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DMIII MultiTest

 User's Manual



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1. SAFETY PRECAUTIONS AND PROCEDURES

1.1. FORWARDS

This instrument conforms to the safety standards EN61557 and EN 61010-1 relating to electronic measuring instruments.



WARNING

For your own safety as well as that of the instrument you are recommended to follow the procedures described in this instruction manual and carefully read all the notes preceded by the symbol .

Strictly adhere to the following instructions before and during measurements:

- ☞ Do not measure voltage or current in wet or dusty places;
- ☞ Do not measure in presence of gas, explosive materials or combustibles;
- ☞ Do not touch the circuit under test if no measurement is being taken;
- ☞ Do not touch exposed metal parts, unused terminals, circuits and so on;
- ☞ Do not effect any measurement in case of unusual conditions of the instrument such as deformation, breakage, leakage of substances, absence of display reading etc;
- ☞ Do not use the External power supply adapter (code **DMT-EXTPS**) if you notice deformation, or breakage in the case, in the wire or in the plugs;
- ☞ Pay careful attention when measuring voltages exceeding 25V in particular places (building yards, swimming pools, etc.) and 50V in ordinary places because of the risk of electric shock;
- ☞ Use only cables and accessories approved by Amprobe;

The following symbols are used in this manual:



Caution: refer to the instructions in this manual; improper use may damage the apparatus or its components.



AC Voltage or Current.



Unidirectional pulsating Voltage or Current.



Rotary switch of the instrument.

1.2. PRELIMINARY INSTRUCTION

- ☞ This instrument has been designed for use in environments with a pollution level 2 and up to (and no more than) 2000 meters altitude.
- ☞ It can be used for Safety Test on Installation with Over voltage Category III 300V~ (phase to earth) and for **voltage and current** measurements on installations with over voltage category III 600 V~ phase-to-phase / 300 V~ phase to earth or CATII 350 V phase to earth.

- ☞ Please keep to the usual safety standards aimed at:
 - ◆ Protecting against dangerous currents;
 - ◆ Protecting the instrument against incorrect operations.
- ☞ Only the accessories supplied with the instrument guarantee compliance with the safety standards. Accordingly, they must be in good conditions and, if necessary, they must be replaced with identical models.
- ☞ Do not take measurements on circuits exceeding the specified current and voltage limits.
- ☞ Before connecting cables, alligator clips and clamps to the circuit under test, make sure that the right function has been selected.
- ☞ Do not take any measurements under environmental conditions beyond the limits specified in paragraph 14.4.
- ☞ Check that batteries are not weak and are installed correctly.
- ☞ Before connecting test leads to the circuit under test, check that rotary switch position is correct.

1.3. DURING USE

Please read the following recommendations carefully and instructions:



WARNING

Non-compliance with the Warnings and/or Instructions may damage the apparatus and/or its components or injure the operator.

- ☞ Before selecting any function disconnect the test leads from the circuit under test.
- ☞ When the instrument is connected to the circuit under test do not touch any unused terminal.
- ☞ Avoid taking resistance measurements in the presence of external voltages; even though the instrument is protected, a high voltage may cause malfunctions.
- ☞ When measuring current, other currents located near the leads may affect the measuring accuracy.
- ☞ When measuring current, always position the wire in the middle of the jaws in order to obtain the highest accuracy.
- ☞ A measured value remains constant if the "HOLD" function is active. Should you notice that the measured value remains unchanged, disable the "HOLD" function.



WARNING

The symbol "■" shows the battery charge: When it is completely black the batteries are full charged, while the "□" symbol indicates weak batteries. When the batteries are too low to execute a test, the instrument will show a warning message.

In this case, interrupt testing and replace batteries, following the procedure described in paragraph 13.2. **The instrument is capable of keeping the data stored even though batteries are not installed. The Instrument Date and Time settings aren't lost if you change the batteries within 24hours.**

1.4. AFTER USE

- After use, turn off the instrument by pressing & holding ON/OFF for a few seconds.
- Remove batteries when the apparatus remains unused for long periods. Please follow the storage instructions described at paragraph 14.4.

2. GENERAL DESCRIPTION


2.1. INTRODUCTION

Dear Customer, we thank you for your patronage. The instrument you have just purchased will grant you accurate and reliable measurements provided that it is used according to the present manual's instructions.

The instrument was designed to grant the user the utmost safety conditions thanks to a new concept assuring double insulation and over voltage category III.

