

OPERATOR'S MANUAL

VACUUM TUBE VOLTMETER MODEL 311-2

S I M P S O N E L E C T R I C C O M P A N Y

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

SECTION 1

GENERAL DESCRIPTION

INTRODUCTION



FIGURE 1

SIMPSON VACUUM TUBE VOLT-OHMMETER MODEL 311-2

The Simpson Vacuum Tube Voltmeter Model 311-2 has been designed to provide an advanced type of measuring instrument having the ability to measure voltages without any serious loading effects. This instrument has been enclosed in a durable metal case for safety and convenience, and also to prevent breakage. All the connections and controls are located conveniently, on the front of the instrument. The large meter on the front panel provides easy reading and accurate indications for all of its applications.

Every operation and indicating convenience has been included in this compact instrument. The controls on the front panel are limited to include only those which are necessary for operation. They include one range switch, one function switch, and two balancing controls.

Meter scale markings include both R.M.S. and peak-to-peak indications for AC and RF voltage measurements. While the R.M.S. scale is applicable only to pure sinusoidal input signals, the instrument indicates correctly the peak-to-peak values for all alternating waveform inputs.

The high input impedance (22 megohms for DC) reduces circuit loading effects to less than any of the previous models of portable Vacuum Tube Voltmeters. The compact and convenient metal case, with the large easy-to-read meter, makes this the most efficient and practical Vacuum Tube Voltmeter available. Conforming to the latest engineering developments, most of the component parts in the Model 311-2 are mounted on a printed circuit board. This simplifies assembly and reduces maintenance, resulting in a lower cost assembly while retaining Simpson quality components.

General Description

Two test leads are furnished with the Model 311-2. One terminates on the instrument end in a banana plug, which fits into the front panel jack marked GROUND. The other end of this lead has a crocodile clip, covered with an insulator, with which the lead can be connected to the reference point in the circuit being measured. The second lead has a connector which fits on the input connector of the front panel. The other end of this lead has a probe with a standard pointed tip. A switch on the probe body sets up a direct connection for either AC/OHMS readings, or connects an isolating resistor into the circuit for DC readings.

The Simpson Vacuum Tube Voltmeter Model 311-2 is supplied with a 3 wire AC line cord and plug requiring 105 to 125 volts, 50 or 60 cycles AC power. Power consumption is 5 watts.

Since the third wire from the cord is connected to the metal case, caution should be exercised in making any measurement in respect to line voltage.

In addition to the external AC power, there is a self-contained 1.5 volt battery which is used for resistance measurements.

Accessories Available

High Frequency Probe Simpson Part No. 0174

10 Kilocycles to 250 Megacycles

DC High Voltage Probe Simpson Part No. 0732

0-30,000 volts DC

For more information on these accessory probes, see Page 22.

SPECIFICATIONS

RANGES AND INPUT IMPEDANCES

D. C. VOLTAGE MEASUREMENTS

Ranges 0 to 1.5/5/15/50/150/500/1500 volts

Input resistance is 22 megohms for all ranges.

General Description

A. C. VOLTAGE MEASUREMENTS

All indications on the black arcs are R. M. S. values based on a pure sine wave input signal. Ranges 0 to 1.5/5/15/50/150/500/1500 volts R. M. S.

Indications on the red arcs are peak-to-peak values.

0 to 4/14/40/140/400/1400/4000 volts peak-to-peak.

Input impedance is 2.2 megohms minimum at 60 cycles.

OHMMETER MEASUREMENTS

Ranges	Center Scale Values
RX1	10 ohms
RX10	100 ohms
RX100	1000 ohms
RX1K	10K ohms
RX10K	1 megohm
RX1M	10 megohms

D. C. GALVONOMETER

Zero center D. C. voltage measurements are possible for any range using the lowest scale arc. This is normally used for such applications as F-M discriminator alignment. (See Operating Instructions, Page 10.)

ACCURACY

With an external power within the range of 105 volts to 125 volts, 60 cycles AC, furnished to operate the instrument, accuracy is $\pm 3\%$ of full scale for DC voltages, $\pm 5\%$ of full scale for AC voltages, and ± 3 degrees of arc for resistance measurements.

