Simpson

INSTRUMENTS THAT STAY ACCURATE

OPERATOR'S MANUAL

VACUUM TUBE VOLTMETER
MODEL 303-2

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie St., Chicago, Illinois 60644
Area Code 312, Telephone 379-1121
In Canada, Bach-Simpson, Ltd., London, Ontario

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FIGURE 1. SIMPSON VACUUM TUBE VOLTMETER MODEL 303-2

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SECTION I

GENERAL DESCRIPTION

INTRODUCTION

The Simpson 303-2 Vacuum-tube Voltmeter offers the service, engineering, and research fields a small, compact and rugged instrument. Its high input impedance and wide frequency response give this instrument the characteristics necessary to deal with the high resistance circuits and high frequencies encountered in radio and television servicing. It indicates quantity measurements for DC or AC Voltages and Decibels as well as DC Resistances.

The instrument is housed in a sturdy, molded black phenolic case for maximum durability. The printed circuit board and all the component parts are mounted to the front panel. The entire instrument slips into and out of the case without disassembly.

The Adjust-A-Vue handle on the case can be used to support the instrument in a convenient sloping position for easy viewing on the bench top. Of course, the tester can also be placed in either a vertical or horizontal position.

The Model 303-2 is supplied with a test probe lead and a ground lead. The ground lead terminates in a banana plug on one end and an insulated crocodile clip on the other. The test probe lead terminates in a connector on one end that fits the input connector on the front panel and a probe with a pointed tip on the other end. A switch on the probe body makes a direct connection for AC and ohms readings, or connects an isolation resistor in series with the lead for DC readings.

ROLL TOP MODEL

The 303-2RT is the same instrument supplied with a convenient, all phenolic, roll top carrying case. This case includes a storage compartment at the bottom for the test leads and the line cord.

ACCESSORIES AVAILABLE

High Frequency Probe	Simpson Part No. 0073
High Voltage Probe 30 KV DC	Simpson Part No. 0186

SPECIFICATIONS

Ranges

DC Voltage (Input Resistance 10 Megohms)

0-1.2 Volts	0-60 Volts
0-6 Volts	0-300 Volts
0-12 Volts	0-1200 Volts

AC VOLTAGE (Input Impedance Including Leads)

(150 pF shunted by 150,000 Ohms minimum)
(350 Volts maximum Superimposed DC)

0-1.2 Volts	0-60 Volts
0-6 Volts	0-300 Volts
0-12 Volts	0-1200 Volts

VOLUME LEVEL IN DECIBELS

(reference 1 milliwatt into 600 Ohms)

−28 to +4 dB
−15 to +17 dB
−9 to +23 dB
+5 to +37 dB
+19 to +51 dB
+31 to +63 dB

DC RESISTANCE

Rx1 for 0-1000 Ohms (10 Ohms center)
Rx10 for 0-10 Kilohms (100 Ohms center)
Rx100 for 0-100 Kilohms (1000 Ohms center)
Rx1K for 0-1 Megohm (10 Kilohms center)
Rx10K for 0-10 Megohms (100 Kilohms center)
Rx1 Meg for 0-1000 Megohms (10 Megohms center)

ACCURACY

DC Volts	0-1200 V	±3% of full scale
AC Volts	0-1200 V	±5% of full scale
Resistance Ranges		±3° of linear arc

FREQUENCY RESPONSE

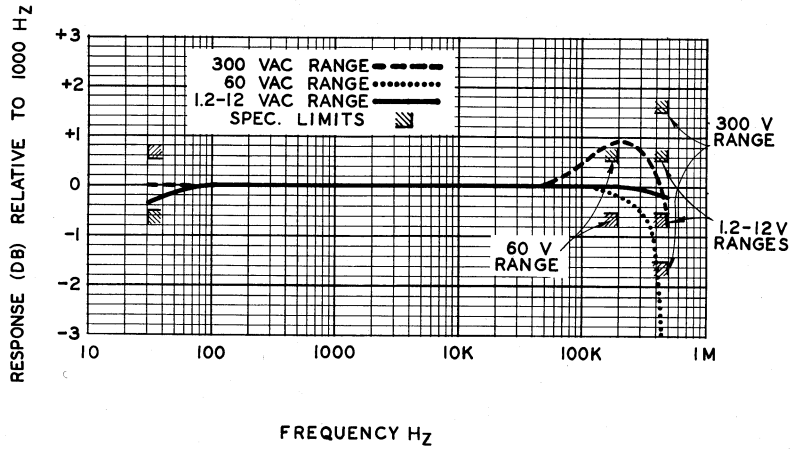
Ranges		
1.2 Volts, 6 Volts, 12 Volts	±0.5 dB	30-500,000 Hz
60 Volts	±0.5 dB	30-200,000 Hz
300 Volts	±1.5 dB	30-500,000 Hz

OVERALL DIMENSIONS 7" H. x 5-1/4" W. x 3-1/8" D.

WEIGHT 3-1/2 lbs.

POWER REQUIREMENTS

The Model 303-2 is normally supplied wired for 115 V, 50-60 Hz operation. The taps on the power transformer may be rewired to allow for 220V, 50-60 Hz operation. Refer to schematic wiring diagram figure 5A or 5B in Maintenance Section IV for proper wiring.



