ENGLISH

User manual

Release EN 2.01 - 13/01/2014

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1. SAFETY PRECAUTIONS AND PROCEDURES

This instrument complies with safety IEC/EN61557-1 and IEC/EN61010-1 guidelines related to electronic measuring instruments.

CAUTION

For your own safety and to avoid damaging the instrument follow the procedures described in this instruction manual and read carefully all notes preceded by this symbol ⚠.

When taking measurements:

- Avoid doing that in humid or wet places - make sure that humidity is within the limits indicated in section “environmental conditions”. Avoid doing that in rooms where explosive gas, combustible gas, steam or excessive dust is present
- Keep you insulated from the object under test
- Do not touch exposed metal parts such as test lead ends, sockets, fixing objects, circuits etc
- Avoid doing that if you notice anomalous conditions such as breakages, deformations, fractures, leakages of battery liquid, blind display etc.
- Be particularly careful when measuring voltages exceeding 25V in particular places (building yards, swimming pools, etc.) and 50V in ordinary places to avoid risks of electrical shocks.

The following symbols are used:

CAUTION - refer to the instruction manual - an improper use may damage the instrument or its components

DC voltage

AC voltage

Danger high voltage: risk of electric shocks.

Double insulated meter.

1.1. PRELIMINARY INSTRUCTIONS

- This instrument has been designed for use in environments of pollution degree 2
- It can be used for tests on electrical installations of overvoltage category III 265V and 550V maximum rated interlinked voltage (and to earth)
- You are recommended to respect the usual safety regulations aimed at protecting you against dangerous currents and protecting the instrument against improper use
- Only the original test leads supplied along with the instrument guarantee compliance with the safety Standards in force. They must be in a good conditions and, if necessary, replaced with identical ones
- Do not test nor connect to any circuit exceeding the specified overload protection
- Do not take measurements under environmental conditions exceeding the limits indicated in this manual
- Make sure that batteries are correctly installed
- Before connecting the test probes to the installation make sure that the right function is chosen.

1.2. DURING USE

Read the recommendations which follow and the instructions in this manual:

CAUTION

An improper use may damage the instrument and/or its components or injure the operator.

- Before selecting any function, first disconnect the test leads from the circuit under test
- When the instrument is connected to circuits never touch any unused terminal
- Do not measure resistance in presence of external voltages; although the instrument is protected, an excessive voltage may cause malfunctioning.

CAUTION

If the “low battery” symbol is displayed during use interrupt testing and replace batteries following the procedure described in § 5.2.

1.3. AFTER USE

- Disconnect the test leads from the circuit under test and switch off the instrument
- If you expect not to use the instrument for a long period remove batteries.

1.4. OVERVOLTAGE CATEGORIES - DEFINITIONS

Standard IEC/EN61010-1 (Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General requirements) defines what a measurement category (usually called “overvoltage category”) is. At § 6.7.4: Measuring circuits it says:

(OMISSIS)

Circuits are divided into the following measurement categories:

- **Measurement category IV** is for measurements performed at the source of the low-voltage installation.

  Examples are electricity meters and measurements on primary overcurrent protection devices and ripple control units.
- **Measurement category III** is for measurements performed in the building installation.

  Examples are measurements on distribution boards, circuit breakers, wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and equipment for industrial use and some other equipment, for example, stationary motors with permanent connection to fixed installation.
- **Measurement category II** is for measurements performed on circuits directly connected to the low voltage installation.

  Examples are measurements on household appliances, portable tools and similar equipment.
- **Measurement category I** is for measurements performed on circuits not directly connected to MAINS.

  Examples are measurements on circuits not derived from MAINS, and specially protected (internal) MAINS-derived circuits. In the latter case, transient stresses are variable; for that reason, the norm requires that the transient withstand capability of the equipment is made known to the user.

2. GENERAL DESCRIPTION

Dear Customer, the instrument you have purchased, whether used according to the instructions given in this manual, will grant you accurate and reliable measurements. Thanks to a development of newest conception assuring double insulation and overvoltage category III you will enjoy the highest safety.

2.1. FEATURES

- **1000V - MΩ**: insulation resistance measurement with test DC voltage of 1000V
- **500V - MΩ**: insulation resistance measurement with test DC voltage of 500V
- **250V - MΩ**: insulation resistance measurement with test DC voltage of 250V
- **LoΩ**: continuity test on earth, protective and potential equalising conductors with a test current higher than 200mA and open voltage ranging from 4V to 24V
- **Ω•))**: measurement of resistance / continuity with sound signal
- **$\tilde{V}$**: AC voltage measurement
- **$\overline{V}$**: DC voltage measurement

3. PREPARATION FOR USE

3.1. PRELIMINARY CHECKS

This instrument was checked both mechanically and electrically prior to shipment. All possible cares and precautions were taken to let you receive the instrument in perfect conditions. Notwithstanding we suggest you to check it rapidly (eventual damages may have occurred during transport – if so please contact the local distributor from whom you bought the item). Make sure that all standard accessories mentioned in § 6.3. are included. Should you have to return back the instrument for any reason please follow the instructions mentioned in § 7.

