BEHA·AMPROBE®

Multifunction Installation Tester

ProInstall-75

User Manual

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ProInstall-75

User Manual

English

5/2019, Rev C

Limited Warranty and Limitation of Liability

Your Beha-Amprobe product will be free from defects in material and workmanship for three years from the date of purchase unless local laws require otherwise. This warranty does not cover fuses, disposable batteries or damage from accident, neglect, misuse, alteration, contamination, or abnormal conditions of operation or handling. Resellers are not authorized to extend any other warranty on the behalf of Beha-Amprobe. To obtain service during the warranty period, return the product with proof of purchase to an authorized Beha-Amprobe Service Center or to an Beha-Amprobe dealer or distributor. See Repair Section for details. THIS WARRANTY IS YOUR ONLY REMEDY. ALL OTHER WARRANTIES - WHETHER EXPRESS, IMPLIED OR STATUTORY - INCLUDING IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, ARE HEREBY DISCLAIMED. MANUFACTURER SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, ARISING FROM ANY CAUSE OR THEORY. Since some states or countries do not allow the exclusion or limitation of an implied warranty or of incidental or consequential damages, this limitation of liability may not apply to you.

Repair

All Beha-Amprobe tools returned for warranty or non-warranty repair or for calibration should be accompanied by the following: your name, company's name, address, telephone number, and proof of purchase. Additionally, please include a brief description of the problem or the service requested and include the test leads with the meter. Non-warranty repair or replacement charges should be remitted in the form of a check, a money order, credit card with expiration date, or a purchase order made payable to Beha-Amprobe.

In-warranty Repairs and Replacement – All Countries

Please read the warranty statement and check your battery before requesting repair. During the warranty period, any defective test tool can be returned to your Beha-Amprobe distributor for an exchange for the same or like product. Please check the "Where to Buy" section on beha-amprobe.com for a list of distributors near you.

Non-warranty Repairs and Replacement – Europe

European non-warranty units can be replaced by your Beha-Amprobe distributor for a nominal charge. Please check the "Where to Buy" section on beha-amprobe.com for a list of distributors near you.

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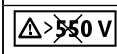
INTRODUCTION

The Beha-Amprobe Model ProInstall-75 is a battery powered multifunction installation tester. This tester is designed to measure and test the following:

- Voltage and Frequency
- Insulation Resistance (EN61557-2)
- Continuity (EN61557-4)
- Loop/Line Resistance (EN61557-3)
- Residual Current Devices (RCD) Tripping Time (EN61557-6)
- RCD Tripping Current (EN61557-6)
- Phase Sequence (EN61557-7)

SYMBOLS

	Caution! Risk of electric shock.
	Caution! Refer to the explanation in this manual.
	Consult user documentation.
	Double insulated (Class II) equipment
	Earth (Ground).
	Fuse.
	Battery.
CE	Conforms to requirements of European Union and European Free Trade Association.
	Conforms to relevant Australian standards.
	Do not use in distribution systems with voltages higher than 550 V.
CAT III / CAT IV	CAT III Testers are designed to protect against transients in fixed equipment installations at the distribution level; CAT IV Testers are designed to protect against transients from the primary supply level (overhead or underground utility service).
	This product complies with the WEEE Directive marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 “Monitoring and Control Instrumentation” product. Do not dispose of this product as unsorted municipal waste.

SAFETY INFORMATION

A Warning identifies hazardous conditions and actions that could cause bodily harm or death.

A Caution identifies conditions and actions that could damage the installation tester or cause permanent loss of data.

⚠⚠Warnings: Read Before Using

To prevent possible electrical shock, fire, or personal injury:

- Use the product only as specified, or the protection supplied by the product can be compromised.
- Do not use the product around explosive gas, vapor or in damp or wet environments.
- Do not use test leads if they are damaged. Examine the test leads for damaged insulation, exposed metal, or if the wear indicator shows. Check test lead continuity.
- Use only probes, test leads, and adapters supplied with the product.
- Measure a known voltage first to make sure that the product operates correctly.
- The battery door must be closed and locked before you operate the Product.
- Examine the case before you use the Product. Look for cracks or missing plastic. Carefully look at the insulation around the terminals.
- Be sure that the battery polarity is correct to prevent battery leakage.
- Repair the Product before use if the battery leaks.
- Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.
- Do not apply more than the rated voltage between the terminals or between each terminal and earth ground.
- Do not use the product if it is damaged.
- Have an approved technician repair the product.
- Do not apply more than the rated voltage between the terminals or between each terminal and earth ground.
- Remove all probes, test leads, and accessories before opening the battery door and the product case.
- Do not operate the product with covers removed or the case open. Hazardous voltage exposure is possible.
- Use caution when working with voltages above 30 V ac rms, 42 V ac peak, or 60 V dc.
- Use only specified replacement fuses.
- Use the correct terminals, function, and range for measurements.
- Keep fingers behind the finger guards on the probes.
- Connect the common test lead before the live test lead and remove the live test lead before the common test lead.
- Replace the batteries when the low battery indicator shows to prevent incorrect measurements.
- Use only specified replacement parts.
- Do not use the tester in distribution systems with voltages higher than 550 V.
- Comply with local and national safety codes. Use personal protective equipment (approved rubber gloves, face protection, and flame-resistant clothes) to prevent shock and arc blast injury where hazardous live conductors are exposed.

UNPACKING AND INSPECTION

Your shipping carton should include:

- ProInstall-75
- Test lead set
- ProInstall-TL-UK (LC38 AMP-MFT, mains test cord)
- Alligator clips
- Test probe
- ProInstall-TL-KIT (Remote test probe and probe tips)
- ProInstall-CC (Soft case with carrying strap)
- TL-75 (Fused test probe, red/blue/green with lantern spring, cap and tip cover)
- Zero-Adapter
- Statement of calibration
- Batteries
- Quick reference guide
- Carry strap for neck/waist
- CD-ROM (User manual)

If any of the items are damaged or missing, return the complete package to the place of purchase for an exchange.

