PHILCO MODEL 027 VACUUM-TUBE VOLTMETER

The Philco Model 027 is a combination Circuit Tester, Vacuum Tube Voltmeter, Megohmmeter, and Capacity Meter. A 6R7G tube is used in the Vacuum Tube Voltmeter and the 150-megohm circuits of the Megohmmeter.

The following ranges are available for tests:

Volts: 10, 30, 100, 300, 1000 A.C., D.C., or Output.
Milliamperes: 10, 100 D.C.
Amperes: 10 D.C.
Resistance: 150, 15,000 ohms, 1.5, 150 megohms.
Vacuum Tube Voltmeter: 10 volt A.C. or D.C.

All functions of this instrument are controlled by two rows of push-buttons. The lower row selects the meter function and the upper row the desired range. Readings are taken on the scale whose color corresponds to the color of the function button in the lower row which is in use.

A-C VOLTS:

Push "A.C." button in the lower row and the desired "Volts" range button in the upper row. Meter connections are made to the binding posts marked "Volts Ohms MA".

OUTPUT:

Push "Output Volts" button in the lower row and the desired "Volts" range button in the upper row. Meter connections are made to the binding posts marked "Volts Ohms MA".

D-C VOLTS:

Push "D.C." button in the lower row and the desired "Volts" range button in the upper row. Meter connections are made to the binding posts marked "Volts Ohms MA" observing polarity.

D-C MILLIAMPERES:

Push "D.C." button in the lower row and the desired "Direct Current" milliampere range button in the upper row. Meter connections are made to the binding posts marked "Volts Ohms MA" observing polarity.

D-C AMPERES:

Push the "D.C." button in the lower row and the "10 Amps" button above "Direct Current" in the upper row. Meter connections are made to the binding posts marked "10 Amps D. C.".

RESISTANCE (150 ohms, 15,000 ohms and 1.5 megohms):

Push "Ohms" button in the lower row and the desired "Ohms" range button in the upper row. Meter connections are made to the binding posts marked "Volts Ohms MA". Zero adjustment is made by shorting the test leads together and adjusting the "Set Zero Ohms-VTVM" control. Zero must be reset for each subsequent range.

RESISTANCE (150 megohms):

(1) Insert power cord in 115 V, 50-60 cycle outlet.

(2) Push "Ohms" button in lower row and the "150 Meg." button in the upper row.

(3) Advance "Set Zero Ohms-VTVM" control just far enough to actuate the switch. Do not advance this control beyond this point until tube filament has reached operating temperature.

(4) Adjust "Set Zero Ohms-VTVM" control until meter reads " ∞ " on the 150 megohm scale with the terminals "150 Meg-VTVM" open.

(5) Short the "150 Meg. VTVM" terminals together and adjust "Set Zero 150 Meg." control until meter reads "0" on the 150 meg. range. The instrument is now ready for measurements.

Leads to the megohmmeter should be kept as short as possible. The device under test should, wherever possible, be connected direct to the megohmmeter binding posts. If leads are necessary they should have good insulation and no shield.

This range is invaluable for checking leakage in condensers, quality of insulation on wires and insulated parts, lug-to-lug resistance in sockets and switch wafers, and testing for leaks between primary and secondary of R.F., I.F., and audio transformers.

VACUUM TUBE VOLTMETER:

In the use of the Philco Model 027 VTVM, a few precautions should be observed. The few listed below should be carefully followed, in order to insure accuracy.