2.2. FUNCTIONS

The instrument is able to perform the following tests:

- ☞ **LOWΩ:** Continuity Test of Protection and Equalising conductors with a test current higher than 200mA and open circuit voltage ranging from 4V to 24V.
- ☞ **INSULATION TEST:** Measurement of insulation resistance with DC test voltage 50V, 100V, 250V, 500V or 1000V.
- ☞ : Indication of phase rotation sequence
- ☞ **GROUND TEST** Measurement of Ground Resistance and Resistivity using Earth rods.
- ☞ **POWER QUALITY:** The Instrument allows the following operations:
 - ✓ **Display in real time** the electrical parameters of a single-phase and three-phase systems and the harmonic analysis of voltage and current.
 - ✓ **Conduct a direct Energy measurement** (without memorizing).
 - ✓ **Memorize** (by pressing the SAVE key) the sampled values of the Parameters present at instrument input generating a "Smp" record inside instrument memory. **It will be possible to analyze the memorized data ONLY by transferring it to a PC.**
 - ✓ **Record simultaneously** (pressing the START key after a proper set up): RMS values of voltages, currents, corresponding harmonics, active, reactive and apparent powers, power factors and $\cos\phi$, active, reactive and apparent energies, voltage anomalies (voltage sag and surge) with 10ms resolution. **It will be possible to analyze the recorded data ONLY by transferring them to a PC.**

WARNING



Please note the difference between **memorize** and **record**. These terms will be used repeatedly in this manual. Please focus on their definitions and distinctions.

3. PREPARATION FOR USE

3.1. INITIAL CONTROL

This instrument has been checked mechanically and electrically prior to shipment. Care has been taken to ensure that the instrument reaches you under safe conditions.

You are recommended, however, to carry out a rapid check to detect any possible damage, which might have been caused during transport. Should this be the case, immediately contact Amprobe.


Also, check that the packaging contains all the parts listed under paragraph 14.5. In case of discrepancies contact the dealer.



In case you have to send the instrument back please follow the instructions reported in paragraph 15.

3.2. POWER SUPPLY

The instrument can be powered by:

- ✓ 6 batteries 1.5V AA series located in the compartment on the back of the instrument (not included in the package). For battery life see paragraph 14.3.2.
- ✓ An external power supply adapter (code **DMT-EXTPS**) **to be used only for POWER QUALITY functions**. We recommend that you use only **DMT-EXTPS** Amprobe Power Supply adapter.

For your own safety you're not able to use the external power supply adapter during Safety Test (LOW Ω , INSULATION TEST, , GROUND TEST rotary Switch positions). If you press the START button the Instrument will show the message "v REMOVE POWER".

The symbol  shows the battery charge: If it is completely "black" the batteries are fully charged, while the  symbol indicates weak batteries. When the batteries are too low to execute the test the instrument will show a warning message. In this case interrupt testing and replace the batteries following the procedure described in paragraph 13.2. **The instrument is capable of keeping the data stored even though batteries are not installed. The Instrument Date and Time settings aren't lost if you change the batteries within 24hours.**

WARNING



For recordings (POWER QUALITY function) ALWAYS use the external power supply adapter (code **DMT-EXTPS**) even the instrument allows the operator to perform a recording using internal batteries. If during a recording the external power supply adapter is de-energized, the instrument will continue the recording using the internal battery power until the batteries are exhausted (the data stored up to the point the instrument shuts down won't get lost). Because of this we recommend you **ALWAYS insert a new set of batteries before a long recording.**

The instrument uses sophisticated algorithms to prolong the battery life. Specifically:

- ✓ The instrument switches OFF the backlight Automatically after 5 seconds.
- ✓ If the instrument is displaying in real time (and the external power supply adapter is not connected), after about 5 minutes from the last key press or switch rotation the instrument turns off automatically ("AUTOPOWER OFF" procedure).
- ✓ If the instrument is recording or is measuring energy (and the external power supply is not connected), after about 5 minutes from the last key press or switch rotation the instrument starts a special procedure to save the batteries ("ECONOMY MODE"): the instrument keeps recording but the display is turned off.

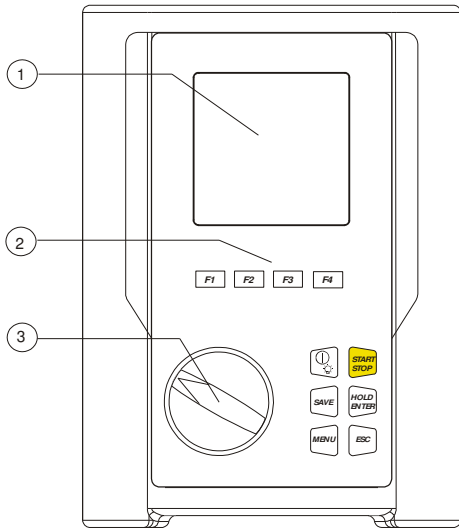
3.3. CALIBRATION

The instrument fulfils the technical specifications listed in this manual. The performance of the specifications is guaranteed for one year.

3.4. STORAGE

In order to maintain the accuracy of the measurements, after a period of storage in extreme environmental conditions, wait the necessary time for the apparatus to return to normal operating conditions (see environmental specifications listed in paragraph 14.4).

4. INSTRUMENT DESCRIPTION



LEGEND:

- 1. Display
- 2. Function Keys
- 3. Rotary switch

Front panel of the Instrument

F1 F2 F3 F4 ➔ Multifunction Keys.



