TRIPLETT

INSTRUCTION MANUAL

MODEL 630

VOLT-OHM-MILLIAMMETER

MANUAL ONLY - $ .50

Rev 41
Part no. 84-85-04 1160-41

MODEL 630

The Triplett Electrical Instrument Company
Bluffton, Ohio

FOREWORD

With your purchase of a Model 630 Volt-Ohm-Milliammeter, you have made a worthwhile investment, not only in a fine instrument, but backed by a company which has been making instruments for more than half a century. The Triplett Company stands behind your 630 and will give all possible assistance in its use and maintenance.

TRIPLETT WARRANTY AND CONDITIONS OF SALE

The Triplett Electrical Instrument Company warrants instruments manufactured by it to be free from defective material or factory workmanship and agrees to repair or replace such instruments which under normal use and service, disclose the defect to be the fault of our manufacturing. Our obligation under this warranty is limited to repairing or replacing any instrument or test equipment which proves to be defective, when returned to us transportation prepaid, within ninety (90) days from the date of original purchase.

This warranty does not apply to any of our products which have been repaired or altered by unauthorized persons or service stations in any way so as, in our judgment, to injure their stability or reliability or which have been subject to misuse, negligence or accident or which have had the serial number altered, effaced, or removed. Neither does this warranty apply to any of our products which have been connected, installed, or adjusted otherwise than in accordance with the instructions furnished by us. Accessories including all vacuum tubes and batteries not of our manufacture used with this product are not covered by this warranty.

The Triplett Electrical Instrument Company reserves the right to discontinue models at any time, or change specifications or design, without notice and without incurring any obligation.

Upon acceptance of the material covered by this invoice the purchaser agrees to assume all liability for any damages and bodily injury which may result from the use or misuse of the material by the purchaser, his employees, or others, and that The Triplett Electrical Instrument Company shall incur no liability for direct or consequential damage of any kind.

This warranty and conditions of sale are in lieu of all others expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

The Triplett Electrical Instrument Company
Bluffton, Ohio

Printed in U. S. A. Part No. 84-85-041160-41

For above Serial No. 180,000

The Model 630 Volt-Ohm-Milliammeter is a rugged long scale multi-range instrument in a compact portable case.

Remove the test leads from the small envelope and notice the two alligator clips enclosed. The clips slide over the ends of the test prods and make very handy connectors.

Plug the small ends of the test leads into the panel jacks marked COM and V-Ω-A. The jacks and plugs are especially made for trouble-free, low resistance connections.

Scales

Notice there are five scales on the meter. The top red scale is used when measuring ohms. This scale is marked from 0 to 1K (at left side). With the switch knob turned to Ω×1, the ohms scale is read just as it is marked. With the switch knob turned to Ω×10, the numbers on ohms scale must all be multiplied by 10. Likewise Ω×1000 and Ω×100,000 mean to multiply by 1000 and 100,000 respectively.

The second scale down (black) is used to read all DC voltages. The third scale (red) is used for all AC voltages except the 3 volt range—the latter is read on the bottom red scale (marked 3 at full scale).

The lowest scale is used for all decibel measurements. Notice the chart near the lower right hand corner of the dial. This is used in conjunction with the DB scale as explained on page 14.

Panel

Just below the meter is a small bakelite screw. This is rotated with a small screw driver to adjust the meter pointer to exactly zero. This need be adjusted only occasionally but for best accuracy the pointer should always be on zero before making a measurement.

The large knob in the lower center of the panel is used to select all ranges. The markings are self explanatory.

Left of the knob is a recessed Ω ADJ control used when making resistance measurements.

Observe the jacks and note carefully the marking for each. You will use the COM and V-Ω-A jacks for most measurements.

PROTECTION: A one ampere fuse is incorporated in the ohm circuits for protecting the ohm circuit when it is accidentally placed across high voltage. A spare fuse is attached to unit inside the tester.

CAUTION: Do not substitute the indicated 3AG Littlefuse for it can disturb the balance of the circuit and read in error.

Accuracy

Your 630 is accurate to within 3% of full scale reading on all DC ranges except the 6000 volt range which is within 5%, 4% on all AC ranges except 6000 volts which is 5%, and 3% of the scale length in all resistance ranges. Precision, non-aging resistors insure lasting accuracy. All units are calibrated at 77° F. AC ranges are calibrated on a 60 cycle sine wave. In choosing ranges always endeavor to have the readings fall in the upper (or right hand) half of the scale for greatest accuracy.

Ranges

The following ranges are self contained in your 630:

DC Volts	0-3-12-60-300-1200-6000 at 20,000 Ohms per Volt
AC Volts	0-3-12-60-300-1200-6000 at 5,000 Ohms per Volt
DC Microamperes	0-60 at 250 Mv.
DC Milliamperes	0-1.2-12-120 at 250 Mv.
DC Amperes	0-12 at 250 Mv.
Ohms	0-1000-10,000.....(4.4-44 at center scale)
Megohms	0-1-100.....(4400-440,000 at center scale)
Output Volts	0-3-12-60-300-1200 AC at 5,000 Ohms per Volt
Decibels	—20 to +11, 23, 37, 51, 63, 77 on 600 Ohm line

Your 630 is well constructed but like any instrument should be handled carefully. You will also want to keep the panel clean as cleanliness and carefulness go hand in hand.

Measuring DC Volts

Rotate the selector switch to the appropriate range for DC volts. Always start with the highest range if in doubt as to the approximate voltage.

In choosing ranges, endeavor to have the readings fall in the upper, or right hand, half of the scale for greatest accuracy.

Plug the black test lead into the COM jack and the red lead into the V-Ω-A jack as shown in Figure 1.

CAUTION: When measuring up to 6000 volts set the selector switch on the 6000/1200 range, plug the red lead into the jack marked 6000 DCV, and leave the black lead in COM.

Connect the test prods ACROSS the voltage source. The red lead is positive. Where polarity is difficult to determine, the meter may read backwards. No damage will be done if this occurs. Simply reverse the leads.

Read all DC voltages on the top black meter scale. Notice that the scales are not all marked exactly the same as the range indicated by the knob position. Thus 0-3 volts is read on the 0-300 scale by omitting two zeros (i. e. ÷ by 100) on all readings, the 0-1200 range is read on the 0-12 scale by adding two zeros, and the 0-6000 range is read on the 0-60 scale by adding two zeros.

The high sensitivity of 20,000 ohms per volt will allow you to take measurements in low current circuits such as grid and discriminator circuits.

CAUTION: For maximum safety do not handle tester or leads when connected to high voltages. Make certain that no condensers are charged to a high voltage.

NOTE: To measure above 1200 volts, red lead must be plugged into the 6000 DCV jack and selector switch set on the 6000/1200 DCV range.

For handy operation chart see pages 16 and 17.