3.2. POWER SUPPLY

The instrument is powered by 4x1.5V batteries type AA LR6. When batteries are low, a low battery indication is displayed. To replace/insert batteries follow the instructions indicated in § 5.2.

3.3. CALIBRATION

The instrument complies with the technical specifications contained in this manual and such compliance is guaranteed for 1 year. Annual recalibration is recommended.

3.4. STORAGE

After a period of storage in extreme environmental conditions exceeding the limits mentioned in § 6.2.1 let the instrument resume normal measuring conditions before using it.

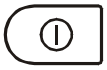
4. OPERATING INSTRUCTIONS

4.1. INSTRUMENT - DESCRIPTION

CAPTION:

1. Inputs
2. Inputs
3. Display
4. ON/OFF key
5. LOCK key
6. ZERO and backlight key
7. GO key
8. FUNC HOLD key

Fig. 1: Instrument description



key to switch on/off the instrument

LOCK key to select the continuous mode measurement and to set the insulation measurement time

ZERO key to calibrate the cables being used
key to on and off the backlight

GO key to start a measurement

ARROW keys to select measurements

4.1.1. Switch on of meter

When the instrument is turned on all display segments are lit for just a while. Then the instrument is ready for DC voltage measurement.

4.1.2. Auto Power OFF

The instrument automatically turns off 15 minutes after last pressure of keys. To resume operation turn on the instrument again. When the instrument must be used for long voltage measurements, the operator may need to disable the auto power off function. In order to do so press the **LOCK** key. On next switch on autopower off will be automatically restored. On the instrument's LCD the symbol is displayed only when auto power off is active.

4.1.3. Backlight

Press **ZERO** key to activate backlight function in any position of selector. This function is automatically off after about 30s or pressing again **ZERO** key.

4.2. V⎓: DC VOLTAGE MEASUREMENT

CAUTION

The maximum input voltage is 550+10%V. Don't try to measure higher voltages to avoid risks of electrical shocks or serious damages to the instrument.

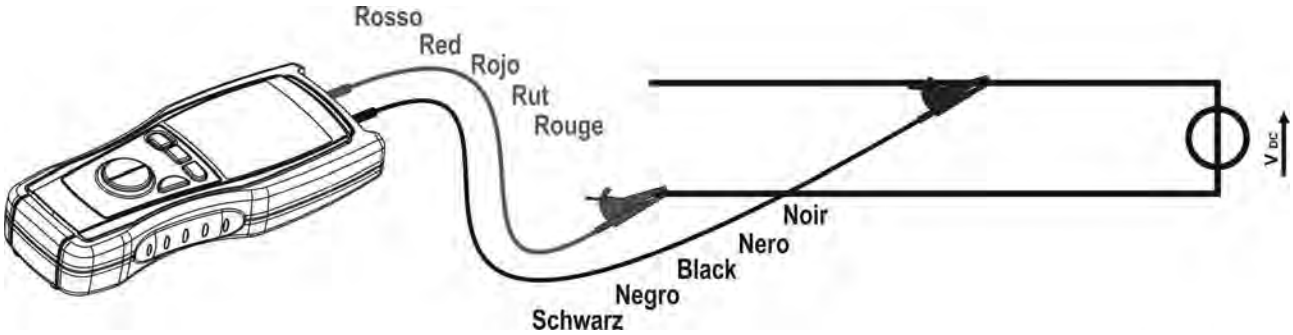
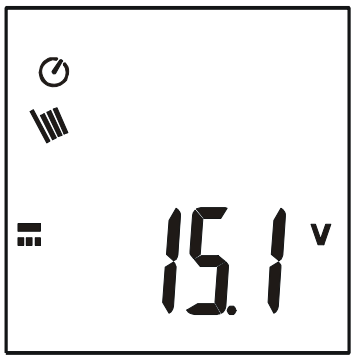


Fig. 2: Connection of the instrument's terminals during V⎓ test

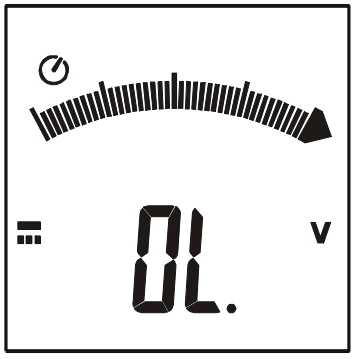
1. Turn on the instrument
2. Press the arrow keys to select V⎓
3. Insert the black and red cables in the corresponding input terminals of the instrument
4. If necessary, insert the croco clips on the test probes
5. Connect the cables to the desired points of the circuit under test as shown in Fig. 2. The voltage value will be displayed
6. Example of display of DC voltage value



DC voltage value

4.2.1. Anomalous cases which may occur during V⎓ measurements

1. The maximum input voltage is 550+10%V. If the detected voltage value exceeds 605V RMS the instrument displays the screen beside. Disconnect immediately the instrument from the circuit under test to avoid electrical shocks and damages to the instrument



4.3. $\tilde{V}$: AC VOLTAGE MEASUREMENT

CAUTION

The maximum input voltage is 550+10%V. Don't try to measure higher voltages to avoid risks of electrical shocks or serious damages to the instrument.

