EurotestAT

MI 3101

Short instructions

Version 4.1, HW5, Code no. 20 751 321

METREL®

Distributor:

Manufacturer:

METREL d.d.
Ljubljanska cesta 77
1354 Horjul
Slovenia

web site: http://www.metrel.si
e-mail: metrel@metrel.si

CE Mark on your equipment certifies that this equipment meets the requirements of the EU (European Union) concerning safety and interference causing equipment regulations

1. Safety and operational considerations

1.1. Warnings

- **This document cannot be a substitute for the Instruction manual!**
- **Before using EurotestAT instrument read the Instruction manual carefully, otherwise use of the instrument may be dangerous for the operator, for the instrument or for equipment under test!**
- **⚠ Symbol on the instrument means »Read the Instruction manual with special care«. The symbol requires an action!**
- **If the test equipment is used in a manner not specified in Instruction manual the protection provided by the equipment may be impaired!**
- **Do not use the instrument and accessories if any damage is noticed!**
- **In case a fuse has blown follow the instructions in Instruction manual to replace it!**
- **Consider all generally known precautions in order to avoid risk of electric shock while dealing with hazardous voltages!**
- **Do not use the instrument in supply systems with voltages higher than 550 V!**
- **Service intervention or adjustment and calibration procedure is allowed to be carried out only by a competent authorized person!**
- **Use only standard or optional test accessories supplied by your distributor!**
- **Consider that older and some of new optional test accessories compatible with this instrument meet over voltage category CAT III / 300 V! It means that maximum allowed voltage between test terminals and ground is 300 V!**
- **Instrument contains rechargeable NiCd or NiMh batteries. The batteries should only be replaced with the same type as defined on the battery placement label or in Instruction manual. Do not use standard batteries while power supply adapter is connected, otherwise they may explode!**
- **Hazardous voltages exist inside the instrument. Disconnect all test leads, remove the power supply cable and switch off the instrument before removing battery compartment cover.**

1.2. Batteries

- ⚠ When battery cells have to be replaced or before opening battery/fuse compartment cover, disconnect any measuring accessory connected to the instrument and power off the instrument, hazardous voltage inside!
- Insert cells correctly, otherwise the instrument will not operate and the batteries could be discharged.
- If the instrument is not used for a long period of time remove all batteries from the battery compartment.
- Alkaline or rechargeable Ni-Cd or Ni-MH batteries (size AA) can be used. The operating hours are given for cells with normal capacity of 2100 mAh.
- Do not recharge alkaline batteries!

The batteries are charged whenever the power supply adapter is connected to the instrument. In-built protection circuits control the charging procedure and assure maximal battery lifetime. Power supply socket polarity is shown in figure below.

Power supply socket polarity

Note:

- Use only power supply adapter delivered from manufacturer or distributor of the test equipment to avoid possible fire or electric shock!

1.3. Communication

There are two communication interfaces available on the instrument: USB and RS 232.

How to select interface port on the instrument:

- Select the MISCELLANEOUS menu and then the COM PORT option.
- With the keys ↑ / ↓ select communication port (RS232 or USB).
- Press the TEST key to confirm selected port.

How to transfer stored data:

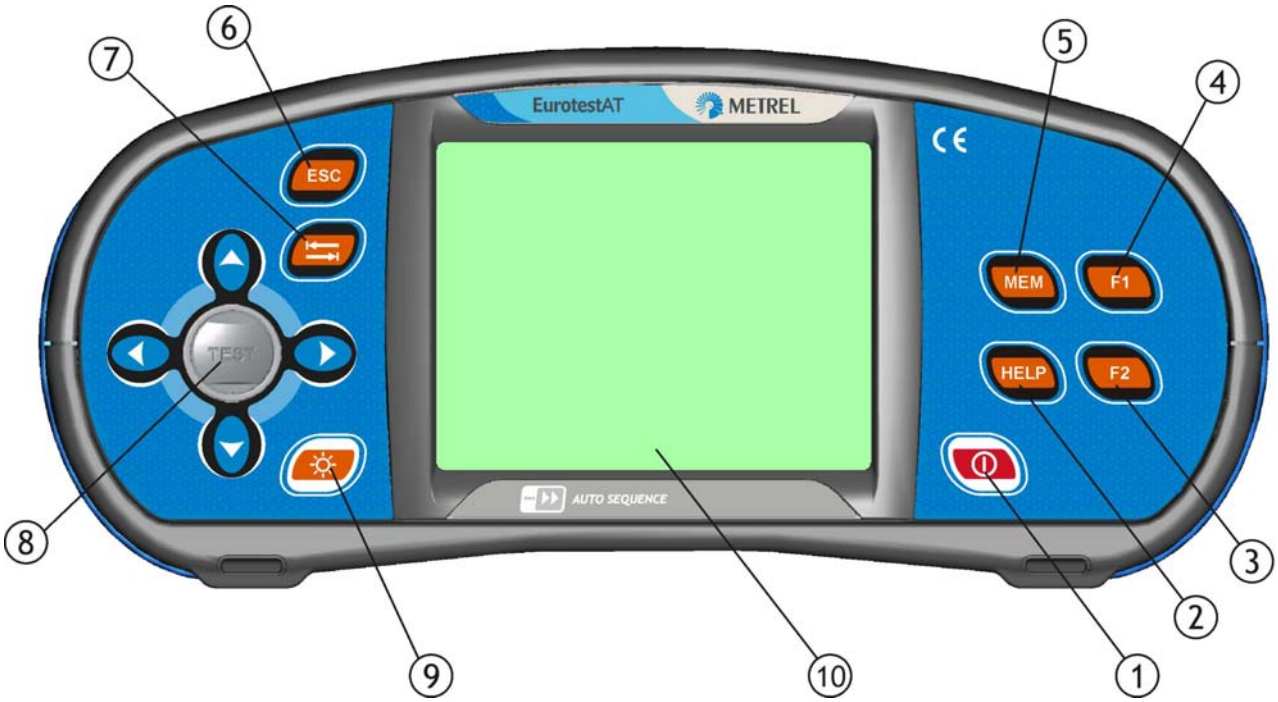
- Select appropriate communication interface (USB / RS 232).
- Power on the PC and the instrument.
- Run the program Eurolink.
- The PC and the instrument automatically recognize each other.
- Use the program for: downloading data, clearing storage, modifying user data, preparing reports and exporting for spreadsheet.

Note:

- Only one interface port of the instrument can be active at the same time.
- USB drivers should be installed on PC before using the USB interface. Refer to USB installation instructions available on installation CD.

Communication transfer speed:
RS 232 ..... 115200 baud
USB ..... 256000 baud

2. Instrument front panel



Legend:

1 ..... Switches the instrument power on or off.
2 ..... Accesses help menus.
3 ..... Adds new memory location/ Confirmation of name entered in edit mode.
4 ..... Enters memory editing mode/ Deletes character on the left in edit mode.
5 ..... Memory handling.
6 ..... Exits selected and displayed option.
7 ..... Jumps between display windows (TAB).
8 ..... Cursor keypad with TEST key.
9 ..... Changes backlight level and contrast.
10 ... 320 x 240 dots matrix display with backlight.

3. Auto sequence

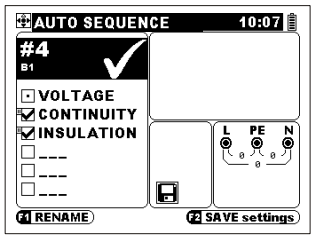
① Set function
- Select Auto sequence in Main menu.
- Use cursors ← / → to select appropriate test sequence.

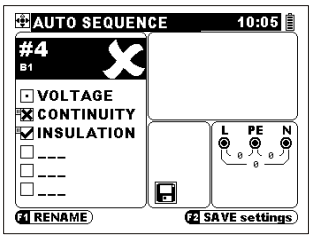
② Set parameters and limits
↓ / ↑ **...** Select auto sequence step or parameter.
← / →**...** Select test function or parameter value.
TAB ..... Enters test function parameters setup menu.
F1..... Name / description or pause / comment menus.

