



MFT-PRO


Quick reference guide



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1. PRECAUTIONS AND SAFETY MEASURES

The models MFT-PRO is been designed in compliance with Directives IEC/EN61557, BS7671 17th edition and IEC/EN61010, relevant to electronic measuring instruments. For your safety and in order to prevent damaging the instrument, please carefully read all notes preceded by symbol .



CAUTION

- Do not carry out any voltage or current measurement in humid environments
- Do not carry out any measurements in case gas, explosive materials or flammables are present, or in dusty environments
- Avoid contact with the circuit being measured if no measurements are being carried out
- Avoid any contact with exposed metal parts, with unused measuring probes, circuits, etc.
- Do not carry out any measurement in case you find anomalies in the instrument such as deformation, breaks, substance leaks, absence of display on the screen, etc.
- The instrument has been designed for use in environments of pollution degree 2.
- Only the accessories provided together with the instrument will guarantee safety standards. They must be in good conditions and replaced with identical models, when necessary.
- Do not test circuits exceeding the specified current and voltage limits.
- Before connecting the measuring cables, the alligator clips and the clamps to the circuit being measured, check that the desired function has been selected.
- Pay special attention when measuring voltages higher than 25V in special environments (such as construction sites, swimming pools, etc.) and 50V in normal environments, since a risk of electrical shock exists.
- The instrument can be used for measurements on installations with overvoltage category CAT III 240V to earth and CAT III 415V between inputs. Category **CAT III** is suitable for measurements carried out on installations inside buildings with low voltage (examples are distribution boards, wirings, switches, fixed installation sockets, electric motors, industrial equipment).
- It is forbidden to open the instrument, except to qualified technicians. Except for battery replacement, which must be carried out as described in § 5.2 of the manual, no other maintenance, replacement or repair of the instrument's internal parts is provided for.

The following symbols are used by the instrument:



CAUTION: it is necessary to consult the instruction manual in order to identify the nature of the potential danger and the actions to be taken. Observe the instructions given in this manual. Improper use could damage the instrument and create dangerous situations for the operator.



High voltage danger: electrical shock hazard



Double insulation



AC voltage or current



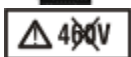
DC voltage or current



Connection to earth



The symbol indicates that the appliance and its accessories must be collected separately and correctly disposed of.



The symbol indicates that the instrument must not be connected to systems with voltage higher than 460V

1.1. BEFORE AND AFTER USE

Please carefully read the following recommendations and instructions:

- Always disconnect the measuring leads from the circuit being measured before changing function.
- When the instrument is connected to the circuit under test, do not touch any unused terminal.
- During current measurement, any other current near the clamps may affect measurement precision.
- When measuring current, always put the conductor as near as possible to the middle of the clamp jaw, to obtain the most accurate reading.

1.2. AFTER USE

- When measurements are completed, switch off the instrument by pressing the **ON/OFF** key.
- If the instrument is not to be used for a long time, follow the instructions for storage described in § 3.4 of the user manual.



CAUTION

For detailed information, please read the instrument's user manual provided on CD-ROM before each use.

1.3. DEFINITION OF MEASUREMENT (OVERVOLTAGE) CATEGORY

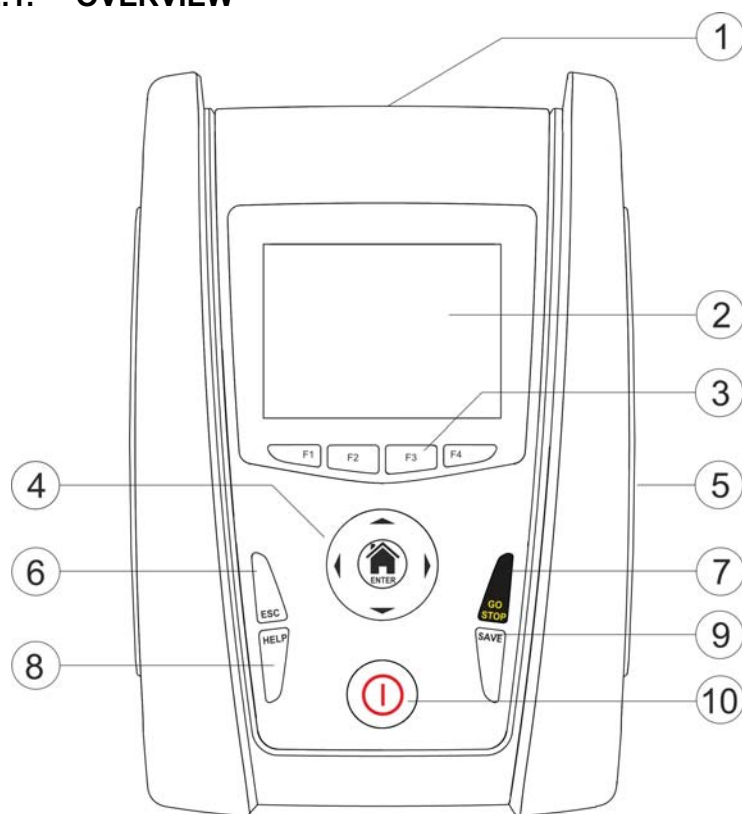
Standard "IEC/EN61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General requirements" defines what measurement category, commonly called overvoltage category, is. § 6.7.4: Measured circuits, reads:

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 on installations inside buildings.
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 standard requires that the transient withstand capability of the equipment is made known to the user.

2. DESCRIPTION OF THE INSTRUMENT

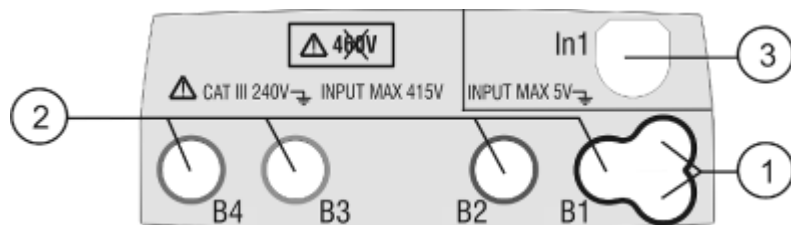
2.1. OVERVIEW



CAPTION:

1. Input leads
2. Touch screen display
3. **F1, F2, F3, F4** function keys
4. Arrow **◀, ▶, ▲, ▼** and **ENTER** key
5. Output for optical/USB connector
6. **ESC** key
7. **GO/STOP** key
8. **HELP** key
9. **SAVE** key
10. **ON/OFF** key

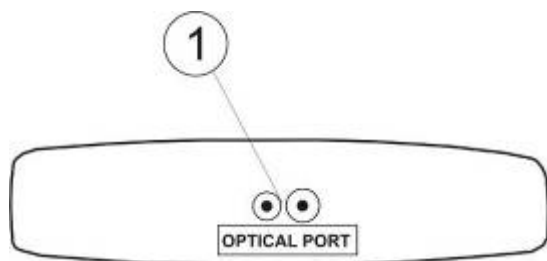
Fig. 1: Description of the front part of the instrument



CAPTION:

1. Input for connecting optional remote lead PR400
2. Inputs **B1, B2** (no COMBIG2), **B3, B4** for connecting measuring leads
3. Input **In1** for connecting clamp transducer/probes

Fig. 2: Description of the instrument's input terminals



CAPTION:






1. Serial output for connection with optical cable/USB C2006 and adaptor optical/WIFI C2013

Fig. 3: Description of the instrument's output connector

2.2. GENERAL DESCRIPTION


The instrument is equipped with a TFT color LCD display, with capacitive "touch-screen" that can be handled simply with the touch of a finger by the user and is structured with an icon-based menu allowing the direct selection of measurement functions for quick and intuitive use.