TYPICAL FREQUENCY RESPONSE CURVE

FIGURE 2. TYPICAL FREQUENCY RESPONSE CURVE

CONTROLS AND CONNECTORS

RANGE SWITCH

The range switch is located at the left side of the lower part of the front panel. It has six positions: 1.2/R x 1, 6/R x 10, 12/R x 100, 60/R x 1K, 300/R x 10K, and 1200/R x 1 Meg.

FUNCTION SWITCH

The function switch, located at the right side of the lower part of the front panel, has five positions: OFF, −DC, +DC, AC, and OHMS. In the OFF position a short is placed across the meter to reduce the possibility of damage when transporting the instrument from one location to another. The −DC and +DC positions eliminate any need to reverse the test leads at the test points.

ZERO ADJUST (electrical zero adjustment control)

The zero adjust control is located above and to the left of the range switch. It is used to electrically zero the instrument on all ranges.

OHMS ADJUST (full scale ohms adjustment control)

The ohms adjust control is located above and to the right of the function switch. This variable resistance in the ohmmeter circuit is used to compensate for the aging of the internal alkaline cell. It is adjusted for a full scale indication on the ohms ranges.

CONNECTORS

There are two connectors located on the front panel. The GROUND connector is located at the lower left-hand corner of the front panel. It is used as the reference for all readings. The INPUT connector is located at the lower right-hand corner of the front panel. The input probe is attached to this connector and is used for all measurements.

SECTION II

OPERATING INSTRUCTIONS

CAUTION

When making voltage measurements, as a personal protection, form the habit of turning off all power to the circuit under test. Connect the test leads at the desired points in the circuit. Then turn on the power and take the readings. Turn off the power before disconnecting the test leads from the circuit.

SHOCK HAZARD (As defined in **Underwriters Laboratories Radio and Television Receiving Appliance Standards for Safety,** eleventh Edition, dated November 1964, and updated to April 18, 1968.)

General:

"A shock hazard shall be considered to exist at any part involving a potential of between 42.4 volts peak and 40 kilovolts peak in the following cases:

A. If the current through a load of not less than 500 ohms exceeds 300 milliamperes after 0.0003 second.

B. If the current through a load of not less than 500 ohms exceeds 5 milliamperes after 0.2 second.

C. If the time required for the current through a load of not less than 500 ohms to decrease to 5 milliamperes is between 0.1 and 0.2 second, and the total quantity of electricity passed through the load up to that time exceeds 4 millicoulombs.

D. If the time required for the current through a load of not less than 500 ohms to decrease to 5 milliamperes to between 0.03 and 0.1 second, and the total quantity of electricity passed through the load up to that time exceeds $75T\text{-}350T^2$ millicoulombs, where T is the time in seconds.

E. If the potential is more than 5 kilovolts peak and if the total capacitance of the circuit is more than 3000 micromicrofarads."

INITIAL ADJUSTMENTS

Zero Adjustment (Mechanical)

Before turning on the power to the instrument, place the instrument in the position that it will be used and check to see that the pointer indicates zero.

If the pointer is off zero, adjust by means of the slotted screw located in the bakelite case directly below the indicator scale. Use a small screwdriver to turn this screw slowly either clockwise or counterclockwise until the pointer is exactly over the zero mark at the left side of the scale.

OPERATION OF CONTROLS

FUNCTION SWITCH

When the function switch is in the OFF position, power is turned off. Turning this switch to the right turns on power which is indicated by a pilot light located on the front panel between the ground jack and the input connector. This switch also selects the function to be used. Two positions, marked —DC and +DC, connect the indicator circuit for measuring DC volts and acts as an indicator reversing switch. With the ground lead connected to the chassis or the common circuit connection, set the switch at +DC for measuring voltage or at —DC for measuring negative voltage.

When the switch is set at AC, the indicator circuits are connected for AC voltage measurements. The internal vacuum tube peak rectifier changes the incoming AC voltage into a proportional DC voltage to be measured with the indicator circuits.

When the switch is set at OHMS, an internal alkaline cell and the associated resistors are switched into the indicator circuit to provide for DC resistance measurements.

RANGE SWITCH

The range switch selects the desired range for the circuit which has been selected with the function switch. There are six positions; each position is marked with the full-scale voltage indi-

cation for either DC or AC (RMS) voltage measurements and is also marked for the multiplier factor to be used when measuring resistances.

ZERO ADJUST (Electrical zero adjustment control)

Turn the power ON, and allow the instrument to warm up for several minutes. Then connect the probe to the ground lead, and turn the knob marked ZERO ADJ. to the right or left until the pointer is directly over the zero point on the scale. When changing ranges or functions it may be necessary to readjust zero.

OHMS ADJUST (full scale ohms adjustment control)

With the function switch set at the OHMS position and the range switch set at one of the resistance measuring positions, the pointer will rest near the right end of the scale (test leads open). The knob marked OHMS ADJ. should be turned right or left until the pointer is directly over the last mark at the right end of the scale, the point of infinite resistance.