③ Building auto sequence procedure
- Select auto sequence in the main menu.
- Press the TEST key.
- Select auto sequence number (← / →).
- Edit name and description if necessary (F1).
- Repeat until finished (maximum 6 steps):
  - Select auto sequence step (↓ / ↑).
  - Select auto sequence function (← / →).
  - Select auto sequence test parameters of the function (TAB).
  - Set / reset pause flag II and select or enter comment if necessary (F1).
- Name (or rename) the auto sequence (F1).
- Save prepared auto sequence (F2).

④ Running auto sequence
- Select auto sequence in the main menu.
- Select correct auto sequence (← / →).
- Connect the instrument to tested object.
- Press TEST key.
- The sequence will pause at the functions marked with pause flag II.
  - Press the TAB key to toggle between comments menu and auto sequence main menu.
  - Press the TEST key to continue with the auto sequence.
  - Press the F1 key to skip the target function or the ESC key to skip the remaining functions and finish the auto sequence.
- The sequence will stop when invalid condition of test terminals is detected. It will:
  - Continue after correct condition is restored.
  - Skip the target function by pressing the F1 key or the remaining functions and finish the auto sequence by pressing the ESC key.
- Results of a finished auto sequence can be viewed and stored.

⑤ View results





Particular test results
- The key ↓ into sequence field.
  - Press TEST key to display result of selected function.
  - Press TEST or ESC key.
  - The key ↓ (or ↑) for next function.
  - Repeat this part for all results.
- The key ↑ or the ESC key to exit view.

Displayed results:
☒ **CONTINUITY**..... Measurement is finished and has failed.
☑ **INSULATION**..... Measurement is finished and has passed.
⊡ **VOLTAGE**..... Measurement is finished. No comparison limit was applied.
☐ **Z-LINE**..... Measurement is not performed yet (during test) or was skipped.
✓ ..... Overall PASS result is reported if all performed tests passed.
✗ ..... Overall FAIL result is reported if one or more performed tests failed.

4. Measurements

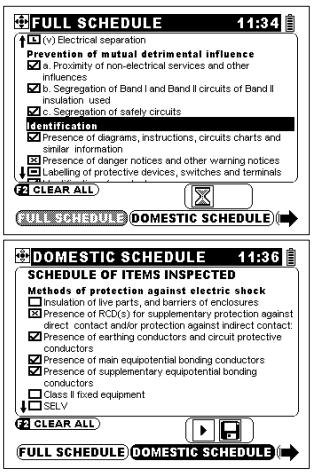
4.1. Inspections

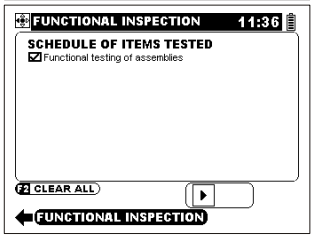
① Set function
- Select Single test in Main menu.
- Use cursors ← / → to find and choose the **VISUAL** function.
- Use cursors ↓ / ↑ to select appropriate item.

② Set parameters
Item..... Inspection schedules.

③ Visual inspection procedure
- Select Schedule type.
- Press TEST key to start inspection.
- Browse through items line by line and apply appropriate flags.
- Press TEST or ESC key to stop inspection.
- Store the result (optional).

④ View results





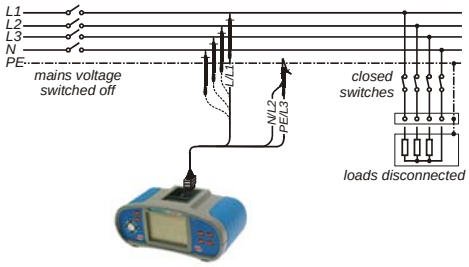
Markings:
- ☐ ..... Inspection was not performed
- ☑ ..... Inspection passed.
- ☒ ..... Inspection failed.
- ◧ ..... Inspection was performed in limited extent.
- ▭ ..... Inspection was not applicable.

4.2. Insulation resistance

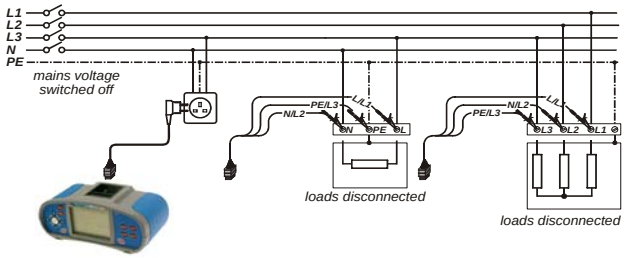
① Set function
- Select Single test in Main menu.
- Use cursors ← / → to find and choose the **INSULATION** function.

② Set parameters and limits
TEST .....Test configuration.
U_{iso} .....Test voltage.
Limit.....Minimum insulation resistance.

③ Test circuits for insulation resistance



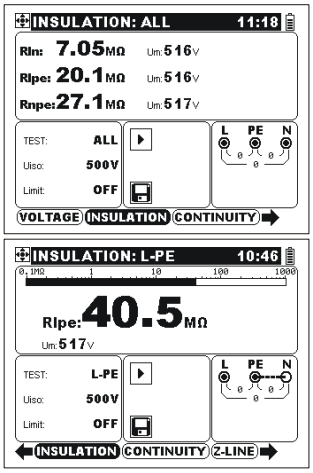
Connection of universal test cable for general insulation resistance measurement (TEST: L-PE)



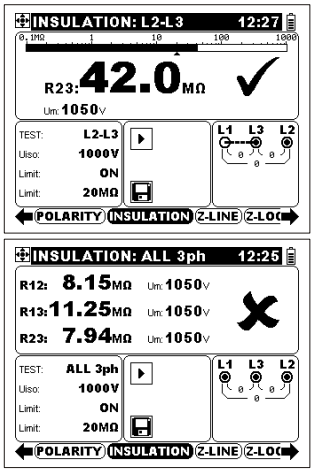
Application of plug cable or universal test cable for insulation resistance measurement (TESTS: 'L-PE,N-PE', 'L-N,L-PE', ALL; L1-L2, L1-L3, L2-L3, All 3ph)

④ Insulation resistance measuring procedure
- **Disconnect** tested installation from mains supply (and discharge tested insulation).
- **Connect** test cable to the instrument and tested item.
- Press the **TEST** key for measurement (keep pressing for continuous measurement).
- After the measurement is finished **store** the result (optional).

⑤ View results



Displayed results:
Rln..... Insulation resistance between L (+) and N (-).
Rlpe..... Insulation resistance between L (+) and PE (-).
Rnpe ... Insulation resistance between N (+) and PE (-).
Um..... Test voltage(s) – actual value(s).



Displayed results:
R12 .....Insulation resistance between L1 (+) and L2 (-).
R13 .....Insulation resistance between L1 (+) and L3 (-).
R23 .....Insulation resistance between L2 (+) and L3 (-).
Um .....Test voltage(s) – actual value(s).

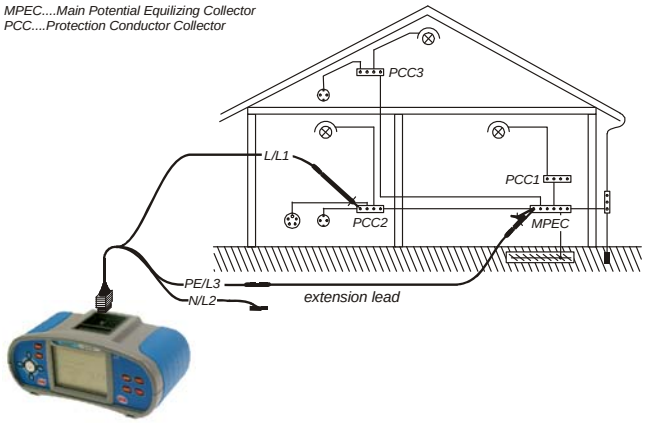
4.2.1. General resistance measurement

① Set function
- Select Single test in Main menu.
- Use cursors ← / → to find and choose the **CONTINUITY** function.
- Use cursors ↓ / ↑ to select sub-function General.

