100 volt position and read voltage directly on -50V · 0 · +50V (Blue) scale.

5. Connect ground lead to ground or low side of voltage to be measured.

6. Place probe tip at point of voltage to be measured and read on Zero Center (Blue) scale.

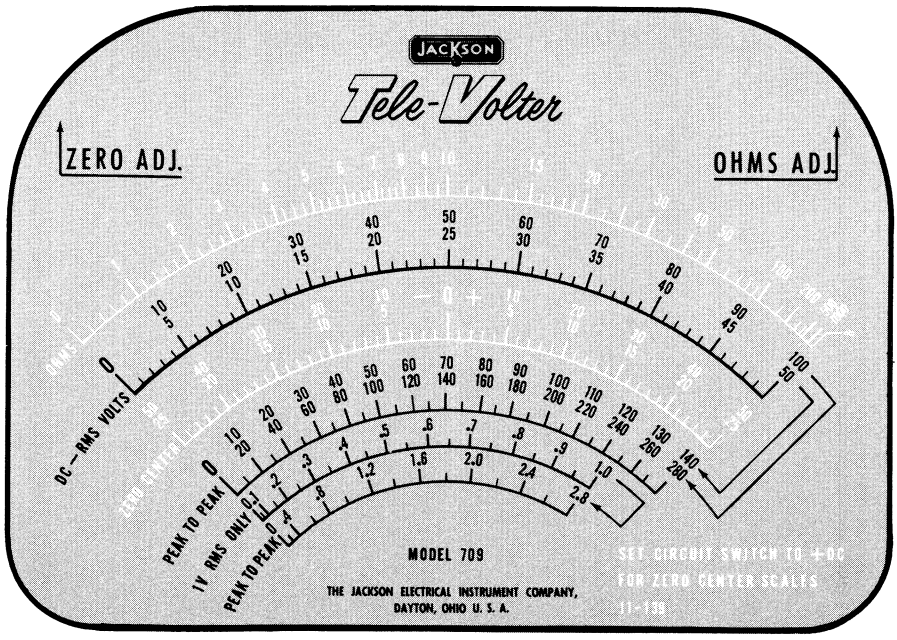

Figure 4

(D) AC VOLTAGE MEASUREMENT

1. Set circuit switch to ACV position.
2. Set probe switch to AC-Ohms position.
3. Set range switch to range position which will cover voltages to be measured.
4. Connect ground lead of Tele-Volter to ground or low voltage side of voltage to be measured.
5. Adjust meter pointer to exactly zero by means of ZERO ADJUST control.
6. Place probe tip at point of voltage to be measured and read RMS value of voltage on RMS (Black) scale. Peak to peak value of voltage is indicated on P - P (Red) scale.

   Two special AC scales 0 - 1 volt RMS and 0 - 2.8 volt P - P are provided and must be used when range switch is in 1 volt position. Voltage measurements to frequencies of 4.5 megacycles can be expected to be accurate if the impedance of the voltage source is relatively low.