The instrument can perform the following tests:

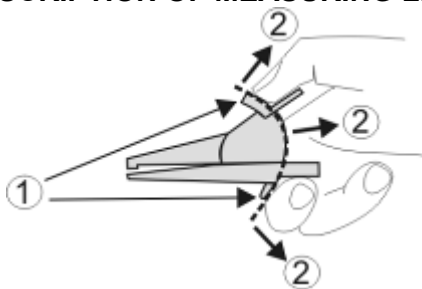
Ω	Continuity test of earth, protective and equipotential conductors with test current higher than 200mA and open-circuit voltage between 4V and 24V
MΩ	Measurement of insulation resistance with continuous test voltage of 50V, 100V, 250V, 500V or 1000V DC
RCD	Test on molded case RCD (Standard – STD) and on earth leakage relay RCD () General (G), Selective (S) and Delayed () of type A () and AC () and B () of the following parameters: tripping time, tripping current, contact voltage
LOOP	Measurement of line impedance/Loop P-N, P-P, P-E with calculation of the assumed short-circuit current, also with high resolution (0.1mΩ) (by means of optional accessory IMP57), overall earth resistance without causing the RCD tripping, check of the interruption capacity of magnetothermal protections (MCB) and fuses, I2t test, protection check in case of indirect contacts
SEQ	Indication of phase sequence with 2- or 1-terminal method
ENV	Measurement of environmental parameters (illuminance, air temperature, humidity) by means of optional external probes and DC voltage signals
LEAKAGE	Measurement of leakage current (by means of the optional accessory HT96U)
ΔV%	Measurement of percentage voltage drop on main lines
PQA	Real time measurement of main parameters (powers, harmonics, power factor/cosφ) in Single phase and Three phase balanced systems

2.3. INSTRUMENT POWER SUPPLY

The instrument is supplied with six 1.5V AA IEC LR6 alkaline batteries, not included in the package.

The symbol "  " indicates the charge level. In case of low battery, stop testing and replace the batteries (see § 5.2). **The instrument is capable of keeping data stored even without batteries.** In order to maximize the instrument's battery life, approximately 5 minutes after the last time a key was pressed, the instrument will automatically switch off ("AUTOPOWER OFF")

2.4. DESCRIPTION OF MEASURING LEADS

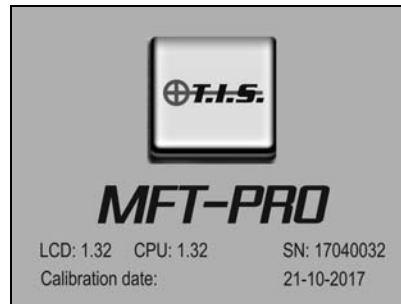


CAPTION:

1. Hand protection
2. Safe area

3. SWITCHING ON THE INSTRUMENT, INITIAL SETTING

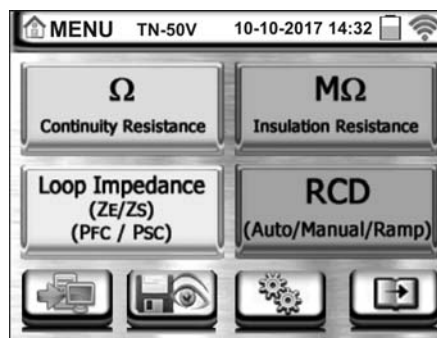
Press the **ON/OFF** key to switch on the instrument. The following initial screen appears on the screen for a few seconds:



It contains (further to the name of the Manufacturer and to the instrument model):


- The serial number (SN:) of the instrument
- The Firmware version of the two instrument's internal microprocessors (LCD and CPU)
- The date of the last calibration (Calibration date)

Then the instrument shows the general MENU screen:



MFT-PRO General menu

To select the desired function, just touch the relevant icon on the screen.

Select icon  to enter the general setting screen of the instrument. In this area, it is possible to change:

- The characteristics of the electric system in which the tests are going to be performed
 - TT, TN or IT system
 - Contact voltage limit (25V, 50V)
 - Rated voltage of the system for calculating the assumed short-circuit current
- System language
- Enabling/disabling of key tone and of auto power off
- Date and time setting
- Operator name setting

For further information, please refer to the instrument's complete user manual.

4. MEASURING

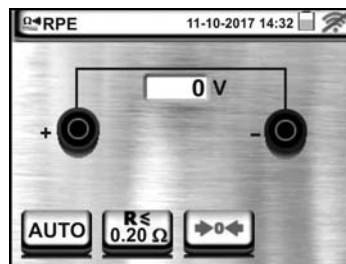
4.1. Ω – CONTINUITY TEST ON PROTECTIVE CONDUCTORS



CAUTION

- The instrument can be used for measurements on installations with overvoltage category CAT III 240V to earth and CAT III 415V between inputs. Category CAT III is suitable for measurements carried out on installations inside buildings with low voltage (examples are distribution boards, wirings, switches, fixed installation sockets, electric motors, industrial equipment).
- We recommend holding the alligator clip respecting the safety area created by the hand protection (see § 2.4).
- Check that no voltage is present at the ends of the item to be tested before carrying out a continuity test.
- The results may be influenced by the presence of auxiliary circuits connected in parallel with the item to be tested or by transient currents.

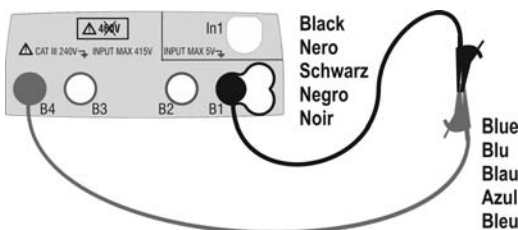
Access the general menu by pressing the **HOME** key and select function . The instrument shows the following screen:



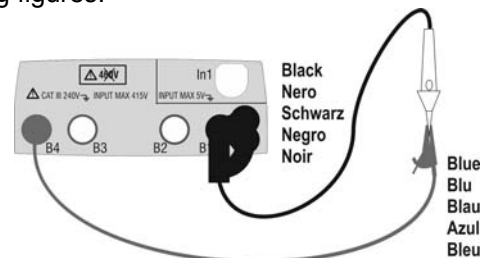
The display of symbol “ 0 ” in red indicates that no cable calibration has been performed.

4.1.1. Calibration of measuring cables

1. Connect the measuring leads as shown in the following figures:



Calibration with measuring leads

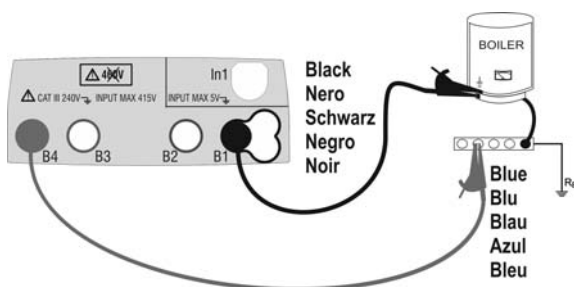


Calibration with remote lead PR400

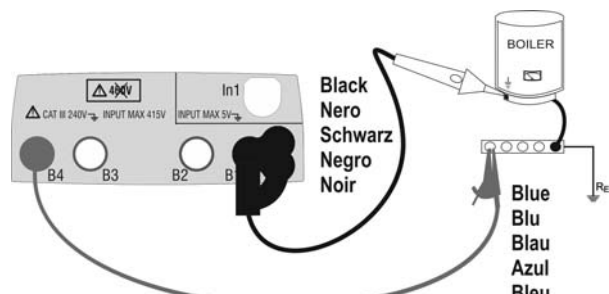
2. Press key **F3** or touch the relevant icon to start cable calibration.
3. At the end of calibration, the instrument will display the symbol “ 0 ” in green.