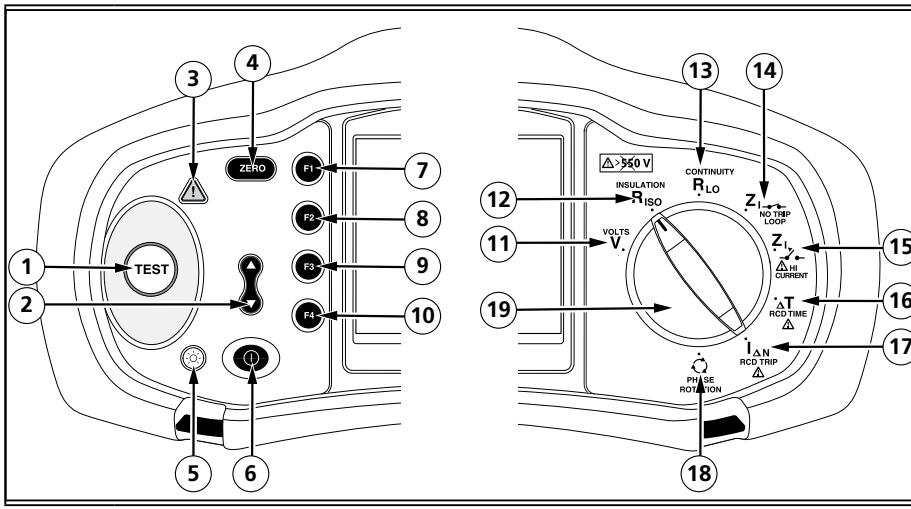
OPERATING THE TESTER

Using the Rotary Switch

Use the rotary switch to select the type of test you want to perform.

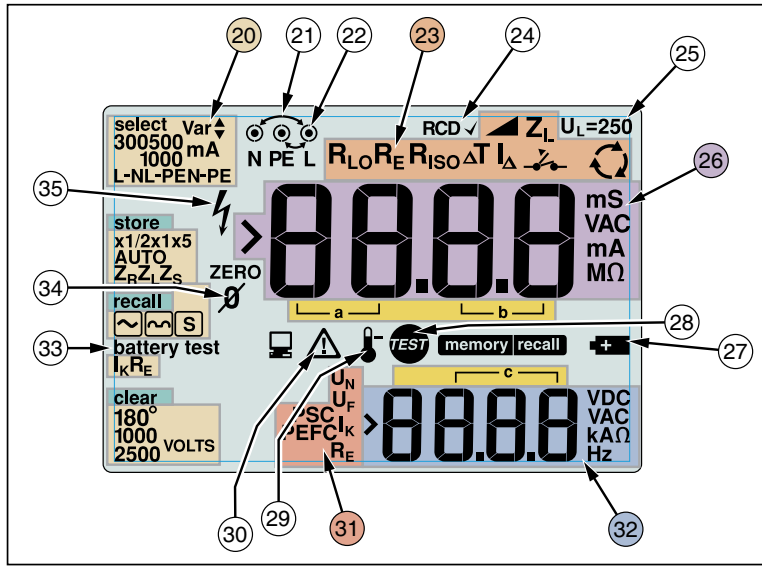
Understanding the Pushbuttons

Use the pushbuttons to control operation of the tester, select test results for viewing, and scroll through selected test results.



Number	Measurement Function
1	Starts the selected test. The TEST key is surrounded by a “touch pad”. The touch pad measures the potential between the operator and the tester’s PE terminal. If you exceed a 100 V threshold, the ⚠ symbol above the touch pad is illuminated.
2	Set RCD variable trip current.
3	Illuminates when > 100 V is detected on the touch pad.
4	Zero the test lead resistance offset.
5	Turns the backlight on and off.
6	Turns the tester on and off. The tester will also shut off automatically if there is no activity for 10 minutes.
7	• Loop input select (L-N, L-PE). • Voltage input select (L-N, L-PE, N-PE). • Insulation test: (L-N, L-PE, N-PE) • RCD current rating (10, 30, 100, 300, 500, 1000 mA or VAR).
8	RCD Current multiplier (x1/2, x1, x5, AUTO).
9	• Select RCD: Type AC (sinusoidal), Type AC Selective, Type A (half-wave), Type A Selective. • Battery test. • Loop No Trip R_E / I_K
10	• RCD test polarity (0, 180 degrees). • Insulation test voltage (250, 500, or 1000 V).
11	Volts.
12	Insulation resistance.
13	Continuity.
14	Loop impedance — No trip mode.
15	Loop impedance — Hi current trip mode.
16	RCD tripping time.
17	RCD tripping level.
18	Phase rotation.
19	Rotary switch.

Understanding the Display



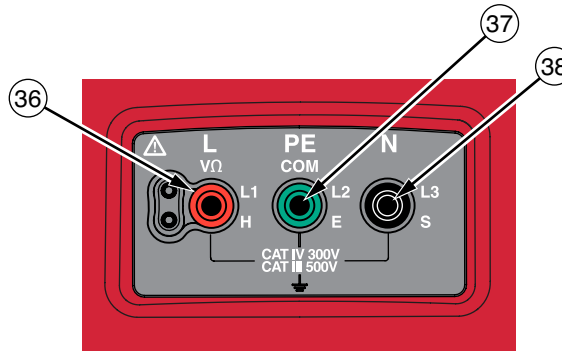
Number	Description
20	Configuration options. Settings you can make within the measurement functions. For example, in the RCD Tripping Time function (ΔT) you can press F2 to multiply the test current by x1/2, x1, x5 and you can press F3 to select the type of RCD you are testing.
21	Arrows above or below the terminal indicator symbol indicate reversed polarity. Check the connection or check the wiring to correct.
22	Terminal indicator symbol. A terminal indicator symbol with a dot ⊙ in the center indicates the terminal is used for the selected function. The terminals are: • L (Line) • PE (Protective Earth) • N (Neutral)
23	Indicates the selected rotary switch setting. The measurement value in the primary display also corresponds to the switch setting. Rotary switch settings are:
24	Indicates that the measured trip current (trip current test) or the measured trip time (trip time test) is according to the appropriate RCD standard and the fault voltage is below the selected limit. For more information, see Maximum Trip Time Table in the Specifications section of this manual.