② Set parameters and limits

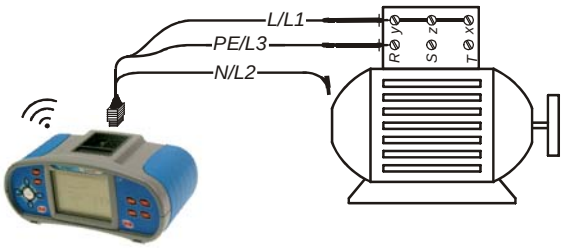
TEST ..... Resistance measurement sub-function.
Current.. Test current (200 mA, 7 mA).
Limit ..... Maximum resistance.

③ Test circuit for General 200 mA measurement



Connection of universal test cable plus optional extension lead

Test circuit for continuous resistance measurement (General 7 mA)

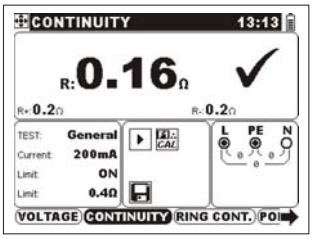


Universal test cable application

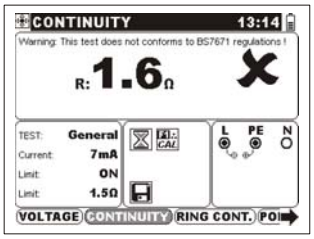
④ Measurement procedure
- **Connect** test cable to the instrument.
- **Compensate** test leads resistance (if necessary).
- **Disconnect** tested installation from mains supply (recommended).
- **Connect** test leads to the tested PE wiring.
- Press the **TEST** key for measurement.
- After the measurement is finished **store** the result (optional).

- **Connect** test cable to the instrument.
- **Compensate** test leads resistance (if necessary).
- **Disconnect** tested object from mains supply (recommended).
- **Connect** test leads to the tested object.
- Press the **TEST** key for continuous measurement.
- Press the **TEST** key to stop measurement.
- After the measurement is finished **store** the result (optional).

⑤ View results



Displayed results:
R .....Main R200mA resistance (average of R+ and R-results),
R+...R200mA sub-resistance with positive voltage at N terminal,
R-....R200mA sub-resistance with positive voltage at PE terminal.



Displayed result:
R....Resistance

4.2.2. Continuity of star circuit connections, R1+R2, R2

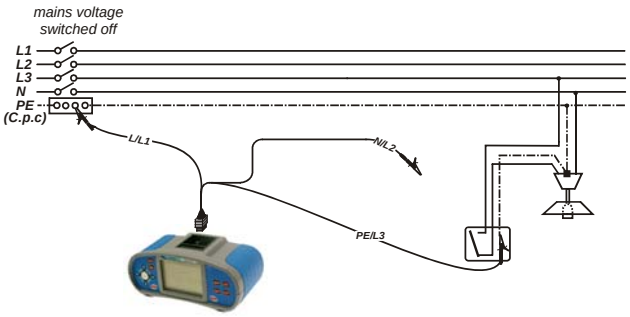
① Set function

- Select Single test in Main menu.
- Use cursors ← / → to find and choose the **CONTINUITY** function.
- Use cursors ↓ / ↑ to select sub-function (R2, R1+R2).

② Set parameters and limits

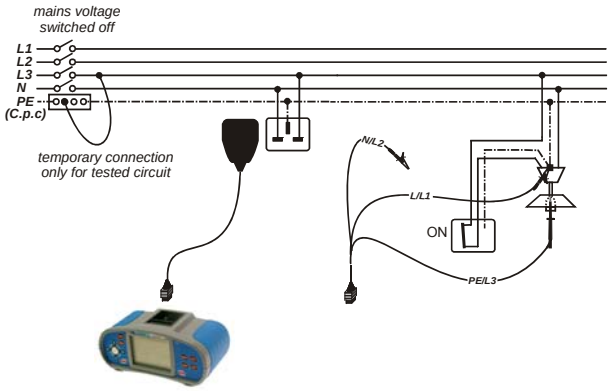
TEST ..... Resistance measurement sub-function.
Cable..... Applied test cable (plug cable, universal).
Limit ..... Maximum resistance.

③ Test circuit for Star R2 measurement



Connection of universal test cable

Test circuit for Star R1+R2 measurement

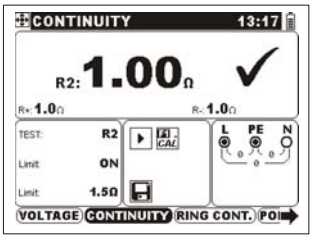


Plug cable and universal test cable application

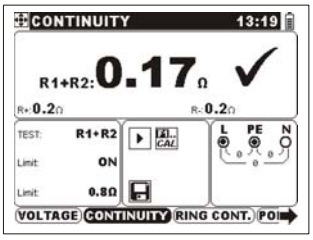
④ Measurement procedure

- **Connect** test cable to the instrument.
- **Compensate** test leads resistance (if necessary).
- **Disconnect** from mains supply and discharge tested installation.
- **Connect** test cable to the tested wiring.
- Press the **TEST** key for measurement.
- **Apply** manual PASS/FAIL (optional).
- After the measurement is finished **store** the result (optional).

⑤ View results



Displayed results:
R2..... Main R2 resistance (average of R+ and R-results),
R1+R2..... Main R1+R2 resistance (average of R+ and R-results),
R+..... Sub-resistance with positive voltage at N terminal,
R-..... Sub-resistance with positive voltage at PE terminal.

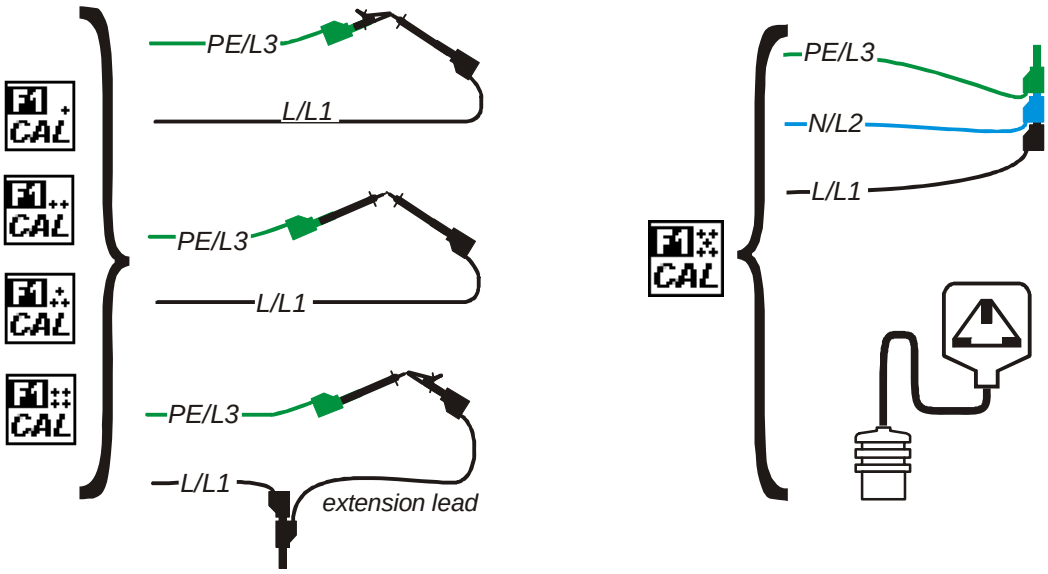


4.2.3. Compensation of test leads resistance

1 Set function
- Select appropriate **CONTINUITY** function in Single test.
- Press **F1** for compensating procedure.

2 Set parameters and limits

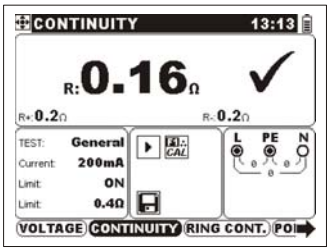
3 Test circuit for compensation of test leads resistance



Shorted test leads

4 Measurement procedure
- **Connect** test cable to the instrument.
- **Short** test leads intended for current earth bond resistance measurement.
- Press the **TEST** key for compensating the test leads resistance.

5 View results



Displayed results:

F1 CAL .... Resistance of the test leads is compensated.

F1 CAL ..... Resistance of the test leads is not compensated.