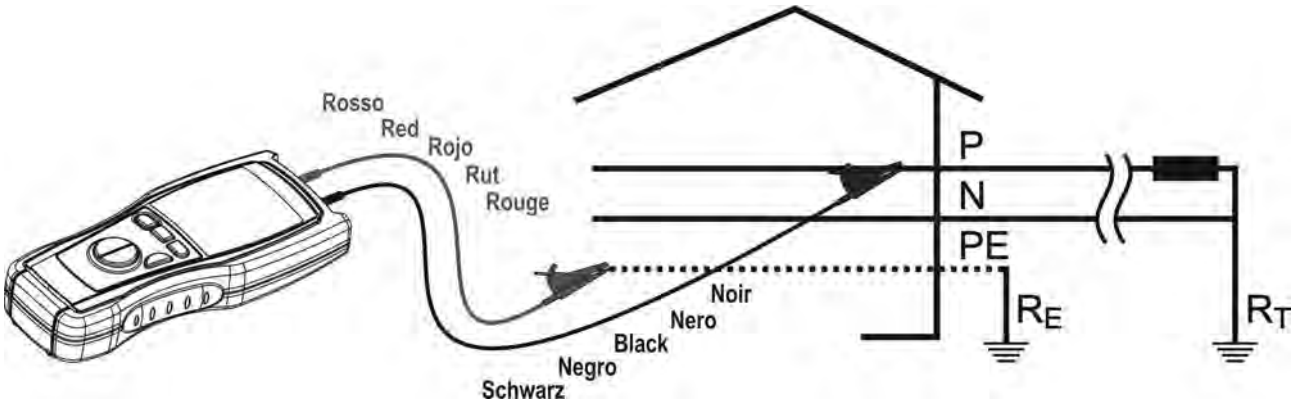
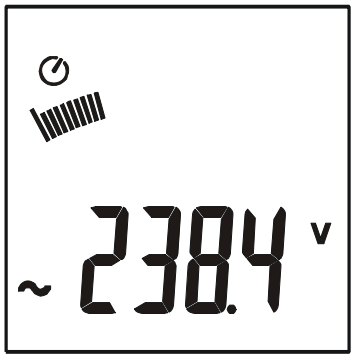


Fig. 3: Connection of the instrument's terminals during $\tilde{V}$ test

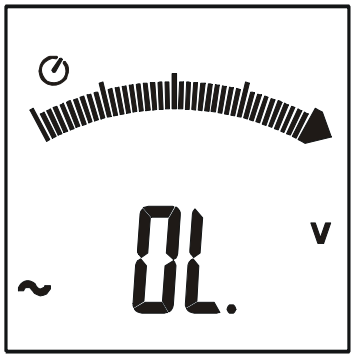
1. Turn on the instrument
2. Press the arrow keys to select $\tilde{V}$
3. Insert the black and red cables in the corresponding input terminals of the instrument
4. If necessary, insert the croco clips on the test probes
5. Connect the cables to the desired points of the circuit under test as shown in Fig. 3. The voltage value will be displayed
6. Example of display of AC voltage value



AC voltage value

4.3.1. Anomalous cases which may occur during $\tilde{V}$ measurements

1. The maximum input voltage is 550+10%V.
   If the detected voltage value exceeds 605V RMS the instrument displays the screen beside.
   Disconnect immediately the instrument from the circuit under test to avoid electrical shocks and damages to the instrument



4.4. Ω•))): RESISTANCE MEASUREMENT AND CONTINUITY TEST

CAUTION

Before taking resistance measurements make sure that the circuit under test is not powered and that eventual condensers are discharged. The measured value is out of accuracy if an input voltage is present.

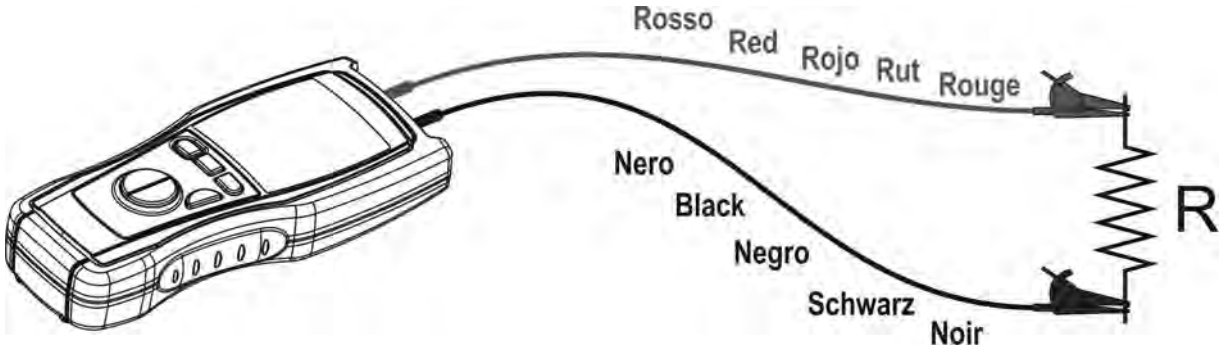


Fig. 4: Connection of the instrument's terminals during Ω•))) test

1. (ON/OFF) Turn on the instrument
2. (arrow keys) Press the arrow keys to select Ω•)))
3. Insert the black and red cables in the corresponding input terminals of the instrument
4. If the measuring cables being used have not been calibrated, first calibrate them as described in § 4.4.1
5. Position the test probes on the desired points of the circuit under test (see Fig. 4)
6. (GO) Press **GO** to perform the measurement