4.1.2. Measuring in AUTO mode

1. Select **AUTO** mode by pressing key **F1** or touching the relevant icon or .
2. Press key **F2** or touch the relevant icon to set the minimum level for measurement
3. Connect the measuring leads as shown in the following figures
4. Press the **GO/STOP** key on the instrument or the **START** key on the remote lead PR400. The instrument starts measuring and provides a result on the display, then gives out a double sound in case the result is positive



Continuity with measuring leads



Continuity with remote lead PR400

5. Press the **SAVE** key or touch the relevant icon to save the result of measurement shown on the display. Confirm saving by pressing the **SAVE** key again, or the relevant icon .

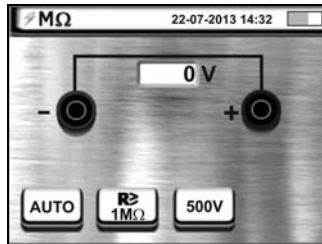
4.2. MΩ - INSULATION TEST

CAUTION

- The instrument can be used for measurements on installations with overvoltage category CAT III 240V to earth and CAT III 415V between inputs. Category CAT III is suitable for measurements carried out on installations inside buildings with low voltage (examples are distribution boards, wirings, switches, fixed installation sockets, electric motors, industrial equipment).
- We recommend holding the alligator clamp respecting the safety area created by the hand protection (see § 2.4)
- Check that the circuit being tested is not live and that all possible loads normally connected to it are disconnected before carrying out insulation measurement.

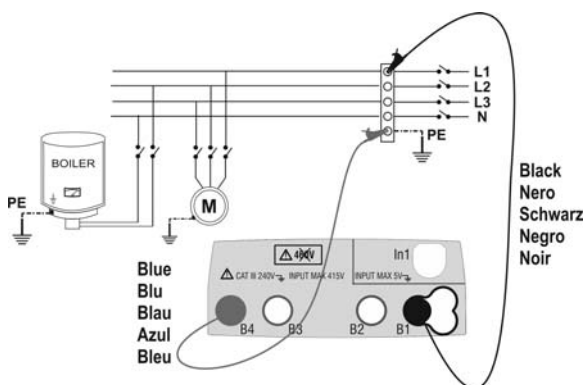


Access the general menu by pressing the **HOME** key and select function . The instrument shows the following screen:

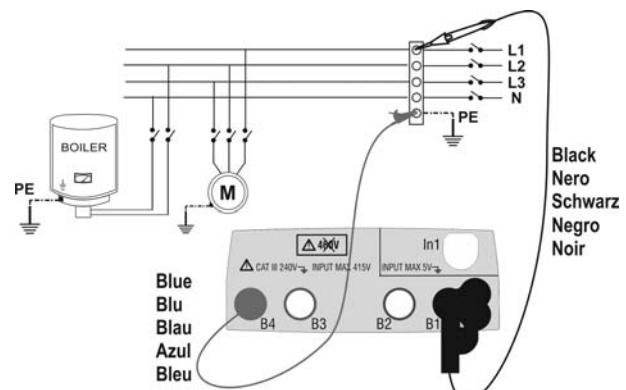


4.2.1. Measuring in AUTO mode

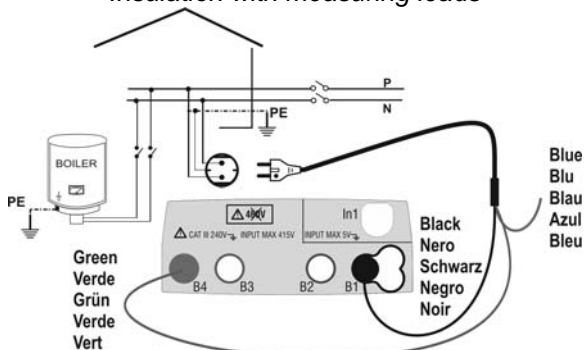
1. Select **AUTO** mode by pressing key **F1** or touching the relevant icon or
2. Press key **F2** or touch the relevant icon to set the minimum level for measurement
3. Press key **F3** or touch the relevant icon (e.g.:) to set the value of test voltage.
4. Connect the measuring leads as shown in the following figures:



Insulation with measuring leads



Insulation with remote lead PR400



Insulation with cable with Shuko-plug

5. Press the **GO/STOP** key on the instrument or the **START** key on the remote lead PR400. The instrument starts measuring and provides a result on the display, then gives out a double sound in case the result is positive.
6. Press the **SAVE** key or touch the relevant icon to save the result of measurement shown on the display. Confirm saving by pressing the **SAVE** key again, or the relevant icon.

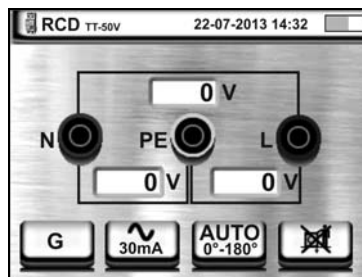
4.3. RCD – FUNCTION TEST OF RESIDUAL CURRENT PROTECTIONS

CAUTION

- The instrument can be used for measurements on installations with overvoltage category CAT III 240V to earth and CAT III 415V between inputs. Category CAT III is suitable for measurements carried out on installations inside buildings with low voltage (examples are distribution boards, wirings, switches, fixed installation sockets, electric motors, industrial equipment).
- We recommend holding the alligator clamp respecting the safety area created by the hand protection (see § 2.4).
- If possible, disconnect all loads connected downstream of the residual current switch since they could produce other leakage currents, further to those produced by the instrument, thus altering test results.
- The results may be influenced by the presence of auxiliary circuits connected in parallel with the item to be tested or by transient currents and/or electric potentials
- **The instrument allows performing tests on earth leakage relay RCD with currents up to 10A (with optional accessory RCDX10). Refer to the user manual for any details**

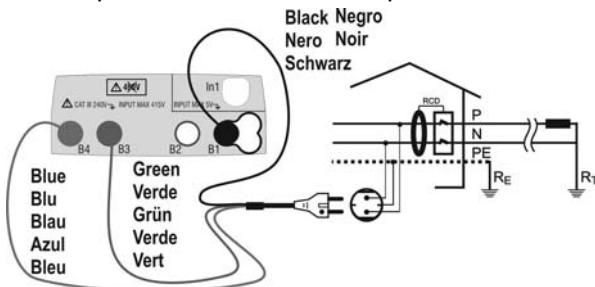


Access the general menu by pressing the **HOME** key and select function . The instrument shows the following screen:

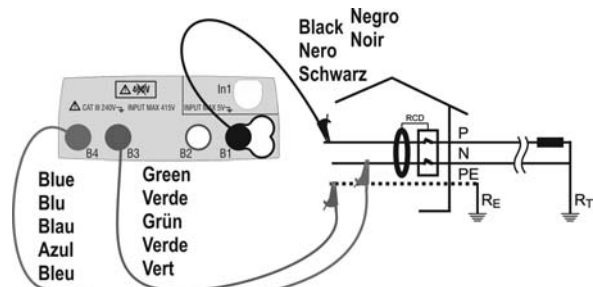


4.3.1. Measuring tripping time in AUTO mode

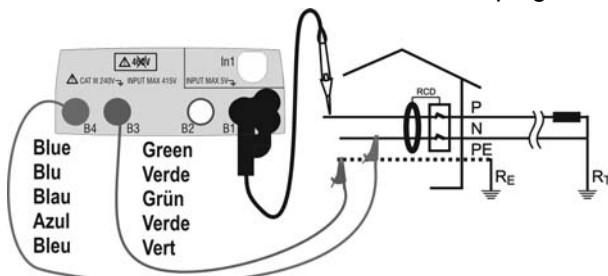
1. Select the RCD type by pressing key **F1** or touching the relevant icon , or
2. Select the rated current by pressing key **F2** or touching the relevant icon (e.g.:)
3. Select AUTO mode by pressing key **F3** or touching the relevant icon (e.g.:)
4. Connect the measuring leads as shown in the following figures, which show typical situations: For the description of other situations, please refer to the user manual.