4.3.1. Continuity in ring final circuits, R1+RN, R1+R2

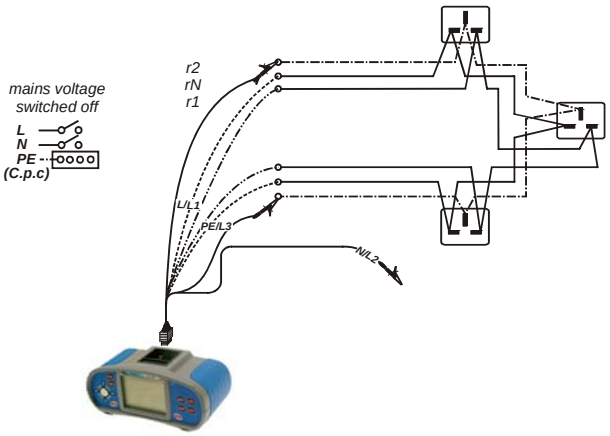
① Set function

- Select Single test in Main menu.
- Use cursors ← / → to find and choose the **RING CONT.** function.
- Use cursors ↓ / ↑ to select sub-function (R1+RN, R1+R2).

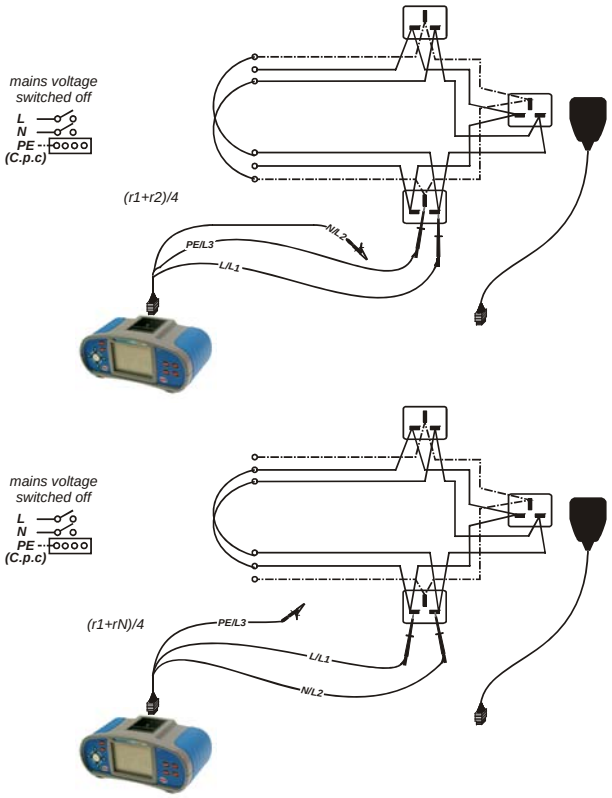
② Set parameters and limits

TEST..... Resistance measurement sub-function.
Cable..... Applied test cable (plug cable, universal).

③ Step 1 – test circuit



Step 2 – cross connections and verification of wall sockets



④ Measurement procedure

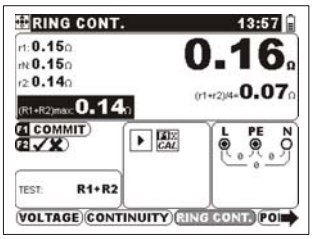
Step 1:

- **Connect** test cable to the instrument.
- **Disconnect** tested installation from mains supply.
- **Compensate** test leads resistance (if necessary).
- Press the **TEST** key for measurements.
- Perform measurement between both ends of phase conductor.
- Commit result to r1.
- Perform measurement between both ends of neutral conductor.
- Commit result to rN.
- Perform measurement between both ends of PE conductor.
- Commit result to r2.

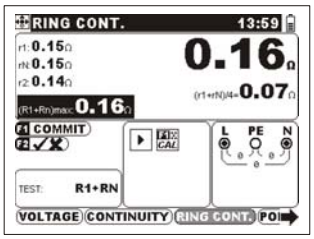
Step 2:

- **Cross-connect** conductors of tested ring circuit.
- Press the **TEST** key for measurements on socket.
- Commit result.
- Perform measurement on next socket.
- Commit result. It will be committed only if it is higher than the previous one.
- Repeat last two steps on all sockets of the circuit.
- **Press** the **F2** key to apply manual pass/fail of the result (optional).
- Press the **ESC** key to exit the measurement.
- After the measurement is finished **store** the result (optional).

⑤ View results



Displayed results:
r1..... line conductor resistance,
rN..... neutral conductor resistance,
r2..... protective conductor resistance,
(r1+r2)/4..... reference value for L-PE,
(r1+rN)/4..... reference value for L-N,
(R1+R2)max... worst socket resistance L-PE,
(R1+RN)max.. worst socket resistance L-N,



4.3.2. Continuity in ring final circuits, Auto

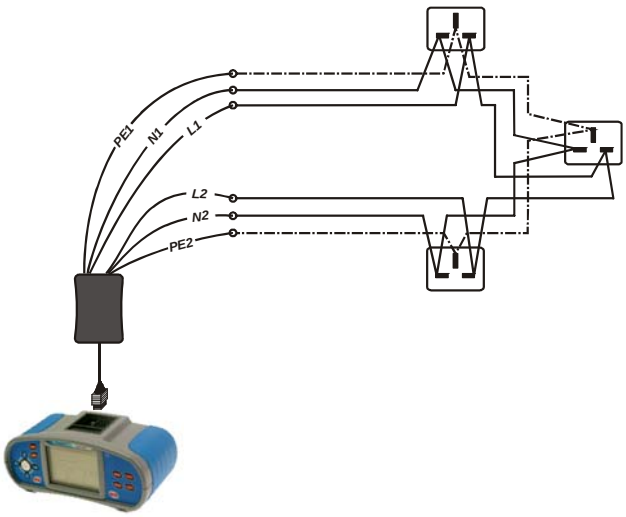
① Set function

- Select Single test in Main menu.
- Use cursors ← / → to find and choose the **RING CONT.** function.
- Use cursors ↓ / ↑ to select sub-function Auto.

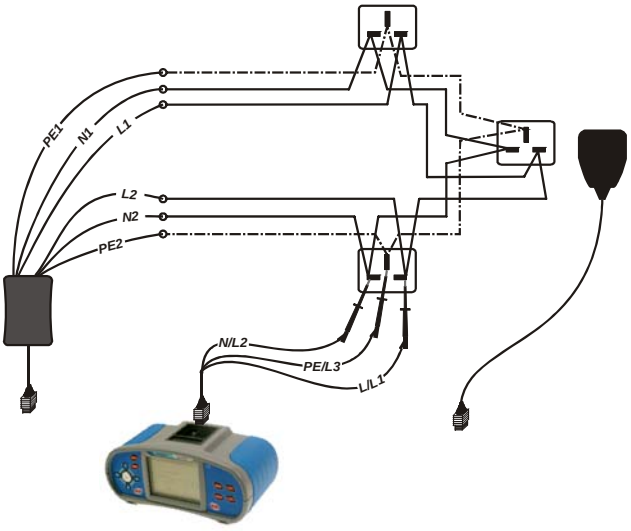
② Set parameters and limits

TEST.....Auto

③ Step 1 – test circuit



Verification of wall sockets



④ Measurement procedure

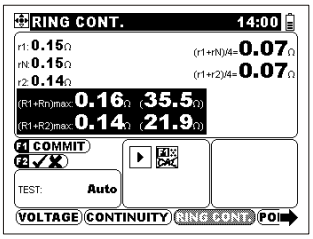
Step 1:

- **Connect** Ring adapter to the instrument.
- **Disconnect** tested installation from mains supply.
- **Connect** Ring adapter to the tested installation.
- **Compensate** test leads resistance (if necessary).
- Press the **TEST** key for measurements.
- Perform measurements of r1, rN, and r2.
- Commit results (F1 key) to r1, rN, and r2.

Step 2:

- **Disconnect** Ring adapter from the instrument.
- **Connect** plug cable or test cable to the instrument.
- Press the **TEST** key for measurements.
- Perform a measurement on socket.
- The resistance R1+R2 slightly increases with length if cross section of PE conductor is smaller than of line conductor.
- Commit results.
- Perform measurement on next socket.
- Commit results again. The results will be committed only if they are higher than the previous.
- Repeat last two steps on all sockets of the circuit.
- **Press** the **F2** key to apply manual pass/fail of the result (optional).
- Press the **ESC** key to exit the measurement.
- After the measurement is finished **store** the result (optional).