MEASURING DC VOLTAGES

1. Set the function switch to the —DC or +DC position, depending on the polarity of the voltage to be measured.
2. Rotate the range switch to select the full-scale range desired. While the 303-2 circuits cannot be easily damaged, it is best to set the range switch to a higher range than needed as a protection to the vacuum tubes and the indicator movement. After the first reading, the range switch may then be set to a lower range if necessary to provide a more accurate reading.
3. Connect the crocodile clip of the GROUND lead to the reference point for the voltage to be measured.
4. Set the switch on the probe handle to DC. Connect the probe tip to the point in the circuit where voltage is to be measured.
5. Turn on the power in the circuit being measured and observe the indicator. If the indicator pointer deflects to the

left, the circuit polarity is opposite to that for which the function switch is set; set the function switch for the correct polarity.

6. Read the voltage on the black arc second from the top, marked VOLTS, reading the figures as follows:

1.2	Volt range —	read 0-12	and divide by 10
6	Volt range —	read 0-60	and divide by 10
12	Volt range —	read 0-12	directly
60	Volt range —	read 0-60	directly
300	Volt range —	read 0-300	directly
1200	Volt range —	read 0-12	and multiply by 100

NOTE

To measure more than 1200 Volts DC see the information on probe in Section VI.

ZERO CENTER DC VOLTAGES

1. Set the function switch to either —DC or +DC and short the test leads together.
2. Rotate the ZERO ADJ. knob until the indicator pointer rests over the zero mark on the zero center scale.
3. Set the range switch to a range which is at least twice the probable circuit voltage. Connect the test leads to the circuit the same as for DC voltage measurements.
4. Observe the indicator pointer indication on the arc marked 3-0-3. If the function switch is set at +DC, positive voltages will be indicated to the right of the center mark; negative voltages will be indicated to the left. Each side of the scale represents one half of the range being used.

The purpose for which the zero center scale is used usually does not require an accurate measurement of the voltage value, but merely an indication of a balanced condition. An example is the alignment of an FM discriminator; the desired balanced condition will result in a zero center indication, while a misaligned condition will cause some deflection away from the zero center.

MEASURING AC VOLTAGES
EFFECT OF WAVEFORM

The 303-2 vacuum tube voltmeter is calibrated using a sinusoidal signal. The circuitry is such that it senses the positive peak of the AC voltage component of the input. Because sine waves are involved in most measurements, the AC and dB scales are calibrated using the RMS values based on a true sine wave. When it is known that other than a sinusoidal signal is being measured, it must be recognized that the accuracy as specified for sinusoidal input will not apply.

MEASURING AC VOLTAGES

1. Set the function switch to the AC position.
2. Set the range switch to the desired range position.
3. Connect the crocodile clip of the GROUND lead to the reference point for the voltage to be measured.
4. Set the switch on the probe handle to AC/OHMS. Connect the probe to the point in the circuit where voltage is to be measured.
5. Turn on the power in the circuit to be measured. Observe the indicator pointer reading. The pointer indicates the RMS value of the AC sinewave voltage present at the test point.
6. For the 1.2 volt range, read the voltage on the red arc marked 1.2V AC ONLY, reading the figures directly. For the other ranges, use the black arc second from the top, reading the figures as follows:

6	Volt range —	read 0-60	and divide by 10
12	Volt range —	read 0-12	directly
60	Volt range —	read 0-60	directly
300	Volt range —	read 0-300	directly
1200	Volt range —	read 0-12	and multiply by 100

VOLUME LEVEL MEASUREMENTS

The connection and operation is the same for volume level measurements and AC voltage measurements with the exception of reading the pointer indication from the arc marked dB and applying the proper conversion factors as shown below:

1.2 Volt range — subtract 13 dB
6 Volt range — read directly
12 Volt range — add 6 dB
60 Volt range — add 20 dB
300 Volt range — add 34 dB
1200 Volt range — add 46 dB

The zero dBm reference level is 1 milliwatt into 600 ohms. Conversion may be made to the 6 milliwatt into 500 ohm zero dB reference level by adding algebraically — 7 dB.

DC RESISTANCE MEASUREMENTS

1. Set the function switch to the OHMS position.
2. Rotate the range switch to select the desired range.
3. Set the switch on the probe handle to AC/OHMS.
4. Short the input probe and the common test clip together and check the indicator pointer for zero reading. If necessary, rotate the ZERO ADJUST control to obtain a zero indication.
5. Separate the input probe and the common test lead. The indicator should deflect to full scale. If necessary, set the OHMS ADJUST control for a full scale indication. When the pointer cannot be brought to full scale, the alkaline cell inside the case needs replacement; see the information in Section IV Maintenance.
6. Be sure no voltage is present in the circuit in which resistance is to be measured. All power should be turned off and all capacitors discharged.
7. Connect the input probe and the common test lead to the two points between which DC Resistance is to be measured.

8. Read the pointer indication from the arc marked OHMS. Multiply the reading by the value indicated by the range switch position. K stands for 1000. MEG stands for 1,000,000. The result will be the resistance in ohms.

SECTION III

THEORY OF OPERATION

The operation of the Simpson Model 303-2 VTVM centers around a vacuum tube bridge circuit using a 12AU7 dual-triode tube. (See schematic diagram, figure 4.) When the bridge is balanced properly, the voltages at the two cathodes will be equal and the indicator, connected between the cathodes, will read zero.