General Description

FREQUENCY RESPONSE

The 1.5/5/15 and 50 volt ranges are within $\pm 5\%$ from 30 c.p.s. to 1 Megacycle, the 150 volt range to 500 KC and the 500 volt range $\pm 10\%$ to 500 KC. Typical frequency response characteristics for the model 311-2 are given in Fig. 2.

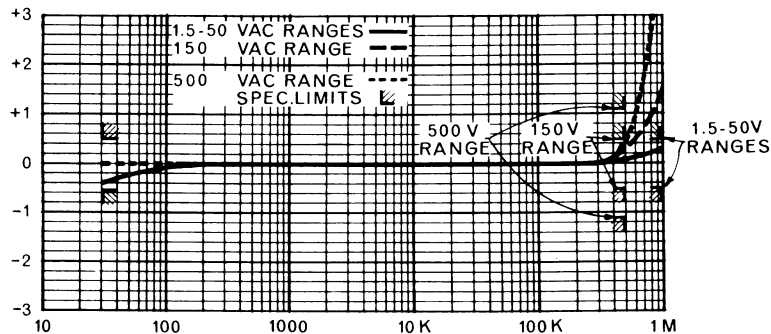


FIGURE 2: TYPICAL FREQUENCY RESPONSE CURVES

DIMENSIONS & WEIGHT

The case dimensions of the Simpson Vacuum Tube Voltmeter Model 311-2 are 7-1/2 inches high by 5-5/8 inches wide by 4-1/2 inches deep. Its weight is 4-1/2 pounds. Shipping weight is 6 pounds.

FRONT PANEL CONTROLS

CIRCUIT SELECTOR SWITCH

When the circuit selector switch is in the OFF position, power is turned off. Turning this switch to the right turns on power

General Description

which is indicated by the pilot light located on the front panel centered between the ground jack and input connector.

This switch also selects the circuit to be used. Two positions, marked - DC and + DC connect the meter circuit for measuring DC volts and act as a meter reversing switch. With the ground lead connected to the chassis or the common circuit connection, set the switch at + DC for measuring positive voltage or at - DC for measuring negative voltage. When the switch is set at AC, meter circuits are connected for AC voltage measurements. The internal peak-to-peak vacuum tube rectifier changes the incoming AC voltage into a proportional DC voltage to be measured with the meter circuits. When the switch is set at OHMS, an internal battery and the associated resistors are switched into the meter circuit to provide for resistance measurements.

RANGE SELECTOR SWITCH

The range switch selects the desired range for the circuit which has been connected with the circuit selector switch. There are seven positions; each position is marked for full scale voltage indication for either DC or AC (R.M.S.) voltage measurements and is also marked with the multiplier factor to be used when measuring resistances.

ZERO ADJUST (ELECTRICAL)

After the power has been turned on and the circuit selector switch has been set for any of its on positions, the knob marked ZERO ADJUST should be turned either to the right or the left until the meter pointer rests over the zero marks at the left side of the scale. Connect the probe and ground lead together while making this adjustment. It may be necessary to readjust for zero when changing ranges or functions.

If an appreciable shift occurs when changing between the AC to DC functions, correction can be accomplished as follows:

General Description

1. Switch to the 1.5 VDC range and adjust the zero adjust knob for zero indication.
2. Switch to 1.5 VAC and adjust R-32 for zero indication. (R-32 can be accessed using a small screwdriver inserted in the hole located on the left side of the case under the lower edge of the handle).

OHMS ADJUST

With the circuit selector switch set at OHMS, separate the test leads. The pointer should move across the meter scale and rest near the right end of the scale. Turn the OHMS ADJUST knob until the pointer is directly over the mark at the right of the scale.

CIRCUIT CONNECTORS

A ground jack is provided in the lower left hand corner and is used with the ground lead provided with the tester.

A male connector is provided in the lower right hand corner and is used with the AC/OHM — DC probe provided with the tester.

SECTION II

OPERATING INSTRUCTIONS

CAUTION

WHEN MEASURING HIGH VOLTAGES, FIRST TURN OFF POWER IN THE CIRCUIT TO BE MEASURED AND DISCHARGE ALL CAPACITORS. CONNECT THE PROBES TO THE CIRCUIT AND THEN TURN ON CIRCUIT POWER. DO NOT TOUCH PROBES OR LEADS WHILE POWER IS ON. TURN OFF POWER AND DISCHARGE CAPACITORS BEFORE PROBES ARE DISCONNECTED OR MOVED.