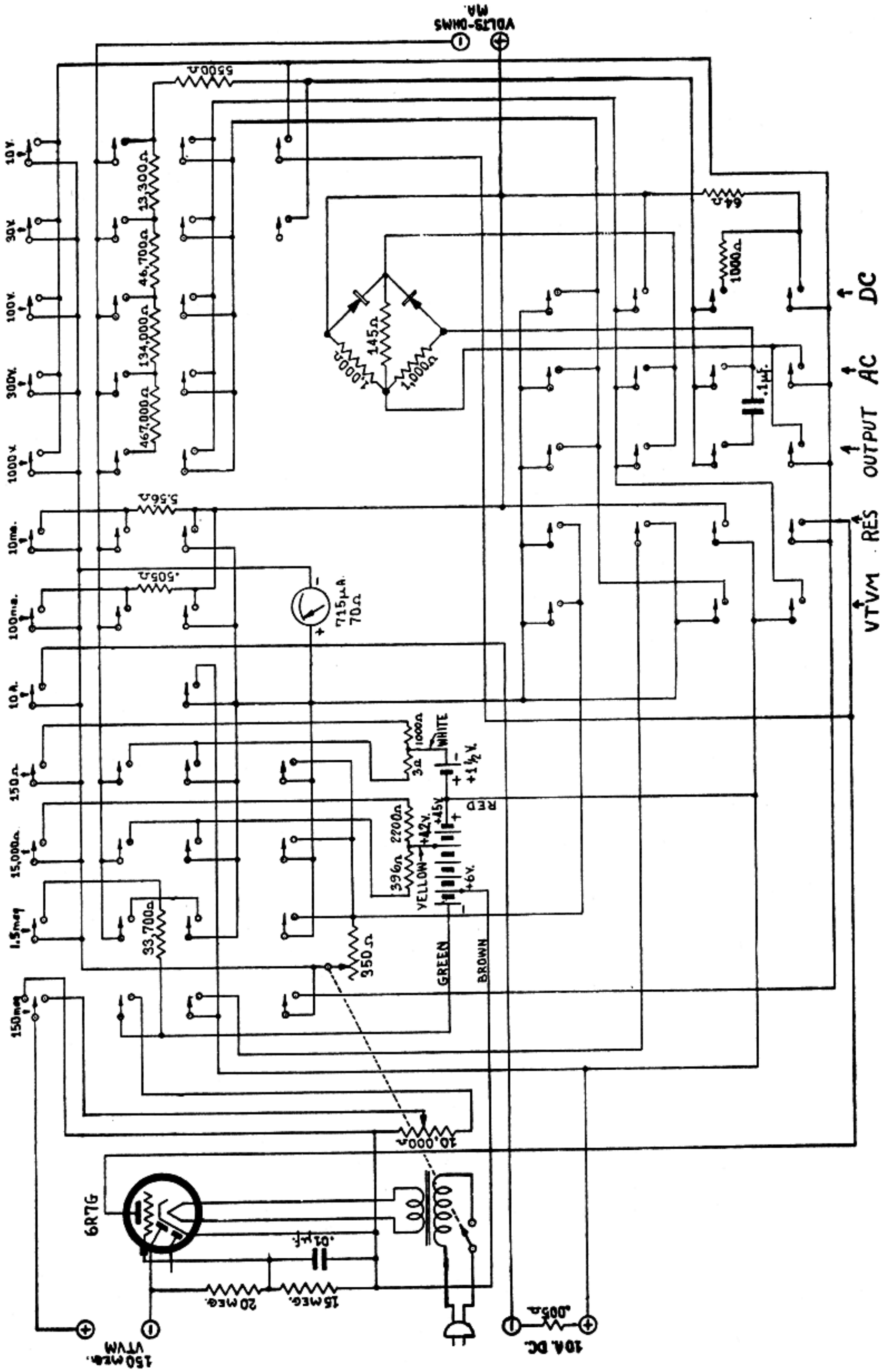
(1) D. C. measurements are made observing polarity as indicated at binding posts.

(2) R.F., I.F., and A.F. measurements are made with the "High" lead connected to that point in the circuit with highest A.C. potential with respect to ground. (Examples: grid or plate.) In A.C. work the length of this lead is critical, and should be kept as short as possible. A 3000 mmfd. condenser, such as Philco part No. 30-1028, should be connected in series with this lead at the meter end.

(3) In making all R.F., I.F., or A.F. measurements, the VTVM leads should be connected, as outlined above, across the voltage source under test when no voltage is present in the source. Zero adjustment of the VTVM should be made under these conditions. If the source under measurement is a tuned circuit, it should be repadded after connection of the VTVM to correct for the detuning effect of the leads. After zero adjustment and repadding, the position of the VTVM leads should not be disturbed.

(4) No potential higher than 50 volts should be connected to the VTVM terminals.

(5) No cabled or shielded leads should be used under any circumstances for the VTVM.



PHILCO MODEL 027 VACUUM-TUBE VOLTMETER (SCHEMATIC DIAGRAM)

OPERATION OF VACUUM TUBE VOLTMETER:

(1) Insert power cord in 115 V, 50-60 cycle outlet.

(2) Push "VTVM" button in lower row and "10" volt button in the upper row.

(3) Meter connections are made to the posts marked "150 Meg. VTVM".

(4) Advance "Set Zero Ohms-VTVM" control just far enough to actuate the switch. Do not advance this control beyond this point until the filament of the tube has reached operating temperature.

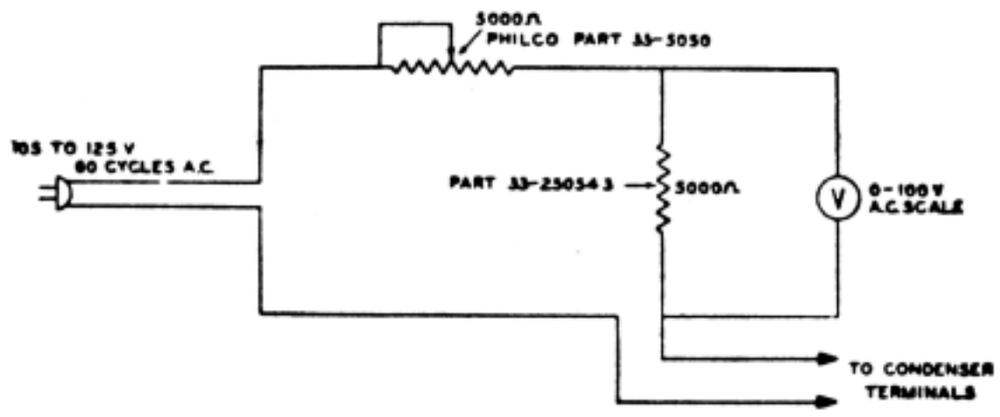
(5) Adjust for zero with this control, following the precautions outlined above.