When a positive voltage is applied to the grid of the left triode section, the current through the left half of bridge increases, causing the voltage at the cathode to increase. The difference in voltage causes a current, proportional to the input voltage, to flow through the indicator.

When the 303-2 is used to measure AC voltage, the input signal is first separated from any possible DC component and then is rectified by a 6AL5 dual-diode tube which serves as a peak rectifier. With an AC signal applied, this tube conducts on the positive half cycle thereby charging the input capacitor. After removing the AC component, all or part of the remaining DC voltage is then applied to the grid of the left triode section of the 12AU7 bridge tube and the circuit action that takes place is the same as in the section on DC Voltage previously described. With the AC rectifier connected, a contact potential is developed and causes a slight zero shift. This zero shift is eliminated by applying a voltage from R_{31} contact potential adjustment, to the AC rectifier circuit.

When the 303-2 is used to measure DC resistance, an alkaline cell with a resistor (selected by the range switch) connected in series is applied to the left triode section of the DC Voltmeter. The resulting DC voltage is measured as previously described. Connecting an external unknown resistance in parallel with the input probe causes a current to flow through the series resistor which produces a voltage drop and thus decreases the indicated value. The value indicated is calibrated in terms of resistance in ohms. For example, if the external resistor equaled the internal series resistor, the indicator would show half scale deflection and, of course, would read the value of the series resistor as well as the external resistor.

SECTION IV

MAINTENANCE

CARE OF THE INSTRUMENT

The Simpson Vacuum Tube Voltmeter Model 303-2 is a durable and rugged instrument which will withstand the wear and tear of every day service work. But it should be protected from rough treatment, dropping, or other unnecessary severe shock; the indicator has delicate jewel-mounted parts which could be damaged under these conditions. With proper care, the Model 303-2 should provide many years of excellent operation.

REMOVAL FROM CASE

The case is designed to provide easy and quick access for all necessary adjustments and replacement of parts. Use a 1/4 inch screwdriver to remove the four screws in the back of the case. Slide the entire front panel straight forward out of the case. The indicating instrument, the front panel, the printed circuit, and the alkaline cell are attached and are removed as a unit.

ALKALINE CELL REPLACEMENT

The 1.5 volt alkaline cell inside the case of the 303-2 is used as the fixed voltage source for the ohmmeter operation. When the indicating instrument pointer cannot be brought up to full scale

deflection with the OHMS ADJUST control, with test probes separated and the function switch at OHMS, replace alkaline cell with a fresh equivalent. This cell is a size AA, alkaline, flashlight type cell. (Although a standard AA dry cell may be used in emergencies, its use is not recommended because short cell life and low accuracy will always result for the resistance measurement function). Open the case for access and observe the polarity of the old alkaline cell in its clamp. Observe this polarity when you mount the new alkaline cell in the clamp. See figure 3 if additional assistance is needed.

CALIBRATION

The Simpson Vacuum Tube Voltmeter Model 303-2 has been carefully calibrated at the factory, and changes should not be necessary. After a long period of use, or when any internal parts have been replaced, recalibration may be required. Use the following procedure:

NOTE:

When calibrating the AC voltage position a sinusoidal waveform is required for highest accuracy.

1. Allow the instrument to warm up for a period of at least one hour. Set the function switch to —DC and the range switch to 1.2VAC.
2. Turn the ZERO ADJUST knob to the extreme left and note the position of the indicator pointer. Return the indicator pointer to zero. Set the function switch to +DC and turn the ZERO ADJUST knob to the extreme right and again note the indicator pointer position. The pointer position should be the same for both polarities. If there is any difference between them, adjust potentiometer R_{33} until the readings are the same. See Figure 3 to help locate potentiometer R_{33} inside the instrument.
3. With the function switch set at —DC, the switch on the probe set at DC, and the probes shorted together, set the ZERO ADJUST control for a zero pointer indication.

4. Set the function switch to the AC position and set the switch on the probe handle to AC. If the pointer does not rest at zero, adjust potentiometer R_{31} to correct this error. See Figure 3 to help locate potentiometer R_{31} inside the instrument.
5. Set the function switch to −DC and set the switch on the probe to DC again. Connect the probes to a known value of DC voltage. Check the indicator reading. If it is not correct, adjust potentiometer R_{27} to calibrate the instrument. See Figure 3 to help locate potentiometer R_{27} inside the instrument.
6. Set the function switch to AC and set the switch on the probe to AC. Connect the probes to a known value of AC voltage. (See page 13.) Check the indicator reading. If it is not correct, adjust potentiometer R_{26} to calibrate the instrument. See Figure 3 to help locate potentiometer R_{26} inside the instrument.

TUBE REPLACEMENT

Two tubes are used in the 303-2. One tube is a 6AL5, used as a peak rectifier for all AC voltages. The other tube is a 12AU7, which is used in the bridge circuit for all measurements. See Figure 3 for the tube locations.

When it is necessary to replace either or both the 12AU7 tube or the 6AL5 tube, the new tubes must be aged for at least 48 hours to keep the characteristics of the tubes from changing after recalibration. Place the new tube or tubes into the sockets and turn on the power to the instrument. Leave the instrument connected and operating for a minimum aging period of 48 hours.

After aging the tubes recalibrate the instrument using the six steps listed under CALIBRATION.