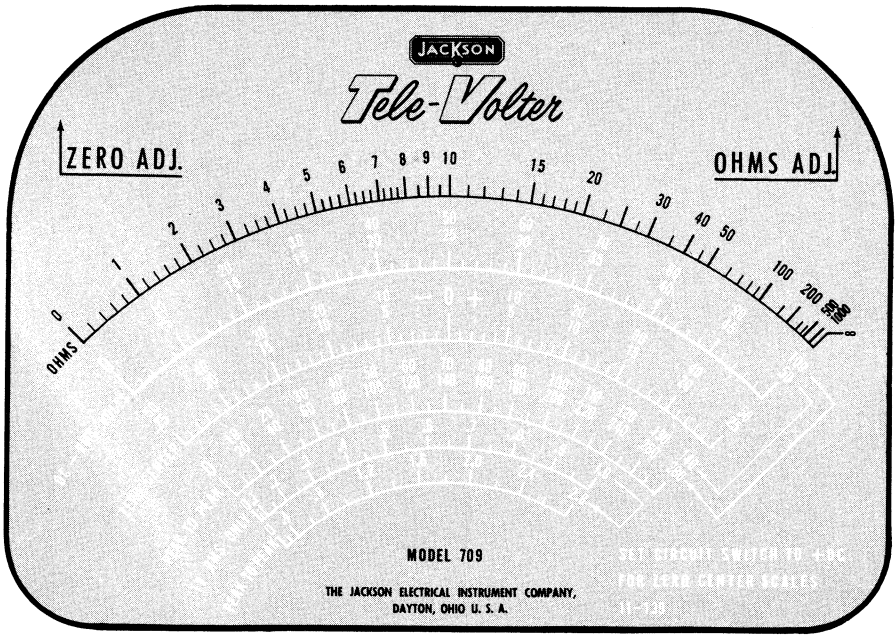

Figure 5

(E) RESISTANCE MEASUREMENT

1. Set circuit switch to OHMS position.

2. Set probe switch to AC-Ohms position.

3. Set range switch to range which will cover resistance to be measured.

4. Short input of Tele-Volter by clipping ground lead to probe tip and adjust meter pointer to exactly zero by means of ZERO ADJUST control.

5. Remove ground lead from probe tip and adjust meter pointer to exactly full scale by means of OHMS ADJUST control. (Full scale = ∞ on green range).

6. Connect ground lead to one terminal of resistance to be measured. (On grounded equipment connect to chassis or low side)

7. After making sure no voltage exists across resistance to be measured place probe tip on opposite terminal and read value on Ohms (Green) scale.

Note: When switching from one of the higher ranges to RX1 range or vice versa, it is necessary to make zero adjustment (Step "4" above). This is due to lead resistance which on this low resistance range must be compensated for. Whenever zero position is readjusted always be sure to readjust full scale position (Step "5" above).

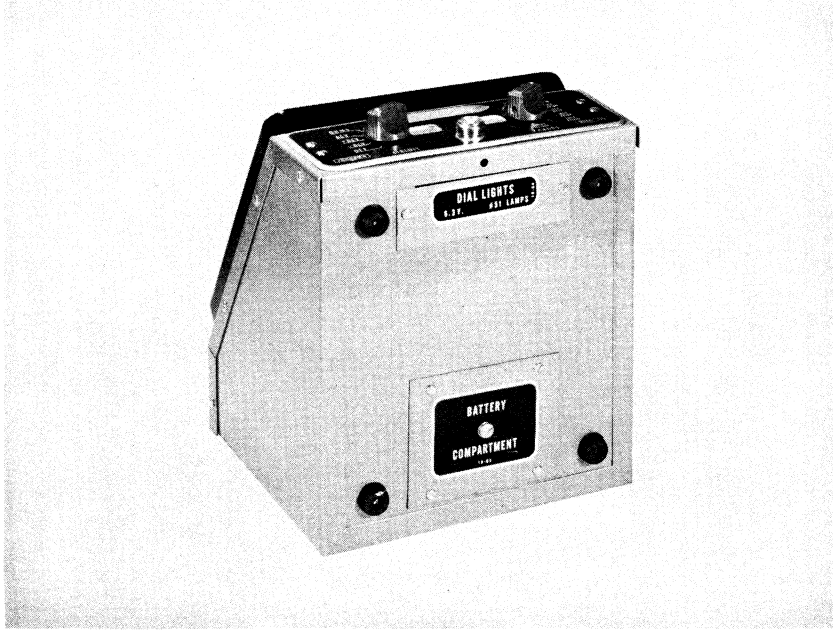

Figure 6

MAINTENANCE

(A) BATTERY REPLACEMENT

The battery used as a voltage source in the ohms circuit of the Tele-Volter will give long service, however, when it is no longer possible to adjust meter pointer to full scale with circuit switch in OHMS position it will be necessary to replace battery. To do this it is not necessary to remove Tele-Volter from case. Remove four screws which are located along edge of Battery Compartment cover plate on bottom of Tele-Volter case. Cover plate with battery holder attached can then be removed from case and fresh battery inserted. Use #2 size "D" flashlight cell for replacement, being careful to observe polarity.