Operating Instructions

METER ZERO ADJUSTMENT (MECHANICAL)

Before turning on power in the Model 311-2, be sure that the meter pointer rests on zero. If the pointer is off zero, adjust it by means of the slotted screw located in the meter cover just below the scale. Use a small screwdriver to turn this adjustment slowly right or left until the pointer rests directly over the zero marks at the left of the scale.

MEASURING DC VOLTAGES 0-1500 VOLTS

1. Set the circuit selector switch in 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 Model 311-2 circuits will not be easily damaged, it is best to set the range switch for a higher range than needed as a protection to the instrument. After the first reading, set the range switch for a lower range if necessary to provide a more accurate reading.
3. Turn off power in the circuit to be measured and discharge all capacitors.
4. Connect the crocodile clip of the GROUND test lead to the reference point for the voltage to be measured.
5. Set the switch in the probe body at DC. Connect the probe tip to the point to be measured.
6. Turn on power in the circuit being measured and observe the meter. If the meter pointer deflects to the left, circuit polarity is opposite to that for which the circuit selector switch is set; set the circuit selector switch for the correct polarity.
7. Read the meter scale indication at the pointer position on one of the black arcs. For the 1.5/15/150 and 1500 volt ranges, use the arc marked 0 to 1.5. For the 5/50 and 500 volt ranges, use the arc marked 0 to 50.
8. Turn off circuit power and discharge capacitors before removing the probes.

Operating Instructions

NOTE

To measure more than 1500 volts DC, see information on high voltage accessory probe on Page 23.

ZERO CENTER DC VOLTAGES

1. Set circuit selector switch at either - DC or + DC. Set the switch on the probe handle at DC and short the test leads together.
2. Rotate the ZERO ADJUST knob until the meter pointer rests over the zero center marker on the lower scale arc.
3. Set the range selector 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 meter pointer indication on the lowest arc marked 5-0-5. If the circuit selector switch is set at + DC, positive voltages will be indicated above 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 purposes for which the zero center scale is used generally do not require an accurate measurement of the values of voltages, but merely an indication of a balanced condition. An example is 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

1. Set the circuit selector switch in the AC position.
2. Set the range switch in the desired range position.
3. Turn off power in the circuit to be measured and discharge all the capacitors.
4. Connect the clip for the GROUND test lead to the chassis or reference point in the circuit to be measured.
5. Set the switch on the probe body at AC/OHMS. Connect the probe tip to the point in the circuit where voltage is to be measured.

Operating Instructions

6. Turn on power in the circuit to be measured. Observe the meter pointer. The pointer indicates voltages on two arcs for AC measurements - R. M. S. and peak-to-peak. Both values apply when the input waveshape being measured is a sine wave. Only the peak-to-peak value is correct when the input waveshape is not a sine wave.

Range Switch Position	Read R. M. S. Voltages On	Read Peak-To-Peak Voltages On
1.5V	Black Arc Marked 0-1.5 Low AC volts	Red Arc Marked 0-4 below 0-1.5V Arc
5V	Black Arc Marked 0-5 Low AC volts	Red Arc Marked 0-14 below 0-5V Arc
15V	Black Arc 0-1.5 (x10)	Red Arc 0-4 (x10)
50V	Black Arc 0-50	Red Arc 0-140
150V	Black Arc 0-1.5 (x100)	Red Arc 0-4 (x100)
500V	Black Arc 0-50 (x10)	Red Arc 0-140 (x10)
1500V	Black Arc 0-1.5 (x1000)	Red Arc 0-4 (x1000)

7. Turn off circuit power and discharge capacitors before removing probe and ground connection.

RESISTANCE MEASUREMENTS

1. Set the circuit selector switch in the OHMS position.
2. Rotate the range selector switch to any desired range.
3. Set the switch on the probe body at AC/OHMS.
4. Short the AC/OHMS probe and the common test clip together and check the meter pointer for a zero indication. If necessary, rotate the ZERO ADJUST control to obtain a zero indication.
5. Separate the AC/OHMS probe and common test lead. The meter pointer should deflect to full scale. Set the OHMS ADJUST control for exactly full scale deflection. When the pointer cannot be brought up to full scale, the battery inside the case needs replacement; see information in Section III, Maintenance.