REPLACEMENT OF RESISTORS, CAPACITORS, ETC.

Most of the parts in the 303-2 are mounted on the printed circuit board. When replacement is necessary, first obtain an

exact equivalent part; then clip the defective part off of the printed circuit board, leaving its leads to be used as connections for the replacement. Carefully twist the leads for the replacement around those leads which were left in the printed circuit board, and solder each connection. Trim away all excess wire and check to see that there are no short circuits to other parts mounted nearby.

REPAIR STATIONS AND PARTS DEPOTS

Simpson Official Repair Stations and Parts Depots have been established throughout the United States and Canada. For fast and expert repair and calibration service for any equipment manufactured by Simpson, contact the Repair Station nearest you, and arrange with them for the service which you require. When ordering parts specify the Simpson part number, the description, and the quantity wanted for each part in your order. A list of these Repair Stations and Parts Depots is included at the end of this manual.

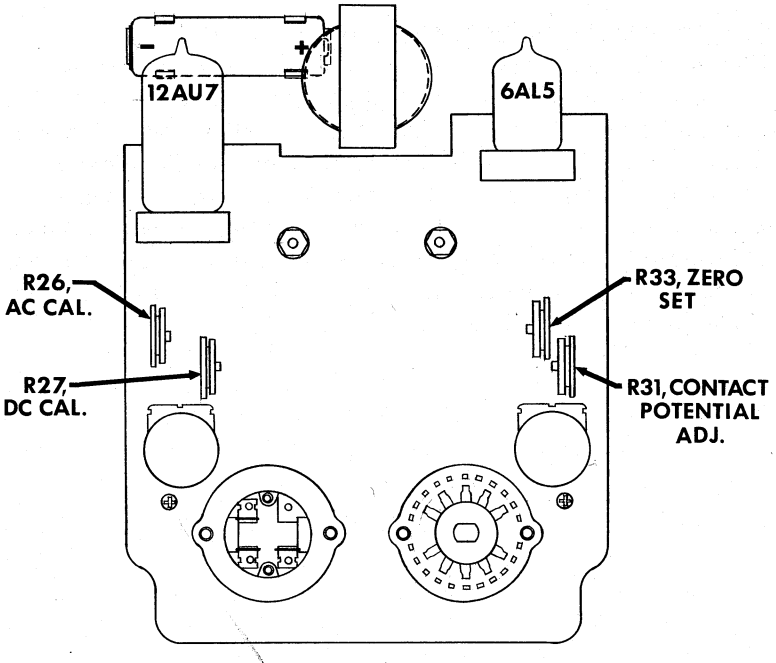


FIGURE 3 CALIBRATION ADJUSTMENT LOCATION AND ALKALINE CELL ORIENTATION

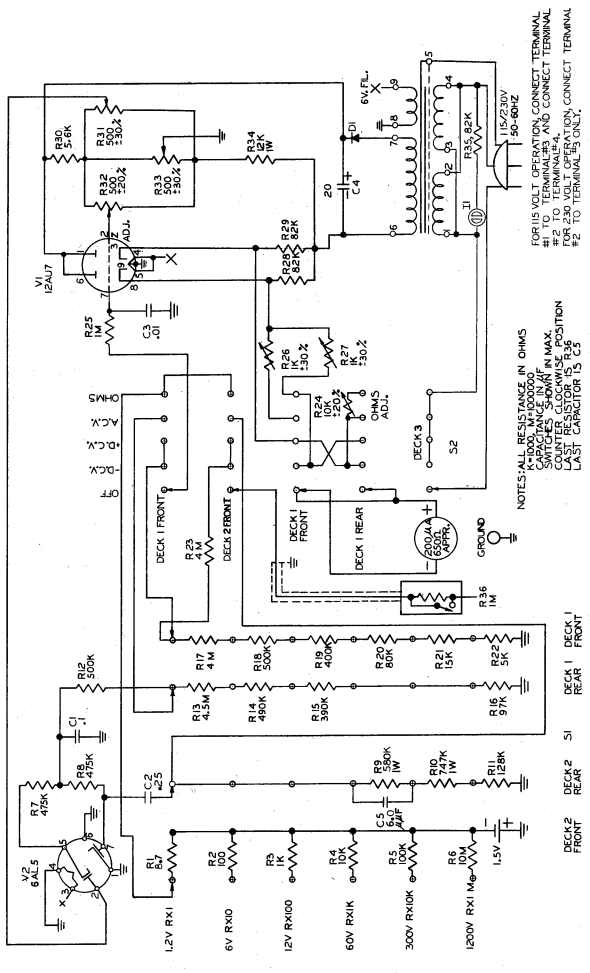


FIGURE 4 SCHEMATIC DIAGRAM, SIMPSON VACUUM TUBE VOLT METER MODEL 303-2

TRANSFORMER CONNECTIONS

PRIMARY RATING: 115/230 50-60 HERTZ

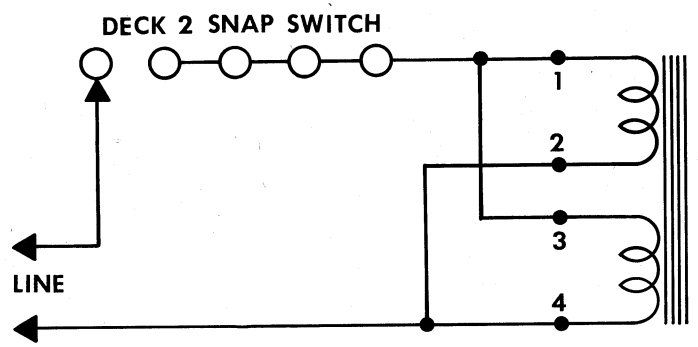


FIGURE 5A CONNECTIONS FOR 115 VOLTS OPERATION

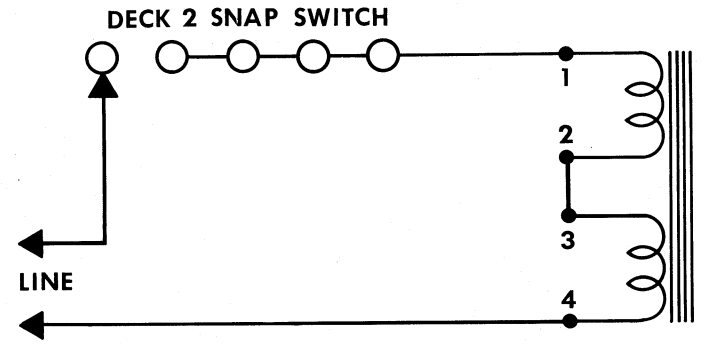


FIGURE 5B CONNECTIONS FOR 230 VOLTS OPERATION

PARTS LIST

Reference Symbol	Description	Simpson Part No.