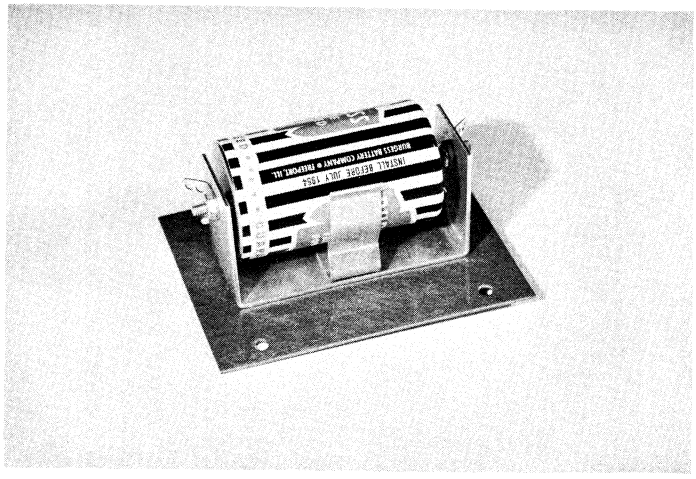

Figure 7

(B) DIAL LAMP REPLACEMENT

Dial lamps can also be replaced without removing Tele-Volter from case. To do this remove the Dial Light Inspection plate which is located on bottom of case and held in place by two screws. The lamps are then accessible. Use #51, 6.3V., .25A lamps for replacement.

(C) TUBE REPLACEMENT

All tubes used in the Tele-Volter are operated well below their maximum ratings and should have exceptionally long life. If it should become necessary to remove the tubes for test or replacement, the following procedure should be taken.

1. Remove eight screws located along edge of front panel on sides of case.

2. Remove four screws from Battery Compartment cover plate.

3. Front panel with entire instrument assembly attached can then be removed from case. Battery holder assembly is removed by passing entire unit through opening in case bottom, leaving wires connected to Tele-Volter.

Note: If 12AU7 is replaced it will be necessary to recalibrate instrument according to procedure given below. If either 6AL5 tube is replaced it will be necessary to recalibrate AC position of instrument only. 6AL5 replacement will not affect DC calibration.

CALIBRATION PROCEDURE

Before attempting any calibration adjustments on Tele-Volter, set circuit switch to -DCV position and allow instrument to warm up for approximately one-half hour.

(A) BRIDGE CIRCUIT BALANCE ADJUSTMENT

1. Set circuit switch to +DCV position.

2. Set range switch to 100V position.

3. Rotate ZERO ADJUST control fully clockwise. Meter pointer should indicate .6 of full scale or 60 on 100V scale. If this is not the case adjust to this position by means of DC balance adjustment R1 which is located on terminal board on under side of chassis.

   (See Figure 9).

   Note: The purpose of the above adjustment is to bring both left hand zero and center zero positions within range of the ZERO ADJUST control when circuit switch is in +DCV position.

(B) DC CALIBRATION PROCEDURE

For DC calibration of the Tele-Volter a standard DC voltage source is required. The instrument is calibrated on the 5V range, the recommended calibration point being 4 volts, although any voltage between 3 and 5 volts may be used as long as the exact value as measured on an accurate standard meter is known. As calibration adjustments are made on both -DCV and +DCV circuit switch positions, both a positive and negative DC voltage, with respect to ground, will be required. If the standard voltage source is a power supply always be sure that the side to which the ground lead of the Tele-Volter is connected is at ground potential. If the source is a battery it would be grounded automatically when the Tele-Volter ground lead is connected.

1. -DC CALIBRATION PROCEDURE

   (a) Set circuit switch to -DCV position.

   (b) Set probe switch to DC position.

   (c) Set range switch to 5V position.

(d) Set meter pointer to exactly zero by means of ZERO ADJUST control.

(e) Connect Tele-Volter ground lead to positive terminal of standard DC voltage source.

(f) Connect probe tip to negative terminal of standard DC voltage source.

(g) If the voltage reading of the Tele-Volter is not correct according to voltage indicated by standard meter adjust -DCV calibration adjustment R14. (See Figure 8).

2. +DC CALIBRATION PROCEDURE

(a) Set circuit switch to +DCV position.

(b) Set probe switch to DC position.

(c) Set range switch to 5V position.

(d) Set meter pointer to exactly zero by means of ZERO ADJUST control.

(e) Connect Tele-Volter ground lead to negative terminal of standard DC voltage source.

(f) Connect probe tip to positive terminal of standard DC voltage source.

(g) If the voltage reading of the Tele-Volter is not correct according to voltage indicated by standard meter, adjust +DCV calibration adjustment R13. (See Figure 8).