Test on RCD with cable with Shuko-plug



Test on RCD with measuring leads



Test on RCD with remote lead PR400

5. Press the **GO/STOP** key on the instrument or the **START** key on the remote lead PR400. The instrument starts a series of **six** consecutive measurements (at 1/2, 1- and 5-fold I_{dn} with polarity 0° and 180°) and provides the results on the display, and it gives out a double sound in case of positive result
6. Press the **SAVE** key or touch the relevant icon to save the result of measurement shown on the display. Confirm saving by pressing the **SAVE** key again, or the relevant icon.

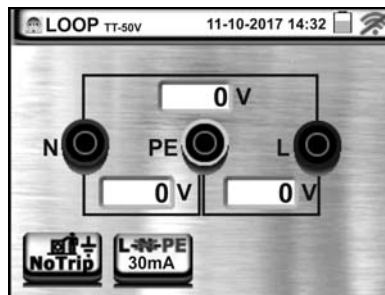
4.4. LOOP – MEASURING OVERALL EARTH RESISTANCE (NOTRIP TEST)

CAUTION

- The instrument can be used for measurements on installations with overvoltage category CAT III 240V to earth and CAT III 415V between inputs. Category CAT III is suitable for measurements carried out on installations inside buildings with low voltage (examples are distribution boards, wirings, switches, fixed installation sockets, electric motors, industrial equipment).
- We recommend holding the alligator clamp respecting the safety area created by the hand protection (see § 2.4).
- Do not measure impedance with rated voltages in the system exceeding a range of $110 \div 240V \pm 10\%$ (Phase-Neutral, Phase-Earth) and $110 \div 415V \pm 10\%$ (Phase-Phase).

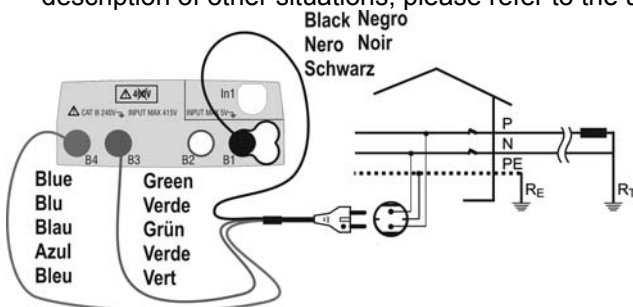


Access the general menu by pressing the **HOME** key and select function . The instrument shows the following screen:

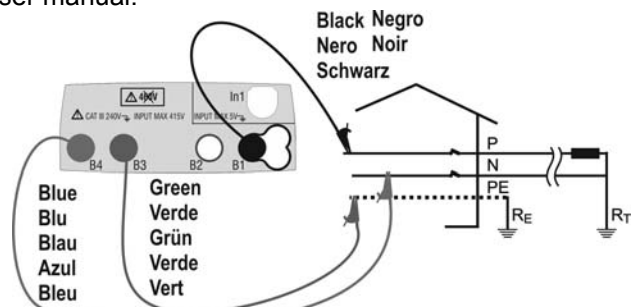


4.4.1. Measuring overall earth resistance with no residual current protection tripping

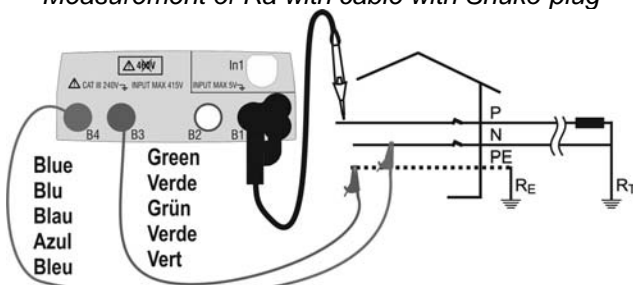
1. Select **NoTrip** mode by pressing key **F1** or touching the relevant icon
2. Select the rated current by pressing key **F2** or touching the relevant icon (e.g.:)
3. Connect the measuring leads as shown in the following figures, which show typical situations: For the description of other situations, please refer to the user manual.



Measurement of Ra with cable with Shuko-plug



Measurement of Ra with measuring leads



Measurement of Ra with remote lead PR400

4. Press the **GO/STOP** key on the instrument or the **START** key on the remote lead PR400. The instrument starts measuring and provides a result on the display, then gives out a double sound in case the result is positive.
5. Press the **SAVE** key or touch the relevant icon to save the result of measurement shown on the display. Confirm saving by pressing the **SAVE** key again, or the relevant icon.

For measuring the assumed short-circuit current, checking the coordination of magnetothermal protections, using the accessory IMP57 and other functions please refer to the user manual.

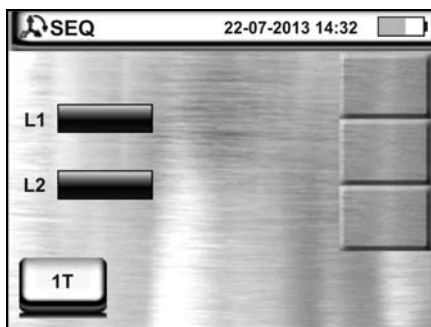
4.5. SEQ FUNCTION – DETECTION OF PHASE ROTATION WITH 1 TEST LEAD

CAUTION

- The instrument can be used for measurements on installations with overvoltage category CAT III 240V to earth and CAT III 415V between inputs. Category CAT III is suitable for measurements carried out on installations inside buildings with low voltage (examples are distribution boards, wirings, switches, fixed installation sockets, electric motors, industrial equipment)
- We recommend holding the alligator clip and the leads respecting the safety area created by the hand protection (see § 2.4)
- Do not measure impedance with rated voltages in the system exceeding a range of $110 \div 240V \pm 10\%$ (Phase-Neutral, Phase-Earth) and $110 \div 415V \pm 10\%$ (Phase-Phase)

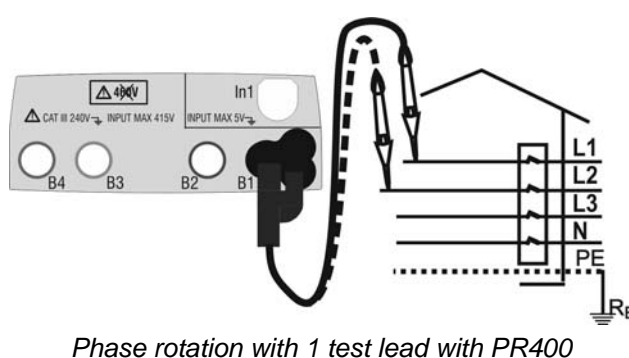
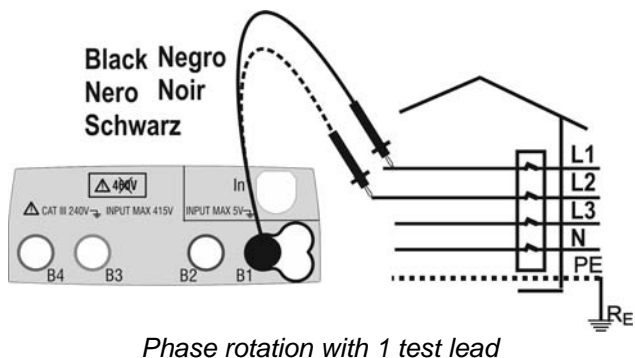