➔ **ON/OFF** and backlight key. Press it for few seconds to switch OFF the instrument, press it briefly to activate the backlight function.



➔ This key starts (and stops) the measurements.



➔ This key saves the result displayed.



➔ This key has 2 functions: it is the confirmation key inside the configuration menu and it freezes the displayed results using the POWER QUALITY function.



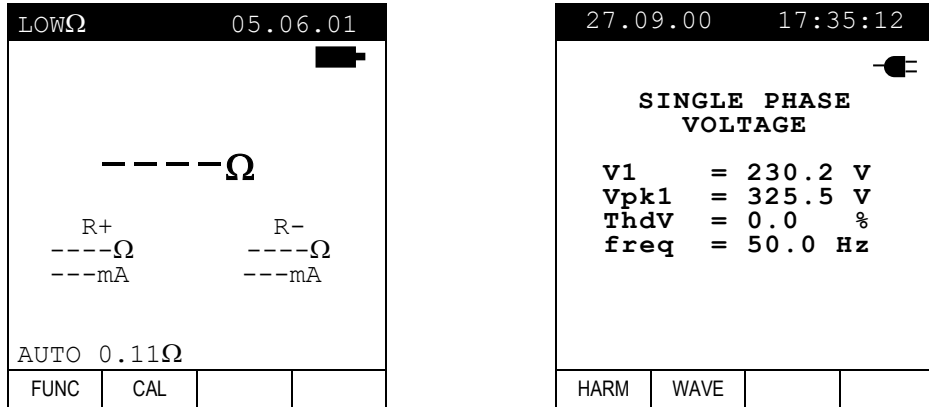
➔ This key opens the General Configuration Menu.



➔ This key cancels modification in the configuration menus or the selected working modes.

4.1. DISPLAY DESCRIPTION

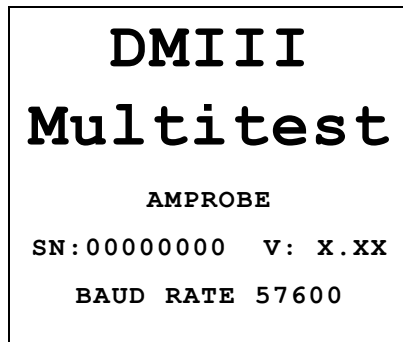
The display is a graphic module with a resolution of 128 x 128 pixels
 The first line of the display shows date and time. If not correct, you can set the exact ones according to the procedure described at paragraph 5.2.
 On the top right corner of the display you can always see the battery indicator and, if the external power supply adapter (code **DMT-EXTPS**) is connected, the corresponding symbol.



These symbols will be omitted in the following illustrations.

4.2. INITIAL SCREEN

When turning on the instrument by pressing ON/OFF, this screen will appear for a few seconds:



Here you can see:

- Serial number of the instrument (SN.:
- Firmware software release (V.X.XX:)
- Transmission speed through serial RS232 (Baud Rate)

4.3. BACKLIGHT FUNCTION

When the instrument is turned on, pressing, briefly, the **ON/OFF** button, the backlight will be enabled. The light will be automatically turned off after 5 seconds.
 If the batteries are too low the instrument will automatically disable the backlight function.

5. INITIAL SETTINGS

By pressing the **MENU** key the following screen will be displayed:

MENU GENERAL			
SAFETY TEST MEMORY			
ANALYZER MEMORY			
RESET			
ANALYZER CONFIG			
RECORDER CONFIG			
CONTRAST			
DATE & TIME			
LANGUAGE			
COUNTRY			
↓	↑		

It's not possible to enter the **MENU** during a recording or a Real Time Energy measurement. Pressing this button during a recording will display the main recording parameters (see paragraph 10.2).

5.1. HOW TO ADJUST THE CONTRAST

By pressing the multifunction keys **F1** and **F2**, position the cursor on the **CONTRAST** item and then press the **ENTER** key.

By pressing the multifunction keys **F3** and **F4**, adjust the contrast (higher values correspond to a higher contrast while lower values correspond to a lower contrast) and press the **ENTER** key to SAVE the change or press **ESC** to quit the modification.

This setting will remain unchanged after turning off the instrument.

5.2. HOW TO SET DATE AND TIME

By pressing the multifunction keys **F1** and **F2**, position the cursor on the **DATE&TIME** item and then press the **ENTER** key.

The time is expressed as **hh:mm** (2 digit for hours, 2 digit for minutes) military time.

Press the **ENTER** key to SAVE the change or press **ESC** to quit the modification.

This setting will remain unchanged after turning off the instrument.

5.3. HOW TO SET THE LANGUAGE

By pressing the multifunction keys **F1** and **F2**, position the cursor on the **LANGUAGE** (EN) or **LINGUA** (IT) item and confirm it by pressing the **ENTER** key.

