MI-10KV

ELECTRONIC MEGOHMMETER

- TECHNICAL SPECIFICATION
- OPERATING INSTRUCTIONS

WARNING

Hazardous voltages exist on the terminals during operation.

Although output current of the megohmmeter is limited, external capacities are charged to very high potentials and there is no protection against them. So, this equipment should only be used by a suitably trained and competent person, strictly applying corresponding security standards.

DESCRIPTION

The CIRCUTOR MI-10KV electronic megohmmeter is a versatile, portable, user friendly, rugged instrument. It uses an efficient, well experienced technology providing reliable, safe and accurate insulation resistance measurements up to 2.000.000MΩ, with four test voltages: 1.000, 2.000, 5.000 and 10.000 V.

Due to its compact size and reduced weight, mechanical strength, self-contained battery supply, this apparatus is particularly suitable for field tests under severe environments. It is easily to be carried, very simple to be operated and stands severe handling conditions including frequent shocks, extreme temperatures, vibrations during transportation through hard roads, long direct exposure to solar radiation, dust, sand and other air-borne impurities, etc. Accuracy is not affected by all these adverse conditions and it is still comparable with that of the best laboratory instruments.

IMMUNITY AGAINST ELECTRIC AND MAGNETIC FIELDS

CIRCUTOR megohmmeters feature an effective filtering system that improves immunity against electromagnetic disturbances and prevents variations induced by industrial frequency fields.

OPERATOR'S SAFETY

Due to the high voltages involved, operator's safety is a must. CIRCUTOR megohmmeters were designed considering this outstanding aspect:

- ENCLOSURE: Molded in high dielectric strength plastic. There are no conductive parts accessible to the operator with the exception of the output terminals. This terminals are located in a hidden and protected position on the enclosure.

• HIGH-VOLTAGE INDICATOR LIGHT: An indicator light (LED) is warning the presence of high voltage at the output terminal during a measurement and remains lit until the discharge process is completed.

TECHNICAL SPECIFICATIONS

MEASURING INTERVALS, TEST VOLTAGES

Test Voltage (volts)	MEASURING INTERVALS (MΩ)				Scale Multiplier	Output. Resistance
	A	B	C	C x 10		
1.000	0- 20	20 - 400	200 - 20.000	2.000 - 200.000	x 2	2 MΩ.
2.000	0- 40	40 - 800	400 - 40.000	4.000 - 400.000	x 5	4 MΩ
5.000	0-100	100 - 2.000	1.000 -100.000	10.000 -1.000.000	x 10	10 MΩ
10.000	0-200	200 - 4.000	2.000 -200.000	20.000 - 2.000.000	X 20	20 MΩ

TEST VOLTAGE STABILITY

1 % during full battery service life.

SHORT-CIRCUIT CURRENT

500 μ A.

CLASS

Class 2 (related scale size) @ 30 º C.

BATTERY TEST

Allows checking battery status under real consumption conditions without interrupting the generation of test voltages.

GUARD TERMINAL

Allows the measurement of very high resistance values, avoiding the effect of stray resistances.

CARRYING CASE

A strong synthetic leather carrying case provides easy transportation for the instrument and attachments. The megohmmeter may operate without being removed from the carrying case.

DIMENSIONS AND WEIGHT

290 x 155 x130 mm (outside dimensions without carrying case)

8 kg. (including apparatus, carrying case, battery and test probes)

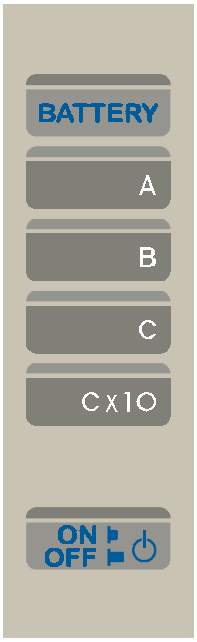
ENVIRONMENTAL OPERATING CONDITIONS

This apparatus is designed to be used in outdoors field work under very unfavorable weather conditions. Room temperature may vary between 0°C and +50°C, with relative humidity close to saturation point without affecting the instrument operation.

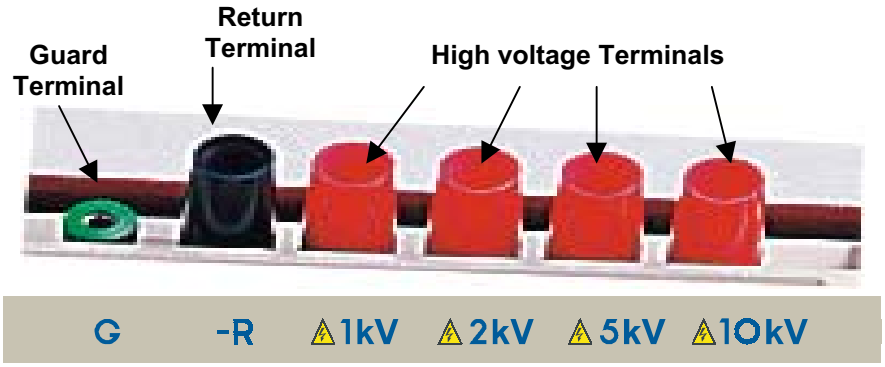
ATTACHMENTS SUPPLIED

Every megohmmeter is supplied with a full set of test leads, rechargeable battery, charger, carrying and operating manual.