R_1	Resistor, 8.7 Ohms (Bobbin, Special)	10-675279
R_2	Resistor, 100 Ohms, 1%, 1/2 watt	1-11021
R_3	Resistor, 1 K Ohms, 1%, 1/2 watt	1-117058
R_4	Resistor, 10 K Ohms, 1%, 1/2 watt	1-117059
R_5	Resistor, 100 K Ohms, 1%, 1/2 watt	1-117060
R_6	Resistor, 10 Meg. Ohms, 1%, 1/2 watt	1-113434
R_7	Resistor, 475 K Ohms, 1%, 1/2 watt	1-114180
R_8	Resistor, 475 K Ohms, 1%, 1/2 watt	1-114180
R_9	Resistor, 580 K Ohms, 1%, 1/2 watt	5-110943
R_{10}	Resistor, 747 K Ohms, 1%, 1 watt	5-110944
R_{11}	Resistor, 128 K Ohms, 1%, 1/2 watt	1-114095
R_{12}	Resistor, 500 K Ohms, 1%, 1/2 watt	1-114090
R_{13}	Resistor, 4.5 Meg. Ohms, 1%, 1/2 watt	1-114093
R_{14}	Resistor, 490 K Ohms, 1%, 1/2 watt	5-110871
R_{15}	Resistor, 390 K, 1%, 1/2 watt	1-113502
R_{16}	Resistor, 97 K Ohms, 1%, 1/2 watt	1-114119
R_{17}	Resistor, 4 Meg. Ohms, 1%, 1/2 watt	1-113362
R_{18}	Resistor, 500 K Ohms, 1%, 1/2 watt	1-114090
R_{19}	Resistor, 400 K Ohms, 1%, 1/2 watt	1-114092
R_{20}	Resistor, 80 K Ohms, 1%, 1/2 watt	1-113313
R_{21}	Resistor, 15 K Ohms, 1%, 1/2 watt	5-110756
R_{22}	Resistor, 5 K Ohms, 1%, 1/2 watt	1-113425
R_{23}	Resistor, 4 Meg. Ohms, 1%, 1/2 watt	1-113362
R_{24}	Potentiometer, 10 K Ohms, 20%	5-110875
R_{25}	Resistor, 1 Meg. Ohms, 10%, 1/2 watt	1-113952
R_{26}	Potentiometer, 1 K Ohms, 30%	5-110715
R_{27}	Potentiometer, 1 K Ohms, 30%	5-110715
R_{28}	Resistor, 82 K Ohms, 5%, 1/2 watt	5-111044
R_{29}	Resistor, 82 K Ohms, 5%, 1/2 watt	5-111044
R_{30}	Resistor, 5.6 K Ohms, 10%, 1/2 watt	1-114465
R_{31}	Potentiometer, 500 Ohms, 30%	5-110873
R_{32}	Potentiometer, 500 Ohms, 20%	5-110874
R_{33}	Potentiometer, 500 Ohms, 30%	5-110873
R_{34}	Resistor, 12 K Ohms, 10%, 1 watt	5-110872