(6) After measurements have been completed, turn off VTVM by rotating "Set Zero Ohms-VTVM" control all the way to the left.

The Vacuum Tube Voltmeter is a highly sensitive instrument used for voltage measurements in cases where no current should be drawn by the meter. Fundamentally, a Vacuum Tube Voltmeter operates on the principle of the vacuum tube. That is, any change in the voltage applied to the grid produces a corresponding change in plate current. From a knowledge of the characteristics of the given tube, the net change in grid voltage which produces the change in plate current can be determined very accurately by means of plate current readings.

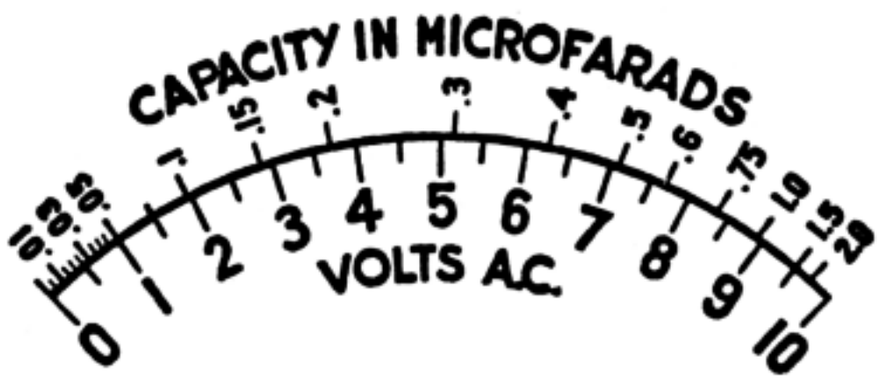
This instrument is useful, in high-impedance or high-resistance circuits, for all measurements of alternating or direct current voltages of small magnitude.

CAPACITY METER:



EXTERNAL CIRCUIT FOR CAPACITY METER

By the use of the circuit shown in the accompanying sketch, capacity measurements may be made on the 100-volt A.C. range. The cut below shows calibrations for this service. Short the "To Condenser Terminals" leads and adjust the potentiometer until the meter reads full scale. The instrument is then ready for capacity measurements.



CAPACITY METER CALIBRATIONS

CAUTION

Never hold down more than one button in each row.

When through with the instrument clear both rows of buttons and turn "Set Zero Ohms-VTVM" switch off.

When using Vacuum Tube Voltmeter or Megohmmeter ranges avoid touching or holding lead marked "High".

To prevent leakage, the terminals of the Megohmmeter should be kept dry and free from dirt.

BATTERIES:

The batteries used in the Model 027 are as follows:

2—22½-volt dry batteries, size 4" x 3" x 2½", with a plus six (6) volt tap and a plus nineteen and one-half (19½) volt tap;

1—1½-volt flashlight cell, size No. 2.

To install the 22½-volt batteries, remove the instrument from its case by removing the fourteen screws around the front panel. Do not remove the four corner screws.

The 22½-volt batteries are secured to the case by means of brackets which are held in place by bolts.

Connect the two 22½ volt batteries in series to give a total of 45 volts. Connect the green lead from the Model 027 unit to the most negative (–) point, the red lead to the most positive (+) point, the brown lead to plus (+) 6 volts, and the yellow lead to plus (+) 42 volts.

These batteries should be replaced when their voltage drops below 17 volts.

To install the 1½-volt cell, remove the plate on the bottom of the Model 027 case. The battery is inserted with the center terminal entering first.

The lug to which the positive terminal of the 1½-volt cell makes contact must be wired to plus (+) 45 volts (where the red lead of the Model 027 unit is connected). After the cell is inserted the square insulator is placed so the lug on it makes connection with minus (–) 1½ volts. Place the spring (furnished) on the insulator and replace the metal plate.

FAILURE IN OPERATION:

CAUTION

Before checking for trouble in this instrument, disconnect the leads to the meter, or short out the meter, to prevent damage to the meter armature. This caution is especially important when making continuity checks.

If instrument gives incorrect d-c or a-c voltage readings, check for change in value of 5500-ohm resistor, open 64-ohm d-c shunt resistor, open 145-ohm a-c shunt resistor, shorted meter rectifier, or corroded or bent switch contacts. Corrosion is more likely to form when the instrument is subjected to dampness.

NOTE—If the meter rectifier is replaced, be care-

ful to observe the polarity. The positive (+) terminal is marked by a red dot.

If instrument fails on 150-ohmmeter range, check for open 3-ohm resistor, open 1000-ohm resistor in series with 1.5-volt cell, or weak or bad cell.

If instrument fails on 15,000-ohmmeter range, check for open 396-ohm shunt resistor, open 2200-ohm resistor in series with 4.5-volt battery, or weak batteries.

If instrument fails on 1.5-megohm range, check for open 33,300-ohm resistor or weak 45-volt battery.