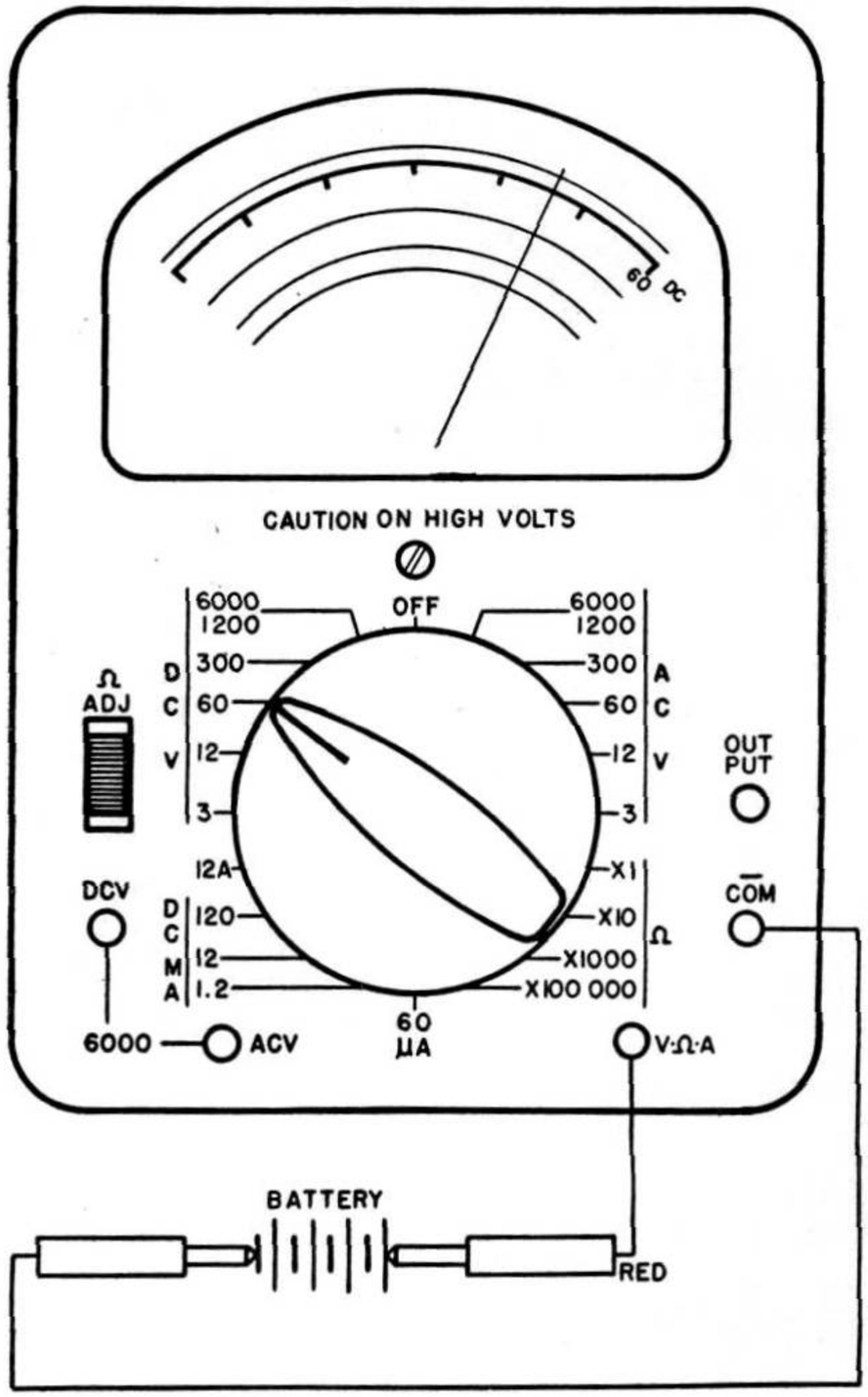


Figure 1—Measuring DC Volts

Measuring AC Volts

Rotate the Selector switch to the appropriate range for AC volts. Always start with the highest range if in doubt as to the approximate voltage.

In choosing ranges, endeavor to have the readings fall in the upper, or right hand, half of the scale for greatest accuracy.

Plug the black test lead into the COM jack and the red lead into the V-Ω-A jack as shown in Figure 2.

CAUTION: When measuring up to 6000 volts set the selector switch on the 6000/1200 range, plug the red lead into the jack marked 6000 ACV, and leave the black lead in COM.

Connect the test prods ACROSS the voltage source. As there is no polarity on AC, the red and black leads may be interchanged without causing the meter to read backwards.

Use the two lower red scales for AC volt readings. Note that the bottom scale is to be used ONLY for one range, namely the 0-3.

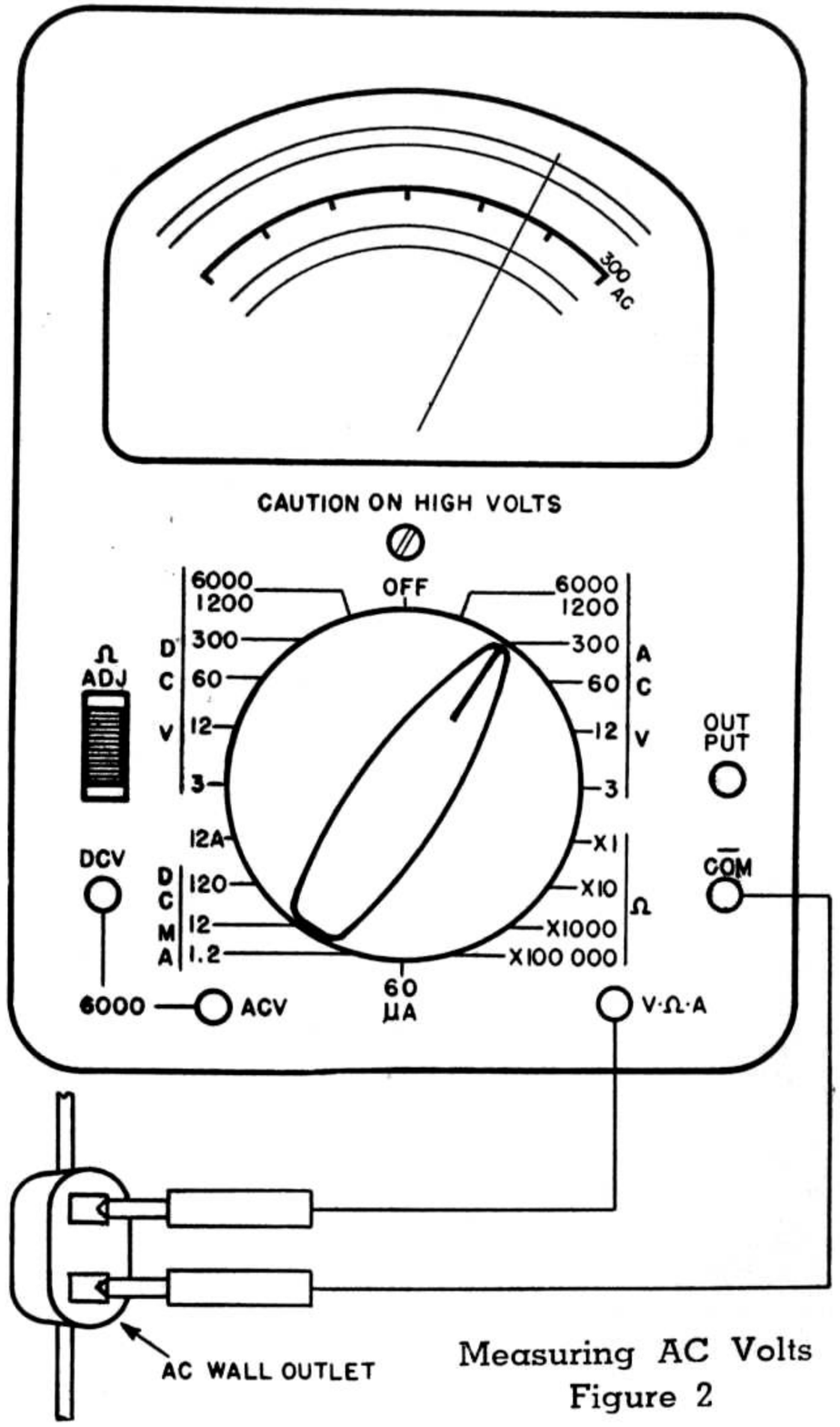
When using the 0-1200 AC volt range, read on the 0-12 scale by adding two zeros. When on the 6000 volt range use the 0-60 scale by adding two zeros.

No correction for frequencies is necessary from 25 c. p. s. to 1000 c. p. s.

CAUTION: For maximum safety do not handle tester or leads when connected to high voltages.

NOTE: To measure above 1200 volts, red lead must be plugged into the 6000 ACV jack and the selector switch set on the 6000/1200 ACV range.

For handy operation chart see pages 16 and 17.



Measuring AC Volts
Figure 2

Measuring DC Resistance

Rotate the selector switch to the appropriate range for ohms determined from the following chart:

To Read	Set Switch to
0-1000 ohms	Ω×1
0-10,000 ohms	Ω×10
0-1 Meg.	Ω×1000
0-100 Meg.	Ω×100,000

Plug the black test lead into the COM jack and the red lead into the V-Ω-A jack as shown in Figure 3.

Short the test prods together and adjust the Ω ADJ knob until the meter pointer reads 0 on the top red (Ω) scale. (The 0 for the ohms scale is at the extreme right side of the scale.)

Connect the test prods across the resistor as shown. If the resistor is wired in a circuit, disconnect one end of the resistor before taking the reading.

Each time an ohm range is changed, it is well to check the 0 setting as outlined in paragraph 3 above.

The basic scale 0-1K (0-1000) is used for reading on all ohm ranges. Simply multiply the scale numbers by 1, 10, 1000, or 100,000 as indicated by the selector switch setting.

It should be kept in mind that in the measurement of resistance a current is passed through the unknown resistor. Generally this current is so small as to be negligible. However on the 0-1000 range fairly high current is employed.

CAUTION: On X1 ohm position reading approximately center scale (4.4 ohms) the current drain from the 1.5 volt battery is 170 MA. It is desirable to make a practice of using one of the higher ohm ranges for general continuity or circuit testing. This will give you much longer battery life.

NOTE: In the ohms circuit the battery polarity at the leads is reversed from what the lead colors would seem to indicate (i. e. the red lead is actually the negative of the battery). In checking diodes and transistors reverse the leads in the tester to provide the proper indicated direction of current flow.