⑤ View results



Displayed results:

r1.....line conductor resistance,
rN.....neutral conductor resistance,
r2.....protective conductor resistance,
(r1+r2)/4.....reference value for L-PE,
(r1+rN)/4.....reference value for L-N,
(R1+R2)max.....worst socket resistance L-PE,
(R1+RN)max.....worst socket resistance L-N,

4.4. Polarity

① Set function

- Select Single test in Main menu.
- Use cursors ← / → to find and choose the **POLARITY** function.

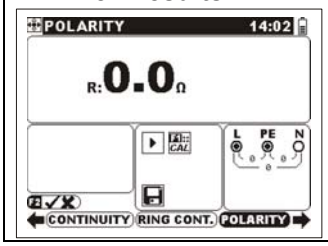
② Set parameters and limits

No parameters in the function.

④ Measurement procedure

- **Connect** test cable to the instrument.
- **Compensate** test leads resistance (if necessary).
- **Connect** test cable to the measured object.
- Press the **TEST** key for continuous measurement.
- Press the **TEST** key to stop measurement.
- **Press** the **F2** key to apply manual pass/fail of the result (optional).
- After the measurement is finished, **store** the result (optional).

⑤ View results



Displayed result:
R ..... Resistance.

4.5. Testing RCDs

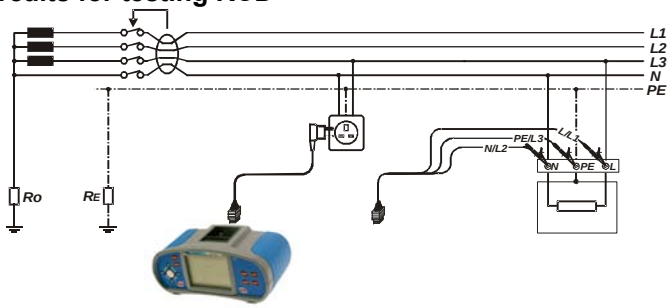
① Set function

- Select Single test in Main menu.
- Use cursors ← / → to find and choose the **RCD** function.
- Use cursors ↓ / ↑ to select sub-function (Contact voltage, Trip-out time, Trip-out current, Fault loop impedance, RCD autotest).

② Set parameters and limits

TEST..... RCD **sub-function** test.
Idn ..... **Rated** RCD residual current sensitivity $I_{\Delta N}$.
type..... RCD **type** [G, S], test current **waveform** plus starting **polarity** .
MUL ..... **Actual** test current relative to rated $I_{\Delta N}$.
U_{lim}..... Conventional touch voltage **limit.**

③ Circuits for testing RCD



Connecting plug cable and universal test cable

④ Measurement procedure

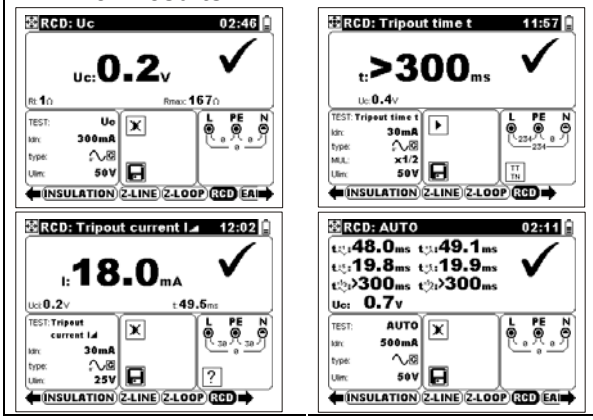
Measurement procedure for Contact voltage, Fault loop impedance, Trip-out time and Trip-out current:

- **Connect** test cable to the instrument.
- **Connect** test leads to the tested object.
- Press the **TEST** key.
- After the measurement is finished **store** the result (optional).

Measurement procedure for RCD Autotest:

- **Connect** test cable to the instrument.
- **Connect** test leads to the tested object
- Press the **TEST** key.
- Test **t1** with $I_{\Delta N}$,0°.
- **Re-activate** RCD.
- Test **t2** with $I_{\Delta N}$, 180°.
- **Re-activate** RCD.
- Test **t3** with $5\times I_{\Delta N}$, 0°.
- **Re-activate** RCD.
- Test **t4** with $5\times I_{\Delta N}$, 180°.
- **Re-activate** RCD.
- Test **t5** with $½\times I_{\Delta N}$, 0°; test **t6** with $½\times I_{\Delta N}$, 180°.
- After the measurement is finished **store** the result (optional).

⑤ View results



Displayed results:
Uc ....Contact voltage for rated $I_{\Delta N}$,
Rl.....Fault loop resistance,
t.....Trip-out time,
I.....Trip-out current,
Uci ...Contact voltage at trip-out current,
R_{MAX}.Limit earth fault loop resistance value acc. to BS 7671.

4.6. Fault loop impedance and prospective fault current

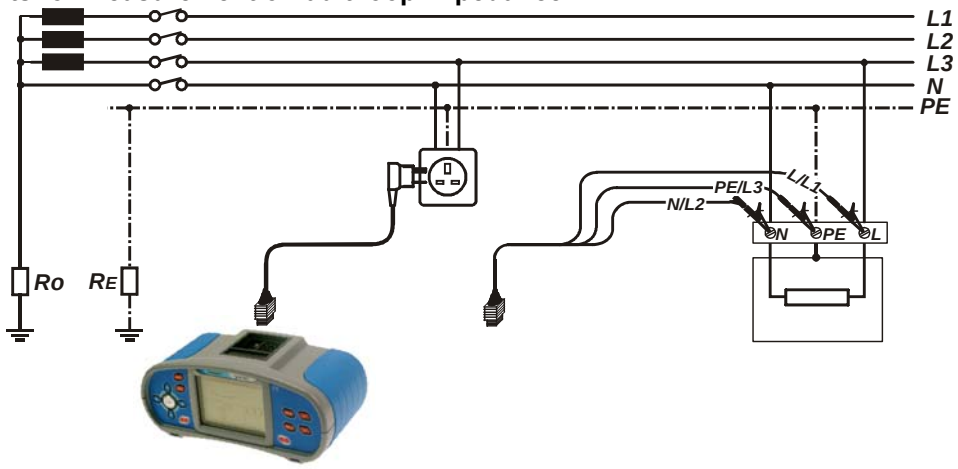
① Set function

- Select Single test in Main menu.
- Use cursors ← / → to find and choose the **Z-LOOP** function.
- The F1 enables / disables **Zmax** function.

② Set parameters and limits

FUSE Type ..... Selection of **fuse type** [---, BS88, BS3036, BS1361, BS1362, B, C, D].
FUSE I ..... Rated current of selected fuse.
FUSE T ..... **Maximum breaking time of selected fuse.**
Z lim ..... Maximum fault loop impedance for selected fuse.

③ Circuits for measurement of fault loop impedance

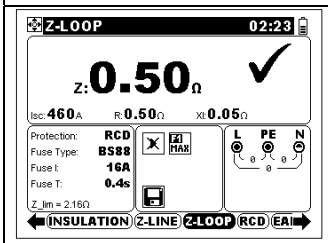


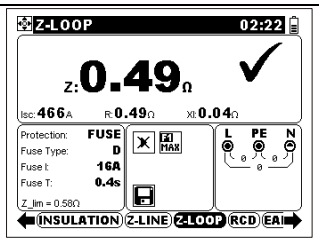
Connection of plug cable and universal test cable

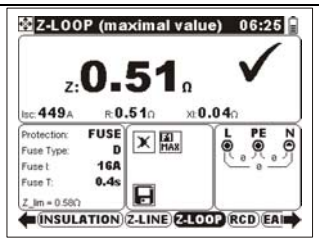
④ Measurement procedure

- **Connect** test cable to the instrument**.**
- **Connect** test leads to the tested object.
- Press the **TEST** key.
- After the measurement is finished **store** the result (optional).