Access the general menu by pressing the **HOME** key and select function . The instrument shows the following screen:



4.5.1. Measuring phase rotation with only 1 test lead

1. Select **1T** mode by pressing key **F1** or touching the relevant icon (e.g.:)
2. Connect the instrument to phase L1 of the system to be tested by using the Black lead or, as an alternative, the remote lead PR400 as shown in the following figures:





3. Press the **GO/STOP** key of the instrument (measurement with two leads) or the **START** key on the remote lead (measurement with one lead). As soon as the instrument detects a reference voltage higher than 100V, measurement is started.
4. Move the Black or the remote lead PR400 onto phase L2.
5. As soon as the instrument detects a reference voltage higher than 100V, the test goes on and, in case of positive result, the instrument gives out a double sound and the messages "123" and "OK" appear on the display. The messages "132" and "NON OK" in addition to a long sound are provided by the instrument in case of negative result.
6. Press the **SAVE** key or touch the relevant icon to save the result of measurement shown on the display. Confirm saving by pressing the **SAVE** key again, or the relevant icon.

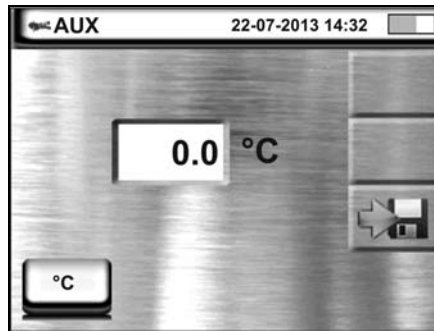
CAUTION

- The message "Time out" is provided by the instrument in case more than 7 seconds have elapsed between the passage from phase L1 to phase L2 and repeating measurement is necessary.
- A message "Vin>Vmax" is shown by the instrument in case voltage Phase-Neutral or to Earth >300V is detected and measurement is automatically interrupted.




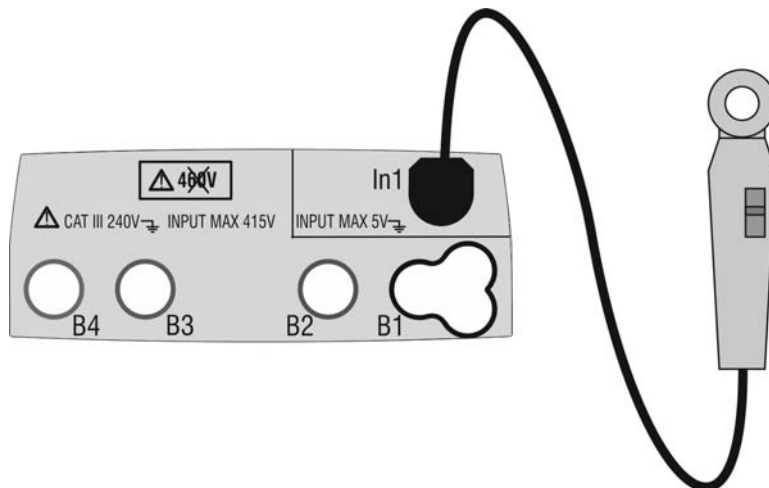
4.6. ENV – MEASURING ENVIRONMENTAL PARAMETERS

Access the general menu by pressing the **HOME** key  and select function . The instrument shows the following screen:





4.6.1. Measuring environmental parameters

1. Selects the type of measurement: TMP °C, TMP °F, RH, Lux (20), Lux (2k), Lux (20k) by using key **F1** or touching the relevant icon (e.g.: )
2. Connect the optional measuring leads to input **In1** as shown in the following figures:

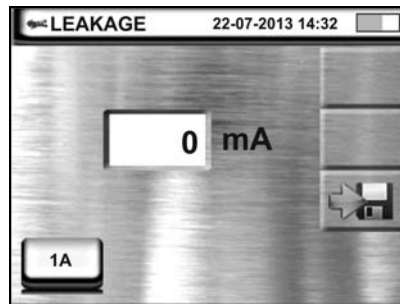


Measurements TMP, UR, Lux with probes HT52/05 and HT53/05


3. Select the measuring functions and the correct ranges on optional probes HT52/05 and HT53/05
4. Measurement is carried out in real time and the measuring result is shown constantly updated.
5. Press the **SAVE** key or touch the relevant icon  to save the result of measurement shown on the display. Confirm saving by pressing the **SAVE** key again, or the relevant icon. 

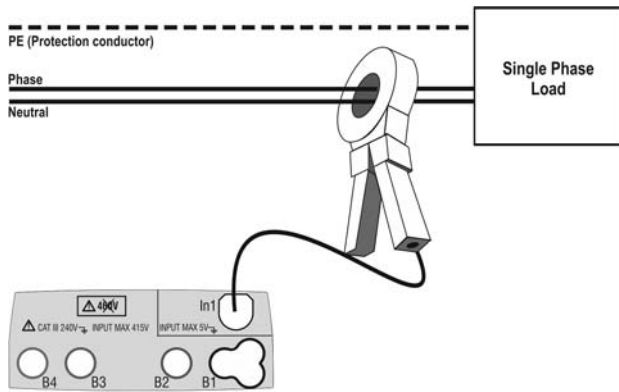
4.7. LEAKAGE – MEASURING LEAKAGE CURRENT

Access the general menu by pressing the **HOME** key  and select function . The instrument shows the following screen:

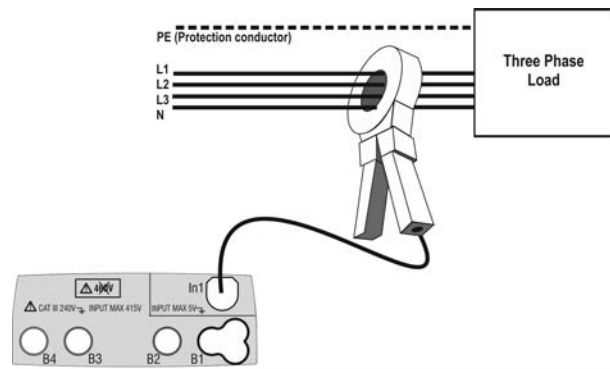


4.7.1. Leakage current measurement

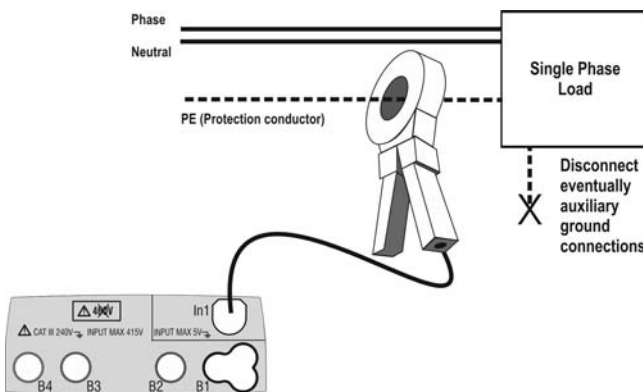
1. Select the desired full scale (typically 1A) by pressing key **F1** or touching the relevant icon. 
2. Connect the optional clamp HT96U to input **In1** as shown in the following figures:



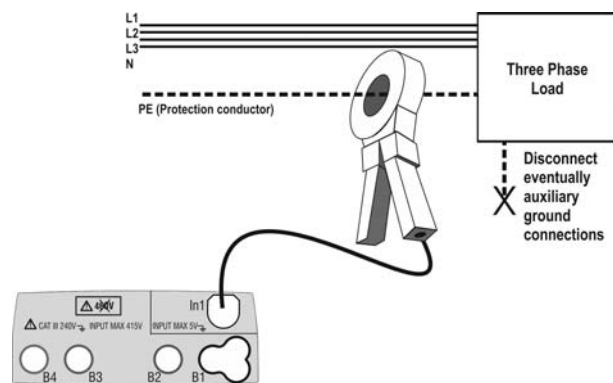
Measuring indirect leakage in single-phase case





Measuring indirect leakage in three-phase case



Measuring direct leakage in single-phase case



Measuring direct leakage in three-phase case

3. Measurement is carried out in real time and the measuring result is shown constantly updated.
4. Press the **SAVE** key or touch the relevant icon  to save the result of measurement shown on the display. Confirm saving by pressing the **SAVE** key again, or the relevant icon. 