Operating Instructions

6. Be sure no voltage is present in the circuit in which resistance is to be measured. Turn off circuit power and discharge all capacitors.
7. Connect the AC/OHMS probe and the common test clip to the two points between which DC resistance is to be measured.
8. Read the arc marked OHMS at the pointer position. Multiply the reading by the value indicated at the range switch position. K stands for 1000. M stands for 1,000,000. The result will be resistance in ohms.

SECTION III

MAINTENANCE

CARE OF INSTRUMENT

The Simpson Vacuum Tube Voltmeter Model 311-2 is a durable and rugged instrument which will withstand the wear and tear of every day use. But it should be protected from rough treatment, dropping, or other unnecessary severe shock; the panel meter has delicate jewel-mounted parts which will be damaged under these conditions. With proper care, the Model 311-2 should provide many years of excellent operation.

REMOVAL FROM CASE

To remove the instrument from its case to replace the battery or to inspect and service its internal parts, remove one screw from the back of the case and two screws at the bottom of the case. Slide the front panel straight forward out of the case. All of the internal parts including the line cord are attached to the front panel and will come out of the case as a complete unit.

Maintenance

BATTERY REPLACEMENT

The 1.5 volt dry cell battery inside the case of the Model 311-2 is used as a voltage source for ohmmeter operation. When the meter 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 the battery with a fresh equivalent. This is a size C flashlight type cell. Open the case for access and observe the polarity of the old battery in its clamp mounting. Observe this polarity when you mount the new battery in the clamp.

CALIBRATION

The Simpson Vacuum Tube Voltmeter Model 311-2 has been calibrated carefully 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:

1. Allow the instrument to warm up for a period of at least one hour. Set the function switch at - DC and the range switch at 1.5V.
2. Turn the ZERO ADJUST knob to the extreme left and note the position of the meter pointer. Return meter pointer to zero. Turn the function switch at + DC and turn the ZERO ADJUST knob to the extreme right. Note the meter pointer position again. The pointer position should be the same for both polarities. If there is any difference between them, adjust potentiometer R29 until the readings are the same. See figure 3, to help locate potentiometer R29 inside the instrument.
3. With the function switch at - DC, the switch on the probe body at DC, connect the probe and ground lead together and set the ZERO ADJUST control for a zero pointer indication.
4. Turn the function switch to AC and set the switch on the probe body at AC. If the pointer does not rest at zero,

Maintenance

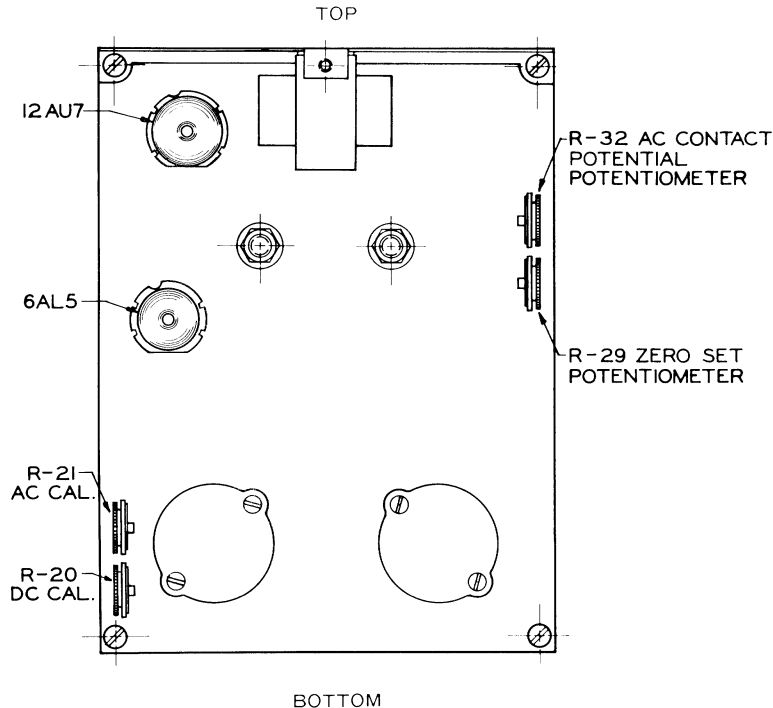


FIGURE 3 BACK VIEW OF PC BOARD

adjust potentiometer R32 to correct it. See figure 3 to help locate potentiometer R32 inside the instrument.