Reference Symbol	Description	Simpson Part No.
R_{35}	Resistor, 82 K Ohms, 10%, 1/2 watt	1-113948
R_{36}	Resistor, 1 Meg. Ohms, 5%, 1/2 watt	1-116349
D_1	Diode, Rectifier	1-117943
C_1	Capacitor, 0.1 uF 400 V	1-110228
C_2	Capacitor, 0.25 uF 400 V	1-113903
C_3	Capacitor 0.01 uF 500 V	1-114872
C_4	Capacitor, 20 uF 150 V	5-110719
C_5	Capacitor, 6 pF 1000 V	5-111729
S_1	Switch, 6 Position Range	5-110870
S_2	Switch, 5 Position Function	5-110869
	Knob for S_1 and S_2	3-260180
	Knob for ZERO ADJ. and OHMS ADJ.	1-114949
V_1	Tube, 12 AU7 Aged	3-310744
V_2	Tube, 6AL5 Aged	3-811288
I_1	Indicator Light	5-110710
	Alkaline cell, 1.5 Volt Manganese	1-110550
	Transformer, Power	5-110865
	Indicator with Panel	15-313831
	Case, Complete with Handle	10-861295
	Case, Rolltop, Complete with Inside Case and Handle	10-861384
	Input Probe	0150
	Ground Lead	7547
	Power Cord	1-110614

SECTION V

APPLICATIONS

The high input resistance of the Simpson 303-2 VTVM permits you to measure voltages without loading the circuits under test as would occur by using a lower input resistance instrument. The following suggestions are only a few of the uses for which it will be found to be a superior instrument.

PLATE VOLTAGE MEASUREMENTS

Inaccurate readings of plate voltage often result when a low resistance voltmeter is used, especially in the case of vacuum tube circuits which require high values of plate resistors. Such voltages can be accurately measured with the Simpson 303-2 VTVM.

PHASE INVERTER BALANCE

The two sections of a phase inverter circuit may be checked for balance with the Simpson 303-2 VTVM. With an audio signal generator connected to the input of the audio amplifier, measure the voltages at the grids and plates and compare these voltages to check the inverter balance.

MEASUREMENT OF STAGE GAIN

The Simpson 303-2 VTVM is an ideal instrument for measuring stage gain. Measure the output of the signal generator and also the voltage at the plate of the tube of the stage being tested. The ratio of the voltages at the input and output of a stage represents the stage gain.

AVC VOLTAGE

The use of the Simpson 303-2 VTVM to measure AVC voltage is possible because the high input resistance of the 303-2 has very little loading effect on such a circuit. Connecting the 303-2 across the AVC network is often more convenient than using an AC voltmeter at the audio output for alignment purposes, as the volume control may be set at its minimum position. It is not necessary to disconnect the AVC to prevent it from interfering

with the alignment procedure. Manufacturer's instructions should be followed for an exact procedure.

DISCRIMINATOR ADJUSTMENT

The zero center scale of the 303-2 VTVM permits easy adjustment of a discriminator stage. Connected across the load resistors the reading will be zero when in balance but will deflect to the right or left if the discriminator is unbalanced. Manufacturer's instructions should be followed for an exact procedure.

FM ALIGNMENT

By connecting the Simpson 303-2 VTVM across the load resistor of the limiter, a reading may be obtained for alignment purposes. Adjust the circuits for maximum indication. Manufacturer's instructions should be followed for an exact procedure.

GRID VOLTAGE

The high input resistance of the Simpson 303-2 VTVM makes it possible to measure voltage at the grids of tubes without excessive loading of the circuit.

BIAS VOLTAGE

Bias voltages can be read accurately with the Simpson 303-2 VTVM. Its input resistance is so high that when connected across a bias resistor, the additional current drawn is negligible.

COUPLING AND BY-PASS CAPACITORS

Inasmuch as a capacitor presents low impedance to AC current, readings may be taken on both sides of the capacitor and should be approximately the same unless the capacitor is defective.

SIGNAL TRACING

The Simpson 303-2 VTVM is very useful in signal tracing or examining the radio and television circuits at various points in the audio or radio frequency, and sweep circuits. The low capacity high frequency probe accessory permits you to check high frequency voltages found in radio and television circuits.

SECTION VI

ACCESSORIES

High Frequency Probe	Part No. 0073
Frequency Response	+1 dB from 20 KHz to 100 MHz
Voltage Range	0-20 Volts peak AC Maximum 0-400 Volts DC Maximum
Probe Input Capacity	2.5 pF
Calibration	RMS value of a sine wave AC voltage
Calibration Accuracy including M303-2	±7.5% of full scale

High Voltage Probe	Part No. 0186
Voltage Range	0-30,000 Volts DC Maximum
Probe Resistance Accuracy	±2%

SIMPSON WARRANTY REPAIR STATIONS AND PARTS DEPOTS

Alabama, Huntsville 35805 — Area Code 205
Electro Tech, Inc. — 539-1250
106 Jordan Lane N.W.

Arizona, Phoenix 85034 — Area Code 602
Kierulff (Metermaster) — 273-7331
2633 E. Buckeye

California, Glendale 91201 — Area Code 213
JSD Enginering Company — 840-6187
6915 San Fernando Road

California, Los Angeles 90022 — Area Code 213
Metermaster/Los Angeles — 685-4340
5646 Jellson St.

California, Palo Alto 94303 — Area Code 415
Kierulff/Metermaster — 968-6292
3969 E. Bayshore Road

California, San Diego 92111 — Area Code 714
Metermaster/Kierulff — 278-2112
8796 Balboa Ave.