⑤ View results





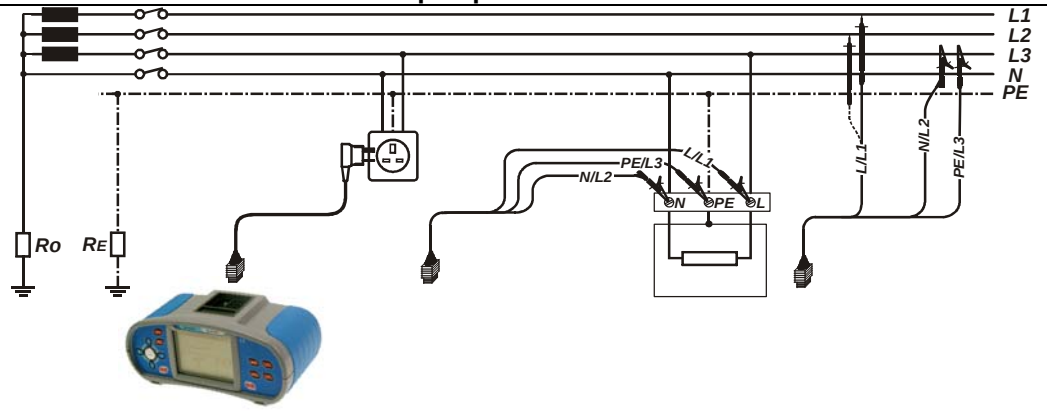


Displayed results:
Z ..... Fault loop impedance / maximum fault loop impedance in Zmax function,
Isc..... Prospective fault current,
R ..... Resistive part of loop impedance,
XL ..... Reactive part of loop impedance,
Uc ..... Contact voltage.

4.7. Line impedance / prospective short-circuit current and Voltage drop

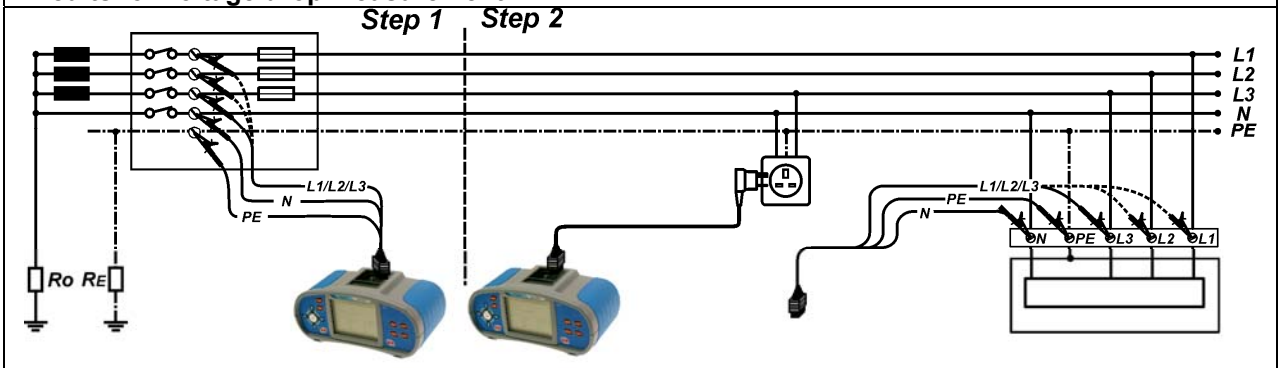
① **Set function**	② **Set parameters and limits**
❑ Select Single test in Main menu. ❑ Use cursors ← / → to find and choose the [redacted] function. ❑ Use cursors ↑ / ↓ to find and choose the Z / ΔU sub-function.	**FUSE Type** .....Selection of fuse type [---, BS88, BS3036, BS1361, BS1362, B, C, D]. **FUSE I**.....Rated current of selected fuse. **FUSE T**.....Maximum breaking time of selected fuse. **Z lim**.....Maximum line impedance for selected fuse. **Limit**.....Maximum voltage drop.

③ **Circuits for measurement of fault loop impedance**



Line-neutral or line-line impedance measurement – connection of plug cable and universal test cable

Circuits for voltage drop measurement



Line-neutral or line-line voltage drop measurement – connection of plug cable and universal test cable

④ Measurement procedure

Line impedance

- **Connect** test cable to the instrument.
- **Connect** test leads to the tested object.
- Press the **TEST** key.
- After the measurement is finished **store** the result (optional).

Voltage drop

Step 1

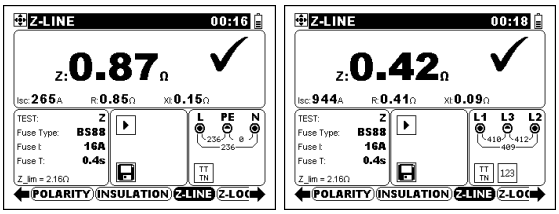
- **Connect** test cable to the instrument.
- **Connect** the test leads to the origin of electrical installation.
- Press the **F1** key to perform the measurement of Zref.

Step 2

- **Connect** test cable or plug cable to the instrument.
- **Connect** the test leads to the tested points.
- Press the **TEST** key to perform the measurement.
- After the measurement is finished **store** the result (optional).

⑤ View results

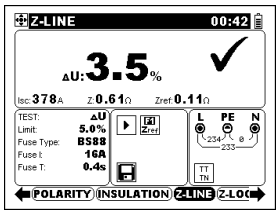
Line impedance



Displayed results:

Z..... Line impedance,
Isc..... Prospective short-circuit current,
R..... Resistive part of line impedance,
XL..... Reactive part of line impedance.

Voltage drop



Displayed results:

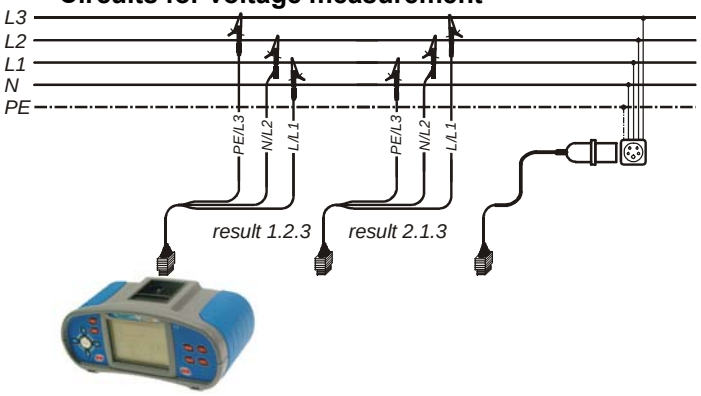
ΔU..... Voltage drop,
Isc..... Prospective short-circuit current,
Z..... Line impedance at measured point,
Zref..... Reference impedance.

4.8. Voltage, frequency and phase sequence

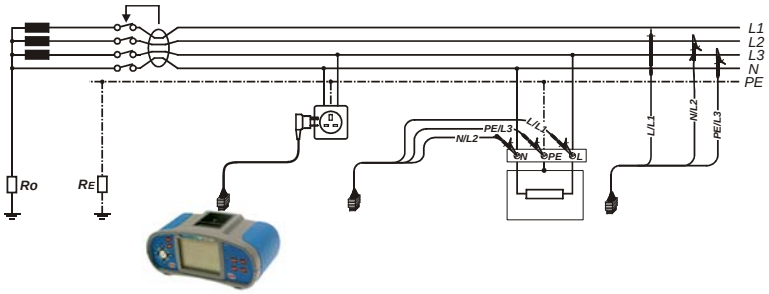
① Set function

- Select Single test in Main menu.
- Use cursors ← / → to find and choose the **VOLTAGE** function.

② Circuits for voltage measurement



Connection of universal test cable and optional adapter in three-phase system

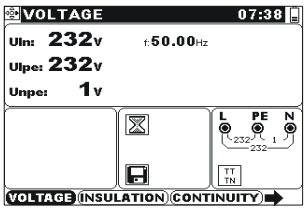


Connection of plug cable and universal test cable in single-phase system

③ Measurement procedure

- Connect test cable to the instrument.
- Connect test leads to the tested object.
- Store current measurement result (optional).