Since the scale of an ohmmeter is non-linear, the accuracy of the reading cannot be expressed as a per cent of full scale. Ohmmeter accuracy is generally referred to a linear scale such as the DC volt scale. Thus ±3% ohmmeter accuracy means an allowable ±1.8 divisions on the DC scale. For example 2 ohms could read from about 1.75 to 2.3 ohms and be within tolerance.

NOTE: Do not touch any metal parts of the circuit when using the high ohm ranges. It is not dangerous but your body resistance can cause serious error.

For handy operation chart see pages 16 and 17.

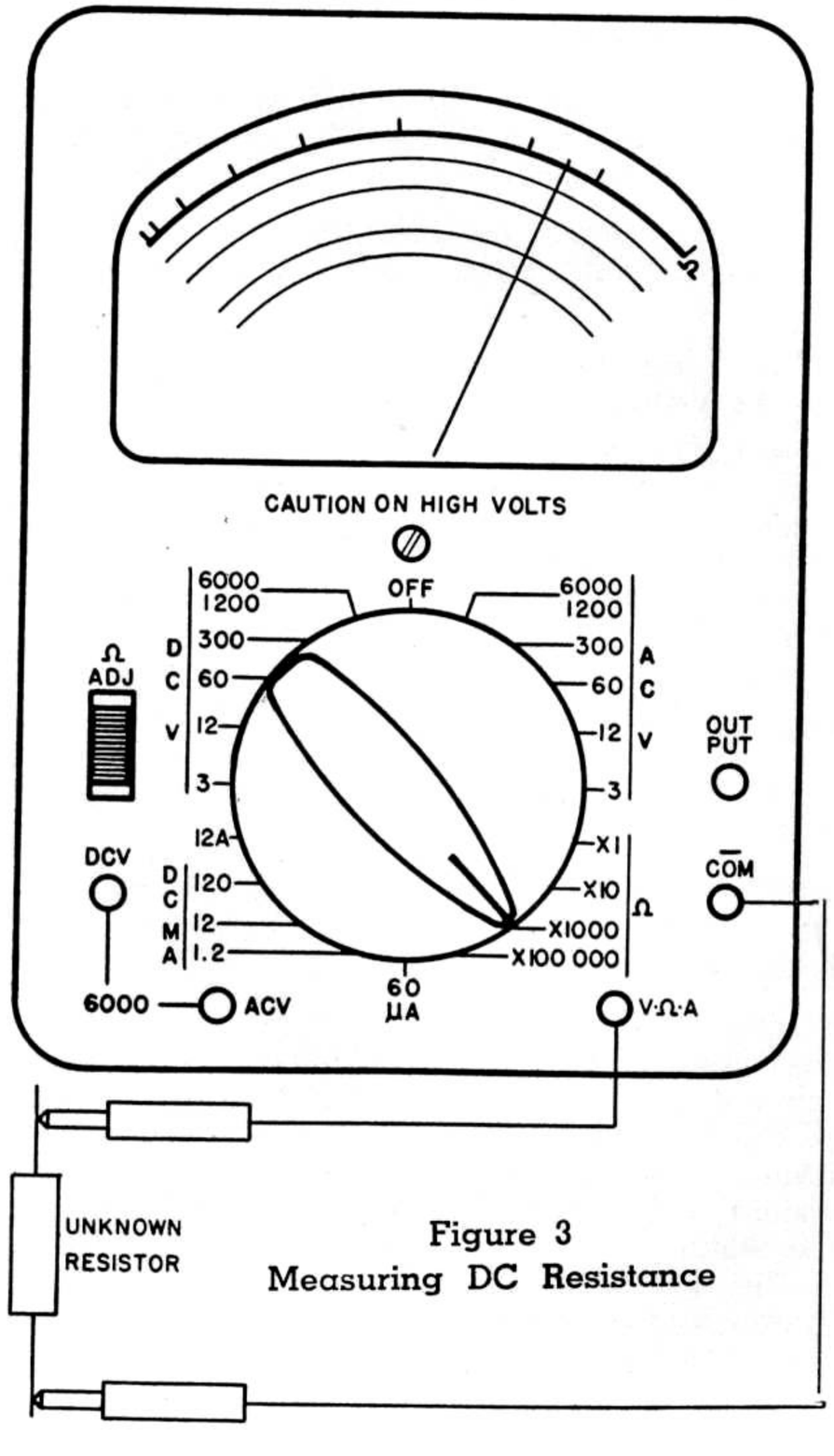


Figure 3
Measuring DC Resistance

Measuring DC Current

Rotate the selector switch to the appropriate range for DC current. Always start with the highest range if in doubt as to the approximate current.

In choosing ranges, endeavor to have the readings fall in the upper, or right hand, half of the scale for greatest accuracy.

Plug the black test lead into the COM jack and the red lead into the V-Ω-A jack as shown in Figure 4.

Connect the test prods in SERIES with the circuit to be measured. Do not test directly across any potential circuits as this may burn out the instrument and shunt. The red lead is positive. Where polarity is difficult to determine, the meter may read backwards. No damage will be done if this occurs. Simply reverse the leads.

Read all current ranges (including microamperes, milliamperes, and amperes) on the upper black scale. When on the 1.2 Ma. range use the 0-12 scale and divide by 10. On the 120 Ma. range again use the 0-12 scale by multiplying by 10.

CAUTION: Turn off the power before connecting the meter to the circuit. Do not handle tester or leads in high voltage circuits.

In using the 60 microampere range, the meter may read differently than calculations would indicate. This is sometimes caused in low current circuits by a slight leakage of voltage due to moisture. Other times a slight potential is generated by soldering or joining of dissimilar metals. Even the proximity of fumes or liquid acids and alkalies may react with the metal parts of the circuit and generate slight currents. The fingers should not be permitted to touch the metal parts of the prods or circuit as body resistance can also upset some circuits.

For handy operation chart see pages 16 and 17.

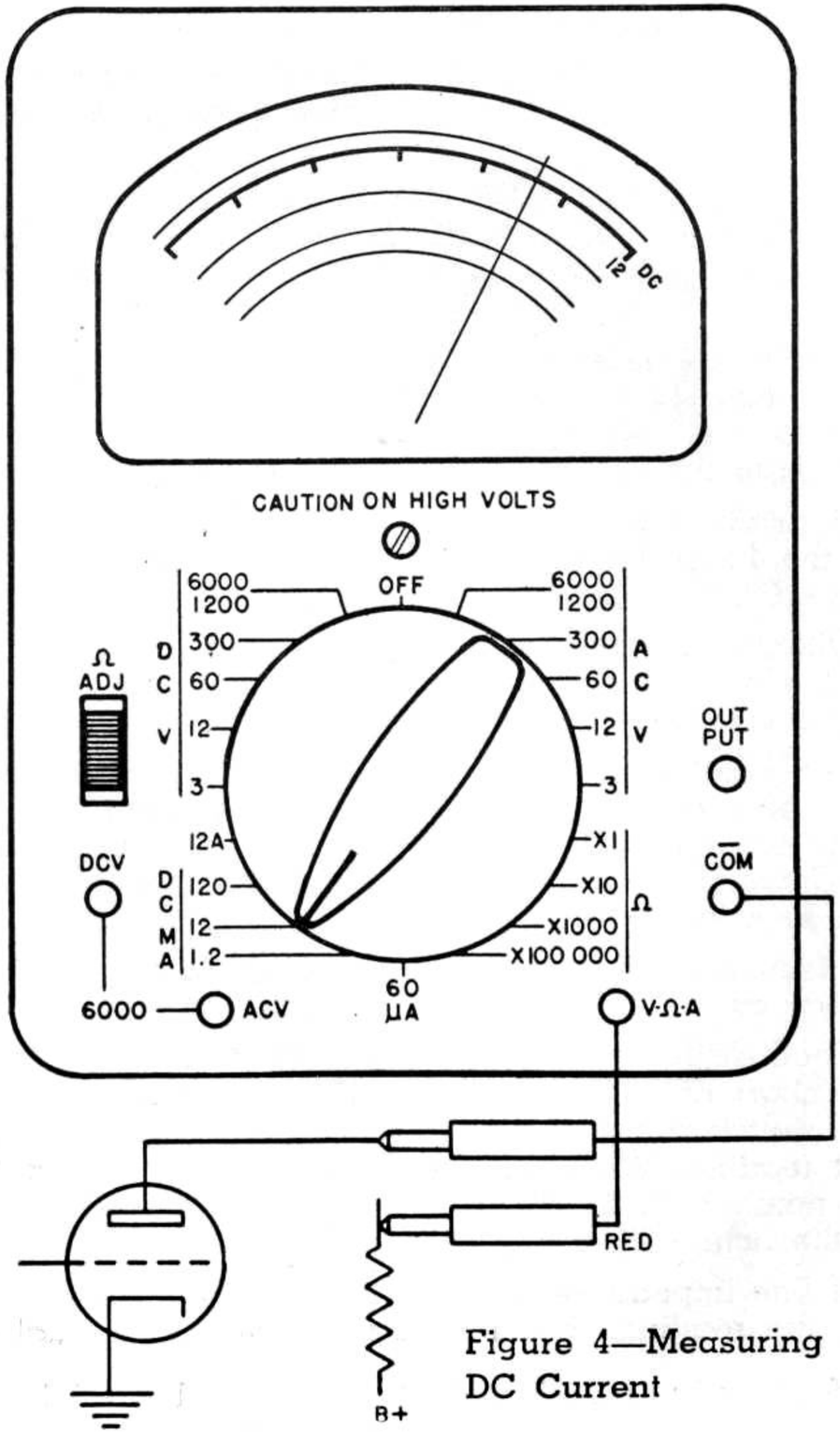


Figure 4—Measuring DC Current

Measuring Output Volts (DB)

Output is generally measured in units called the decibel, a terminology used to indicate power levels in amplifiers or telephone work.