Resistance value

7. Example of display of resistance value. If such value is lower than 2Ω the instrument emits an acoustic signal
8. (LOCK) + (GO) Press **LOCK** and **GO** together to perform the measurement in continuous mode, the symbol **LOCK** is displayed. Press **GO** another time to stop the continuous mode measurement
9. In lock mode the instrument emits an acoustic signal and the auto power off is disabled

4.4.1. "ZERO" mode

1. Any addition or replacement of cables, extensions and croco clips nullify the previous calibration and make necessary a new calibration before performing further measurements. Therefore the instrument must be calibrated in the same conditions at which it will operate during measurements

2. Short-circuit the cable ends with each other as shown in Fig. 5 making sure that the metallic parts of test probes and crocodiles are in good touch

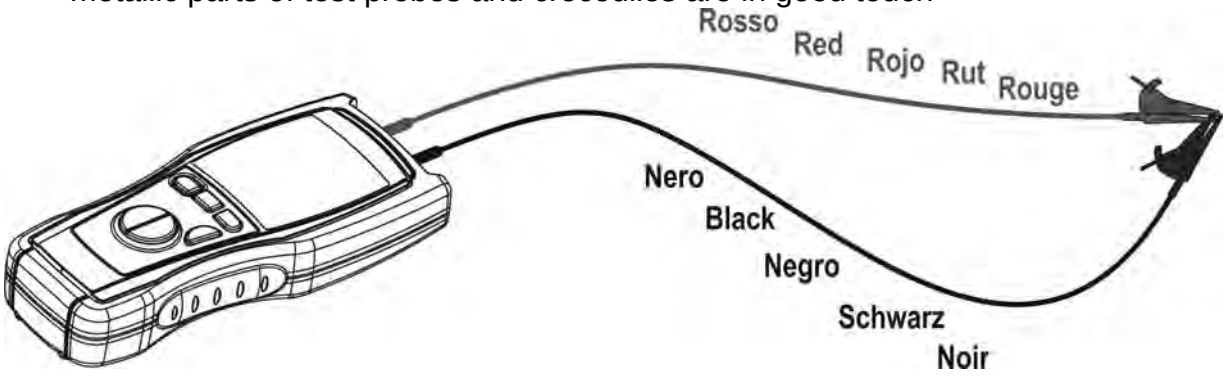


Fig. 5: Connection of the instrument's terminals during calibration procedure

3. GO Press **GO** to perform the measurement

4. MODE PEAK Press and hold **ZERO** key for 2s. The instrument resets the resistance of the cables, the symbol **ZERO** is displayed

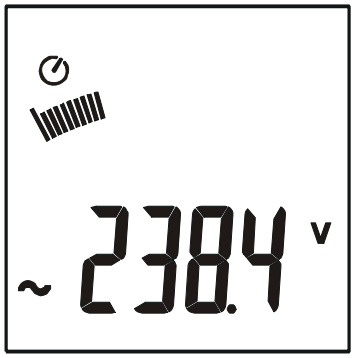
5. The measured value is stored by the instrument and used as offset (which means it's deducted from all continuity tests performed) until a new pressing of the **ZERO** key for 2s that voids the calibration

6. Each time the instrument is switched off or changing position of selector, the calibrated value is lost

4.4.2. Anomalous cases which may occur during Ω•)) measurement

1. The full scale of the instrument is 199.9Ω. If the resistance value is higher than this value, or in case of open or interrupted probes, the instrument displays the screen beside.

2. If the voltage present at the terminals is higher than 24V the instrument does not perform the test. The screen beside is displayed



Input voltage

4.5. LoΩ: CONTINUITY TEST ON EARTH, PROTECTIVE AND EQUALIZING POTENTIAL CONDUCTORS

The measurement is performed with a test current higher than 200mA (R<5Ω) and open circuit voltage ranging from 4 to 24V DC according IEC/EN 61557-4 and VDE 0413 part 4.

CAUTION

Before taking resistance measurements make sure that the circuit under test is not powered and that eventual condensers are discharged. The measured value is out of accuracy if an input voltage is present.

