



MODEL 500 W/mirror scale,

INSTRUCTIONS

MODEL 500 MULTITESTRE

The Multitester is a compact and reliable instrument designed for use in the production, servicing and maintenance of electronic, radio and television equipment. It will measure a wide range of voltages, currents, resistances and audio power.

It has a sensitivity of 30,000 ohms per volt on DC volts and 15,000 ohms per volt on AC volts. The best of components have been used in the assembly for accuracy and long life. Only 1% tolerance resistors are used for the voltage multipliers, current shunts and resistance circuit. A rugged and sensitive meter movement, 33 microamperes full scale, and clear clean-cut scales are used, protected by an unbreakable plastic window. A specially designed and constructed low resistance switch on a rugged printed circuit board with positive indexing and a novel three-position knob is used for easy and rapid range selection. Heavy duty, low resistance test leads and jacks are included.

The multitester is designed for the following functions:

1. To measure DC voltages from 0.005 to 1,000 volts
2. To measure AC voltages from 0.05 to 1,000 volts
3. To measure DC currents from 1 microampere to 12 amperes
4. To measure audio output voltages
5. To measure audio power levels from -20 to +56 db on a 600 ohm line
6. To obtain an audible indication on low resistance circuits, below about 2 ohms
7. To measure resistances from 5 ohms to 60 megohms

SPECIFICATIONS

DC VOLTAGES: 0 0.25 1 2.5 10 25 100 250 500 1,000 V at 30,000 ohms per volt

AC VOLTAGES: 0 2.5 10 25 100 250 500 1,000V at 15,000 ohms per volt

DC CURRENTS: 0.05 5 50 500mA, 0 12A

RESISTANCE: 0 60K 6M 60M (350, 35K, 350K, at midscale)

DECIBELS: 20 to +56db (0db = 1mW, 600ohms)

AUDIO OUT: Capacitor in series with AC volt ranges

SHORT TEST: Internal buzzer

ACCESSORY: 1 pair heavy test leads

BATTERIES: 1 Burgess Z (1.5V), 1 Burgess Y10 (15V) or equivalents

SIZE: 3 5/16" x 6 5/16" x 2 3/4" (85 x 160 x 70mm)

WEIGHT: 1.4 lb approx. (0.63kg)

GENERAL

The most commonly used ranges for measurements of voltages, currents and resistances are selected by the range switch with the test leads

inserted in the "V- Ω -mA + " and " - COM" jacks. Separate jacks are used for the DC 12A, DC 1,000V, AC 1,000V and OUT connections. Before using the instrument, it is recommended that the reader follow the simple directions for operation in order to gain the maximum service from this multimeter.

DC VOLTAGE MEASUREMENTS

The instrument is capable of measuring DC voltages from 0.005 to 1,000 volts at 30,000 ohms per volt. Full scale voltages of 0.25, 1, 2.5, 10, 25, 100, 250, and 500 volts are selected by the range switch. The 1,000 volt range uses the jack marked DC 1KV. The meter sensitivity of 30,000 ohms per volt minimizes the current drain from the circuits under test, and can be disregarded in most cases. The maximum current consumption is 33 microamperes at full scale for all ranges. The 0.25 and 1 volt ranges are very convenient for measuring the low transistor voltages. The accuracy of the voltage readings is $\pm 2\%$ full scale.

Measurements up to 500 volts.

☆ Insert the red test lead in the "V- Ω -mA + " jack and the black test lead in the " - COM" jack.

☆ Set the range switch pointer with the white marking to the desired range on one of the 8 settings along the left side marked "DCV". If the voltage is not known at the start of tests, then set to 600 and work down until a reading is obtained reasonably high up on the scale.

☆ The test lead tips are connected across the load under test. Connect the red test lead to the positive side and the black test lead to the negative side of the load.

☆ Make certain that the proper polarities are observed, otherwise the pointer will swing in the opposite direction.

☆ Read along the black arc markings. The full scale readings are as follows:

Range	Scale	Multiplier	volts per division
500V	0 50	10	10
250	0 250	1	5
100	0 10	10	2
25	0 250	.1	.5
10	0 10	1	.2
2.5	0 250	.01	.05
1	0 10	.1	.02
0.25	0 250	.001	.005

NOTE: The three lower ranges should be used with care.

Measurements up to 1,000 volts.