KEYBOARD



BATTERY	When pressed, the battery test is performed under actual consumption conditions
A	Low resistance range. Read values at *A* scale
B	Read values at *B* scale
C	Read values at *C* scale
C x 1O	Higher resistance range. Read values at *C* scale, then multiply it by 10.
ON/OFF	*ON/OFF* Switch



OPERATING INSTRUCTIONS

1) Be sure that there are no voltage differences between the points at which the megohmmeter will be connected, nor between them and ground.

2) Determine the value of test voltage to be used in the insulation resistance measurement.

3) Connect the ***red banana pin*** of the ***red*** cable to the 1.000, 2.000, 5.000 or 10.000 V terminal in accordance with the selected test voltage.

4) Connect the ***black cable*** to the ***-R*** megohmmeter terminal and the yellow terminal to terminal ***G***.

5) The green ***GUARD*** terminal is not always used. Technical Note #32 explains the use of *GUARD* terminal in order to minimizing the effect of stray resistances. When measurement is carried out between parts which none of them is grounded, (like between high-side and low-side windings of a transformer), *GUARD* terminal must be connected to ground in order to fix the apparatus potential. **At any time a measurement is performed, either the "-R " or *GUARD* terminals must be connected to ground but never both simultaneously.** If none of these terminals are connected to ground, the megohmmeter can reach a high potential that may result in an unstable non-reliable reading. **If both terminals are simultaneously connected to ground**, there is a short-circuit between them and consequently the megohmmeter **will measure with error**.

6) Connect the free ends of cables (*alligator clips*) to the element to be measured.

7) Before turning on the apparatus, be sure that the key corresponding to ***A*** scale is pressed. Turn on the apparatus by pressing the ***ON/OFF*** key. Then the high-voltage generator starts operating and the corresponding indication light turns on at the front panel. The meter pointer will indicate the value of the unknown resistance. If the element to be measured is strongly capacitive it will initially indicate a low resistance value, which will be gradually increased while the charging of that capacitance takes place.

8) When the measured resistance exceeds the maximum value in range ***A***, press range ***B*** key, and if still the value is not achieved, press keys of ranges ***C*** or ***Cx10***, as required.

9) Always remember to multiply the reading by the factor stated in the following table, depending on selected test voltage:

1.000 V x 2
2.000 V x 4
5.000 V x 10
10.000 V x 20

10) When key ***C x 10*** is used, reading shall be carried out in range ***C*** and shall be multiplied by 10, in addition to the factor corresponding to the test voltage.

11) To finish measurement press again and release ***ON/OFF*** key. The megohmmeter will start discharging the potentials accumulated in the apparatus internal capacitances and in those of the element under test as well. When this discharging process is over (up to 60 seconds after turn off) the high-voltage indicator will turn off automatically. Then, test leads may be disconnected.

12) In certain instances, when the apparatus is disconnected the pointer exceeds the infinite position to the right side. This is a normal behavior.

13) **Checking battery status**. Battery measurement can be performed without interrupting high-voltage generation, which will provide a better evaluation of the battery status, by pressing the ***BATTERY*** key during the measurement. So, the battery test is performed under actual consumption conditions and, for long lasting measurements, (i.e. *Polarization Index*), the evolution of battery status can be checked without affecting the measurement.

The meter pointer should stop over the blue zone. If the pointer stop over the red zone this means that the battery is discharged and shall be charged

14) **Infinite setting.** The mechanical zero of galvanometer must be periodically checked. In order perform this checking, be sure that the megohmmeter is off. The pointer should stay on the right end of the scale just over the infinite mark on scale ***C***. In other case, the plastic screw at the bottom of the galvanometer acrylic cover shall be adjusted.

TECHNICAL NOTE # 32

USE OF *GUARD* TERMINAL IN MEGOHMMETERS

When insulation resistance measurements are performed with megohmmeters, specially with high-sensitivity instruments measuring high resistance values, the use of the *GUARD* terminal avoids the harmful influence of stray resistances.

In order to better explain the function of this terminal, let us start reviewing the megohmmeter basic circuit diagram of Fig. 1.