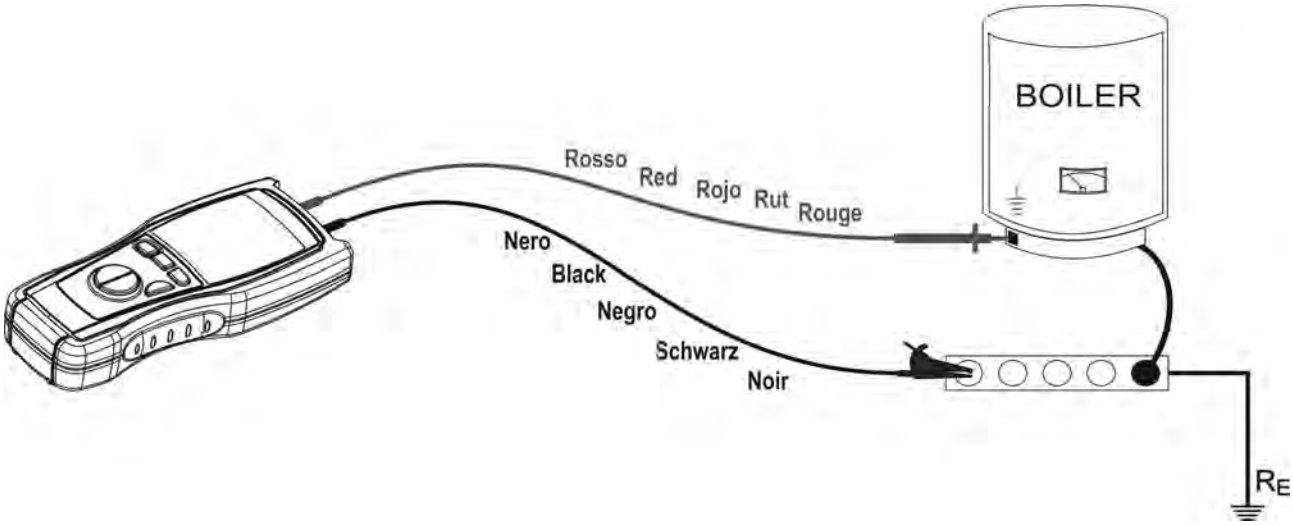
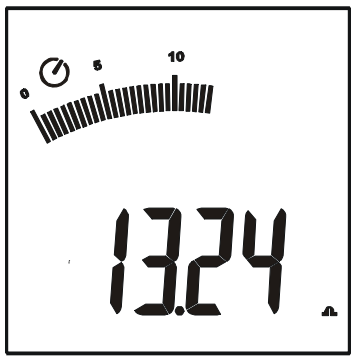


Fig. 6: Connection of the instrument's terminals during LoΩ test

1. Turn on the instrument
2. Press the arrow keys to select LoΩ
3. Insert the black and red cables in the corresponding input terminals of the instrument
4. If the measuring cables being used have not been calibrated, first calibrate them as described in § 4.5.1
5. Position the test probes on the desired points of the circuit under test (see Fig. 6)
6. Press **GO** to perform the measurement



Resistance value

7. LOCK + GO Press **LOCK** and **GO** together to perform the measurement in continuous mode, the symbol **LOCK** is displayed. Press **GO** another time to stop the continuous mode measurement
8. In lock mode the instrument emits an acoustic signal and the auto power off is disabled

4.5.1. "ZERO" mode

1. Any addition or replacement of cables, extensions and croco clips nullify the previous calibration and make necessary a new calibration before performing further measurements. Therefore the instrument must be calibrated in the same conditions at which it will operate during measurements
2. Short-circuit the cable ends with each other as shown in Fig. 7 making sure that the metallic parts of test probes and crocodiles are in good touch

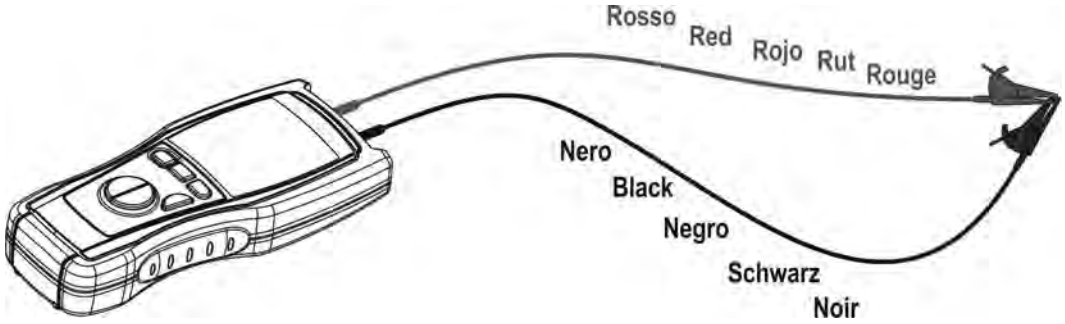


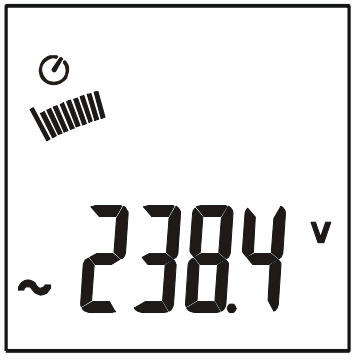
Fig. 7: Connection of the instrument's terminals during calibration procedure