The 1,000 volt range uses the "DC 1KV" jack for the insertion of the red test lead. The black test lead is inserted in the " - COM" jack. The range switch is set to "500 & UP". The readings are as follows:

Range	Scale	Multiplier	volts per division
1,000V	0 10	100	20

URING HIGH VOLTAGES ESPECIALLY WHEN THESE VOLTAGES ARE NOT KNOWN.

AC VOLTAGE MEASUREMENTS

The instrument will measure AC voltages from 0.05 to 1,000 volts at 15,000 ohms per volt. The full scale readings are 2.5, 10, 25, 100, 250, 500 and 1,000 volts. The accuracy of the AC voltage readings is $\pm 4\%$ of full scale.

Measurements up to 500 volts.

- ⚡ Insert the red and black test leads in the "V- Ω -mA + " and the "COM" jacks, respectively.
- ⚡ Set the range switch pointer with the white marking to the desired range on the right hand side marked "ACV". If the voltage is not known, start from the 500V setting and work down until a reading is obtained reasonably high up on the scale.
- ⚡ The test leads are connected across the load or source under test. The polarities are not important but it is a good habit to use the black test lead for the lower potential or the grounded side of the circuit.
- ⚡ There are two scales for the AC voltages, 0-2.5V and the other for the higher voltages. The AC scales are printed in red. The range markings for the higher voltages are the same as those for the DC ranges. The readings are as follows for the full scales:

Range	Scale-RED	Multiplier	volts per division
500V	0 50	10	10
250	0 250	1	5
100	0 10	10	2
25	0 250	.1	.5
10	0 10	1	1
2.5	0 250	.01	.05

Measurements up to 1,000 volts.

The "AC 1KV" jack is used for the 1,000 volt range. Insert the red test lead in this jack, and set the range switch to "500 & UP". The readings are as follows:

Range	Scale	Multiplier	volts per division
1,000V	0 10	100	20

CAUTION!! BE CAREFUL WHEN MEASURING HIGH AC VOLTAGES!!

RESISTANCE MEASUREMENTS

Resistances from 5 ohms to 60 megohms can be measured. The accuracy is within 3% of the total scale length on either side of the indicated value.

Insert the red and black test leads in the "V- Ω -mA + " and "- COM" jacks respectively.

Set the range switch to one of the ranges, depending upon the resistance to be measured.

Range	Resistance, ohms	Center scale
$\times 10K$	0 60K	350 ohms
$\times 1K$	0 6Meg	35 K
$\times 10K$	0 60Meg	350 K

Note: K kilo 1,000; Meg 1,000,000

Before measuring, it is necessary to make a zero ohm check, or a shorting check. First connect the tips of the test leads together, and the pointer should swing to the 0Ω , or the extreme right on the outer scale.

To set to the "0" mark, slowly rotate the " Ω ADJ." knob on the left side of the panel, keeping the tips connected together. The meter is now ready to measure resistance.

The test leads are then connected across the resistance device. The resistance values are read on a single scale, and it will be necessary to apply one of the three multipliers, depending on the range.

In order to make the most effective use of the ohm ranges, it is suggested that the following settings be used:

$\times 10$ up to 2,000 ohms (2K)

$\times 1K$ up to 200 K

$\times 10K$ over 200 K

IMPORTANT !!

When measuring the resistance of a component wired in a radio, amplifier, transmitter, etc., it is necessary that the power source is turned off in the equipment. This is to prevent damage to the meter. It is also important to make certain that one or both ends of the device be "open" or free. It is best to check on the schematic of the equipment to be sure. If there is any doubt, disconnect one end from the circuit.

Battery replacement. When the zero ohm check fails to bring the pointer to the " 0Ω " mark, the batteries must be replaced. The case is opened by removing the four rubber feet and the fastening screws at the bottom. The batteries are easily replaced in the respective compartments. Due to the greater current requirements from the 1.5 volt cell, it will usually be necessary to make more frequent replacements than 15 volt unit.

DC CURRENT MEASUREMENTS

With this instrument, DC currents from 1 microampere to 12 amperes can be measured. Currents up to 500 milliamperes are measured by setting the range switch to one of the four positions, 500, 50, 5 or 0.05 DC mA, along the lower arc. The 12 ampere range uses a jack. The accuracies are 2% up to and including the 500 mA range and 4%

for the 12 ampere range, of full scale.

DC currents up to 500 mA.

☆Insert the red and black test leads in the "V-Ω-mA + " and " COM " jacks respectively.

☆Set the range switch to "500 DCmA"

☆Turn off the power to the equipment under test. Open the circuit under test, and connect the test leads in series, observing the proper polarities, the red test lead to the plus and black test lead to the minus.