V	Volts	R_{ISO}	Insulation
R_{LO}	Continuity	ΔT	RCD trip time
Z_I	Loop no trip	I_Δ	RCD trip current
Z_I	Loop hi current trip		Phase Rotation

25	Indicates the preset fault voltage limit. The default setting is 50 V. Some locations require the fault voltage be set to 25 V, as specified by local electrical codes. Press F4 when you turn on the tester to toggle the fault voltage between 25 V and 50 V. The value you set will appear on the display and will be saved when you turn the tester off.
26	Primary display and measurement units.
27	Low battery icon. See "Testing and Replacing the Batteries" section for additional information on batteries and power management.
28	Appears when you press the Test button. Disappears when the test is completed.
29	Appears when the instrument is overheated. The Loop test and RCD functions are inhibited when the instrument is overheated.
30	Appears when an error occurs. Testing is disabled. See "Error Codes" on page 9 for a listing and explanation of possible error codes.
31	Name of the secondary measurement function. **U_N** Test voltage for insulation test. **U_F** Fault voltage. Measures neutral to earth. **PSC** Prospective Short Circuit. Calculated from measured voltage and impedance when reading line to neutral. **PEFC** Prospective Earth Fault Current. Calculated from voltage and loop impedance which is measured line to protective earth. **I_K** In combination with the PSC or PEFC symbol, indicates a short circuit current. **R_E** Earth resistance.
32	Secondary display and measurement units. Some tests will return more than one result or return a computed value based on the test result. This will occur with: • Volts Secondary display shows line frequency. • Insulation tests Secondary display shows actual test voltage. • Loop/line impedance Secondary display shows PEFC (Prospective Earth Fault Current) or R_E PSC (Prospective Short Circuit Current). • RCD switching time Secondary display shows U_F fault voltage. • RCD tripping current Secondary display shows U_F fault voltage.
33	Appears only in Volts. For more information see "Testing and Replacing the Batteries" Section.
34	Appears when you press the ZERO button to zero the leads. After the zeroing operation, the icon stays illuminated indicating that zeroing has been performed. Only used when performing continuity or loop testing.
35	Potential danger. Appears when measuring or sourcing high voltages.

Input Terminals

Use the rotary switch to select the type of test you want to perform.



Number	Description
36	L (Line)
37	PE (Protective Earth)
38	N (Neutral)

Error Codes

Various error conditions are detected by the tester and are indicated with the ⚠ icon, "Err", and an error number on the primary display. See table below. These error conditions disable testing and, if necessary, stop a running test.

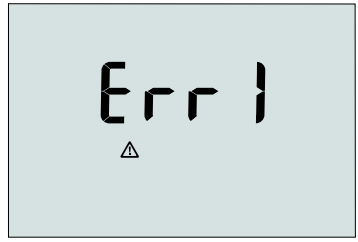
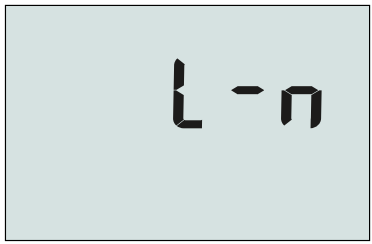


Figure 1. Error Display

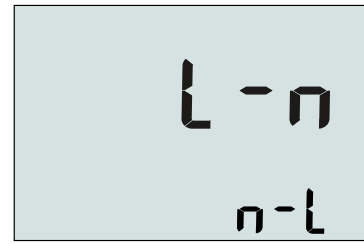
Error Condition	Code	Solution
Self-test Fails	1	Return the tester to your distributor or Beha-Amprobe.
Over-temp	2	Wait while the tester cools down.
Fault Voltage	4	Check the installation, in particular, the voltage between N and PE.
Excessive Noise	5	Switch off all appliances (Loop, RCD measurements)

Power-On Options

To select a power-on option, press ⏻ and the function key simultaneously and then release the ⏻ button. Power-on options are retained when the tester is turned OFF. See Table below.



UK - Mode Selected



Automatic Lead Swapping Mode Selected

Figure 2. Lead Swapping Modes

Keys	Power-on Options
⏻ F2	Loop/Line Impedance I_K limit. Toggles the I_K limit between 10 kA and 50 kA. The default is 10 kA.
⏻ F3	Line and Neutral Swap mode. Two modes of operation are available. You can configure the tester to operate in L-n mode or L-n n-L mode, • In L-n mode, the L and N phase conductors must NEVER be reversed. This is a requirement in some regions including the UK. The icon appears on the display indicating that the system L and N conductors are swapped and testing is inhibited. Investigate and rectify the cause of this system fault before proceeding. L-n mode also changes the RCD x1/2 trip time duration to 2 seconds as required in the UK. • In L-n n-L mode, the unit allows the L and N phase conductors to be swapped and testing will continue. Note: In locations where polarized plugs and outlets are used, a swapped lead icon ( ) may indicate that the outlet was wired incorrectly. Correct this problem before proceeding with any testing.
⏻ F4	Fault voltage limit. Toggles the fault voltage between 25 V and 50 V. The default is 50 V.
⏻ ☼	Continuity beeper toggle. Toggles the continuity beeper on and off. The default is on.

Measuring Volts and Frequency

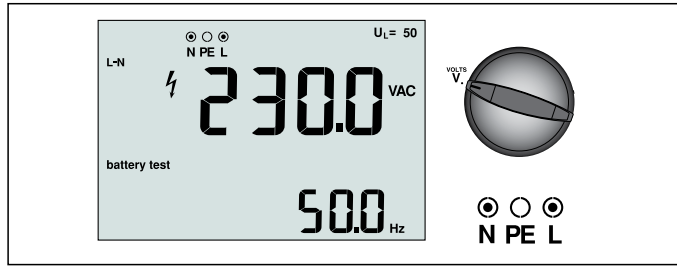


Figure 3. Volts Display/Switch and Terminal Settings

To measure voltage and frequency:

1. Turn the rotary switch to the V position.
2. Use two (red and blue) terminals for this test. You can use test leads or mains cord when measuring AC voltage.
   - The primary (upper) display shows the AC voltage. The tester reads AC voltage to 500 V. Press F1 to toggle the voltage reading between L-PE, L-N, and N-PE.
   - The secondary (lower) display shows mains frequency.

⚠⚠Warning
It is not possible to check reliably the connections of N- and PE-circuits in the socket by voltage measurement. To ensure this, we suggest to verify this while performing Loop and Line impedance measuring.

Reason for this is that the voltages L-N, L-PE and N-PE are measured by the tester at the same time and will be influenced by open wires together with resistances (loads) and capacitances of the installation network in combination with internal resistances of the tester itself.

This issue happens especially when N is missing/open and can lead to wrong reading.

Measuring Insulation Resistance

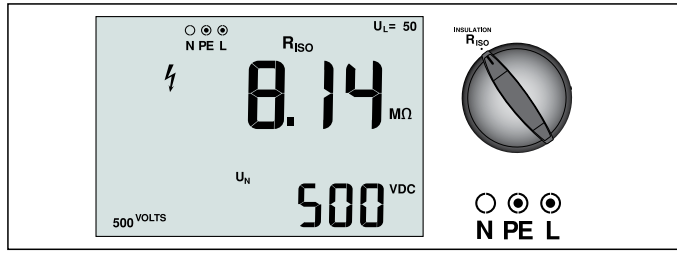


Figure 4. Insulation Resistance Display/Switch and Terminal Settings

⚠⚠Warning
To avoid electric shock, measurements should only be performed on de-energized circuits.