(C) AC CIRCUIT ADJUSTMENT

1. AC BALANCE ADJUSTMENT

(a) Set circuit switch to +DCV position.

(b) Set range switch to 1V position.

(c) Set meter pointer to exactly zero by means of ZERO ADJUST control.

(d) Now change circuit switch to ACV position and notice position of pointer. If pointer has moved away from zero, reset to exactly zero by means of AC balance adjustment R19 which is located on top center of chassis near front panel. (See Figure 8).

Note: If pointer cannot be returned to zero at any adjustment of R19 interchange the two 6AL5 tubes. If pointer still cannot be returned to zero one or both of the 6AL5 tubes is/ are defective.

2. AC CALIBRATION

For AC calibration of the Tele-Volter a standard AC voltage source is required. The instrument is calibrated on the 50V range. The recommended calibration voltage is 40 volts, however, any voltage between 30 and 50 volts may be used as long as it is measured with an accurate standard meter.

(a) Set circuit switch to ACV position.

(b) Set probe switch to AC-Ohms position.

(c) Set range switch to 50V position.

(d) Set meter pointer to exactly zero by means of ZERO ADJUST control.

(e) Connect Tele-Volter ground lead to grounded side of standard AC voltage source.

(f) Connect probe tip to high side of standard AC voltage source.

(g) If the voltage reading of the Tele-Volter is not correct according to voltage indicated by standard meter, adjust ACV calibration adjustment R12. (See Figure 8).

If there is no damage to the component parts all other ranges will be within required accuracy. Other ranges may be checked as listed above with standard meters and power sources that fall within the selected range.