Do not confuse the DB with the VU (Volume Unit). The VU is based on .001 watt dissipated in a 600 ohm line and is measured with a meter having special ballistic characteristics.

Rotate the selector switch to the appropriate AC volt range. Refer to the small chart on the meter dial for the range to use. Always start with the highest range if in doubt as to the approximate number of decibels.

Normally it is recommended to measure output by plugging the black lead into the COM jack and the red lead into the OUTPUT jack as shown in Figure 5.

Oftentimes a DC voltage is present in the circuit where output is to be measured. The extra jack marked OUTPUT with a .1 mfd condenser in series is provided to block the DC.

The condenser impedance is generally disregarded in most measurements. Where no DC is present, this output voltage can be read accurately by using the 630 as a regular AC voltmeter (i. e. by plugging the red lead into the V-Ω-A jack instead of OUTPUT).

Connect the test prods across the plate circuit or speaker voice coil.

Read all DB ranges on the bottom black scale using the small chart on the meter dial. For example, when the selector switch is set on the 3 AC volt range, the DB scale is direct reading. When on the 12 AC volt range, add 12 to each number on the DB scale, thus with the meter reading —2, the actual DB reading is +10 DB.

If line impedance is not 600 ohms (as in speaker voice coils) the readings will be only relative—not actual DB.

For handy operation chart see pages 16 and 17.

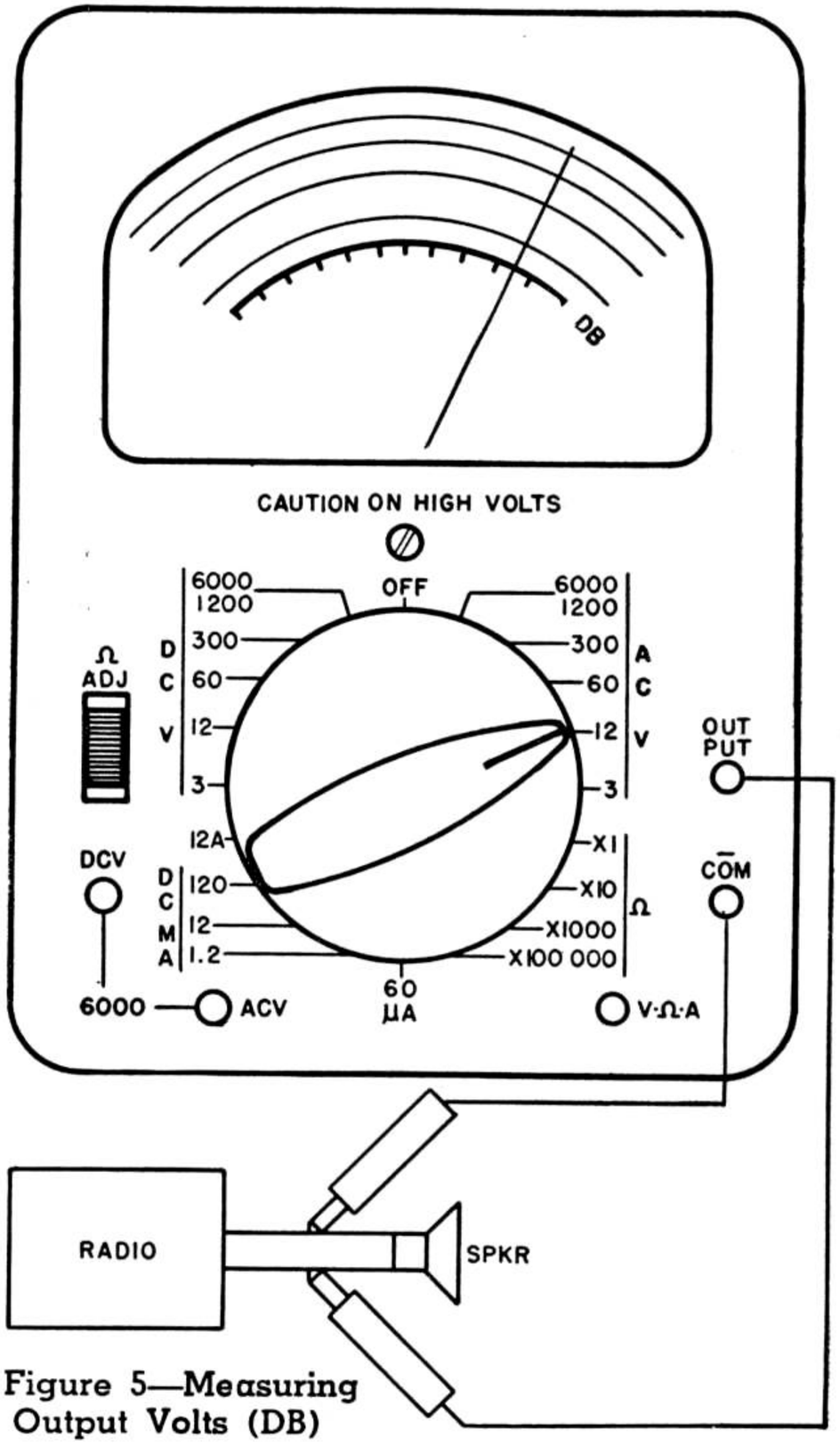


Figure 5—Measuring Output Volts (DB)

To Measure	Set Selector Switch To	Plug Red* Test Lead In Jack Marked	Read On	Each Scale Div. Equals
DC VOLTS			BLACK SCALE	
0-3	3 DCV	V-Ω-A	0-300 DC÷100	0.05 Volt
0-12	12 DCV	V-Ω-A	0-12 DC×1	0.2 Volt
0-60	60 DCV	V-Ω-A	0-60 DC×1	1.0 Volt
0-300	300 DCV	V-Ω-A	0-300 DC×1	5.0 Volt
0-1200	1200/6000 DCV	V-Ω-A	0-12 DC×100	20.0 Volts
0-6000	1200/6000 DCV	6000 DCV	0-60 DC×100	100.0 Volts
AC VOLTS			RED SCALE	
0-3	3 ACV	V-Ω-A	0-3V AC×1	0.05 Volt
0-12	12 ACV	V-Ω-A	0-12 AC×1	0.2 Volt
0-60	60 ACV	V-Ω-A	0-60 AC×1	1.0 Volt
0-300	300 ACV	V-Ω-A	0-300 AC×1	5.0 Volt
0-1200	1200/6000 ACV	V-Ω-A	0-12 AC×100	20.0 Volts
0-6000	1200/6000 ACV	6000 ACV	0-60 AC×100	100.0 Volts
DC CURRENT			BLACK SCALE	
0-60 Ua DC	60 μa	V-Ω-A	0-60 DC×1	1.0 μa
0-1.2 Ma DC	1.2 DCMA	V-Ω-A	0-12 DC÷10	0.02 Ma
0-12 Ma DC	12 DCMA	V-Ω-A	0-12 DC×1	0.2 Ma
0-120 Ma DC	120 DCMA	V-Ω-A	0-12 DC×10	2.0 Ma
0-12 AMPS DC	12 AMP	V-Ω-A	0-12 DC×1	0.2 Amp
OHMS			Each Scale Division Equals (in ohms)	
0-1000	Ω×1	V-Ω-A		
0-10,000	Ω×10	V-Ω-A		
0-1 Meg	Ω×1000	V-Ω-A		
0-100 Meg	Ω×100,000	V-Ω-A		
DECIBELS			BLACK SCALE	
−20 to +11	3 ACV	Output	DB plus 0	
− 8 to +23	12 ACV	Output	DB plus 12	
+ 6 to +37	60 ACV	Output	DB plus 26	
+20 to +51	300 ACV	Output	DB plus 40	
+32 to +63	1200/6000 ACV	Output	DB plus 52	
+46 to +77	1200/6000 ACV	6000 ACV	DB plus 66	

RED SCALE	0-4	4-5	5-10	10-20	20-50	50-200
Ω×1	.1	.2	.5	1	5	50
Ω×10	1	2	5	10	50	500
Ω×1000	100	200	500	1K	5K	50K
Ω×100,000	10K	20K	50K	100K	500K	5 Meg

*** Black test lead plugged in "COM" jack for all measurements**

Measuring Capacity

Your 630 can be used to measure capacity by the arrangement shown in Figure 6. It is set up as an AC voltmeter. See page 8.