To measure insulation resistance:

1. Turn the rotary switch to the R_{ISO} position.
2. Use the L and PE (red and green) terminals for this test.
3. Use the F4 to select the test voltage. Most insulation testing is performed at 500 V, but observe local test requirements.

4. Press and hold (TEST) until the reading settles.

   Note: Testing is inhibited if voltage is detected in the line.

   - The primary (upper) display shows the insulation resistance.
   - The secondary (lower) display shows the actual test voltage.

   Note: For normal insulation with high resistance, the actual test voltage (UN) should always be equal to or higher than the programmed voltage. If insulation resistance is bad, the test voltage is automatically reduced to limit the test current to safe ranges.

Measuring Continuity

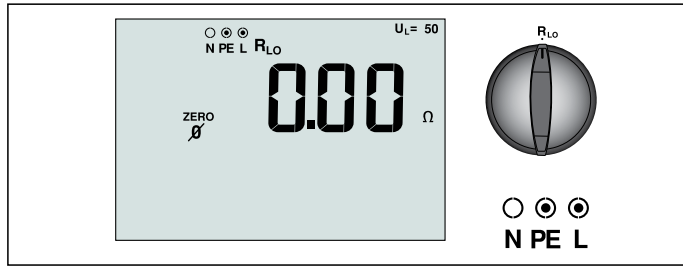


Figure 5. Continuity Zero Display/Switch and Terminal Settings

A continuity test is used to verify the integrity of connections by making a high resolution resistance measurement. This is especially important for checking Protective Earth connections.

Note: In countries where electrical circuits are laid out in a ring, it is recommended that you make an end-to-end check of the ring at the electrical panel.

⚠⚠Warning

- **Measurements should only be performed on de-energized circuits.**
- **Measurements may be adversely affected by impedances or parallel circuits or transient currents.**

To measure continuity:

1. Turn the rotary switch to the RLO position.
2. Use the L and PE (red and green) terminals for this test.
3. Before making a continuity test, use the Zero adapter to zero the test leads. Press and hold (ZERO) until the ZERO annunciator appears. The tester measures probe resistance, stores the reading in memory, and subtracts it from readings. The resistance value is saved even when power is turned off so you don't need to repeat the operation every time you use the instrument.

   Note: Be sure the batteries are in good charge condition before you compensate the test leads.

4. Press and hold (TEST) until the reading settles. If the continuity beeper is enabled, the tester beeps continuously for measured values less than 2 Ω and there is no stable reading beep for measured values 2 ohms or greater. If a circuit is live, the test is inhibited and the AC voltage appears in the secondary (lower) display.

Measuring Loop/Line Impedance

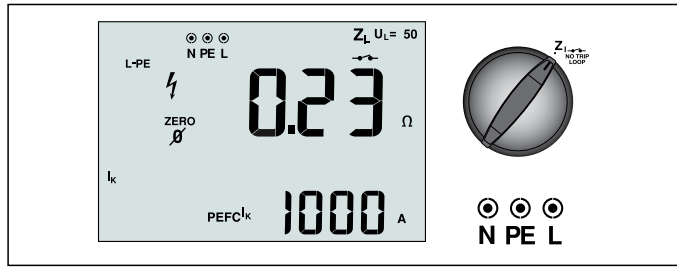


Figure 6. Loop/Line Impedance/Switch and Terminal Settings

Loop Impedance (Line to Protective Earth L-PE)

Loop impedance is source impedance measured between Line (L) and Protective Earth (PE). You can also ascertain the Prospective Earth Fault Current (PEFC) that is the current that could potentially flow if the phase conductor is shorted to the protective earth conductor. The tester calculates the PEFC by dividing the measured mains voltage by the loop impedance. The loop impedance function applies a test current that flows to earth. If RCDs are present in the circuit, they may trip. To avoid tripping, always use the Zl No Trip function on the rotary switch. The no trip test applies a special test that prevents RCDs in the system from tripping. If you are certain no RCDs are in the circuit, you can use the Zl Hi Current function for a faster test.

Note: If the L and N terminals are reversed, the tester will auto-swap them internally and continue testing. If the tester is configured for UK operation, testing will halt. This condition is indicated by arrows above or below the terminal indicator symbol (⊙ ○ ⊙).

Tip: We recommend to measure in addition to each loop impedance measurement also the line impedance to ensure correct wiring.

This will proof the correct connection of live (L) and neutral (N) wire for short circuit and overload protection.

To measure loop impedance no trip mode:

⚠⚠Warning

To prevent tripping RCDs in the circuit:

- **Always use the Z_I NO TRIP position for loop measurements.**
- **Preload conditions can cause the RCD to trip.**
- **An RCD with a nominal fault current of 10 mA will trip.**

Note: To do a Loop impedance test in a circuit with a 10 mA RCD, we recommend a trip time RCD test. Use a nominal test current of 10 mA and the factor x ½ for this test.

If the fault voltage is below 25 V or 50 V, dependent on the local requirement, the loop is good. To calculate the loop impedance, divide the fault voltage by 10 mA (Loop impedance = fault voltage x 100).

1. Turn the rotary switch to the Z_I NO TRIP position.
2. Connect all three leads to the L, PE, and N (red, green, and blue) terminals of the tester.
3. Press F1 to select L-PE. The display shows the Z_I and ⊶ indicator.
4. Before you do a loop impedance test, use the zero adapter to zero the test leads or the mains cord. Press and hold (ZERO) for more than two seconds until the ZERO annunciator appears. The tester measures the lead resistance, stores the reading in memory, and subtracts it from readings. The resistance value is saved even when the power is turned

off so it is unnecessary to repeat the operation each time you use the tester with the same test leads or mains cord.

Note: Be sure the batteries are in good charge condition before you zero the test leads.

5. Connect all three leads to the L, PE, and N of the system under test or plug the mains cord into the socket under test.