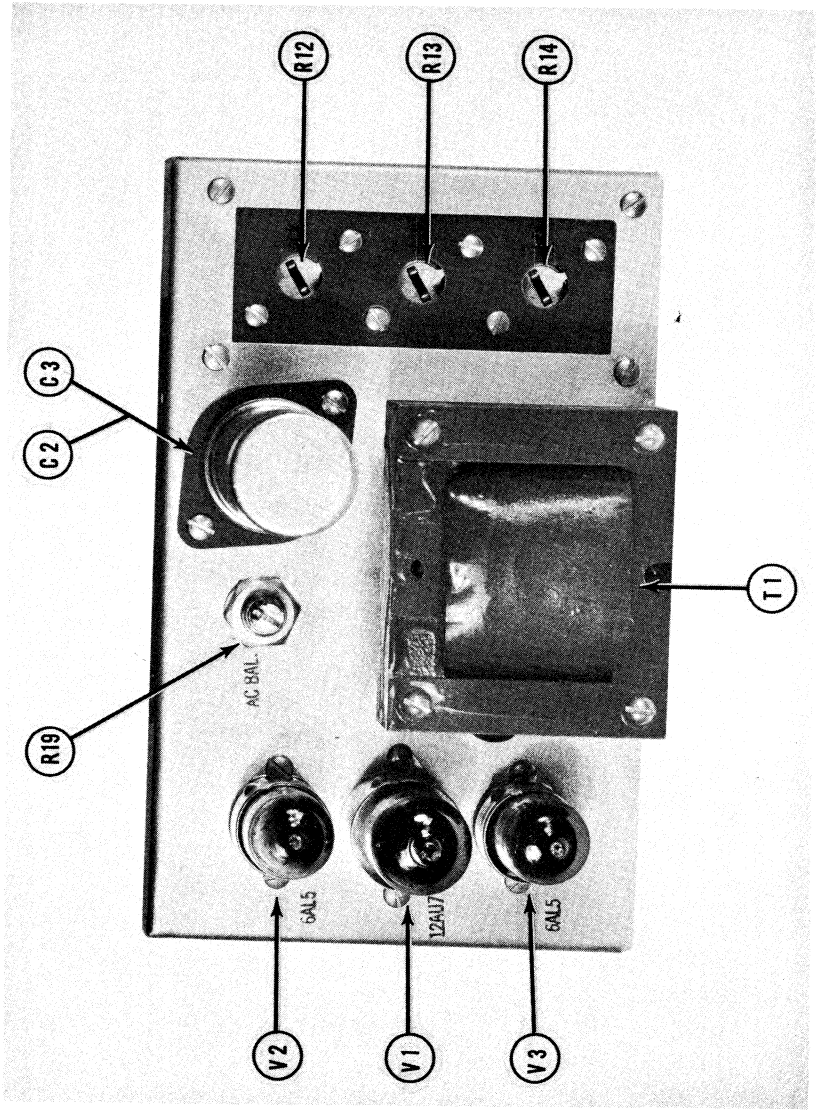

Figure 8

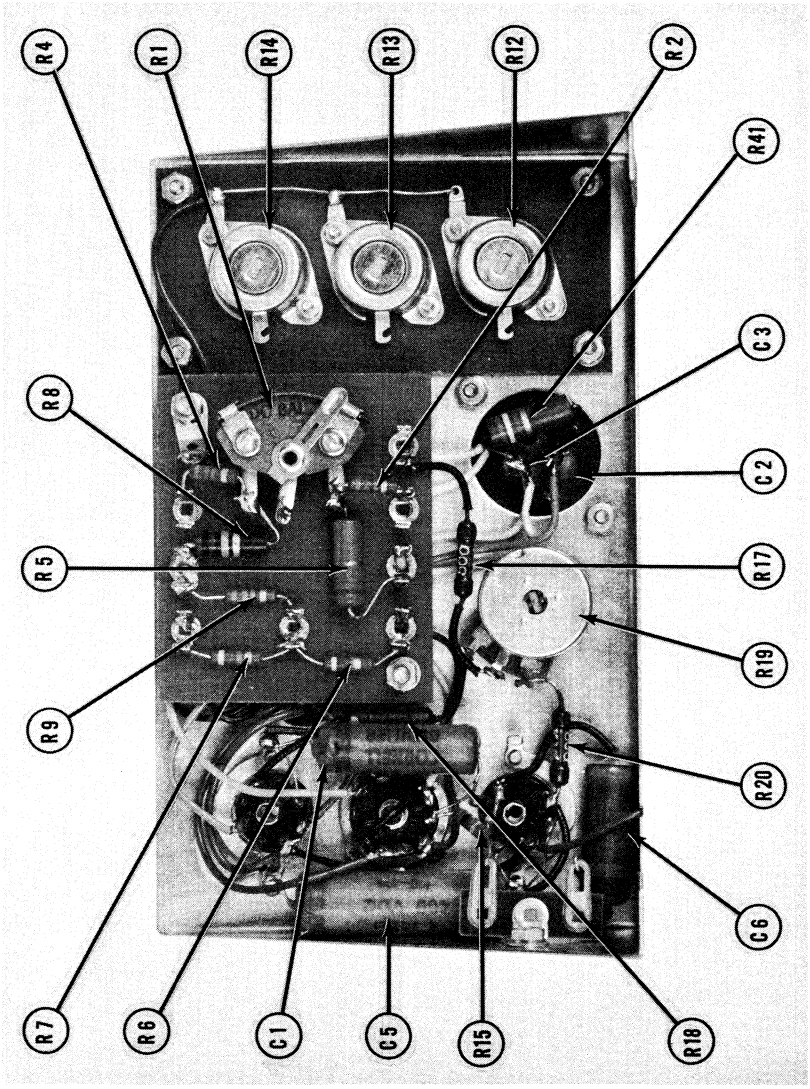
R4
R1
R14
R13
R12
R2
R41
C3
C2
R17
R19
R20
C6
R18
C1
C5
R15
R6
R7
R9
R5
R8