3. GO Press **GO** to perform the measurement
4. MODE PEAK Press and hold **ZERO** key for 2s. The instrument resets the resistance of the cables, the symbol **ZERO** is displayed
5. The measured value is stored by the instrument and used as offset (which means it's deducted from all continuity tests performed) until a new pressing of the **ZERO** key for 2s that voids the calibration
6. Each time the instrument is switched off or changing position of selector, the calibrated value is lost

4.5.2. Anomalous cases which may occur during LoΩ measurement

1. The full scale of the instrument is 19.99Ω. If the resistance value is higher than this value, or in case of open or interrupted probes, the instrument displays the screen beside

2. If the voltage present at the terminals is higher than 24V the instrument does not perform the test. The screen beside is displayed



Input voltage

4.6. MΩ: INSULATION RESISTANCE MEASUREMENT TEST VOLTAGE 250V, 500V, 1000V DC

The measurement is performed according to IEC/EN61557-2 and VDE 0413 part 1.

CAUTION

- Before performing the insulation test make sure that the circuit under test is not energized and all relative loads are disconnected.
- The insulation measurement requires particolar care and attention to avoid providing wrong test results and causing damages to third parties.
- Before the insulation test prepare the plant adequately by disconnecting everything must not be tested. During the insulation test continuously make sure that the applied voltage is not accessible to third parties.
- A measurement with a cable disconnected by mistake may provide a good result also in presence of a faulty insulation. It's necessary to take all possibile cares to avoid that. Once prepared the plant and connected the measuring cables, make sure that they are correctly connected. In case of doubt, bifore performing an insulation test, perform a Ω 0.2A measurement by short-circuiting the cables under test at a point of the plant which is as far as possibile from the measuring clips. Remove the short circuit before performing the insulation test.

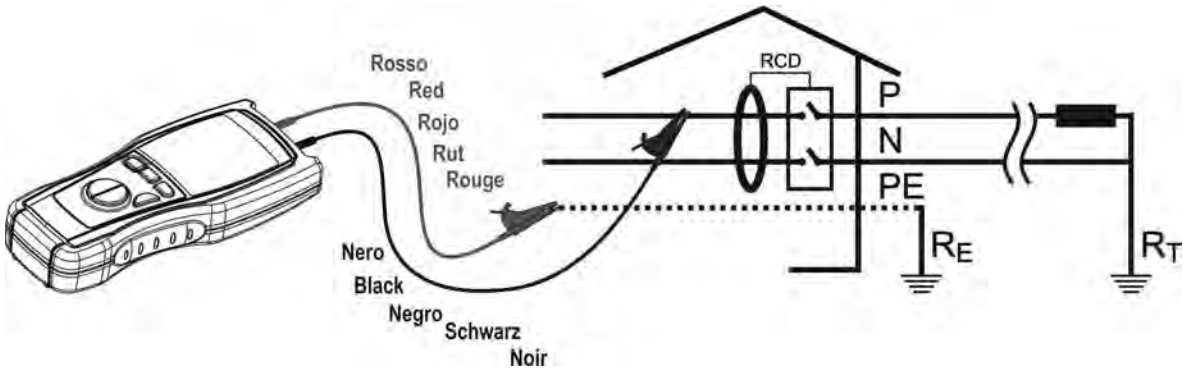


Fig. 8: Connection of the instrument's terminals during MΩ test

1. Turn on the instrument

2. Press the arrow keys to select **MΩ**

3. Insert the black and red cables in the corresponding input terminals of the instrument, If the cable length is not sufficient for the measurement extend the black one with an adequately insulated cable, as its insulation is in parallel to the resistance to be measured. It must be suspended and not laid to earth and all supports must be of insulated material

4. If necessary insert the croco clips on the test probes

5. Disconnect the circuit or the part of plant under test from power and all eventual loads

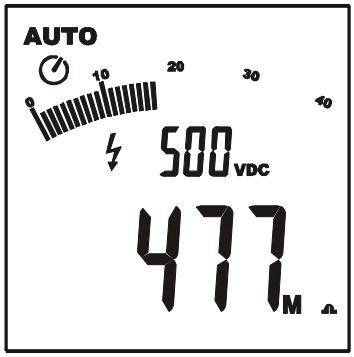
6. Connect the instrument's terminals to the end of the conductors on which the insulation test must be performed (see Fig. 8)

7. Press **GO** to start the measurement for the set time (see par. 4.6.1). Press **GO** to stop the measurement before the end of the set time

CAUTION

The message ϟ on the display means that the instrument is discharging eventual capacitors. During this phase never disconnect nor touch test leads.