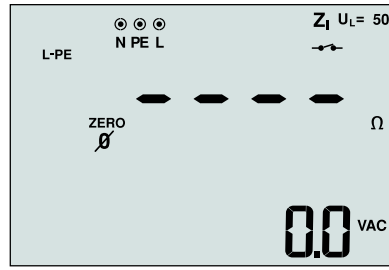


Figure 7. Display After Zeroing

6. Press and release (TEST). Wait for the test to complete. The primary (upper) display shows the loop impedance.
7. To read the Prospective Earth Fault Current, press the (F3) key and select Ik. The Prospective Earth Fault Current appears in amps or kilo amps in the secondary (lower) display.
8. If the mains is too noisy, Err 5 will be displayed. (The measured value accuracy is degraded by the noise.) Press the down arrow to display the measured value. Press the up arrow to return to the Err 5 display.

This test will take several seconds to complete. If the mains is disconnected while the test is active, the test automatically terminates.

Note: Errors may occur due to preloading the circuit under test.

To measure loop impedance—Hi current trip mode:

If no RCDs are present in the system under test, you can use the high current Line Earth (L-PE) loop impedance test.

1. Turn the rotary switch to the Z_I HI CURRENT position.
2. Connect all three leads to the L, PE, and N (red, green, and blue) terminals of the tester.
3. Press F1 to select L-PE. The appears to indicate that hi current trip mode is selected.
4. Repeat Steps 4 through 8 from the preceding test.

⚠⚠Warning

The symbol on the LCD indicates the high current loop mode - any RCDs in the system will trip - ensure there are no RCDs present.

Earth Resistance Testing by Loop Method

You can also use the tester to measure the earth resistance component of the total loop resistance. Check your local regulations to determine if this method is acceptable in your area. You can use three leads or the mains cord to perform this test. Use the connection shown in Figure 8 when making a 3-wire connection for earth resistance loop test. Zero the test leads (see sequence for Loop Impedance measurement).

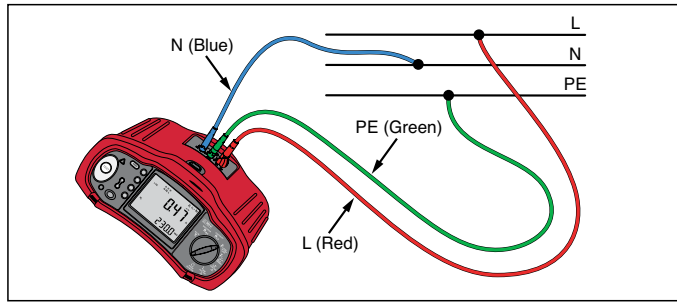


Figure 8. 3-Wire Connection for Earth Resistance Loop Test

To measure earth resistance using the loop test no trip mode:

1. Turn the rotary switch to the Z_I NO TRIP position
2. Press F1 to select L-PE.
3. Press F3 to select RE (resistance).
4. Press and release TEST. Wait for the test to complete.
   - The primary (upper) display shows the loop impedance.
   - The secondary (lower) display shows the earth resistance.

Line Impedance

Line impedance is source impedance measured between Line conductors or Line and Neutral. This function allows the following tests:

- Line to Neutral loop impedance.

  Tip: We recomend to measure in additon to each loop impedance measurement also the line impedance to ensure correct wiring.
  This will proof the correct connection of live (L) and neutral (N) wire for short circuit and overload protection.
- Line to Line impedance in 3-phase systems.
- Two wire L-PE loop measurement when Neutral is not available. This is a way of making a high current, 2-wire loop measurement. Therefore connect Line to L input and PE to N input. It cannot be used on circuits protected by RCDs because it will cause them to trip.
- Prospective Short Circuit Current (PSC). PSC is the current that can potentially flow if the phase conductor is shorted to the neutral conductor or another phase conductor. The tester calculates the PSC current by dividing the measured mains voltage by the line impedance.

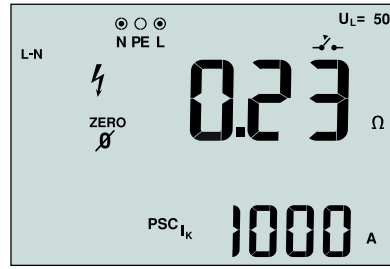


Figure 9. Line Impedance Display

To measure line impedance:

1. Turn the rotary switch to the Z_{LINE} ⚠ HI CURRENT position. The LCD indicates that the high current loop mode is selected by displaying the Z_{LINE} symbol.
2. Connect the red lead to the L (red) and the blue lead to the N (blue) terminals of the tester.
3. Press F1 to select L-N.
4. Use the zero adapter to zero the test leads or the mains cord.
5. Press and hold ZERO for more than two seconds until the ZERO annunciator appears. The tester measures the lead resistance, stores the reading in memory, and subtracts it from readings. The resistance value is saved even when the power is turned off so it is unnecessary to repeat the operation each time you use the tester with the same test leads or mains cord.

Note: Be sure the batteries are in good charge condition before you zero the test leads.

⚠⚠Warning

At this step, be careful not to select L-PE because a high current loop test will take place. Any RCDs in the system will trip if you proceed.

Note: Connect the leads in a single-phase test to the system line and neutral. To measure line-to-line impedance in a 3-phase system, connect the leads to 2 phases.

7. Press and release TEST. Wait for the test to complete.
   - The primary (upper) display shows the line impedance.
   - The secondary (lower) display shows the Prospective Short Circuit Current (PSC).
8. If the mains is too noisy, Err 5 will be displayed. (The measured value accuracy is degraded by the noise). Press the down arrow to display the measured value. Press the up arrow to return to the Err 5 display.

Use the connection shown in Figure 10 when measuring in a 3-phase 500 V system.

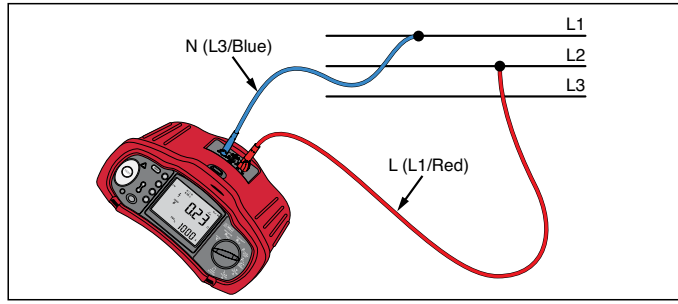


Figure 10. Measuring in a 3-Phase System

Measuring RCD Tripping Time

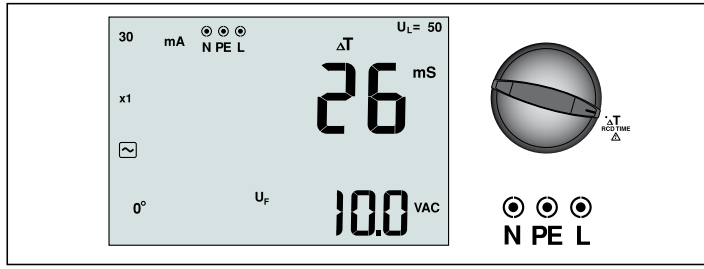


Figure 11. RCD Tripping Time Display/Switch and Terminal Settings

In this test, a calibrated fault current is induced into the circuit, causing the RCD to trip. The meter measures and displays the time required for the RCD to trip. You can perform this test with test leads or using the mains cord. The test is performed with a live circuit.