Figure 9

REPLACEMENT PARTS LIST

REF. SYMBOL	JACKSON STOCK NO.	NAME AND DESCRIPTION		
C1	26-98	Paper Tubular Capacitor	.01 mf.	400 V.
C2	26-124	Electrolytic Capacitor	20 mf.	150 V.
C3	26-124	Electrolytic Capacitor	20 mf.	150 V.
C5	26-96	Paper Tubular Capacitor	.1 mf.	400 V.
C6	26-125	Metalized Paper Capacitor	.5 mf.	200 V.
I1	22-29	Dial Lamp	6.3 V.	.25 A.
I2	22-29	Dial Lamp	6.3 V.	.25 A.
M1	1-41	Meter	200 ua.	750 ohm
P1	9-17	Line Cord and Plug		
P2	5-41	Probe Cable Connector		
P3	5-43	Probe Chassis Connector		
R1	4-40	Adjustable Resistor, Wire Wound	1000 ohm	
R2	27-235	Composition Resistor	2700 ohm	1/2 W 10%
R3	4-85	Potentiometer, Carbon	1000 ohm	
R4	27-235	Composition Resistor	2700 ohm	1/2 W 10%
R5	27-197	Composition Resistor	5100 ohm	1 W 5%
R6	27-218	Composition Resistor	47,000 ohm	1/2 W 10%
R7	27-218	Composition Resistor	47,000 ohm	1/2 W 10%
R8	27-367	Composition Resistor	12,000 ohm	1 W 10%
R9	27-232	Composition Resistor	33,000 ohm	1/2 W 10%
R10	4-19	Potentiometer, Carbon	2000 ohm	
R11	27-318	Composition Resistor	3300 ohm	1/2 W 10%
R12	4-86	Adjustable Resistor, Wire Wound	3000 ohm	
R13	4-84	Adjustable Resistor, Wire Wound	2000 ohm	
R14	4-84	Adjustable Resistor, Wire Wound	2000 ohm	
R15	27-206	Composition Resistor	1 megohm	1/2 W 10%
R16	27-349	Precision Resistor	1 megohm	1/2 W 1%
R17	27-350	Precision Resistor	500,000 ohm	1/2 W 1%

R18	27-350	Precision Resistor	500,000 ohm	1/2 W 1%
R19	4-87	Potentiometer, Carbon	500,000 ohm	
R20	27-350	Precision Resistor	500,000 ohm	1/2 W 1%
R21	27-369	Precision Resistor	600,000 ohm	1 W 1%
R22	27-370	Precision Resistor	430,000 ohm	1/2 W 1%
R23	27-353	Precision Resistor	320,000 ohm	1/2 W 1%
R24	27-354	Precision Resistor	9.25 ohm	1/2 W 1%
R25	27-355	Precision Resistor	90 ohm	1/2 W 1%
R26	27-356	Precision Resistor	900 ohm	1/2 W 1%
R27	27-357	Precision Resistor	9000 ohm	1/2 W 1%
R28	27-358	Precision Resistor	90,000 ohm	1/2 W 1%
R29	27-359	Precision Resistor	900,000 ohm	1/2 W 1%
R30	27-360	Precision Resistor	9 megohm	1 W 1%
R31	27-361	Precision Resistor	8 megohm	1 W 1%
R32	27-362	Precision Resistor	1.05 megohm	1/2 W 1%
R33	27-363	Precision Resistor	830,000 ohm	1/2 W 1%
R34	27-361	Precision Resistor	8 megohm	1 W 1%
R35	27-349	Precision Resistor	1 megohm	1/2 W 1%
R36	27-351	Precision Resistor	800,000 ohm	1/2 W 1%
R37	27-364	Precision Resistor	100,000 ohm	1/2 W 1%
R38	27-365	Precision Resistor	80,000 ohm	1/2 W 1%
R39	27-366	Precision Resistor	10,000 ohm	1/2 W 1%
R40	27-366	Precision Resistor	10,000 ohm	1/2 W 1%
R41	27-282	Composition Resistor	3900 ohm	1 W 10%
S1	8-119B	Two Wafer Ceramic Switch (Line Switch Attached)		
S2	8-120B	Three Wafer Ceramic Switch		
S3	24-70	Probe Switch Contact Spring		
T1	30-271	Power Transformer	115 V.	50-60 cycle AC
	30-283	Power Transformer	115 V.	25 cycle AC
	30-284	Power Transformer	230 V.	50-60 cycle AC
V1	22-47	Electron Tube Type 12AU7		
V2	22-51	Electron Tube Type 6AL5		
V3	22-51	Electron Tube Type 6AL5		

GENERAL INFORMATION

Mail the registration card for your tester promptly, giving correct name and mailing address so that additional technical data from our factory will be properly delivered. Notify us of a change of address, listing the model and serial numbers of your instrument.

REPAIRS AND ADJUSTMENTS

Repairs and adjustments will be made under the terms and conditions stated in the guarantee furnished with the instrument. The instrument should not be returned to our factory except where we authorize such return to be advisable. When corresponding concerning this instrument be sure to always mention the model and serial numbers. Be certain to describe fully and accurately the information desired.

Manufactured by

THE JACKSON ELECTRICAL INSTRUMENT COMPANY

DAYTON, OHIO U.S.A.