By pressing the multifunction keys **F1** and **F2**, position the cursor on the desired language and press the **ENTER** key to SAVE the change or press **ESC** to cancel the modification.

This setting will remain unchanged after turning off the instrument.

5.4. HOW TO ADJUST THE COUNTRY

By pressing the multifunction keys **F1** and **F2**, position the cursor on the **COUNTRY** item and confirm it by pressing the **ENTER** key. By pressing the multifunction keys **F1** and **F1**, select the Country among the following possibilities:

UE_m: European Countries: Distance setting in "meter" for Resistivity measurement
Date format DD/MM/YY

US_m: United States: Distance setting in "meter" for Resistivity measurement
Date format MM/DD/YY

US_ft: United States: Distance setting in "feet" for Resistivity measurement
Date format MM/DD/YY

Press the **ENTER** key to SAVE the change or press **ESC** to quit the modification.

This setting will remain unchanged after turning off the instrument.

5.5. RESET

This option re-establishes the default settings of the instrument.

✓ ANALYZER CONFIG:

Type of electrical equipment:	Three Phase 4 wires
Frequency:	<i>not modified</i>
Clamp full scale:	<i>not modified</i>
Clamp type:	<i>not modified</i>
Transforming ratio of voltmetric transformers:	1
Password:	disabled

✓ RECORDER CONFIG:

Start:	manual (the recording is started at 00 sec mark on clock after pressing START/STOP)
Stop:	manual
Integration period:	15min
Recording of harmonics:	ON
Recording of voltage anomalies (sags and surges):	ON
Voltage reference for detection of sags and surges:	110V
Upper limit for detection of sags and surges:	6%
Lower limit for detection of sags and surges:	10%
Selected voltages:	V1, V2, V3
Selected voltage harmonics:	THD, 01, 03, 05, 07
Selected currents:	I1, I2, I3, IN
Selected current harmonics:	THD, 01, 03, 05, 07
CO-GENERATION:	OFF
Selected powers, Pf and $\cos\varphi$:	Pt, P1, P2, P3 Qti, Q1i, Q2i, Q3i Qtc, Q1c, Q2c, Q3c St, S1, S2, S3 Pft, Pf1, Pf2, Pf3 dpft, dpf1, dpf2, dpf3
Energies:	Eat, Ea1, Ea2, Ea3 Erit, Eri1, Eri2, Eri3 Erct, Erc1, Erc2, Erc3 Est, Es1, Es2, Es3

The RESET command will not erase the instrument's memory.

6. SAFETY TEST FUNCTIONS

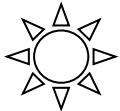
6.1. LOW Ω : CONTINUITY TEST WITH 200mA TEST CURRENT

The measurement is taken according to EN 61557-2 and VDE 0413 part 4.



WARNING

Before carrying out the continuity test be sure that there is no voltage at the ends of the conductor under test.



Turn the rotary knob to the **LOW Ω** position.

F1

This key allows the operator to select one of the following measuring modes:

- ☞ **AUTO** mode (the instrument carries out two measurements with reversed polarity and displays their average value). This mode is recommended for the continuity test.
- ☞ **RT+** mode (measurement with positive polarity and the ability to set the duration time of the test). In this case the operator can set a measuring time long enough to permit them to move the protective conductors while the instrument is carrying out the test so as to detect any bad connections.
- ☞ **RT-** mode (measurement with negative polarity and the ability to set the duration time of the test). In this case the operator can set a measuring time long enough to permit him to move the protective conductors while the instrument is carrying out the test so as to detect any bad connection.

F2

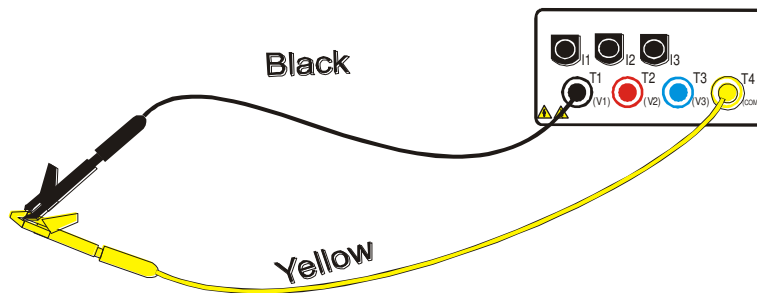
This key permits the operator to perform a calibration (compensation for the resistance of the cables used for the measurement).

N.B. If the resistance is lower than 5 Ω (including the resistance of the calibration) the continuity test is executed by the instrument with a test current higher than 200mA. If the resistance is higher than 5 Ω the continuity test is executed by the instrument with a current lower than 200mA.

We recommend that you check the calibration of the test leads before executing a measurement according to next paragraph.