☆Turn on the power. If the pointer does not swing in the expected direction, turn the power off and reverse the test lead connections. The range switch should be set at 50 or 5 mA for lower currents.

☆When using the 0.05 mA position, extreme care should be taken by making certain that the current in the circuit is in the microampere range. Check up on the schematic, or make a rough calculation to be sure, and prevent a meter burnout.

☆Always turn the power off when removing the test leads, and the power should be turned on only after the circuit connections have been restored.

☆Too much caution cannot be taken when using the instrument for current measurements.

Using the 12 ampere DC current range.

This range is mainly used for testing the current consumption of auto radios and for battery charging.

☆Set the range switch to "12A", and insert the red test lead in the DC 12A jack at the left side of the panel, and the black test lead in the "- COM" jack.

☆The power should be turned off when connecting the test leads in the circuit.

☆The current is read on the black scale, second from the bottom on the dial, marked DC 0 to 12A.

☆Battery measurements. The "Current Capacity", or the "AMPERE-HOURS" of any type of a battery should never be measured directly with this instrument using the current ranges. Special equipment and procedures are required for this type of data.

BUZZER OPERATION

This instrument is provided with a self-contained buzzer actuated by the same 1.5 volt battery for measuring OHMS. It is possible to check connections within the equipment under test for opens, short-circuits, etc., through audible means. Resistances under 1 or 2 ohms are indicated audibly, and is a convenient means of checking for continuity.

☆Set the range switch to BUZZ and connect the test leads across the circuit under test.

☆If the resistance is more than about 2 ohms, there will be no sound.

☆Do not operate the buzzer continuously as this will wear out the battery.

AUDIO OUTPUT MEASUREMENTS

The instrument is very convenient for measurements of the output vol-

tages in audio circuits. The "ACV" ranges are used to indicate the voltages across the primary of an output transformer, lines, speaker moving coils, etc. The high internal resistances of the various ranges result in very low loading of the circuits. The internal series capacitor effectively blocks out the DC component. It is to be noted that capacitor is rated at 600 working volts, and the sum of the DC voltage plus the signal voltage should not exceed this value.

- ✧ Insert the red test lead in the "OUT" jack and the black test lead in the "- COM" jack.
- ✧ Set the range switch to "ACV" 500, 250 or 100 for measurements across the primaries of the output transformers and 25, 10 or 2.5 for speaker moving coils.
- ✧ Where the DC voltage exceeds 400 volts, an external 0.1 mfd rated at 1,000 WVDC should be used in series with the red lead, with the latter inserted in the "V-Ω-mA + " jack.
- ✧ Where there are no DC voltages present in the circuit under test, the output measurements can be made with the instrument set up as for AC voltage measurements, as outlined above.

DECIBEL MEASUREMENTS

This instrument will indicate the audio power level in db (decibels) referred to 1 milliwatt (0.775 V) on a 600 ohm line. The total range is from -20 to +56 db (0.01 milliwatt to 200 watts). The "ACV" settings and the lowest scale, marked from -20 to +10 db, are used. The latter is the common scale used for all ranges, and for the higher levels, the AC voltage switch settings are changed with the increase in the levels. The appropriate number of db, as shown in the table on the dial is added. The actual method of determining the power levels is by measuring the voltage across the 600 ohm line or load, and the procedure is the same as for the AC voltage measurements.

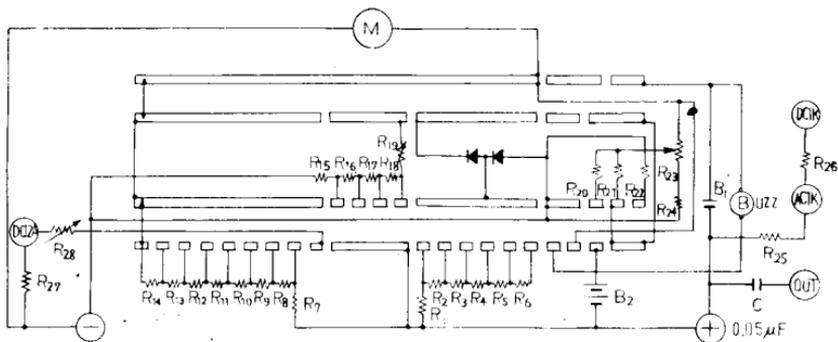
- ✧ Insert the red and black test leads in the "V-Ω-mA + " and "- COM" jacks respectively.
- ✧ Set the range switch to "ACV" 500 as a precautionary measure and connect the test leads across the 600 ohm load. Lower the voltage range as required. Add the db shown in the table on the dial for the range used.
- ✧ For impedances other than 600 ohms, comparative measurement can be made on the db basis since the decibel is a ratio unit. An arbitrary setting can be employed for a given set of conditions in the equipment under test and subsequent readings referred to this value.
- ✧ If the load under test has DC voltage present, then the red test lead should be inserted in the "OUT" jack to put the blocking capacitor in circuit.