You can also use the tester to perform the RCD tripping time test in Auto mode, which makes it easier for one person to perform the test. If the RCD has a special nominal current setting other than the standard options, 10, 30, 100, 300, 500 1000 mA, you can use a custom setting with the VAR mode.

Note: When measuring trip time for any type of RCD, the tester first does a pretest to determine if the actual test will cause a fault voltage exceeding the limit (25 or 50 V).

To avoid having an inaccurate trip time for S type (time delay) RCDs, a 30 second delay is activated between the pretest and the actual test. This RCD type needs a delay because it contains RC circuits that are required to settle before applying the full test.

⚠⚠Warning

- **Test the connection between the N-conductor and earth before starting the test. A voltage between the N-conductor and earth may influence the test.**
- **Leakage currents in the circuit following the residual current protection device may influence measurements.**
- **The displayed fault voltage relates to the rated residual current of the RCD.**
- **Potential fields of other earthing installations may influence the measurement.**
- **Equipment (motors, capacitors) connected downstream of the RCD may cause considerable extension of the tripping time.**

Note: If the L and N terminals are reversed, the tester will auto-swap them internally and continue testing. If the tester is configured for UK operation, testing will halt and you will need to determine why the L and N are swapped. This condition is indicated by arrows above or below the terminal indicator symbol (⦿○⦿).

Type A RCDs do not have the 1000 mA option available.

To measure RCD tripping time:

1. Turn the rotary switch to the **ΔT** position.
2. Press F1 to select the RCD current rating (10, 30, 100, 300, 500, or 1000 mA).
3. Press F2 to select a test current multiplier (x ½, x 1, x 5, or Auto). Normally you will use x 1 for this test.
4. Press F3 to select the RCD test-current waveform:

~ – AC current to test type AC (standard AC RCD) and type A (pulse-DC sensitive RCD)

~ – Half-wave current to test type A (pulse-DC sensitive RCD)

~ S – Delayed response to test S-type AC (time delayed AC RCD)

~ S – Delayed response to S-type A (time delayed pulse-DC sensitive RCD)

5. Press F4 to select the test current phase, 0° or 180°. RCDs should be tested with both phase settings, as their response time can vary significantly depending on the phase.
6. Press and release (TEST). Wait for the test to complete.
   - The primary (upper) display shows the trip time.
   - The secondary (lower) display shows the fault voltage (N to PE) related to the rated residual current.
   - If the trip time is according to the appropriate standard of the RCD, the RCD indicator displays. For more information, see Maximum Trip Time Table on page 31.

To measure RCD tripping time for a custom RCD setting – VAR mode:

1. Turn the rotary switch to the ΔT position.
2. Press (F1) to select the VAR current rating. The current custom setting shows on the primary display. Use the ↕ arrow keys to adjust the value.
3. Press (F2) to select a test current multiplier. Normally you will use x 1/2 or x 1 for this test.
4. Repeat steps 4 through 6 listed in the preceding RCD tripping time procedure.
5. To view the nominal setting used for the test, depress the ↕ arrow key.

Note: The maximum setting for type A RCDs is 700 mA.

To measure RCD tripping time using Auto mode:

1. Plug the tester into the outlet.
2. Turn the rotary switch to the ΔT position.
3. Press F1 to select the RCD current rating (10, 30, or 100 mA).
4. Press F2 to select Auto mode.
5. Press F3 to select the RCD test-current waveform.
6. Press and release (TEST)

   The tester supplies ½x the rated RCD current for 310 or 510 ms (2 seconds in the UK). If the RCD trips, the test terminates. If the RCD does not trip, the tester reverses phase and repeats the test. The test terminates if the RCD Trips.

   If the RCD does not trip, the tester restores the initial phase setting and supplies 1x the rated RCD current. The RCD should trip and the test results appear in the primary display.
7. Reset the RCD.
8. The tester reverses phases and repeats the 1x test. The RCD should trip and the test results appear in the primary display.
9. Reset the RCD.
10. The tester restores the initial phase setting and supplies 5x the rated RCD current for up to 50 ms. The RCD should trip and the test results appear in the primary display.
11. Reset the RCD.
12. The tester reverses phase and repeats the 5x test. The RCD should trip and the test results appear in the primary display.
13. Reset the RCD.

    • You can use the ↕ arrow keys to review test results. The first result shown is the last measurement taken, the 5x current test. Press the down arrow key ↕ to move backward to the first test at ½x the rated current.

Measuring RCD Tripping Current

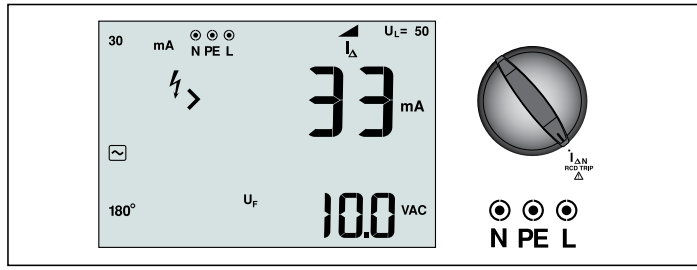


Figure 12. RCD Tripping Current/Switch and Terminal Settings

This test measures the RCD tripping current by applying a test current and then gradually increasing the current until the RCD trips. You can use the test leads or mains cord for this test. A 3-wire connection is required.

⚠⚠Warning

- **Test the connection between the N-conductor and earth before starting the test. A voltage between the N-conductor and earth may influence the test.**
- **Leakage currents in the circuit following the residual current protection device may influence measurements.**
- **The displayed fault voltage relates to the rated residual current of the RCD.**
- **Potential fields of other earthing installations may influence the measurement.**

Note: If the L and N terminals are reversed, the tester will auto-swap them internally and continue testing. If the tester is configured for UK operation, testing will halt and you will need to determine why the L and N are swapped. This condition is indicated by arrows above or below the terminal indicator symbol ( ).