6.1.1. Calibrating the test leads ("CAL" Mode)

1. Connect the black and yellow test leads to **T1** and **T4** input terminals respectively.



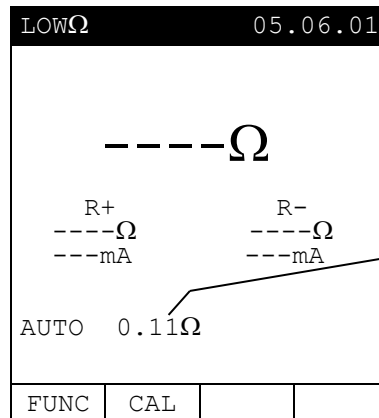
Connection of instrument terminals during calibration procedure.

2. If the test leads supplied with the instrument are not long enough for the measurement you can extend the black cable.
3. Short-circuit the measuring cable ends making sure that the conductive parts of the alligator clips make good contact with each other (see previous picture).
4. Press the **F2** key. The instrument performs the calibration.

F2

WARNING

Never disconnect the test leads when the message **"MEASURING"** is displayed.



A numerical value in this field means that the instrument has been calibrated; this value **remains on the display for any further measurement** even though the unit is switched off and on again.

5. At the end of the test the result is stored and used as **OFFSET (that is to say that it is subtracted from any continuity test carried out)** for all the subsequent measurements.

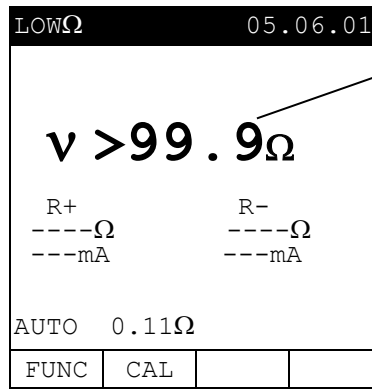
Note: The instrument performs the calibration only if the resistance of the test leads is lower than 5Ω.

TEST LEADS

Before each measurement always assure that the calibration is for the cables in use. During a continuity test, if the resistance value free of calibration (that is the resistance value less the calibration offset value) is **negative**, the symbol ν is displayed. Probably the calibration resistance value stored in the instrument memory is not for the cables in use, therefore a new calibration must be performed.

6.1.1.1. Procedure to reset test leads calibration parameters

☞ To cancel calibration parameters it is necessary to perform a **calibration procedure with a resistance of test leads higher than 5Ω** (for example with open test leads). When a cancellation is effected **the screen to the right** is displayed temporarily.

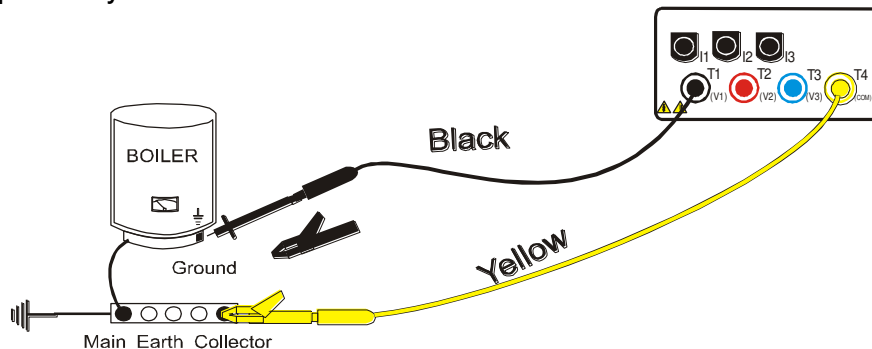


Message >99.9Ω:
means that the instrument detected a resistance higher than 5Ω therefore it will proceed with Reset procedure.

6.1.2. Measurement Procedure

F1

1. Select the desired mode using the **F1** key.
2. Connect the black and yellow test leads to **T1** and **T4** input terminals respectively



Connection of the test leads during LOWΩ test.

3. If the cables supplied with the instrument are not long enough for the measurement you can extend the black cable.
4. Short-circuit the test leads making sure that the conductive parts of the alligator clips make a good contact to each other. Press the **START** key. **If the display doesn't show 0.00Ω repeat the test leads calibration** (see paragraph 6.1.1).
5. Connect the instrument terminals to the ends of the conductor under test (see previous picture).
6. **If the mode "RT+" or "RT-" was selected use the F3, F4 keys to set the duration of the test.**
7. Press the **START** key. The instrument will execute the measurement. In RT+/RT- (Timer mode) you can press **START** key again if you want to stop the test before the duration set is expired.