Use the following chart to determine the AC voltage range to use. ALWAYS start with the selector switch on the 300 volt range since, if the condenser is shorted, serious damage may result to the meter when on a low range.

To Measure MFD	Set Selector Switch to	Deflection in AC Volts
.002	3 ACV	.45
.004		.83
.006		1.25
.008		1.65
.010		2.10
.020	12 ACV	4.3
.04		7.7
.05		9.7
.08	60 ACV	14.5
.10		17.5
.2		30.0
.4		45.0
.6		57.0
.8	300 ACV	65.0
1.0		75.0
2.0		85.0
5.0		95.0
10.0		100.0

CAUTION: Do not attempt to use this test on electrolytic condensers.

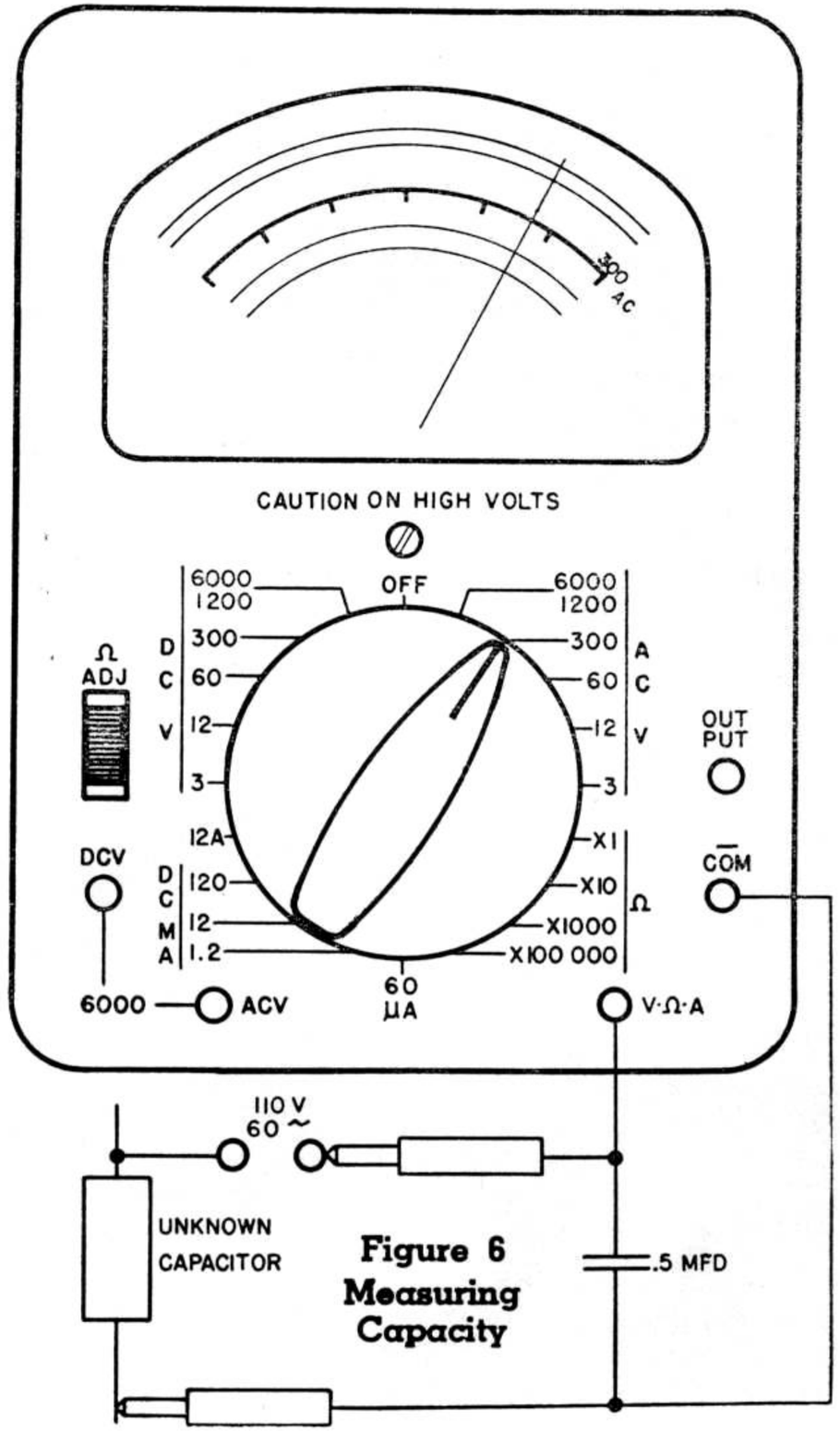


Figure 6 Measuring Capacity

Measuring Kilovolts

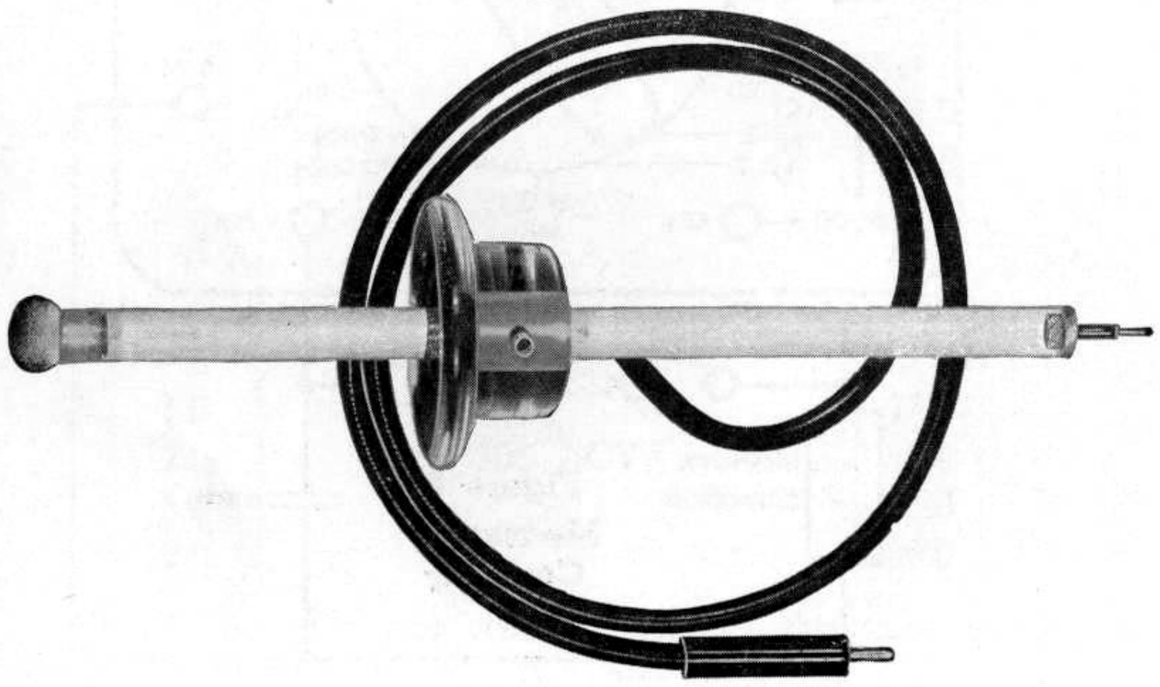
For measuringthe high voltage employed in television receivers and in other applications, an external probe is available. See Figure 7. Probes are made in three ranges 0-12,000, 0-30,000, and 0-60,000 volts. Common usage is on D. C. Probes for AC are also available in the lower ranges.

To use the Kilovolt probe set range selector switch on 3 volt D. C. position if the D. C. probe is to be used. When the A. C. probe is used set range selector switch on 3 Volt A. C. position. Substitute the high voltage probe for one of the normal leads. Put the high voltage probe into the "hot" side of the voltage under test and observe correct polarity.