Type A RCDs do not have the 1000 mA option available.

To measure RCD tripping current:

1. Turn the rotary switch to the $I_{\Delta N}$ position.
2. Press F1 to select the RCD current rating (10, 30, 100, 300, or 500 mA). If the RCD has a special nominal current setting other than the standard options, 10, 30, 100, 300, 500 1000 mA, you can use a custom setting with the VAR mode.
3. Press F2 to select the RCD test-current waveform:

– AC current to test type AC (standard AC RCD) and type A (pulse-DC sensitive RCD)

– Half-wave current to test type A (pulse-DC sensitive RCD)

S – Delayed response to test S-type AC (time delayed AC RCD)

S – Delayed response to S-type A (time delayed pulse-DC sensitive RCD)

4. Press F4 to select the test current phase, 0° or 180°. RCDs should be tested with both phase settings, as their response time can vary significantly depending on the phase.

5. Press and release (TEST). Wait for the test to complete.
   - The primary (upper) display shows the RCD trip current.
   - If the trip current is according to the appropriate standard of the RCD, the RCD indicator displays. For more information, see Maximum Trip Time Table on page 31.

To measure RCD tripping current for a custom RCD setting - VAR mode:

1. Turn the rotary switch to the I ΔN position.
2. Press (F1) to select the VAR current rating. The current custom setting shows on the primary display. Use the ⇕ arrow keys to adjust the value.
3. Repeat steps 3 through 5 listed in the preceding RCD tripping current procedure.
4. To view the nominal test setting, depress the ⇕ arrow key.

Note: The maximum setting for RCDs is 700 mA.

RCD testing in IT systems

RCD testing at locations with IT systems requires a special test procedure because the Protective Earth connection is grounded locally and is not tied directly to the power system.

The test is conducted at the electrical panel using probes. Use the connection shown in Figure 13 when performing RCD testing on IT electrical systems.

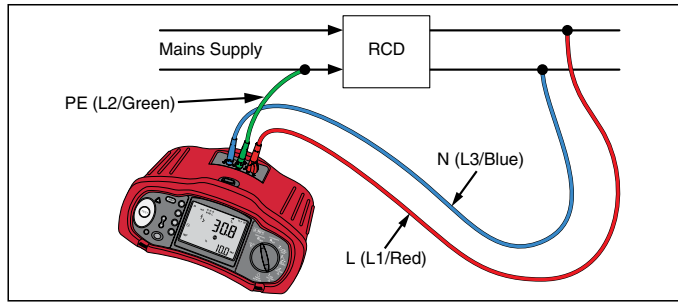


Figure 13. Connection for RCD Testing on IT Electrical Systems

The test current flows through the upper side of the RCD, into the L terminal, and returns though the PE terminal.

Testing Phase Sequence

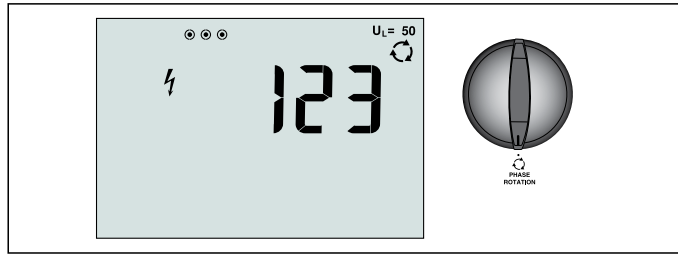


Figure 14. Phase Sequence Display/Switch and Terminal Settings

Use the connection shown in Figure 15 for a phase sequence test connection.

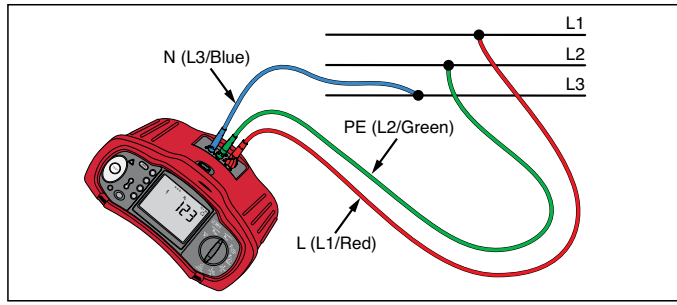


Figure 15. Phase Sequence Test Connection

To perform a phase sequence test:

1. Turn the rotary switch to the ⟲ position.
2. The primary (upper) display shows:
   - 123 for correct phase sequence.
   - 321 for reversed phase sequence.
   - Dashes (---) instead of numbers if insufficient voltage is sensed.

MAINTAINING THE TESTER

Cleaning

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents.

Dirt or moisture in the terminals can affect readings.

To clean the terminals:

1. Turn the meter off and remove all test leads.
2. Shake out any dirt that may be in the terminals.
3. Soak a new swab with alcohol. Work the swab around each terminal.

Testing and Replacing the Batteries

Battery voltage is continuously monitored by the tester. If the voltage falls below 6.0 V (1.0 V/cell), the low battery icon ▬ appears on the display, indicating that there is minimal battery life left. The low battery icon continues to appear on the display until you replace the batteries.

⚠⚠Warning

To avoid false readings, which could lead to possible electric shock or personal injury, replace the batteries as soon as the battery icon (▬) appears.

Be sure that the battery polarity is correct. A reversed battery can cause leakage.

Replace the batteries with six AA batteries. Alkaline batteries are supplied with the tester but you can also use 1.2 V NiCd or NiMH batteries. You can also check the battery charge so that you can replace them before they discharge.

⚠⚠Warning

To avoid electrical shock or personal injury, remove the test leads and any input signals before replacing the battery. To prevent damage or injury, install ONLY specified replacement fuses with the amperage, voltage, and speed ratings shown in the General Specifications section of this manual.

To test the batteries:

1. Turn the rotary switch to the V position.
2. Press F3 > 2 seconds to initiate the battery test. The Voltage function display clears and is replaced by the measured battery voltage in the secondary display for 2 seconds, the Voltage function display then returns.

To replace the batteries (refer to Figure 16):

1. Press ⏻ to turn the tester off.
2. Remove the test leads from the terminals.
3. Remove the battery door by using a standard-blade screwdriver to turn the battery door screws (3) one-quarter turn counterclockwise.
4. Press the release latch and slide the battery holder out of the tester.
5. Replace the batteries and the battery door.
6. Secure the door by turning the screws one-quarter turn clockwise.