5. Turn the function switch to - DC and set the switch on the probe body to DC again. Connect the probe and ground lead to a known value of DC voltage. Check the meter indication. If it is not correct, adjust potentiometer R20 to calibrate the instrument. See figure 3, to help locate potentiometer R20 inside the instrument.
6. Turn the function switch to AC and set the switch on the probe body to AC again. Connect the probe & ground lead to a known value of AC voltage. Check the meter indication.

Maintenance

If it is not correct, adjust potentiometer R21 to calibrate the instrument. See figure 3, to help locate potentiometer R21 inside the instrument.

TUBES AND REPLACEMENT

Two tubes are used in the Model 311-2. One is a type 6AL5, used as a peak-to-peak rectifier for all AC voltages. The other is a type 12AU7, which operates in the bridge circuit for all measurements. See Fig. 3 for location.

When it is necessary to replace the type 12AU7 tube, the new tube must be aged for at least 48 hours to eliminate its transient characteristics before the instrument is recalibrated. Place this new tube in the socket and turn on power for the instrument. Leave the instrument connected and operating for the 48-hour aging period. Then recalibrate it with the six steps shown under CALIBRATION.

REPLACEMENT OF RESISTORS, CAPACITORS, ETC.

Most of these parts in the Model 311-2 are mounted on the printed circuit board. When replacement is necessary, first obtain an exact equivalent part; then clip the defective part off the printed circuit board, leaving its leads to use as connections for the replacement. Carefully twist the leads of the replacement around those leads which were left in the 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.

OBTAINING REPLACEMENT PARTS

When any replacement parts are required, use the following parts list and order the necessary parts from Simpson Electric Company, 5200 W. Kinzie St., Chicago, Illinois 60644. Specify the Simpson Part Number and the description for each part in your order.

PARTS LIST (cont'd.)

Reference Symbol	Description	Simpson Part No.
R18	Resistor 33K $\pm 10\%$ 1/2 watt	1-113945
R19	Potentiometer 10K $\pm 20\%$	5-110717
R20	Potentiometer 3K $\pm 30\%$	5-110714
R21	Potentiometer 6K $\pm 30\%$	5-110716
R22	Resistor 1 meg. $\pm 1\%$ 1/2 watt	1-110761
R23	Resistor 100K $\pm 10\%$ 1/2 watt	1-113949
R24	Resistor 100K $\pm 10\%$ 1/2 watt	1-113949
R25	Potentiometer 1K $\pm 20\%$	5-110718
R26	Resistor 270 Ω $\pm 10\%$ 1/2 watt	1-115386
R27	Resistor 270 Ω $\pm 10\%$ 1/2 watt	1-115386
R28	Resistor 12K $\pm 10\%$ 1/2 watt	1-115655
R29	Potentiometer 1K $\pm 30\%$	5-110715
R30	Resistor 10K $\pm 10\%$ 1/2 watt	1-111671
R31	Resistor 8.2K $\pm 10\%$ 1/2 watt	1-113050
R32	Potentiometer 3K $\pm 30\%$	5-110714
R33	Resistor 3.82 meg. $\pm 1\%$ 1 watt	5-110722
R34	Resistor 22 meg. $\pm 10\%$ 1/2 watt	1-116674
R35	Resistor 22 meg. $\pm 10\%$ 1/2 watt	1-116674
R36	Resistor 22 meg. $\pm 10\%$ 1/2 watt	1-116674
R37	Resistor 22 meg. $\pm 10\%$ 1/2 watt	1-116674
R38	Resistor 3.5 meg. $\pm 1\%$ 1/2 watt	1-117224
R39	Resistor 3.5 meg. $\pm 1\%$ 1/2 watt	1-117224
T1	Power Transformer	5-110703
V1	Tube type 6AL5 aged	3-811288
V2	Tube type 12AU7 aged	3-310744
	Knobs black 3/4" dia.	5-110701
	Knobs black 1 1/4" dia.	5-110707
	Meter Movement	15-AC2311-2
	DC/AC-ohms Test Probe	10-837594
	Ground Lead	10-837547
	Case with handle	10-861236
L1	Pilot light, cloudy-clear, with mtg. clip	5-110710