4.8. ΔV% – VOLTAGE DROP ON MAIN LINES

This feature allows to evaluating the percentage value of voltage drop between two points of a main line in which a protection device is installed and comparing this value to possible limit value specified by guidelines.

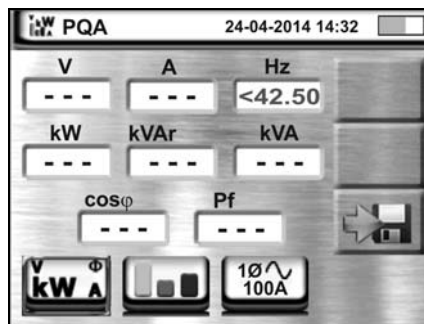
For any details on measurement please refer to the user manual of the instrument

4.9. PQA – REAL TIME MEASUREMENT OF NETWORK PARAMETERS

CAUTION

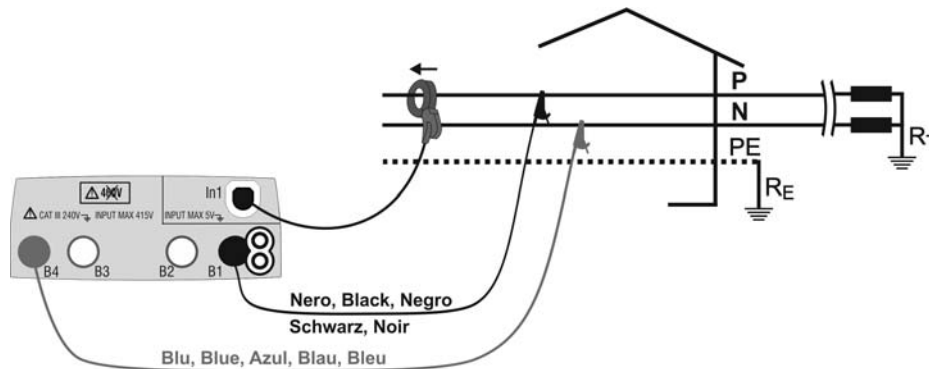
- The instrument can be used for measurements on installations with overvoltage category CAT III 240V to earth and CAT III 415V between inputs. Category CAT III is suitable for measurements carried out on installations inside buildings with low voltage (examples are distribution boards, wirings, switches, fixed installation sockets, electric motors, industrial equipment)
- We recommend holding the alligator clip and the leads respecting the safety area created by the hand protection (see § 2.4)
- The maximum voltage allowed between inputs **B1** and **B4** is equal to 460V. Exceeding such a limit may cause electrical shock to the user or damage the instrument.

Access the general menu by pressing the **HOME** key and select function . The instrument shows the following screen:



4.9.1. Measurement of network parameters in Single phase systems

1. Select the “” measurement and the desired full scale of the optional clamp by pushing the **F3** key or touch the icon
2. Connect the optional clamp to the **In1** input and the test leads for the voltage measurement as shown in the below picture:
- 3.



4. The measurement is in real time and the results are shown at display
5. Push the **F2** key or touch the icon for the visualization of harmonic analysis parameter (Hxx, THDx) of voltage and current by touching the icons at display for selection of the pages relative to the harmonics of higher order (up to the 25th)
6. Press the **SAVE** key or touch the relevant icon to save the result of measurement shown on the display. Confirm saving by pressing the **SAVE** key again, or the relevant icon.

For any details and for the measurement on Three phase balanced systems please refer to the user manual of the instrument

5. MAINTENANCE

5.1. GENERAL INFORMATION

Do not use the instrument in environments with high humidity levels or high temperatures. Do not expose to direct sunlight. Always switch off the instrument after use.

5.2. BATTERY REPLACEMENT



CAUTION

Only expert and trained technicians should perform this operation. Before replacing the battery, disconnect the test leads from live circuits in order to avoid electric shocks.

1. Disconnect live cables and clamps from the circuit being measured.
2. Switch off the instrument by pressing the **ON/OFF** key and remove all test cables from it.
3. Remove the fastening screw and remove the battery compartment cover.
4. Remove the batteries and replace them with the same number of batteries of the same type.
5. Restore the battery compartment cover into place and fasten it by means of the relevant screw.
6. Do not scatter old batteries into the environment. Use the relevant containers for disposal.

5.3. INSTRUMENT CLEANING

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

6. POWER SUPPLY

Battery type:	6 x1.5V alkaline batteries type IEC LR6 AA MN1500 6 x1.2V NiMH type AA
Battery life:	>500 test for each test function
Auto Power OFF (can be disabled):	after 5 minutes idling

7. REFERENCE GUIDELINES

Instrument safety:	IEC/EN61010-1, IEC/EN61557-1, -2, -3, -4, -5, -6, -7, -10
EMC :	IEC/EN61326-1
Technical documentation:	IEC/EN61187
Safety of measuring accessories:	IEC/EN61010-031, IEC/EN61010-2-032
Insulation:	double insulation
Encapsulation:	IP40
Pollution level:	2
Max height of use:	2000m (6562ft)
Measurement category:	CAT III 240V to earth, max 415V between inputs
Ω measurement (200mA):	IEC/EN61557-4, BS7671 17th ed.
Insulation (M Ω):	IEC/EN61557-2, BS7671 17th ed.
RCD:	IEC/EN61557-6, BS7671 17th ed.
LOOP P-P, P-N, P-PE:	IEC/EN61557-3, BS7671 17th ed.
Phase sequence:	IEC/EN61557-7, BS7671 17th ed.
Multifunction instrument:	IEC/EN61557-10, BS7671 17th ed.