Use EXTREME CAUTION in measuring these high voltages such as found in television receivers. Clip common lead to the circuit so you will have only one probe in your hand.

Kilovolt Probe	Set Selector Switch	Read on Range	Multiply By
0-12KV DC	3 V DC	0-12V	1000
0-30KV DC	3 V DC	0-300V	100
0-60KV DC	3 V DC	0-60V	1000
0-12KV AC	3 V AC	0-12V	1000
0-30KV AC	3 V AC	0-300V	100

Figure 7



Measuring High DC Current

External plug-in shunts are available to extend the DC current ranges of your 630 from the self-contained 0-12 amps to 0-30 amps. External portable shunts up to 120 amperes also are available. (See paragraph on accessories.)

Set the 630 selector switch to the 12 Ma. position and plug the desired external shunt into the COM and V-Ω-A jacks. Connect the line to be measured to the binding posts on top of the shunts. The external portable shunts are too large to plug into the panel and must be connected to the panel jacks by the leads furnished with the shunts.

Accessories

The following accessories for your 630 are available from your distributor:

Item	Part No.
RF Probe 250 MC	T-79A-145
DC Hi-Voltage probe 0-12 Kv	T-79-68
AC Hi-Voltage probe 0-12 Kv	T-79-69
DC Hi-Voltage probe 0-30 Kv	T-79-70
AC Hi-Voltage probe 0-30 Kv	T-79-71
DC Hi-Voltage probe 0-60 Kv	T-79-93
Carrying cases	639, 639-N & 639-P
Plug-in external shunt 0-30 DC Amp.	T-91-247
Portable external shunt 0-60 DC Amp.	T-91-248
Portable external shunt 0-120 DC Amp.	T-91-255
Clamp-on Adapter, Model 10	60A-211
Lead assembly, No. 611 (used in conjunction with Model 10)	79A-160
Line separator, Model 101 (used in conjunction with Model 10)	60A-218

Special instruments or testers can be obtained from the Triplett Company which manufactures a complete line ot electrical measuring instruments, radio and TV test equipment.

In The Home

When your refrigerator motor fails to "kick out" the starting winding, use the 630 to measure the AC line voltage. If the voltage is below about 100 volts, notify your power company.

If your electric stove does not seem to heat quickly enough, measure the voltage input to the stove with all burners turned on and again with all burners turned off. If the difference between these two voltages is 10 or 15 volts, the power cable to the stove has defective connections or is not of large enough current carrying capacity.

Blown fuses sometimes do not visibly indicate they are burned out. With your 630, measure the voltage ahead and behind the fuse. Voltage ahead of the fuse but no voltage following indicates a blown, defective, or loose fuse. Sometimes it is easier to remove the fuse and measure its resistance. This should be substantially zero.

Your 630 is handy for locating trouble in desk and floor lamps. Pull the plug from the wall socket and check for a faulty cord, plug, switch, socket, or bulb by measuring resistance on the $\Omega \times 1$ range. 100 watt 120 volt bulbs should read 10 to 20 ohms. 50 watt 120 volt bulbs should read 20 to 40 ohms.

For the Radio Man

In addition to all common voltage, current, and resistance measurements used in servicing radios, the high sensitivity of your 630 is well adapted to measuring AFC, AVC, bias, and FM discriminator voltages.

Measurements of the high voltage up to 27,000 volts used in some television receivers for the picture tube can be effected with the special high voltage probe shown on page 20.

Considerable trouble is had with leakage in automobile radio antennas (due to moisture). Your 630 with the high ohm range 0-100 meg. is ideal to check this leakage. Disconnect the antenna from the receiver before making this check.

In The Industrial Plant

Your 630 will be a big help in checking voltage drop caused by adding that extra machine on the already overloaded line. Correcting this will often save time later when a rush comes and the line "just happens" to burn up.

Measure the voltage at the machine first with the machine turned off and again with the machine in operation. If the voltage is proper with the machine off but low with the machine in operation, the circuit wiring or transformers have too small a capacity. If the voltage is low even with the machine off, the circuit is probably already overloaded and the machine should be wired into another circuit.

Equipment using automatic electric controls can be checked with the 630. Faulty relay or control action is often caused by low voltage applied to the relay or control. This low voltage in turn, may be caused by burned or dirty contacts on the control device. Use the $\Omega \times 1$ range to check for high or unstable contact resistance.

When a phone on your dial telephone system fails, measure the line current and the voltage to the particular relay in question. If the voltage is proper, measure the contact resistance of the relay contacts using the $\Omega \times 1$ scale on your 630. If this resistance is over a fraction of an ohm or if the resistance seems to waver, clean and adjust the relay contacts.

In The Garage

Fuses in the automobiles have a tendency to look perfectly good and yet not function due to corrosion under the metal end cap. Measure voltage ahead and behind the fuse to determine a defective unit; or remove the fuse and measure its resistance. Anything over a fraction of an ohm is too high.

Checking automobile wiring, light switches, heaters, radios, etc., can be speeded up by simple use of your 630.

In The Laboratory

Your 630 is built with all precision, non-aging resistors. The specially designed switch and special banana type plugs insure lasting accuracy. The meter with specially finished and selected pivots and jewels and a well designed stable magnet further makes the 630 a must for the laboratory.

Special Applications

The unusually high range ohmmeter in your 630 permits some indication of condenser leakage resistance. Measure as a resistor, see page 10, using the highest range. A good paper or mica condenser under 1 mfd. will indicate at the 100 Meg mark or above. If a steady reading (taken after the initial surge required to charge the condenser) of less than 100 megohms is obtained, the condenser probably has defective insulation. Good paper condensers over 1 mfd. may read somewhat less than 100 megohms. Electrolytic condensers should read above .1 megohm. In checking electrolytic condensers, the black test lead ("com" jack) should be connected to the positive terminal of the condenser.

Checks of insulation resistance for motors, generators, telephone cables, power cables, etc., can be made on the high ohmmeter range of your 630. The actual value of resistance may vary from a few megohms to over 100 meg, depending on weather conditions and quality of insulation. The best method, therefore, is to make periodic checks on important cables or equipment and observe the trend in readings. As the readings tend to be lower and lower, it is time to start drying out the equipment or determine the cause of deterioration. Dirt, mice, or foreign matter can sometimes cause excessive leakage.

Battery Replacement

Two batteries are used for the ohmmeter circuits, a 1.5 volt Burgess No. 2 or equivalent and a 30 volt Eveready No. 413 or equivalent. An alternate 1½ V leakproof battery is Eveready No. E95.

When the meter pointer can no longer be adjusted to zero (see page 10) ohms on the Ω×1, Ω×10, or Ω×1000 ranges, replace the 1.5 volt battery.

When the meter pointer can no longer be adjusted to zero ohms on the Ω×100,000 range, replace the 30 volt battery.

To replace batteries, remove the four screws in the bottom of the case and lift panel from the case. Simply remove the old, and replace with a new battery being careful to observe polarity.

Care

A little precaution in handling and caring for your 630 can pay big dividends in satisfaction. Treat your tester like you would a fine watch.

Avoid placing your tester on a bench where machine tools are used or severe vibration is encountered.

Do not place your 630 near the edge of a shelf or bench where it can be easily knocked off.

When possible keep your 630 in a place of moderate temperatures. Avoid places with extreme temperatures or severe temperature changes.

In use, don't take chances on overloading the meter. If in doubt as to the approximate reading always start with the highest range.