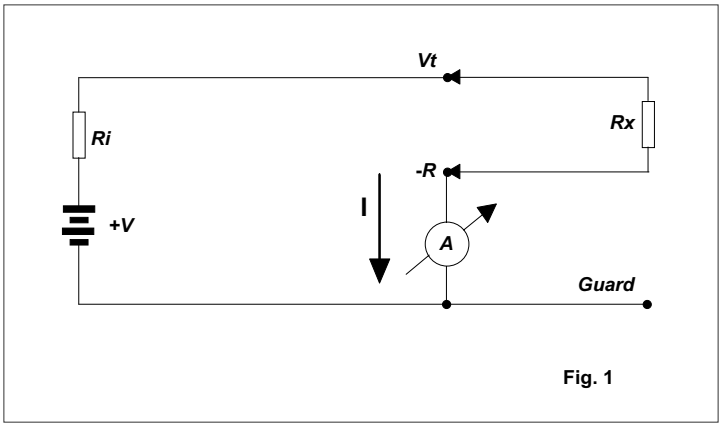


Fig. 1

Where:

V : DC high-voltage generator

Ri: Generator internal resistance

A : Indicator meter (microammeter)

The unknown resistance (***Rx***) is connected between ***Vt*** and ***R*** terminals. Its value determines the current passing through the circuit, which in turn is indicated by the microammeter. The value of ***Rx*** can be determined as follows:

$$Rx = \frac{V}{I} - Ri$$

In many cases the resistance to be measured is in parallel with other stray resistances which influence on Rx should be minimized.

A typical example of this situation is when the insulation resistance between primary and secondary windings of a transformer mounted inside a metal housing is to be measured.

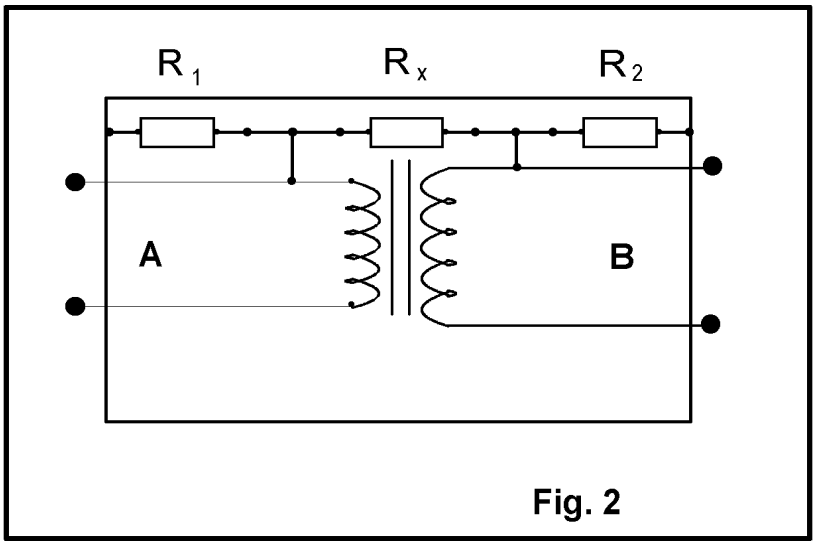


Fig. 2

Rx: Insulation resistance between primary and secondary winding.

R1: Insulation resistance between primary winding and housing.

R2: Insulation resistance between secondary winding and housing.

If megohmmeter (terminals ***Vt*** and ***R***) is connected to transformer terminals **A** and **B**, and considering that the resistance of the coils on each side of the transformer may be disregarded, **Rx** appears to be in parallel with (**R1 + R2**).

The situation is changed if we connect the transformer housing to **GUARD** terminal.

Then the circuit will be:

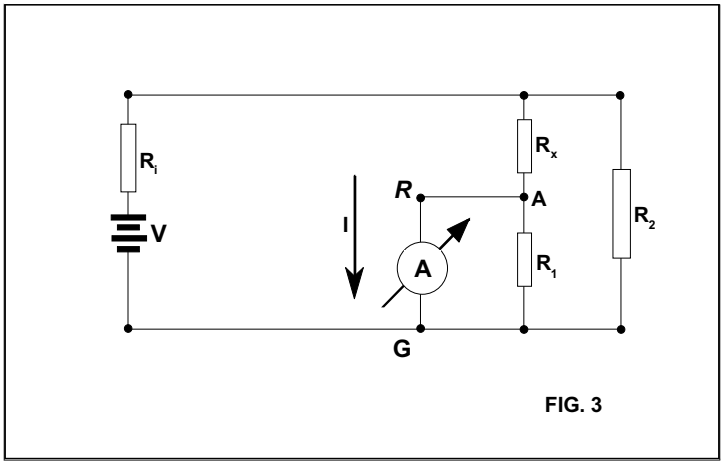


FIG. 3

In the circuit of Fig. 3 it may be noted that R1 is in parallel with a low-value resistance (the one of the microammeter) therefore its influence is minimized during reading.