④ View results



Displayed results for single phase system:
Ul-n.....Voltage between phase and neutral conductors.
Ul-pe.....Voltage between phase and protective conductors.
Un-pe.....Voltage between neutral and protective conductors.

Displayed results for three-phase phase system:
U1-2.....Voltage between phases L1 and L2.
U1-3.....Voltage between phases L1 and L3.
U2-3.....Voltage between phases L2 and L3.
1.2.3 .....Correct connection.
2.3.1 .....Invalid connection.

4.9. Resistance to earth

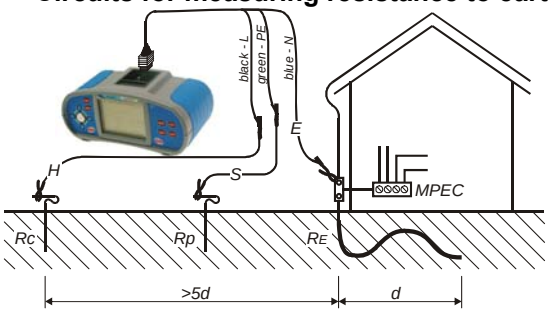
① Set function

- Select Single test in Main menu.
- Use cursors ← / → to find and choose the **EARTH** function.
- Use cursors ↓ / ↑ to select test sub-function.

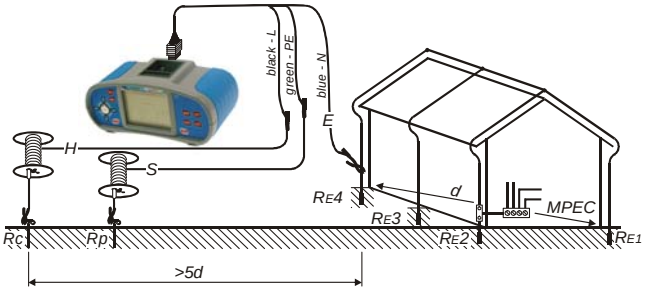
② Set parameters and limits

Test..... Selection of test principle [3-wire, specific earth resistance ρ]
Limit ..... Maximum resistance [OFF, 1 Ω ÷ 5 kΩ, 20 Ω (two clamps)]
For ρ only:
Distance ... Distance between probes [0.1 m ÷ 30.0 m] or [1 ft ÷ 100 ft].

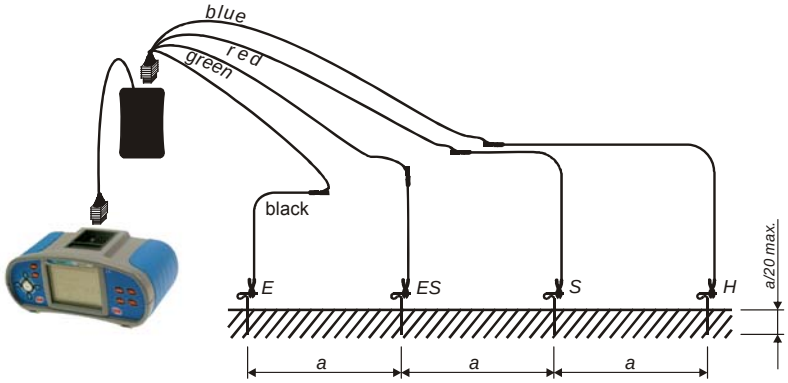
③ Circuits for measuring resistance to earth



Resistance to earth measurement – PE grounding



Resistance to earth measurement – lightning protection

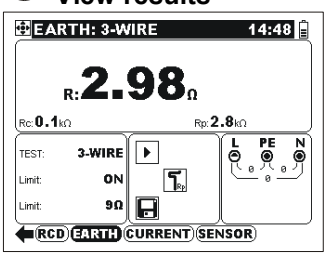


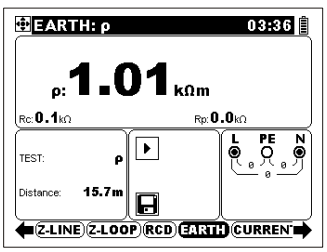
Specific earth resistance measurement with ρ-adapter

④ Measurement procedure

- **Connect** test cable / ρ adapter to the instrument.
- **Disconnect** tested object from mains supply.
- **Connect** test leads / ρ adapter to the tested object.
- Press the **TEST** key.
- After the measurement is finished **store** the result (optional).

⑤ View results





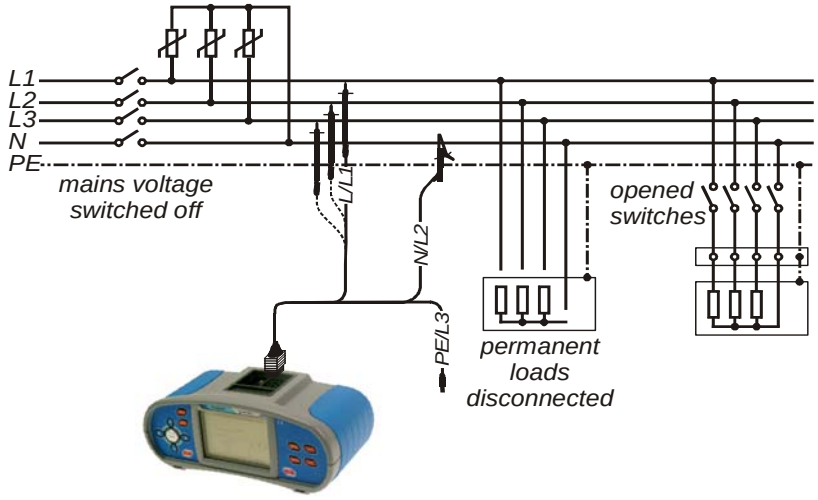
Displayed results for earth resistance measurement:
R..... Earth resistance.
ρ ..... Specific earth resistance.
Rc ..... Resistance of S probe.
Rp ..... Resistance of H probe.

4.10. Varistor test

① Set function
- Select Single test in Main menu.
- Use cursors ← / → to find and choose the **VARISTOR TEST** function.

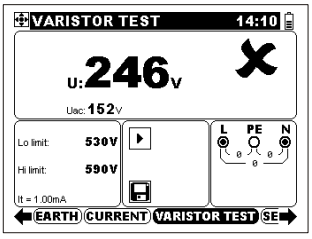
② Set parameters and limits
Lo limit ..... Minimum DC threshold voltage [50 V ÷ 1000 V].
Hi limit ..... Minimum DC threshold voltage [50 V ÷ 1000 V].

③ Circuit for varistor test



④ Measurement procedure
- Disconnect mains supply and consumers from tested overvoltage device.
- **Connect** test cable to the instrument and tested item.
- Press the **TEST** key for measurement.
- After the measurement is finished wait until tested item is discharged.
- **Store** the result (optional).

⑤ View results



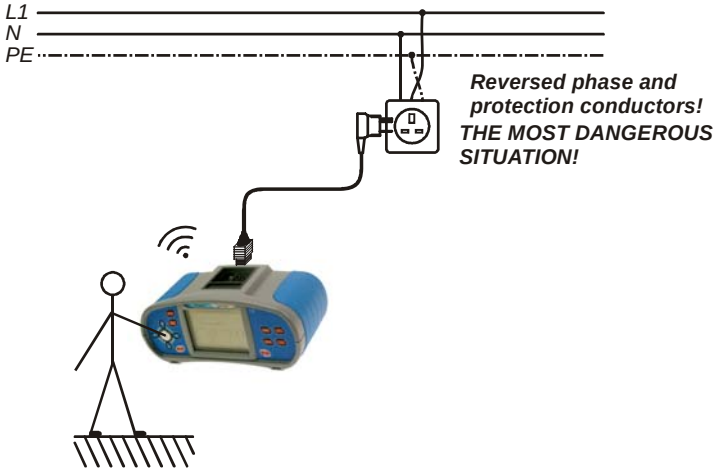
Displayed results for varistor test:
U.....Measured threshold voltage at It (1 mA).
Uac.....Rated AC voltage.