8. ENVIRONMENTAL CONDITIONS FOR USE

Reference calibration temperature:	23°C \pm 5°C ; (73°F \pm 41°F)
Operating temperature:	0°C \div 40°C ; (32°F \div 104°F)
Allowable relative humidity:	<80%RH
Storage temperature:	-10°C \div 60°C ; (14°F \div 140°F)
Storage humidity:	<80%RH

This instrument complies with the prescriptions of the European directive on low voltage 2014/35/EU (LVD) and 2014/30/EU (EMC)

This instrument satisfies the requirements of 2011/65/EU (RoHS) directive and 2012/19/EU (WEEE) directive

9. TECHNICAL SPECIFICATIONS

Accuracy is calculated as: $\pm[\% \text{reading} + (\text{no. of digits}) * \text{resolution}]$ at 23°C, <80%RH

SAFETY TEST

AC TRMS Voltage

Range [V]	Resolution [V]	Accuracy
15 ÷ 460	1	$\pm(3\% \text{rdg} + 2 \text{dgt})$

Frequency

Range [Hz]	Resolution [Hz]	Accuracy
47.0 ÷ 63.6	0.1	$\pm(0.1\% \text{rdg} + 1 \text{dgt})$

RPE - Continuity of protective conductors (Ω)

Range [Ω]	Resolution [Ω]	Accuracy (*)
0.01 ÷ 99.99	0.01	$\pm(5.0\% \text{rdg} + 3 \text{digits})$

(*) after test leads calibration

Test current:

>200mA DC up to 2 Ω (cables included)

Resolution in current measurement:

1mA

Open-circuit voltage:

4 < V₀ < 12V

M Ω - Insulation resistance

Test voltage [V]	Measuring range [M Ω]	Resolution [M Ω]	Accuracy
50	0.01 ÷ 9.99	0.01	$\pm(2\% \text{rdg} + 2 \text{dgt})$
	10.0 ÷ 49.9	0.1	
	50.0 ÷ 99.9		$\pm(5\% \text{rdg} + 2 \text{dgt})$
100	0.01 ÷ 9.99	0.01	$\pm(2\% \text{rdg} + 2 \text{dgt})$
	10.0 ÷ 99.9	0.1	
	100 ÷ 199		1
250	0.01 ÷ 9.99	0.01	$\pm(2\% \text{rdg} + 2 \text{dgt})$
	10.0 ÷ 99.9	0.1	
	100 ÷ 499		1
500	0.01 ÷ 9.99	0.01	$\pm(2\% \text{rdg} + 2 \text{dgt})$
	10.0 ÷ 199.9	0.1	
	200 ÷ 499		
	500 ÷ 999	$\pm(5\% \text{rdg} + 2 \text{dgt})$	
1000	0.01 ÷ 9.99	0.01	$\pm(2\% \text{rdg} + 2 \text{dgt})$
	10.0 ÷ 199.9	0.1	
	200 ÷ 999		
	1000 ÷ 1999	$\pm(5\% \text{rdg} + 2 \text{dgt})$	

Open-circuit voltage:

nominal test voltage -0% +10%

Nominal measuring current:

>1mA @ 1k Ω x V_{nom} (50V, 100V, 250V, 1000V), >2,2mA @ 230k Ω @ 500V

Short-circuit current:

<6.0mA for each test rated voltage

Safety protection:

error message for input voltage >10V

Line/Loop impedance (Phase-Phase, Phase-Neutral, Phase-Earth)

Range [Ω]	Resolution [Ω]	Accuracy (*)
0.01 ÷ 9.99	0.01	$\pm(5\% \text{rdg} + 3 \text{dgt})$
10.0 ÷ 199.9	0.1	

(*) 0.1 m Ω in range 0.1 ÷ 199.9 m Ω (by using optional accessory IMP57)

Maximum test current:

5.81A (at 265V); 10.10A (at 457V)

Test voltage range Phase-Neutral / Phase-Phase:

(100V \pm 265V) / (100V \pm 460V), 50/60Hz \pm 5%

Protection types:

MCB (B, C, D, K), Fuse (aM, gG, BS882-2, BS88-3, BS3036, BS1362)

Insulating sheath materials:

PVC, Butyl rubber, EPR, XLPE

First fault current – IT systems

Range [mA]	Resolution [mA]	Accuracy
0.1 ÷ 0.9	0.1	$\pm(5.0\% \text{rdg} + 1 \text{dgt})$
1 ÷ 999	1	$\pm(5.0\% \text{rdg} + 3 \text{dgt})$

Limit contact voltage (ULIM)

25V, 50V

RCD – Molded type residual current protection test

Residual current protection type (RCD):

AC (⌚), A (⌚), B (⌚) – General (G), Selective (S) and Delayed (⌚)

Voltage range Phase-Earth, Phase-Neutral:

100V ±265V RCD type AC and A, 190V ±265V RCD type B

 Rated tripping currents (I_{ΔN}):

10mA, 30mA, 100mA, 300mA, 500mA, 650mA, 1000mA

Frequency:

50/60Hz ± 5%

Molded type residual current protection tripping current (⌚) – (for RCD General only)

RCD type	I _{ΔN}	Range I _{ΔN} [mA]	Resolution [mA]	Accuracy
AC, A	I _{ΔN} = 10mA	(0.3 ÷ 1.1) I _{ΔN}	≤ 0.1I _{ΔN}	- 0%, +10%I _{ΔN}
	10mA ≤ I _{ΔN} ≤ 650mA			- 0%, +5%I _{ΔN}
B	30mA ≤ I _{ΔN} ≤ 100mA			

Duration of molded type RCD tripping time test – TT/TN systems

	x 1/2			x 1			x 2			x 5			AUTO					
	\	G	S	⌚	G	S	⌚	G	S	⌚	G	S	⌚	G	S	⌚	G	S
10mA	AC	999	999	999	999	999	999	200	250	50	150	✓	✓				310	
	A	999	999	999	999	999	999	200	250	50	150	✓	✓				310	
	B																310	
30mA 100mA	AC	999	999	999	999	999	999	200	250	50	150	✓	✓				310	
	A	999	999	999	999	999	999	200	250	50	150	✓	✓				310	
	B	999	999	999	999	999	999							310				
300mA	AC	999	999	999	999	999	999	200	250	50	150	✓	✓				310	
	A	999	999	999	999	999	999	200	250	50	150	✓	✓				310	
	B	999	999	999	999	999	999							310				
500mA 650mA	AC	999	999	999	999	999	999	200	250	50	150	✓	✓				310	
	A	999	999	999	999	999	999	200	250							310		
	B													310				
1000mA	AC	999	999	999	999	999	999	200	250									
	A	999	999	999	999	999	999											
	B																	

Table with duration of tripping time measurement [ms] - Resolution: 1ms, Accuracy: ±(2.0%rdg + 2dgt)

Duration of molded type RCD tripping time test – IT systems

	x 1/2			x 1			x 2			x 5			AUTO					
	\	G	S	⌚	G	S	⌚	G	S	⌚	G	S	⌚	G	S	⌚	G	S
10mA	AC	999	999	999	999	999	999	200	250	50	150	✓	✓				310	
	A																	
	B																	
30mA 100mA 300mA	AC	999	999	999	999	999	999	200	250	50	150	✓	✓				310	
	A																	
	B																	
500mA 650mA	AC	999	999	999	999	999	999	200	250	50	150	✓	✓				310	
	A																	
	B																	
1000mA	AC	999	999	999	999	999	999	200	250									
	A																	
	B																	

Table with duration of tripping time measurement [ms] - Resolution: 1ms, Accuracy: ±(2.0%rdg + 2dgt)

Test on earth leakage relay RCD (with accessory RCDX10)

Residual current protection type (RCD): AC (⌚), A (⌚), B (⌚) – General (G), Selective (S) and Delayed (⌚)
 Voltage range Phase-Earth, Phase-Neutral: 100V ÷ 265V RCD type AC and A, 190V ÷ 265V RCD type B
 Rated tripping currents (I_{ΔN}): 0.3A ÷ 10A
 Frequency: 50/60Hz ± 5%

Earth leakage relay RCD tripping current (⌚) – (for RCD General only)

RCD type	I _{ΔN}	Range I _{ΔN} [mA]	Resolution [mA]	Accuracy
AC, A, B	300mA ≤ I _{ΔN} ≤ 10A	(0.3 ÷ 1.1) I _{ΔN}	≤ 0.1 I _{ΔN}	- 0%, +5% I _{ΔN}