SECTION IV

APPLICATIONS

The extremely high input resistance of the Simpson Vacuum Tube Voltmeter Model 311-2 permits it to be used in many applications where a voltmeter with lower resistance would result in excessive circuit loading. The following suggestions show only a few sample uses for which it will be found to be a superior instrument.

MEASURING PLATE VOLTAGES

Lower resistance voltmeters will reduce a plate voltage when it is measured, especially when there is a high resistance plate load. Such voltages will be measured accurately with the Model 311-2 because its high input impedance for all ranges will reduce this loading interference.

PHASE INVERTER BALANCE

The two sections of a push-pull circuit may be checked for balance with the Model 311-2. With a signal generator connected to the amplifier input, measure the plate and grid voltages and compare them at each similar circuit point.

MEASURING STAGE GAIN

The Model 311-2 is an ideal instrument for measuring amplifier stage gain. Apply the output of a signal generator to the amplifier input, and measure and compare the input and output signal for each stage. The ratio of voltage between the output and the input represents the stage gain. When the Model 311-2 is set to measure AC voltages, a series capacitor, C3, blocks any DC present and prevents it from interfering with the readings.

AVC VOLTAGE

The use of the Simpson Volt-Ohmmeter Model 311-2 to measure A.V.C. voltages is possible due to the high input resistance of the DC voltage circuit which has little or no noticeable loading effect on such a circuit. Connecting the Model 311-2 across the A.V.C. network is often more convenient than using an output meter for alignment purposes, as the volume control may be set at its minimum position. It is not necessary to disconnect the A.V.C. to prevent its interfering with the alignment procedure.

MEASURING GRID VOLTAGES

The high input resistance of the Model 311-2 makes it possible to measure voltage between the control grid and cathode of a tube without any serious loading effect. The operation of a local oscillator may be checked throughout its tuning range; when it is oscillating, a small voltage is present and when it stops oscillating there is no voltage between the grid and the cathode.

MEASURING BIAS VOLTAGES

Bias voltages are usually small. The ranges of the Model 311-2 permit accurate measurement of bias, even when it is only a fraction of one volt, without loading interference.

DISCRIMINATOR ADJUSTMENT

The zero center scale on the dial of the Model 311-2 permits easy adjustment of a discriminator stage. With the input connected across the discriminator load resistors and the instrument set up for zero center DC voltage operation, discriminator balance will be shown when the meter pointer is at the zero center mark. Any unbalance in the discriminator will cause the pointer to be deflected to the right or to the left of the zero center mark.

FM ALIGNMENT

By connecting the Model 311-2 across the first limiter grid leak resistor, a reading will be obtained for FM alignment purposes. Adjust the circuits for a maximum indication. Follow the receiver manufacturer's instructions for the exact procedure as it applies to his particular receiver.

COUPLING AND BY-PASS CAPACITORS

A coupling capacitor or a bypass capacitor normally will present a low impedance for AC at the frequencies which it is designed to handle. To identify an open capacitor in either of these applications, measure the AC voltage at each side of the capacitor in its circuit when a normal frequency is applied through the circuit; a good capacitor will show almost as much voltage at its output as is present at its input. An open capacitor will show a normal or high input voltage, but little or no output voltage.

To identify a shorted capacitor, isolate it from its circuit by removing either one of its leads. Then set the Model 311-2 for OHMS measurements on a low range and measure the resistance across the capacitor. If the meter shows a drop towards zero when the probes are first connected to the capacitor, and then rises towards the high end of the scale, wait until the pointer comes to rest to read the resistance across the capacitor. This condition is normal, and the amount of such action will be determined by a combination of the amount of capacity and the ohmmeter range used. If the capacitor is shorted, the meter will not show a charging condition and will usually indicate a very low or zero ohms reading.