4.11. PE test terminal

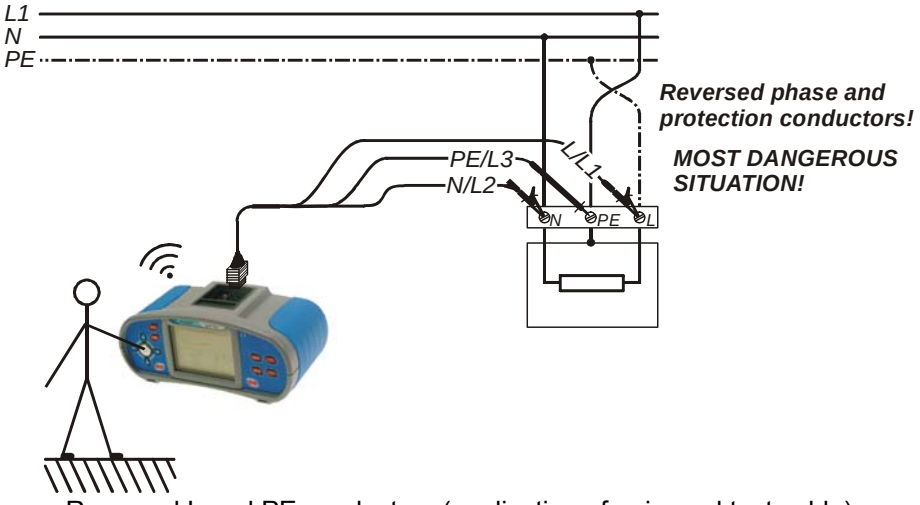
① **Measurement procedure**

- **Connect** test cable to the instrument.
- **Connect** test leads to the tested object.
- Touch PE test probe (the **TEST** key) for at least one second.
- If PE terminal is connected to phase voltage the warning message is displayed, instrument buzzer is activated and further measurements are disabled.

② **Examples for intention of PE test terminal**



Reversed L and PE conductors (application of plug cable)



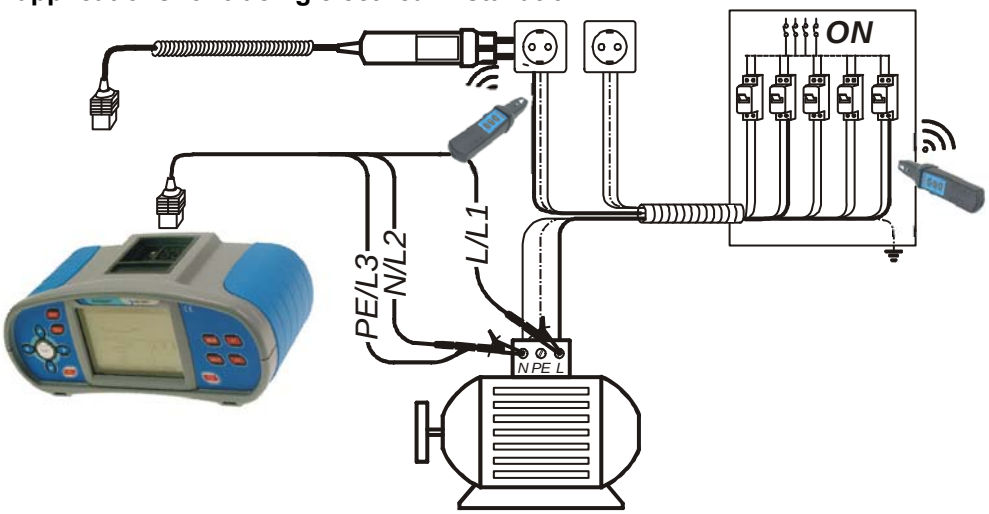
Reversed L and PE conductors (application of universal test cable)

4.12. Locator

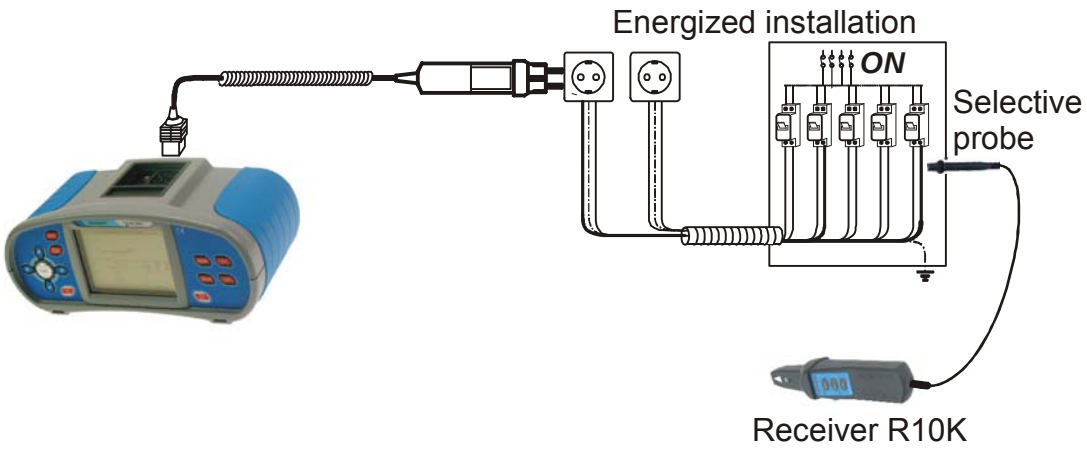
① **Measurement procedure**

- Select the **LOCATOR** function in MISC menu.
- **Connect** test cable to the instrument.
- **Connect** test leads to the tested object.
- Press the **TEST** key.
- Trace lines with receiver (in IND mode) or receiver plus its optional accessory.
- After tracing is finished press the **TEST** key again to stop generation of test signal.

② **Typical applications for tracing electrical installation**



Tracing wires under walls and in cabinets



Locating individual fuses

5. Maintenance

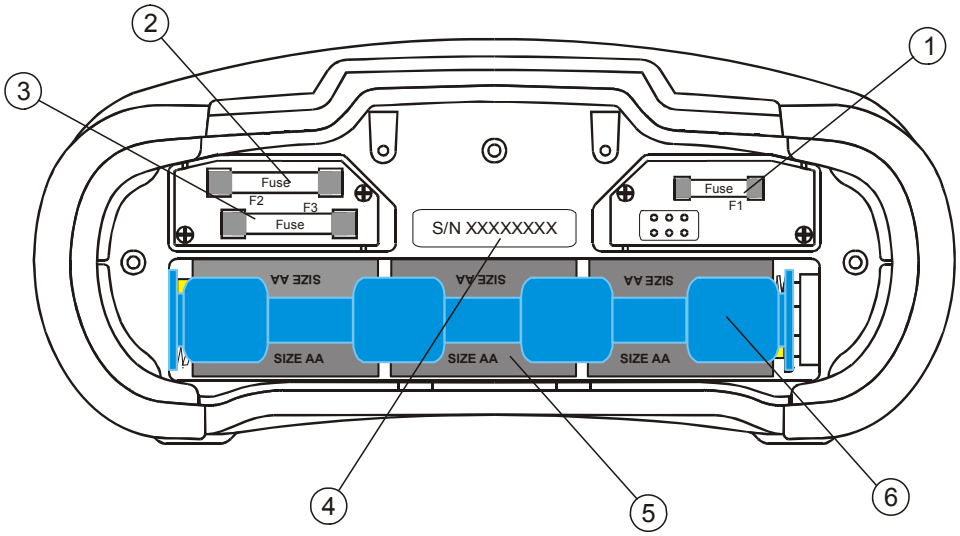
5.1. Replacing fuses

- F1
  M 0.315 A / 250 V, 20x5 mm
  This fuse protects internal circuitry of low-value resistance function if test probes are connected to the mains supply voltage by mistake.

- F2, F3
  F 4 A / 500 V, 32x6.3 mm
  General input protection fuses of test terminals L/L1 and N/L2.

Warnings:

- ⚠Disconnect any measuring accessory and power off the instrument before opening battery/fuse compartment cover, hazardous voltage inside!
- Replace blown fuse with original type only, otherwise the instrument may be damaged and/or operator's safety impaired!



Battery and fuse compartment

Legend:

1 .....Fuse F1.
2 .....Fuse F2.
3 .....Fuse F3.
4 .....Serial number label.
5 .....Batteries or accus (size AA).
6 .....Battery holder.