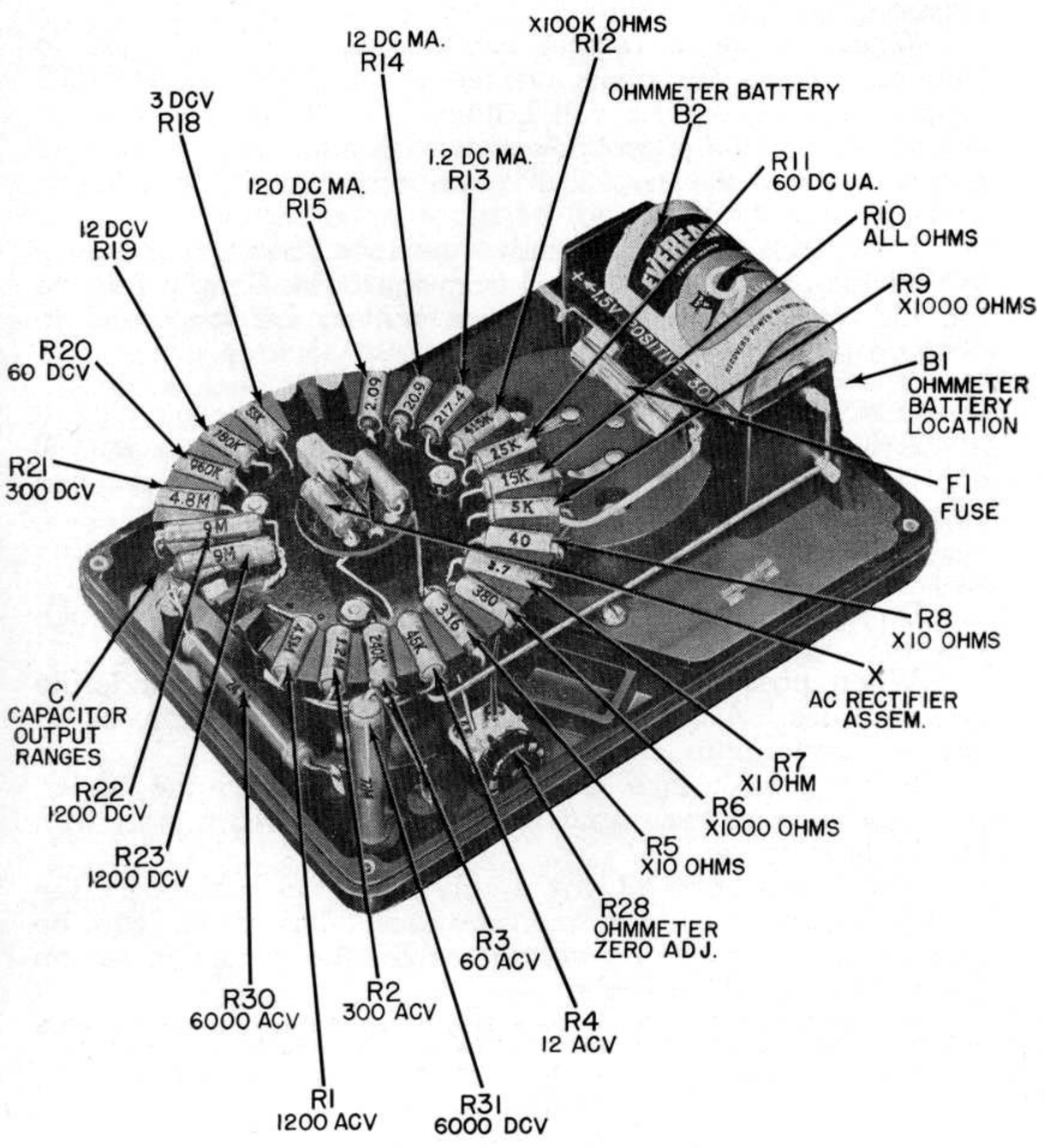
Get in the habit of double checking the position of the switch before making a measurement. The meter can be burned out by applying voltage when the switch is set on the current or ohms scale.

If the unit has not been in use for a long period of time, rotating the switch in both directions several times will wipe the contacts clean for good contact.

Turn the selector switch to OFF when the unit is to be carried. The meter is highly damped in this position to prevent wild swinging of the pointer.

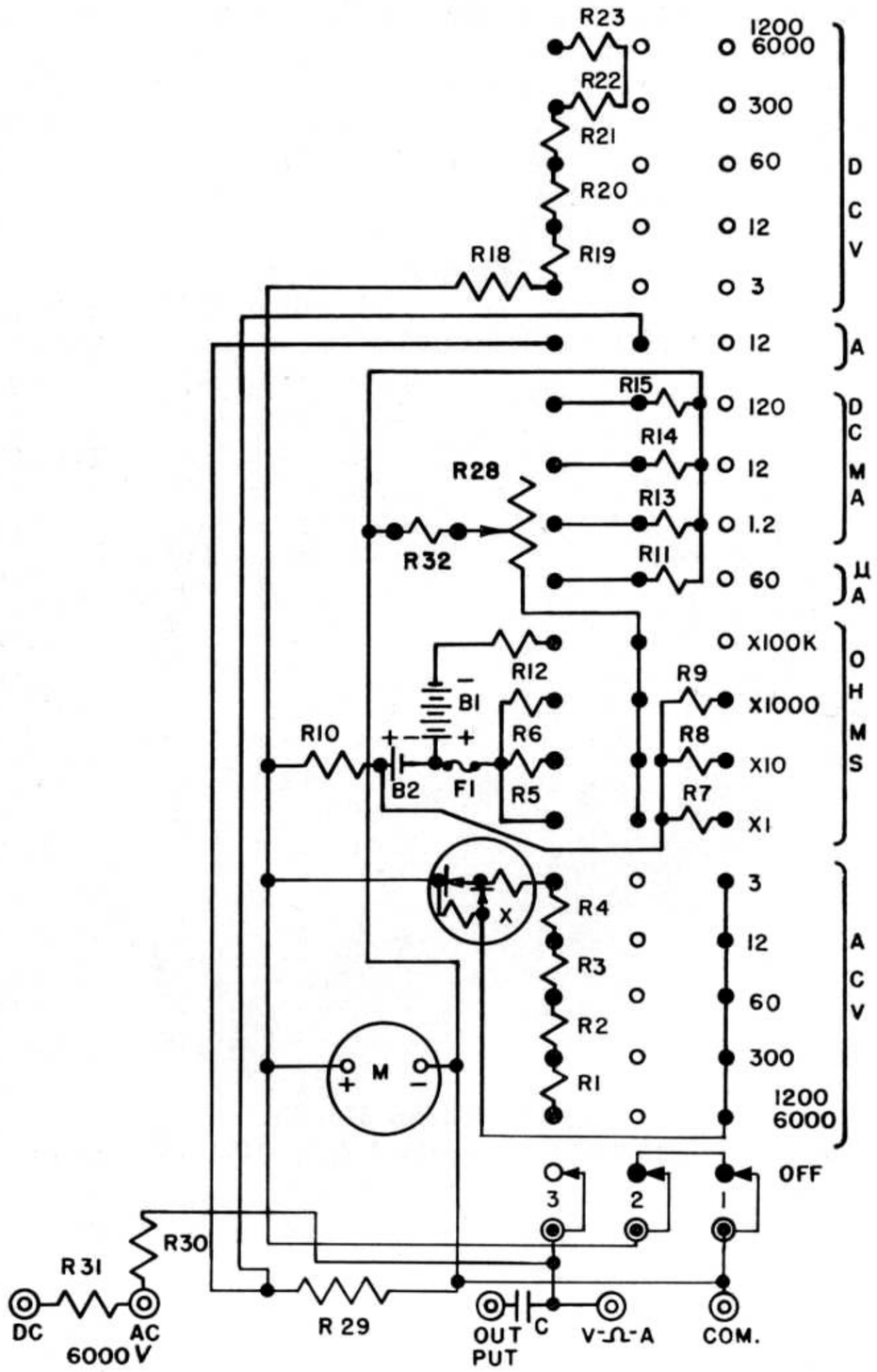
INTERIOR VIEW

PARTS LOCATION



Ref. No.	DESCRIPTION		Part No.
B1	Battery	30V Eveready 413, or NEDA # 210	T-37-19
B2	Battery	1.5V Burgess #2 or NEDA #13	T-2426-1
C	Capacitor	.1 Mfd. 400 DCWV	T-43-69
M	Instrument	50 μa, 250 Mv with panel. Bar Ring	52-1424
R1	Resistor	4.5 Megohm ±1% Film ½W	T-15-1231
R2	Resistor	1.2 Megohm ±1% Film ½W	T-15-1230
R3	Resistor	240K Ohm ±1% Film ½W	T-15-1238
R4	Resistor	45K Ohm ±1% Film ½W	T-15-1060
R5	Resistor	3.16 Ohm Wirewound ±1%	T-15-1256
R6	Resistor	380 Ohm ±1% Film ½W	T-15-1234
R7	Resistor	3.7 Ohm Wirewound ±1%	T-15-3223
R8	Resistor	40 Ohm ±1% Film ½W	T-15-2816
R9	Resistor	5K Ohm ±1% Film ½W	T-15-1009
R10	Resistor	15K Ohm ±1% Film ½W	T-15-1206
R11	Resistor	25K Ohm ±1% Film ½W	T-15-1235
R12	Resistor	415K Ohm ±1% Film ½W	T-15-1228
R13	Resistor	217.4 Ohm ±1% Film ½W	T-15-2287
R14	Resistor	20.9 Ohm ±1% Film ½W	T-15-2814
R15	Resistor	2.09 Ohm Wirewound ±1%	T-15-1253
R18	Resistor	55K Ohm ±1% Film ½W	T-15-1236
R19	Resistor	180K Ohm ±1% Film ½W	T-15-1237
R20	Resistor	960K Ohm ±1% Film ½W	T-15-1229
R21	Resistor	4.8 Megohm ±1% Film ½W	T-15-1232
R22) R23)	Resistor	9 Megohm ±1% Film ½W	T-15-1233
R28	Resistor	20K Ohm Variable	T-16-31
R29	Shunt	12 Amp. 250 Mv Strip Type	T-90-212
R30	Resistor	24 Megohm ±1% Film 2W	T-15-1226
R31	Resistor	72 Megohm ±1% Film 2W	T-15-1227
R32	Resistor	5100 Ohm ±5% ½W	T-15-1411
X Rectifier Assem.			T-2250-13
	Case	Phenolic with Strap Handle	T-10-784
	Knob	2-15/32" long, molded (clip 2451-51)	34-61
	Leads	Banana, plug-type, alligator clips, 4'	T-79-127
	Switch	20-pos., 3 deck without resistors	22B-311
	Front Assembly	(panel)	T-28-495
	Rubber Feet		T-3236-10
	Switch	20-pos., 3 deck with resistors	22-312
F1	Fuse	1 Amp. Littlefuse 3AG 312001	3207-15