SIGNAL TRACING

The Model 311-2 is very useful for signal tracing or for examining a radio circuit at various points in audio or radio frequency circuits. Its accessory, low capacity, high frequency probe permits its use in high frequency circuits which are present in FM and TV receivers.

SECTION V

ACCESSORY PROBES

HIGH FREQUENCY PROBE

GENERAL DESCRIPTION

- Frequency Response 10KC to 250 MC within 1DB
- Probe Input Capacitance 2.0 pf
- Voltage Range 40 volts rms (maximum)
110 volts peak-to-peak (maximum)
- Probe Accuracy $\pm 3\%$ of full scale
- Reading RMS or P-P value of sine wave
- Maximum Input Input capacitor rated at 500
volts peak

The High Frequency Probe, part number 0174, for the Simpson Model 311-2 is designed primarily to measure voltages, at frequencies above the range of the regular AC/OHMS-DC probe furnished with the tester. The cable terminates with the same type of connecting plug.

The crystal diode contained within the probe body rectifies the voltage under test, charging the 680 pf capacitor proportional to the positive peak value. This direct current is then fed through the 15 Meg. resistor and into the DC input of the instrument circuit where it is read directly on the meter scale in RMS or P-P value.

It is important to note that the probe circuit works as a peak detector and responds only to the positive peak value of the signal under test.

OPERATING INSTRUCTIONS

Connect the cable plug on the end of the Probe cord to the Model 311-2 VTVM input connector. Set the circuit selector switch on Model 311-2 to - DC, and the range switch to the desired range. Connect the probe's ground lead crocodile clip to ground adjacent to the point of measurement, and touch the tip of the probe to the point being measured.

Read either RMS or P-P scale on the Model 311-2 VTVM for the corresponding desired range, while checking sine wave amplitudes. When checking the signals of unsymmetrical wave shapes convert meter reading to positive peak reading by dividing the reading on P-P scale by 2.

HIGH DC VOLTAGE PROBE

DESCRIPTION

Accessory probe, part number 0732, is available for use in high DC voltage measurements. It has a multiplier resistor in the probe body which will increase total input resistance to 2200 megohms. Basic instrument ranges will be increased to 100 times the value marked on the front panel.

OPERATION

Disconnect the probe and ground lead from the instrument. Connect the accessory high voltage probe to the input connector; it has a special ground lead which is connected to the instrument automatically. Proceed as for ordinary DC voltage measurements, with ranges equal to 100 times the range switch position markings.

Accessory Probes

RANGE SWITCH POSITION	INSTRUMENT RANGE WITH ACCESSORY H-V PROBE
15 V	0-1500 volts DC
50 V	0-5000 volts DC
150 V	0-15,000 volts DC
500 V	*0-50,000 volts DC

*Full range indication would be 50,000 volts; maximum allowable voltage for safe operation is 30,000 volts.

WARNING

Do not apply more than 30,000 volts to the circuit of the High Voltage Probe and the Model 311-2; greater voltages may short out the input circuits and cause irreparable damage to both the probe and the instrument.

SIMPSON WARRANTY REPAIR STATIONS AND PARTS DEPOTS

Arizona, Phoenix 85016 Metercraft Inc. 3308 N. 24th St.	Area Code 602 279-6249
California, San Diego 92111 Meter Master, Inc. 8139 Engineer Road	Area Code 714 278-2200
California, Glendale 91201 JSD Engineering Company 6915 San Fernando Road	Area Code 213 849-6187
California, Los Angeles 90022 Meter Master, L. A. Div. of Kierulff Electronics, Inc. 5645 East Washington Blvd.	Area Code 213 685-7313
California, Mountain View 94041 Kierulff/Metermaster 2484 Middlefield Road	Area Code 415 968-6292
California, San Francisco 94105 Pacific Electrical Instrument Lab. 111 Main Street	Area Code 415 421-7185
Canada, London, Ontario Bach-Simpson Ltd. 1255 Brydges Street P.O. Box 484	Area Code 519 451-9490
Colorado, Denver 80209 Metermaster Instrument Corporation 748 So. Broadway	Area Code 303 722-8462
Connecticut, New Haven 06511 Kaufman Instrument Labs Inc. 810 Dixwell Avenue	Area Code 203 776-7201
Florida, Miami 33136 Florida Precision Instrument Corp. 800 N.W. 7th Avenue	Area Code 305 374-1731