F3

F4

START STOP

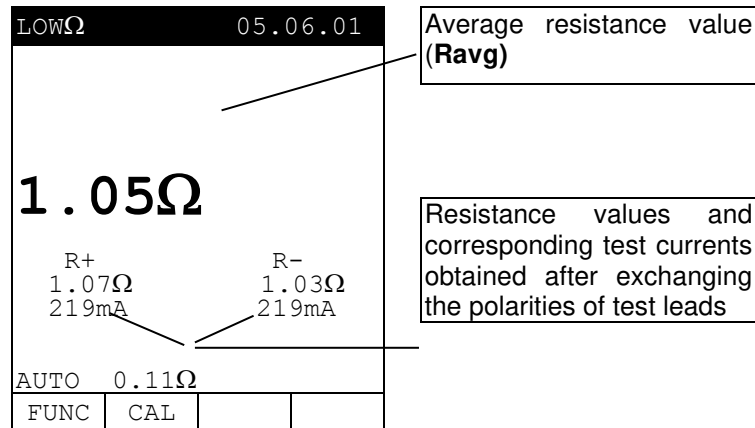


ATTENTION

Never disconnect the test leads when the message **"Measuring"** is displayed.

6.1.3. Results of "AUTO" mode

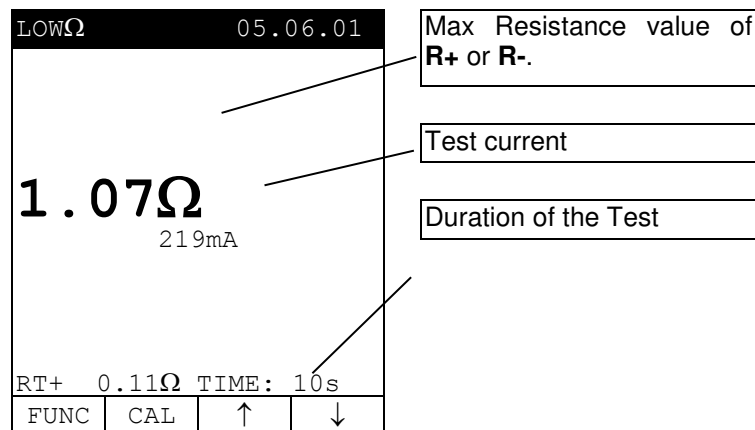
☞ At the end of the test, if the **average resistance value Ravg is lower than 5Ω** the instrument emits a **double sound signal** indicating the **positive outcome of the test** and displays a screen similar to the screen to the right.



The displayed result can be stored by pressing the **SAVE** key **twice** (refer to paragraph 9.1).

6.1.4. Results of "RT+" and "RT-" modes

☞ If a **resistance value RT+ or RT- lower than 5Ω** is detected, the instrument emits a **double sound signal** indicating the **positive outcome** of the test displays a screen similar to the screen to the right.



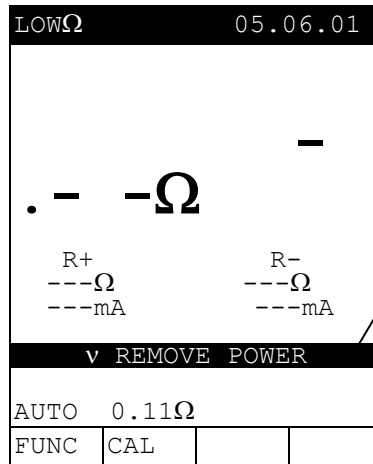
Note: We recommend the use of alligator clips and to assure the alligator clips make good contact with the conductor under test. Indeed, in this test the instrument gives as a final result the maximum measured value of R+ or R- and using test leads instead of alligator clips could give you faulty results due to faulty contact between the test leads and conductor under test



The displayed result can be stored by pressing the **SAVE** key **twice** (refer to paragraph 9.1).

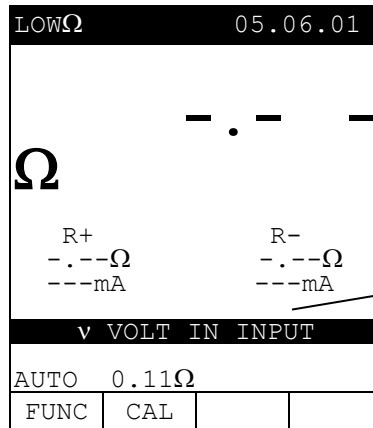
6.1.5. "AUTO", RT+", "RT-" faulty cases

If the instrument detect the External Power supply adapter connected to instrument will show the message displayed to the right.



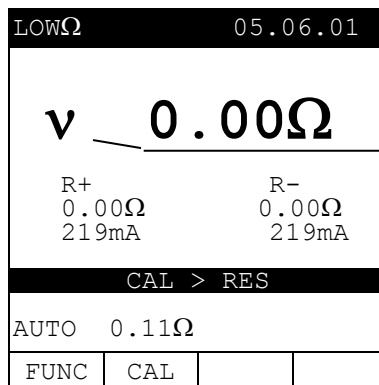
Disconnect the External Power Supply Adapter

If the terminal voltage is higher than 15V, the instrument does not perform the test and displays the screen to the right for 5 seconds.



ATTENTION: the test was not performed because of voltage at the terminal ends.