California, San Francisco 94105 — Area Code 415
Pacific Electrical Instrument Lab. — 421-7185
111 Main Street

Colorado, Denver 80209 — Area Code 303
Meter Master Instrument Service — 722-5766
748 South Broadway

Connecticut, Middletown — Area Code 203
The Mancib Co. — 347-5629
Randolph Road and Coe

Connecticut, New Haven 06511 — Area Code 203
Kaufman Instrument Lab. — 776-7201
810 Dixwell Avenue

Florida, Miami 33136 — Area Code 305
Florida Precision Instrument Corp. — 374-1731
800 N.W. 7th Avenue

Florida, Orlando 32806 — Area Code 305
Electro Tech, Inc. — 423-5589
307 - 27th Street

Georgia, Hapeville 30054 — Area Code 404
Electro Tech, Inc. — 767-8761
3020 Commerce Way

Hawaii, Honolulu 96819
Electronic Measurement Corp.
2979 Ualena Street

Illinois, Chicago 60648 — Area Code 312
A & M Instrument, Inc. — 774-3500
6251 W. Touhy

Illinois, Chicago 60644 — Area Code 312
Pacific Indicator Company — 261-1330
5924 West Madison Street

Kansas, Wichita 67211 — Area Code 316
Main Electronics, Inc. — 267-3581
363 Pattie

Louisiana, New Orleans 70115 — Area Code 504
Industrial Instrument Works — 895-5621
3305 Tchoupitoulas Street

Maryland, Beltsville 20705 — Area Code 301
Meter Devices — 345-7775
11325 Maryland Ave.

Maryland, Timonium 21093 — Area Code 301
E. I. L. Instrument Div. — 252-1260
110 W. Timonium Road

Massachusetts, Burlington 01803 — Area Code 617
The Mancib Company — 272-9450
Middlesex Turnpike at "A"

Massachusetts, Needham Heights 02194 — Area Code 617
Instruments, Inc. — 444-9410
570 Hillside Avenue

Michigan, Ferndale 48220 — Area Code 313
Ram Meter, Inc. — 547-1000
1100 Hilton Road

Minnesota, Minneapolis 55427 — Area Code 612
Instrumentation Services — 544-8916
957 Winnetka Ave.

Missouri, St. Louis 63112 Scherrer Instruments 5449 Delmar Blvd.	Area Code 314 862-5449
New Jersey, Belleville 07109 Marshall Instruments, Inc. 236 Washington Avenue	Area Code 201 751-1190
New Jersey, Roselle 07203 E. T. Instrument & Controls 205 Columbus Ave.	Area Code 201 241-8282
New Mexico, Albuquerque 87108 Eberline Instrument Corp. P.O. Box 8885, 1404 San Mateo, S.E.	Area Code 505 265-6655
New York, Buffalo 14216 Electrical Instrument Labs. 932 Hertel Avenue	Area Code 716 876-0880
New York, Great Neck, L.I. 11022 A & M Instrument, Inc. Community Drive	Area Code 516 487-0330
New York, Great Neck, L.I. 11022 Simpson Instrument Sales & Service 130 Cutter Mill Road	Area Code 212 683-0674
New York, New York 10011 E. T. Instrument & Control Co. 85 Tenth Avenue	Area Code 212 675-2400
New York, New York 10013 Nilsson Electronic Labs 103 Lafayette Street	Area Code 212 WA 5-1730
New York, Syracuse 13215 Syracuse Instrument Laboratories 4895 South Avenue	Area Code 315 492-1651
New York, Vestal 13850 Compton Industries, Inc. 413 Commerce Road	Area Code 607 729-9221
North Carolina, Charlotte 28206 Electro Tech, Inc. 5141 Belhaven Blvd.	Area Code 704 392-7451

Ohio, Cleveland 44103 Pioneer-Standard Electronics, Inc. 5403 Prospect Avenue	Area Code 216 432-0010
Ohio, Cleveland 44135 Weschler Electric Corp. 4250 West 130th Street	Area Code 216 251-4609
Ohio, Dayton 45404 Srepco Electronics Div. 314 Leo Street	Area Code 513 224-0871
Oklahoma, Tulsa 74120 Agra Engineering Company 551 S. Quaker	Area Code 918 582-5754
Oregon, Portland 97217 Westcon, Inc. 1910 Killingsworth Street	Area Code 503 285-6629
Pennsylvania, Monroeville 15235 E. I. L. Instrument Div. 2366 Holliday Park Shopping Center	Area Code 412 327-4450
Pennsylvania, Philadelphia 19115 Sunshine Scientific Instrument 1810 Grant Avenue	Area Code 215 673-5600
Texas, Dallas 75204 Ultra Instrument Lab., Inc. 3515 Swiss Avenue	Area Code 214 826-6395
Texas, Houston 77003 Electrical Instrument & Meter Co. 369 M & M Building	Area Code 713 227-6252
Washington, Seattle 98119 The Instrument Lab., Inc. 934 Elliott Avenue West	Area Code 206 283-5850
Wisconsin, Milwaukee 53202 The Electro-Mechano Company 241 East Erie Street	Area Code 414 272-4050

Warranty

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

Simpson **ELECTRIC COMPANY**
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IN CANADA: Bach-Simpson Ltd., London, Ontario
IN INDIA: Ruttonsha-Simpson Private Ltd., International House, Bombay-Agra Road, Vikhroli, Bombay
AGM DIVISION

Quality is the indispensable component
of every Simpson instrument . . . . . .