Florida, Orlando 32806 Electro Tech Inc. 307 - 27th Street	Area Code 305 423-5589	Michigan, Detroit 48220 Ram Meter, Inc. 1100 Hilton Road Ferndale	Area Code 313 547-1000
Georgia, Hapeville 30054 Electro-Tech, Inc. 3020 Commerce Way	Area Code 404 758-7205	Minnesota, Minneapolis 55411 Instrumentation Services Inc. 917 Plymouth Avenue	Area Code 612 521-8803
Hawaii, Honolulu 96817 Electronic Systems Inc. 1622-26 Silva Street	851-457 811-132	Missouri, St. Louis 63112 Scherrer Instruments 5449 Delmar Blvd.	Area Code 314 367-9800
Illinois, Chicago 60625 A & M Instrument, Incorporated 4801 North Ridgeway Avenue	Area Code 312 539-4460	New Jersey, Belleville 07109 Marshall Instruments, Inc. 236 Washington Avenue	Area Code 201 751-1190
Illinois, Chicago 60644 Pacific Indicator Company 5217 W. Madison Street	Area Code 312 261-1330	New York, Buffalo 14216 Electrical Instrument Labs. 932 Hertel Avenue	Area Code 716 876-0880
Illinois, Chicago 60644 Simpson Electric Company 5200 W. Kinzie Street	Area Code 312 379-1121	N. Y., Great Neck, Long Island 11022 Simpson Instrument Sales & Service, Inc. 130 Gutter Mill Road	Area Code 212 683-0674 Area Code 516 482-3103
Kansas, Shawnee Mission 66205 Sturtz Instrument Co. 4705 Mission	Area Code 913 236-4705	New York, Great Neck, L.I. 11022 A & M Instrument, Inc. Community Drive	Area Code 516 487-0500
Louisiana, New Orleans 70115 Industrial Instrument Works 3305 Tchoupitoulas Street	Area Code 504 895-5621	New York, New York 10011 Electro-Tech Equipment Company 85 Tenth Avenue	Area Code 212 675-2400
Maryland, Baltimore 21211 Edgerly Instrument Lab., Inc. 205 West 28th Street	Area Code 301 243-6611	New York, Syracuse 13215 Syracuse Instrument Lab. 4895 South Avenue Box 96	Area Code 315 492-1651
Massachusetts, Cambridge 02138 A. S. Mancib 363 Walden Street	Area Code 617 864-2494	New York, Vestal 13850 Compton Industries Inc. 333 Vestal Parkway East P.O. Box 351	Area Code 607 748-3349
Massachusetts, Needham Heights 02194 Instruments, Incorporated 570 Hillside Avenue	Area Code 617 444-9410	North Carolina, Charlotte 28206 Electro-Tech Inc. 3107 Gullman Avenue	Area Code 704 333-0326

WARRANTY

Ohio, Cleveland 44135 Weschler Electric Company 4250 W. 130th Street	Area Code 216 251-4609
Ohio, Cleveland 44103 Pioneer-Standard Electronics, Inc. 5403 Prospect Avenue	Area Code 216 432-0010
Ohio, Dayton 45404 SREPCO Electronics Div. of Pioneer Standard Electronic, Inc. 314 Leo Street	Area Code 513 224-0871
Oklahoma, Tulsa 74011 Tri-State Instrument Lab. 3244 East 15th Street, Box 5057	Area Code 918 936-0489
Oregon, Portland 97217 Industrial Instrument Repair Lab. 1910 N. Killingsworth St.	Area Code 503 285-6629
Pennsylvania, Philadelphia 19115 Sunshine Scientific Instrument 1810 Grant Avenue	Area Code 215 673-5600
Texas, Dallas 75204 Ultra Instrument Lab., Inc. 3515 Swiss Avenue, Suite 117	Area Code 214 826-6395 826-6396
D.C., Washington 20001 Electronic Wholesalers, Inc. 2345 Sherman Avenue N.W.	Area Code 202 483-5200
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

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Simpson ELECTRIC COMPANY

5200 Kinzie St., Chicago 44, Illinois • Phone: EStebrook 9-1121 • Long Distance Dial 312

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