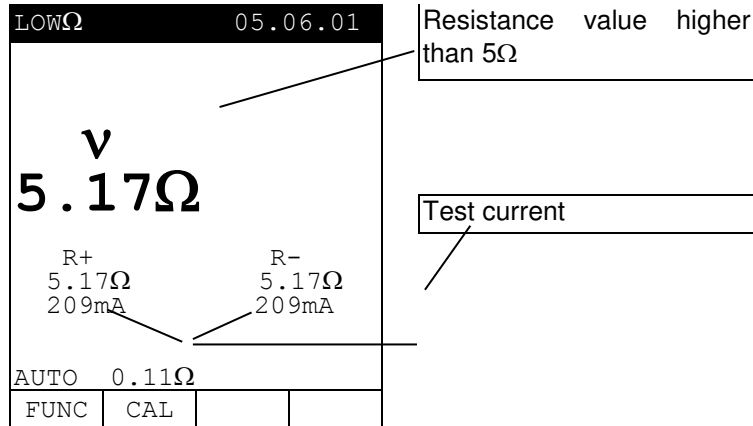
In the case that: $R_{CALIBRATION} > R_{MEASURED}$ the instrument displays the screen to the right.



ATTENTION: $R_{CALIBRATION} > R_{MEASURED}$

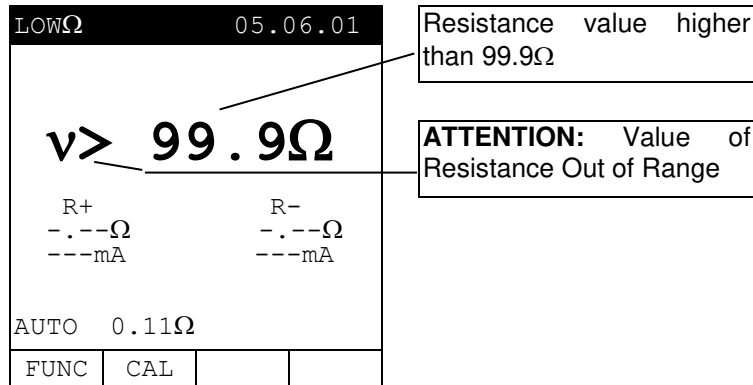
THE PREVIOUS RESULTS CAN'T BE SAVED.

If the value of **Resistance is higher than 5Ω** (but lower than 99.9Ω) the instrument emits a long beep and displays a screen similar to the screen to the right



The displayed result can be stored pressing the **SAVE** key **twice** (refer to paragraph 9.1).

If the value of **Resistance is higher than 99.9Ω** the instrument emits a long beep and displays the screen to the right.



The displayed result can be stored pressing the **SAVE** key **twice** (refer to paragraph 9.1).

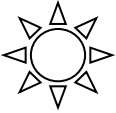
6.2. INSULATION TEST: INSULATION RESISTANCE MEASUREMENT

The measurements comply with IEC 61557-2 and VDE 0413 part 1.

ATTENTION



Before performing an insulation test make sure that the circuit under test is not energised and all the loads are disconnected.



Turn the rotary knob to the **INSULATION TEST** position.

F1

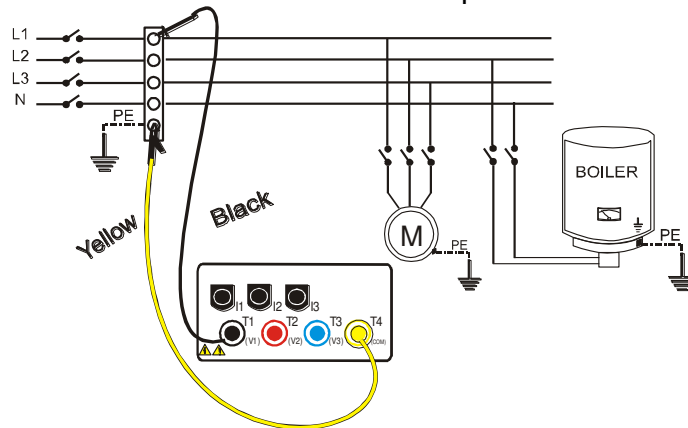
The **F1** key allows the operator to select one of the following measuring modes:

- ☞ **MAN** mode (Manual mode) Recommended test.
- ☞ **TMR** mode (Timer mode: test duration depends on the selected interval from 10 to 999 seconds). This test can be executed when the test required a defined duration.

6.2.1. Measurement Procedure

F1

1. Select the desired mode using the **F1** key.
2. Connect the test leads to the instrument input terminals **T1** and **T4** respectively,



Example: insulation measurement between phase and earth in an electrical installation using untied cables.

3. If the cables supplied with the instrument are not long enough for the measurement you can extend the black cable.
4. Connect the instrument terminals to the object that is to be submitted to the insulation test **after de-energizing the circuit under test and all the relative loads** (see previous picture).