Duration of earth leakage replay RCD tripping time test – TT/TN systems

	x 1/2			x 1			x 2			x 5			AUTO			⌚			
	\	G	S	⌚	G	S	⌚	G	S	⌚	G	S	⌚	G	S	⌚	G	S	⌚
0.3A ÷ 1.0A	AC	999	999	999	999	999	999	200	250		50	150		✓	✓		310		
	A	999	999	999	999	999	999	200	250		50	150		✓	✓		310		
1.1A ÷ 3.0A	B	999	999	999	999	999	999										310		
	AC	999	999	999	999	999	999	200	250		50	150		✓	✓		310		
3.1A ÷ 6.5A	A	999	999	999	999	999	999	200	250		50	150		✓	✓		310		
	B	999	999	999	999	999	999										310		
6.6A ÷ 10.0A	AC	999	999	999	999	999	999	200	250										
	A	999	999	999	999	999	999												
	B																		

Table with duration of tripping time measurement [ms] - Resolution: 1ms, Accuracy: ±(2.0%rdg + 2dgt)

Duration of earth leakage replay RCD tripping time test – IT systems

	x 1/2			x 1			x 2			x 5			AUTO			⌚			
	\	G	S	⌚	G	S	⌚	G	S	⌚	G	S	⌚	G	S	⌚	G	S	⌚
0.3A ÷ 3.0A	AC	999	999	999	999	999	999	200	250		50	150		✓	✓		310		
	A																		
3.1A ÷ 6.5A	B																310		
	AC	999	999	999	999	999	999	200	250		50	150		✓	✓		310		
6.6A ÷ 10.0A	A																		
	B																		

Table with duration of tripping time measurement [ms] - Resolution: 1ms, Accuracy: ±(2.0%rdg + 2dgt)

NoTrip – Global earth resistance with no residual current protection tripping

Voltage range Phase-Earth, Phase-Neutral: 100V ÷ 265V
 Frequency: 50/60Hz ± 5%

Global earth resistance in systems with Neutral

Range [Ω]	Resolution [Ω]	Accuracy
0.01 ÷ 9.99	0.01	-±(5%rdg + 0.1Ω)
10.0 ÷ 199.9	0.1	-±(5%rdg + 1Ω)
200 ÷ 1999	1	-±(5%rdg + 3Ω)

Maximum current: <15mA
 Ut LIM (UL): 25V or 50V

Global earth resistance in systems without Neutral

Range [Ω]	Resolution [Ω]	Accuracy
1 ÷ 1999	1	-±(5%rdg + 3Ω)

Maximum current: < ½ I_{ΔN} set
 Ut LIM (UL): 25V or 50V

Contact voltage (measured during RCD and Ra test)

Range [V]	Resolution [V]	Accuracy
0 ÷ Ut LIM	0.1	-0%, +(5.0%rdg + 3V)

Phase sequence test with 1 test lead

Voltage range P-N, P-PE [V]	Frequency range
100 ÷ 265	50Hz/60Hz ± 5%

Measurement is only carried out by direct contact with live parts (not work by touching the insulation sheath of the cables)

Leakage current (input In1 – STD clamp)

Range [mA]	Resolution [mA]	Accuracy
2 ÷ 999	1	±(5.0%rdg + 2dgt)

Environmental parameters

Measurement	Range	Resolution	Accuracy
°C	-20.0 ÷ 60.0°C	0.1°C	±(2%rdg + 2dgt)
°F	-4.0 ÷ 140.0°F	0.1°F	
HR%	0.0% ÷ 100.0%HR	0.1%HR	
DC Voltage	0.1mV ÷ 1.0V	0.1mV	
Lux	0.001 ÷ 20.00lux (*)	0.001 ÷ 0.02Lux	
	0.1 ÷ 2.0klux (*)	0.1 ÷ 2Lux	
	1 ÷ 20.0klux (*)	1 ÷ 20Lux	

(*) Accuracy of luxmeter probe is according to Class AA

MEASUREMENT OF NETWORK PARAMETERS AND HARMONICS
Voltage

Range [V]	Resolution [V]	Accuracy
15.0 ÷ 459.9	0.1V	±(1.0%rdg + 1dgt)

Crest factor ≤ 1,5 ; Frequency: 42.5 ÷ 69.0 Hz

Frequency

Range [Hz]	Resolution [Hz]	Accuracy
42.5 ÷ 69.0	0.01	±(2.0%rdg + 2dgt)

Allowed voltage: 15.0 ÷ 459.9V ; Allowed current: 5%FS clamp ÷ FS clamp

AC Current

FS clamp	Range [A]	Resolution [A]	Accuracy
≤ 10A	5% FS ÷ 9.99	0.01	1Ph: ±(1.0%rdg + 3 dgt) 3Ph: ±(2.0%rdg + 5 dgt)
10A ≤ FS ≤ 200	5% FS ÷ 199.9	0.1	
200A ≤ FS ≤ 3000	5% FS ÷ 2999	1	

Range: 5 ÷ 999.9 mV, values under 5mV are zeroed

Crest factor ≤ 3; Frequency: 42.5 ÷ 69.0 Hz

Active power (@ 230V in 1Ph systems, 400V in 3Ph systems, cosφ=1, f=50.0Hz)

FS clamp	Range [kW]	Resolution [kW]	Accuracy
≤ 10A	0.000 ÷ 9.999	0.001	1Ph: ±(2.0%rdg + 5 rdg) 3Ph: ±(2.5%rdg + 8 rdg)
10A ≤ FS ≤ 200	0.00 ÷ 999.99	0.01	
200A ≤ FS ≤ 1000	0.0 ÷ 999.9	0.1	
1000A ≤ FS ≤ 3000	0 ÷ 9999	1	

Reactive power (@ 230V in 1Ph systems, 400V in 3Ph systems, cosφ=0, f=50.0Hz)

FS clamp	Range [kVAr]	Resolution [kVAr]	Accuracy
≤ 10A	0.000 ÷ 9.999	0.001	1Ph: ±(2.0%rdg + 7 rdg) 3Ph: ±(3.0%rdg + 8 rdg)
10A ≤ FS ≤ 200	0.00 ÷ 999.99	0.01	
200A ≤ FS ≤ 1000	0.0 ÷ 999.9	0.1	
1000A ≤ FS ≤ 3000	0 ÷ 9999	1	

Power factor (@ 230V in 1Ph systems, 400V in 3Ph systems, f=50.0Hz)

Range	Resolution	Accuracy
0.70c ÷ 1.00 ÷ 0.70i	0.01	±(4.0%rdg + 10rdg) if I ≤ 10%FS ±(2.0%rdg + 3rdg) if I > 10%FS

cosφ (@ 230V in 1Ph systems, 400V in 3Ph systems, f=50.0Hz)

Range	Resolution	Accuracy
0.70c ÷ 1.00 ÷ 0.70i	0.01	±(4.0%rdg + 10rdg) if I ≤ 10%FS ±(1.0%rdg + 7rdg) if I > 10%FS

Voltage harmonics (@ 230V in 1Ph systems, 400V in 3Ph systems, f=50.0Hz)

Range [%]	Resolution [%]	Ordine	Accuracy
0.1 ÷ 100.0	0.1	01 ÷ 25	±(5.0%rdg + 5rdg)

Fundamental frequency: 42.5 ÷ 69.0 Hz, DC accuracy not declared

Current harmonics (f=50Hz)

Range [%]	Resolution [%]	Order	Accuracy
0.1 ÷ 100.0	0.1	01 ÷ 9	±(5.0%rdg + 5rdg)
		10 ÷ 17	±(10.0%rdg + 5rdg)
		18 ÷ 25	±(15.0%rdg + 10rdg)



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