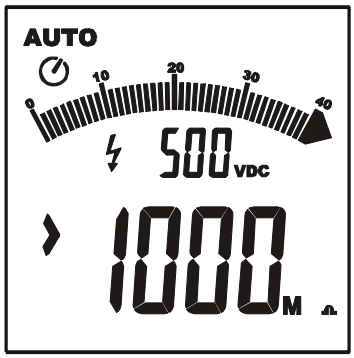
8. At the end of the test the instrument automatically discharge eventual capacitors and parasite capacitances present among the conductors involved in the measurement
9. At the end of the test a screen similar to this is displayed



Nominal test voltage value

Resistance value

10. If the resistance value is higher than the full scale, a screen similar to this is displayed.
    Note! An insulation value higher than the full scale is an excellent insulation value, generally much higher than the minimum requirements prescribed by standards



Nominal test voltage value

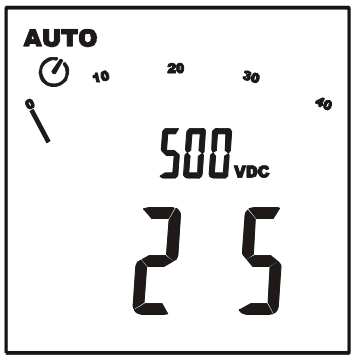
11. LOCK + GO Press **LOCK** and **GO** together to perform the measurement in continuous mode, the symbol **LOCK** is displayed. Press **GO** another time to stop the continuous mode measurement
12. In lock mode the instrument emits an acoustic signal and the auto power off is disabled

4.6.1. Measurement time setting mode

LOCK Press **LOCK** more than one second, a screen similar to this is displayed

Press the arrow keys to select the desired time value

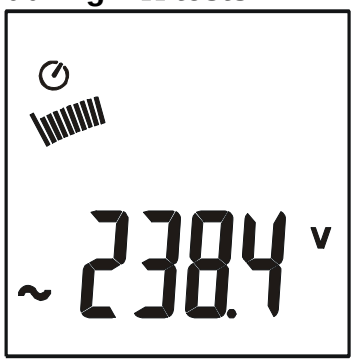
GO Press **GO** to confirm the selected value



Setting values between 2s an 60s

4.6.2. Anomalous cases which may occur during MΩ tests

If, during measurement, the input voltage present at terminals is higher than 24V, the instrument suspends the test.
A screen similar to this is displayed showing the input voltage value.



Input voltage value

5. MAINTENANCE

5.1. GENERAL

This is a precision instrument. Strictly follow the instructions for use and storage reported in this manual to avoid any possible damage or danger during use.
Do not use this tester under unfavorable conditions of high temperature or humidity. Do not expose to direct sunlight.
Be sure to turn off the tester after use. If the instrument is not to be used for a long period you are recommended to remove batteries to avoid leakages of battery liquid which may damage its internal circuits.

5.2. BATTERY REPLACEMENT

When the low battery indication (refer to § 6.1.3) is displayed the batteries are to be replaced.

CAUTION

Only skilled technicians can open the instrument and replace batteries. Before removing batteries disconnect the test leads from the input terminals to avoid electrical shocks.

1. Switch off the instrument
2. Remove test leads from the input terminals
3. Remove the battery compartment cover by using a screwdriver
4. Remove all batteries replacing them with new ones all of the same type (refer to § 6.1.3) respecting the polarity signs
5. Re-allocate the battery pack taking care that the part from which the black and red wires come out is positioned backwards
6. If the battery pack is re-allocated in a wrong way, the battery compartment can not be closed. In this case do not force the plastic parts, but re-position the battery pack correctly before closing
7. Replace the battery compartment cover making a pressure to close it
8. Use the appropriate battery disposal methods for your area

5.3. CLEANING

Use a soft dry cloth to clean the instrument. Never use wet cloths, solvents, water, etc.

5.4. END OF LIFE

Caution: this symbol indicates that equipment and its accessories shall be subject to a separate collection and correct disposal.

6. TECHNICAL SPECIFICATIONS

6.1. CHARACTERISTICS

Accuracy is indicated as [%reading + (digit number*resolution)] at 23°C±5°, RH <70%.

DC Voltage

Range	Resolution	Accuracy	Input impedance	Overload protection
0.1 ÷ 600.0V	0.1mV	±(0.5% rdg + 1 dgt)	3MΩ	605V AC max RMS

AC Voltage

Range	Resolution	Accuracy (40 ÷ 500Hz)	Input impedance	Overload protection
0.1 ÷ 600.0V	0.1mV	±(0.8% rdg + 4 dgt)	3MΩ	605V AC max RMS

Max crest factor: $\sqrt{2}$

Resistance and Test Continuity

Range	Resolution	Accuracy	Overload protection
0.0 ÷ 199.9Ω	0.1Ω	±(2.0% rdg + 3 dgt)	605V AC max RMS per 1 minute

The buzzer sounds while measured resistance is lower than 2Ω

Ω 0.2A: Continuity test

Range	Resolution	Accuracy	Overload protection
0.00 ÷ 19.99Ω	0.01Ω	±(2.0% rdg + 3 dgt)	605V max RMS

Test current: >200mA DC up to 5Ω (measuring cables resistance included)
Test current: >10mA DC over 5Ω (measuring cables resistance included)
Open circuit voltage: $4 < V_0 < 24V$