F2

5. By means of **F2** select the test voltage suitable for the type of test to be performed (see Table1). The values to be selected are:
 - 50V (test on telecommunication system)
 - 100V
 - 250V
 - 500V
 - 1000V

Standard	Brief description	Test voltage	Maximum limit value
CEI 64-8/6	Systems SELV or PELV	250VDC	> 0.250MΩ
	Systems up to 500V (Civil installations)	500VDC	> 0.500MΩ
	Systems over 500V	1000VDC	> 1.0MΩ
CEI 64-8/4	Floor and wall insulation in civil installations	500VDC	> 50kΩ (se V<500V)
	Floor and wall insulation in systems over 500V	1000VDC	> 100kΩ (se V>500V)
EN60439	Electrical panel boards 230/400V	500VDC	> 230kΩ
EN60204	Electrical equipment of machines	500VDC	> 1MΩ
CEI 64-4	Floor insulation in medical rooms	500VDC	<1MΩ (if the floor is at least 1 year old) <100MΩ (if the floor is at least 1year old)

Table1: Table reporting the test voltage and the corresponding limit values for few Guidelines.

Rated voltage selected for the test	R _{MAX} = Maximum resistance value
50VDC	99.9MΩ
100VDC	199.9MΩ
250VDC	499MΩ
500VDC	999MΩ
1000VDC	1999MΩ

Table2: Table of maximum resistance values which can be measured under MΩ mode depending on the rated voltage selected.

- F3** 6. If the "TMR" mode was selected use the **F3**, **F4** keys to set the duration time of the test:
- F4**

ATTENTION



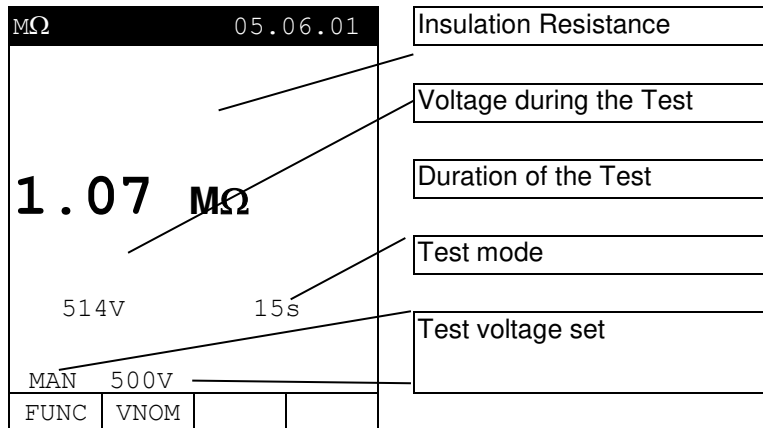
Never disconnect the test leads from the circuit under test when the message "MEASURING" is being displayed, as the circuit under test may remain charged at a dangerous voltage. The instrument has an internal "safety resistor" which is connect to output terminal before the end of the test in order to discharge the parasite capacities of the installation.



7. Press the **START** key.
- The instrument will start the test.
- ✓ MAN Mode: The test will take 4 seconds (maximum). If you keep the START key pressed longer than 4 seconds the test continues until the key is released.
 - ✓ TMR mode: The test will take the time set. If you want to stop the test when it's running, press the START/STOP key again.

6.2.2. Results of "MAN" mode

☞ At the end of the test if the insulation resistance is **lower than R_{MAX}** (see Table2) and the instrument generates the **Nominal test Voltage**, the instrument emits a **double beep**, indicating the **positive outcome of the test** and displays a screen similar to the screen to the right.

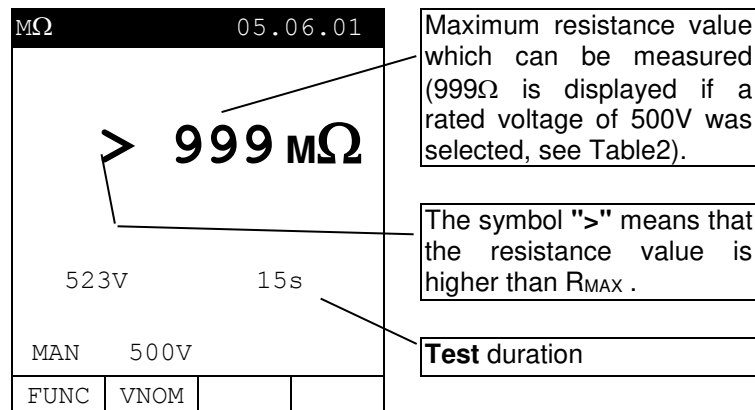


In order to evaluate the test you must compare the result with the limits indicated in the Guidelines (see Table1).



The displayed result can be stored pressing the **SAVE** key **twice** (according to paragraph 9.1).

☞ If the Insulation resistance is **higher than R_{MAX}** (see Table2), the instrument emits a **double beep** at the end of the test **indicating the positive outcome of the test** and displays one screen similar to the screen to the right.



The displayed result can be stored by pressing the **SAVE** key **twice** (refer to paragraph 9.1).