"OFF" POSITION

The instrument is provided with an "OFF" position where the range switch should be set when not in use or during transit.

The meter is heavily damped to prevent damage to the movement.

SCHEMATIC DIAGRAM



PARTS LIST

<table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 10%;">R 1</td><td style="width: 15%;">27 K</td><td style="width: 10%;">ohm</td><td></td></tr> <tr><td>R 2</td><td>97.5 K</td><td></td><td></td></tr> <tr><td>R 3</td><td>195 K</td><td></td><td></td></tr> <tr><td>R 4</td><td>975 K</td><td></td><td></td></tr> <tr><td>R 5</td><td>1.95 M</td><td></td><td></td></tr> <tr><td>R 6</td><td>3.25 M</td><td></td><td></td></tr> <tr><td>R 7</td><td>7 K</td><td>pot</td><td></td></tr> <tr><td>R 8</td><td>22.5 K</td><td></td><td></td></tr> <tr><td>R 9</td><td>45 K</td><td></td><td></td></tr> <tr><td>R 10</td><td>225 K</td><td></td><td></td></tr> <tr><td>R 11</td><td>450 K</td><td></td><td></td></tr> <tr><td>R 12</td><td>2.25 M</td><td></td><td></td></tr> <tr><td>R 13</td><td>4.5 M</td><td></td><td></td></tr> <tr><td>R 14</td><td>7.5 M</td><td></td><td></td></tr> </table>	R 1	27 K	ohm		R 2	97.5 K			R 3	195 K			R 4	975 K			R 5	1.95 M			R 6	3.25 M			R 7	7 K	pot		R 8	22.5 K			R 9	45 K			R 10	225 K			R 11	450 K			R 12	2.25 M			R 13	4.5 M			R 14	7.5 M			<table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 10%;">R 15</td><td style="width: 15%;">1</td><td style="width: 10%;">ohm</td><td></td></tr> <tr><td>R 16</td><td>9</td><td>ohm</td><td></td></tr> <tr><td>R 17</td><td>90</td><td>ohm</td><td></td></tr> <tr><td>R 18</td><td>9.9 K</td><td></td><td></td></tr> <tr><td>☆R 19</td><td>5 K</td><td></td><td>pot</td></tr> <tr><td>☆R 20</td><td>300 K</td><td></td><td></td></tr> <tr><td>☆R 21</td><td>27 K</td><td></td><td></td></tr> <tr><td>☆R 22</td><td>340</td><td>ohm</td><td></td></tr> <tr><td>☆R 23</td><td>10 K</td><td>ohm</td><td>ADJ</td></tr> <tr><td>☆R 24</td><td>15 K</td><td></td><td></td></tr> <tr><td>R 25</td><td>6.5 M</td><td></td><td></td></tr> <tr><td>R 26</td><td>8.5 M</td><td></td><td></td></tr> <tr><td>R 27</td><td>0.01</td><td>ohm</td><td></td></tr> <tr><td>☆R 28</td><td>5 K</td><td></td><td></td></tr> </table>	R 15	1	ohm		R 16	9	ohm		R 17	90	ohm		R 18	9.9 K			☆R 19	5 K		pot	☆R 20	300 K			☆R 21	27 K			☆R 22	340	ohm		☆R 23	10 K	ohm	ADJ	☆R 24	15 K			R 25	6.5 M			R 26	8.5 M			R 27	0.01	ohm		☆R 28	5 K		
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<p>M: Meter, 33 DC microamps f. s.</p> <p>RECT: Rectifier</p> <p>BUZZ: Buzzer</p> <p>C: 0.05 μF, 600 WVDC</p> <p>B1: 1.5V Battery : Burgess Z, Eveready 912, etc.</p> <p>B2: 15V Battery : Burgess Y10, Eveready 504, etc.</p>																																																																																																																	

☆ Adjustment

Printed in Japan