Inst. Form 709-1 No. 32-47 653

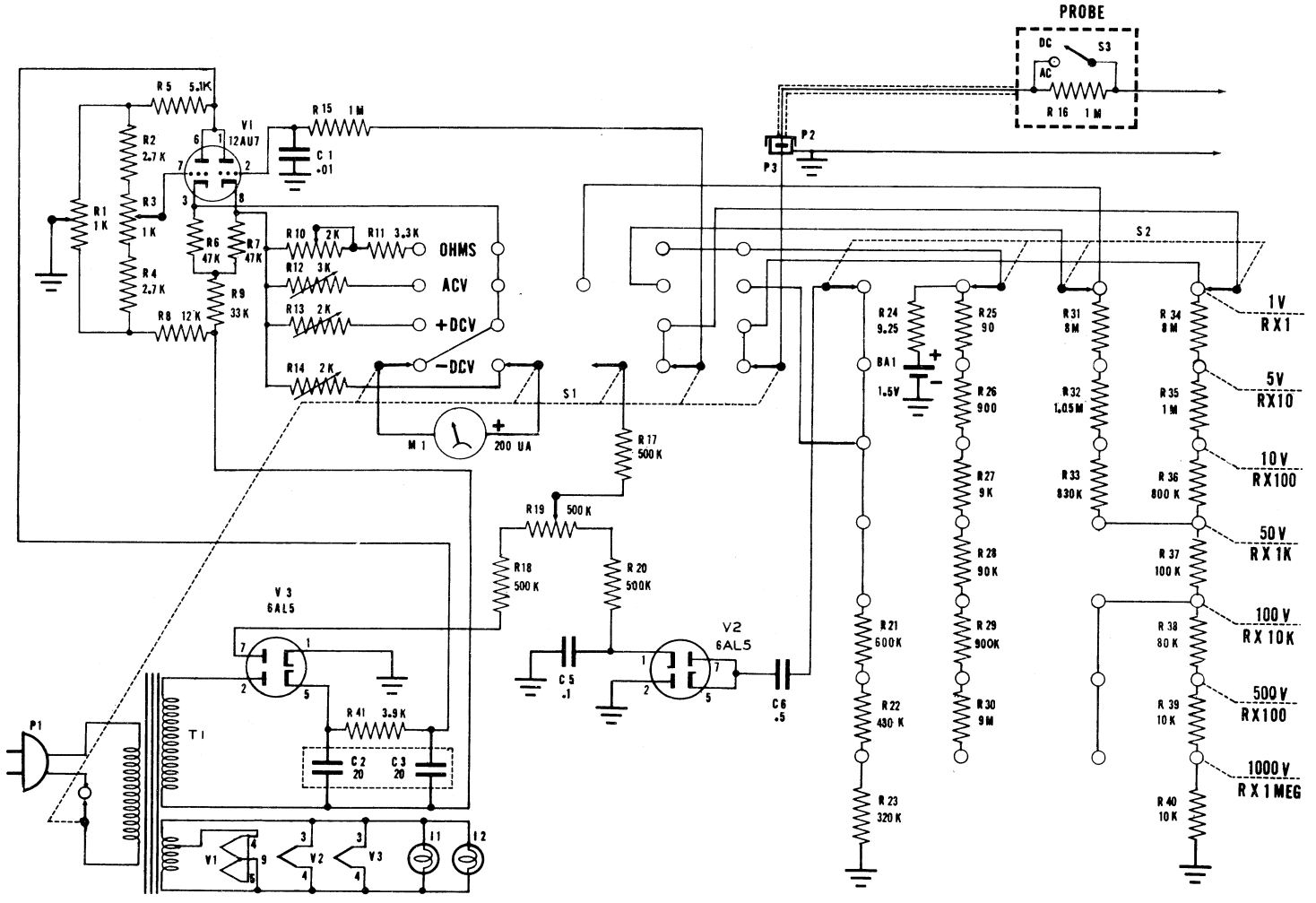

Figure 10

THE JACKSON ELECTRICAL INSTRUMENT CO. DAYTON, OHIO	
709 CIRCUIT	
DATE 2-9-53	SCALE
DWN. BY	CHKD. BY RCG.
PART NO. C-516	SER. NO.
DRAWING NO. C-C-516	