MΩ: Insulation resistance

Test voltage	Range	Resolution	Accuracy	Overload protection
250V	0.001 ÷ 0.100MΩ	0.001MΩ	±10dgt	605V max RMS
	0.101 ÷ 3.999MΩ	0.001MΩ	±(2.0%rdg+ 5dgt)	
	4.00 ÷ 39.99MΩ	0.01MΩ		
	40.0 ÷ 399.9MΩ	0.1MΩ	±(5.0%rdg +5dgt)	
	400 ÷ 1000MΩ	1MΩ		
500V	0.001 ÷ 0.250MΩ	0.001MΩ	±15dgt	
	0.251 ÷ 3.999MΩ	0.001MΩ	±(2.0%rdg +5dgt)	
	4.00 ÷ 39.99MΩ	0.01MΩ		
	40.0 ÷ 399.9MΩ	0.1MΩ		
	400 ÷ 2000MΩ	1MΩ	±(5.0%rdg +5dgt)	
1000V	0.001 ÷ 0.250MΩ	0.001MΩ	±15dgt	
	0.251 ÷ 3.999MΩ	0.001MΩ	±(2.0%rdg +5dgt)	
	4.00 ÷ 39.99MΩ	0.01MΩ		
	40.0 ÷ 399.9MΩ	0.1MΩ		
	400 ÷ 1000MΩ	1MΩ	±(3.0%rdg +5dgt)	
	1000 ÷ 4000MΩ	1MΩ	±(5.0%rdg +10dgt)	

Autorange
Open circuit voltage: $<1.3 \times V_0$
Accuracy of nominal voltage: –0% +10%
Short circuit current: <15mA
Nominal testing current: 1mA @ 1KΩ x V (1mA @ 500KΩ)

6.1.1. Electrical

Conversion:	Average value
Display refreshing rate:	2 times per second

6.1.2. Safety standards

The instrument complies with:	IEC/EN61010-1, IEC/EN61557-1-2-4
Insulation:	double insulation
Pollution level:	2
Max height of use:	2000m ; 6562ft
Measurement category:	CAT III 550V (phase to earth) CAT III 550V (phase to phase)

6.1.3. General specifications

Mechanical features

Dimensions (L x W x H):	240 x 100 x 45mm ; 9 x 4 x 2in
Weight (batteries included):	450g ; 16ounces

Power supply

Battery type:	4x1.5V batteries type AA LR6 AM3 MN 1500
Low battery indication:	symbol "⊟" is displayed
Battery life:	Multimeter: About 50 hours LoΩ: > 1000 tests @ 1Ω MΩ 250V: > 1000 tests @ 480kΩ MΩ 500V: > 1000 tests @ 480kΩ MΩ 1000V: > 1000 tests @ 480kΩ

Display

Features:	4 LCD with max. reading 9999 counts + symbol and decimal point

6.2. ENVIRONMENT

6.2.1. Environmental conditions

Reference temperature:	23°C ± 5°C ; 73°F ± 41°F
Working temperature:	0°C ÷ 40°C ; 32°F ÷ 104°F
Relative humidity allowed:	<70% RH
Storage temperature:	-10° ÷ 60° C ; 14°F ÷ 140°F
Storage humidity:	<70% RH

This instrument complies with the requirements of the European Low Voltage Directive 2006/95/CE (LVD) and EMC Directive 2004/108/CE

6.3. ACCESSORIES

6.3.1. Standard accessories

- Set of 2 R/B cables, 1.5m + 2 R/B alligator clips + 1 R test lead
- Batteries
- Carrying bag
- Certificate of test
- User manual

7. SERVICE

7.1. WARRANTY CONDITIONS

This instrument is guaranteed against material or production defects, in accordance with our general sales conditions. During the warranty period the manufacturer reserves the right to decide either to repair or replace the product.

Should you need for any reason to return back the instrument for repair or replacement take prior agreements with the local distributor from whom you bought it. Do not forget to enclose a report describing the reasons for returning (detected fault). Use only original packaging. Any damage occurred in transit due to non original packaging will be charged anyhow to the customer.
The manufacturer will not be responsible for any damage to persons or things.

The warranty doesn't apply to:

- Accessories and batteries (not covered by warranty).
- Repairs made necessary by improper use (including adaptation to particular applications not foreseen in the instructions manual) or improper combination with incompatible accessories or equipment.
- Repairs made necessary by improper shipping material causing damages in transit.
- Repairs made necessary by previous attempts for repair carried out by non skilled or unauthorized personnel.
- Modifications to the equipment without explicit authorization from our technical department.
- Adaptation to a particular application not provided for by the definition of the equipment or by the instruction manual.

The contents of this manual may not be reproduced in any form whatsoever without the manufacturer's authorization.

Our products are patented and our logotypes registered. We reserve the right to modify specifications and prices in view of technological improvements or developments which might be necessary.

7.2. AFTER-SALE SERVICE

Shouldn't the instrument work properly, before contacting your distributor make sure that batteries are correctly installed and working, check the test leads and replace them if necessary. Make sure that your operating procedure corresponds to the one described in this manual.

Should you need for any reason to return back the instrument for repair or replacement take prior agreements with the local distributor from whom you bought it. Do not forget to enclose a report describing the reasons for returning (detected fault). Use only original packaging. Any damage occurred in transit due to non original packaging will be charged anyhow to the customer. The manufacturer will not be responsible for any damage to persons or things.