Figure 8—Circuit Diagram



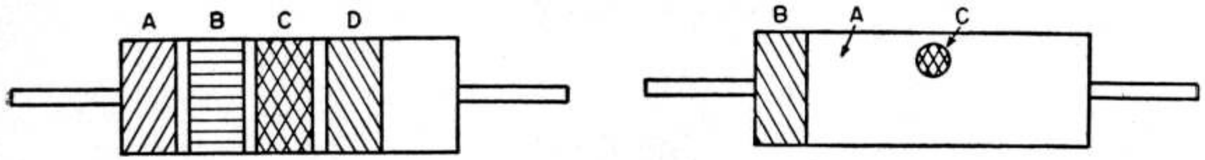
DB CHART

0 DB at 1 Mw Decibels with 600 ohm line	Line Power Mw	RMS Volts with line Imped. of 600 ohms
—20	.01	.0775
—10	.1	.245
—5	.316	.436
0	1.00	.775
+10	10.0	2.45
+15	31.6	4.36
+20	100	7.75
+30	1000	24.5
+40	10,000	77.5
+50	100,000	245.
+60	1,000,000	775.
+70	10,000,000	2450

Note:

The range of audibility can be considered to lie from 70 db below the normal speech level to 70 db above the same level, or a total range of 140 db.

EIA RESISTOR COLOR CODE



COLOR	INDICATES
A	First number
B	Second number
C	Number of zeros
D	Tolerance

Color	Number	Color	Number
Black	0	Violet	7
Brown	1	Gray	8
Red	2	White	9
Orange	3	Gold	5% tolerance
Yellow	4	Silver	10% tolerance
Green	5	None	20% tolerance
Blue	6		

The resulting value is in ohms.

Example:

A 250,000 ohm 20% resistor.

A red
B green
C yellow
D no color

EIA SPEAKER COLOR CODE

Voice—Coil:

Green—finish
Black—start

Field Coils:

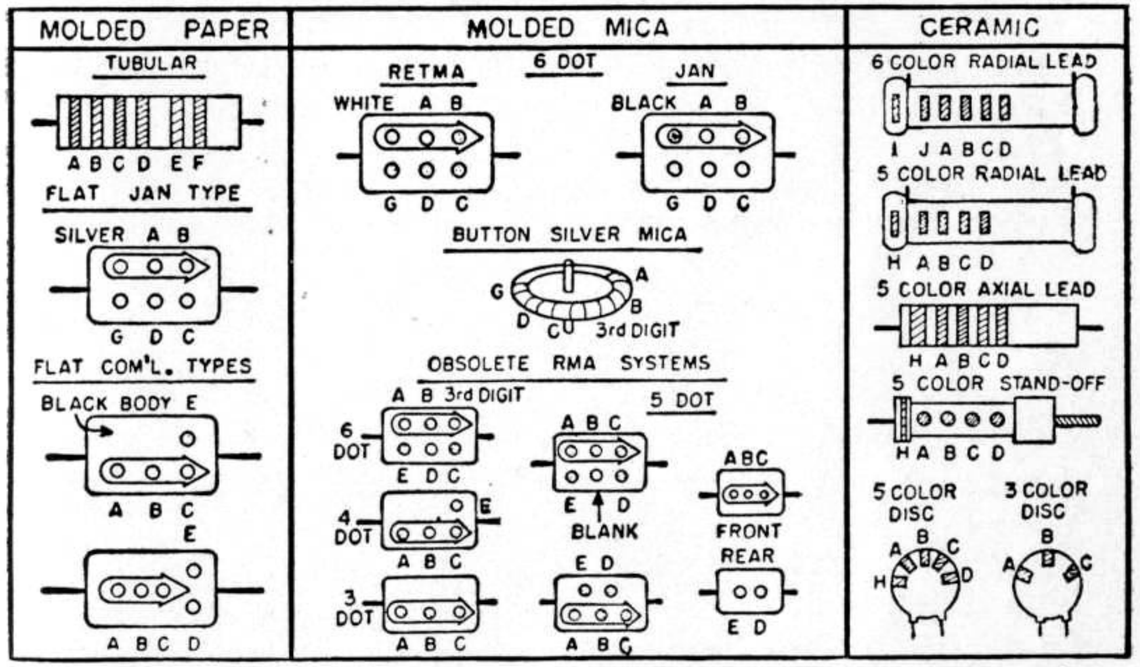
Black and red—start
Yellow and red—finish
Slate and red—tap (if any)

EIA WIRING COLOR CODE

B+	Red
Ground	Black
Plate	Blue
Grid	Green
Cathode	Yellow
High Heater	Brown
Low Heater	Black
Screen Grid	Orange
AVC	White

EIA MICA CONDENSER COLOR CODE

	MOLDED PAPER		MOLDED MICA		CERAMIC	
Color	Multiplier	Tolerance	Multiplier	Tolerance	Multiplier	Tolerance
Black	1	20%	1	20%	1	20% or 2.0μμfd.*
Brown	10		10		10	1%
Red	100		100	20% EIA	100	2%
Orange	1000		1000	3% EIA	1000	2.5% EIA
Yellow	10,000	5%	10,000		10,000	
Green				5% EIA		5% or 0.5μμfd.*
Blue						
Violet						
Gray					0.01	0.25μμfd.*
White		10%			0.1	10% or 1.0μμfd.*
Gold	0.1	5%	0.1	5% (JAN)		
Silver		10%	0.01	10%		* Capacitance
None		20%				less than 10μμfd.



(Courtesy Popular Electronics)

Capacitance is given in μμfd.

Colors—Same value as on resistors except as indicated in tables.

COLORS	INDICATES
A	First digit
B	Second digit
C	Multiplier
D	Tolerance
E & F	Voltage Rating in hundreds of volts

[(E) Ratings less than 1000 volts, (E) & (F) First two digits of ratings 1000 volts or more. Values of colors for (E) & (F) are same as in resistance values. (G) is class or characteristics of capacitor. (H), (I) & (J) give temperature coefficient. (G), (H), (I) & (J) are not listed in the tables.]

EIA TRANSFORMER COLOR CODE

I. F. Transformers:

Blue—plate lead
Red—"B" + lead
Green—grid (or diode) lead
Black—grid (or diode) return

NOTE: If the secondary of the i. f. t. is center-tapped, the second diode plate lead is green-and-black striped, and black is used for the center-tap lead.

Power Transformers:

1. Primary Leads. . . . .Black
   If tapped:
   Common . . . . . .Black
   Tap—Black and Yellow Striped
   Finish—Black and Red Striped
2. High-Voltage Plate Winding . . . . . .Red
   Center-Tap — Red and Yellow Striped
3. Rectifier Fil. Winding. . .
   Yellow
   Center-Tap—Yellow and Blue Striped
4. Fil. Winding No. 1. Green
   Center-Tap — Green and Yellow Striped
5. Fil. Winding No. 2. Brown
   Center-Tap — Brown and Yellow Striped
6. Fil. Winding No. 3. Slate
   Center-Tap — Slate are Yellow Striped

A. F. Transformers:

Blue—plate (finish) lead of primary

Red—"B" + lead (this applies whether the primary is plain or center-tapped).

Brown—plate (start) lead on center tapped primaries (Blue may be used for this lead if polarity is not important.)

Green—grid (finish) lead to secondary

Black—grid return (this applies whether the secondary is plain or center-tapped.)

Yellow—grid (start) lead on center tapped secondaries. (Green may be used for this lead if polarity is not important.)

Note: These markings apply also to line-to-grid, and tube-to-line transformers.