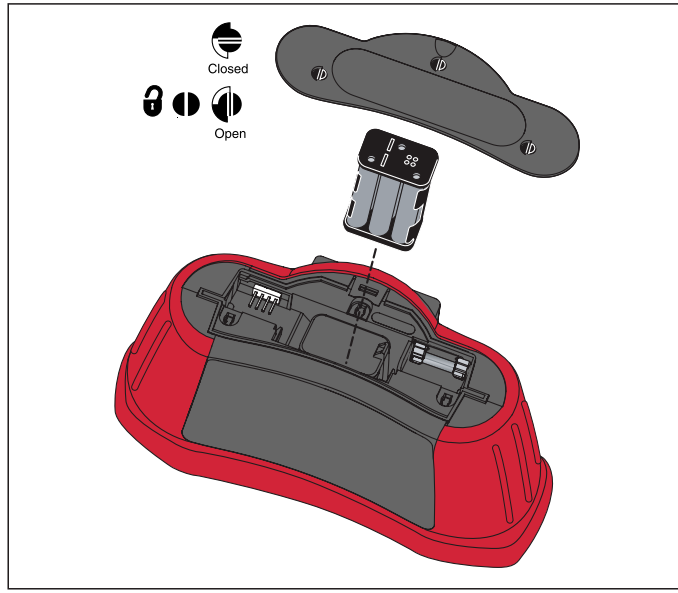


Figure 16. Replacing the Batteries

Testing the Fuse

A fuse test is performed each time you turn on the tester. If leads are plugged into the L and PE terminals, the fuse test is skipped. If a blown fuse is detected, testing is disabled, FUSE appears on the primary display, and the tester issues a warning beep.

You can also perform a manual check of the fuse.

To manually check the fuse:

1. Turn the rotary switch to R_{LO} switch setting.
2. Short the leads and press and hold (TEST)
3. If the fuse is bad, FUSE or Err1 will appear on the display to indicate the tester is damaged and needs repair. Contact Beha-Amprobe Service for repair (see Contacting Beha-Amprobe).

DETAILED SPECIFICATIONS

Features

Measurement Function	
Voltage & Frequency	√
Wiring polarity checker	√
Insulation Resistance	√
Loop & Line Resistance	√
Prospective Short-Circuit current (PSC/I_K)	√
RCD switching time	√
RCD tripping level	√ ramp test
RCD variable current	√
Automatic RCD test sequence	√
Test pulse current sensitive RCDs (Type A)	√
Phase Sequence Indicator	√
Other Features	
Self-test	√
Illuminated Display	√
Included Accessories	

- Test lead set
- ProInstall-TL-UK (LC38 AMP-MFT, mains test cord)
- Alligator clips
- Test probe
- ProInstall-TL-KIT (Remote test probe and probe tips)
- ProInstall-CC (Soft case with carrying strap)
- TL-75 (Fused test probe, red/blue/green with lantern spring, cap and tip cover)
- Zero-Adapter
- Statement of calibration
- Batteries
- Quick reference guide
- Carry strap for neck/waist
- CD-ROM (User manual)

General Specifications

Specification	Characteristic
Size	10 cm (L) x 25 cm (W) x 12.5 cm (H)
Weight (with batteries)	1.3 kg
Battery size, quantity	Type AA, 6 ea.
Battery type	Alkaline supplied. Usable with 1.2 V NiCd or NiMH batteries (not supplied)
Battery life (typical)	200 hours idling
Fuse	T3.15 A, 500 V, 1.5 kA 6.3 x 32 mm (PN 2030852)
Operating Temperature	-10 °C to 40 °C
Storage Temperature	-10 °C to 60 °C indefinitely (to -40 °C for 100 hrs)
Relative Humidity	80 % 10 to 35 °C; 70 % 35 to 40 °C
Operating Altitude	0 to 2000 meters
Shock, Vibration	Vibration to Class 3 per MIL-PRF-28800F 1 meter drop test, six sides, oak floor
Sealing	IP 40
EMC	Complies with EN61326-1
Safety	Complies with EN61010-1 Overvoltage Category: 500 V/CAT III, 300 V/CAT IV Measurement Category III is for measurements performed in the building installation. Examples are distribution panels, circuit breakers, wiring and cabling. Category IV equipment is designed to protect against transients from the primary supply level, such as an electrical meter or an overhead or underground utility service. Performance EN61557-1, EN61557-2, EN61557-3, EN61557-4, EN61557-6, EN61557-7. EN61557-10.
Pollution Degree	2
Maximum voltage between any terminal and earth ground	500 V
Surge Protection	6 kV peak per EN 61010-1

Category Ratings and Usage

Part/Accessory	Printed CAT Rating	CAT II 250 V	CAT III 500 V	CAT IV 300 V
Electrical Installation Tester	CAT III 500 V CAT IV 300 V	√ √	√ √	√ √
ProInstall-TL-UK, British Mains Cord	CAT II 250 V	√		
ProInstall-TL-Kit Remote Test Probe (red)	CAT III 1000 V	√	√	√
Test Lead (red/green/blue)	CAT III 1000 V	√	√	√
Test Probe (red/green/blue)	CAT III 1000 V	√	√	√
Alligator Clip (red/green/blue)	CAT III 1000 V	√	√	√
TL-75 Fused Test Probes: (red/green/blue)	CAT III 1000 V CAT IV 600 V	√ √	√ √	√ √

ELECTRICAL MEASUREMENT SPECIFICATIONS

The accuracy specification is defined as ±(% reading +digit counts) at 23 °C ±5 °C, ≤80 % RH. Between -10 °C and 18 °C and between 28 °C and 40 °C, accuracy specifications may degrade by 0,1 x (accuracy specification) per °C. The following tables can be used for the determination of maximum or minimum display values considering maximum instrument operating uncertainty per EN61557-1, 5.2.4.

Insulation Resistance (R_{ISO})

250 V		500 V		1000 V	
Limit Value	**Maximum Display Value**	**Limit Value**	**Maximum Display Value**	**Limit Value**	**Maximum Display Value**
1	1.3	1	1.3	1	1.3
2	2.4	2	2.4	2	2.4
3	3.5	3	3.5	3	3.5
4	4.6	4	4.6	4	4.6
5	5.7	5	5.7	5	5.7
6	6.8	6	6.8	6	6.8
7	7.9	7	7.9	7	7.9
8	9.0	8	9.0	8	9.0
9	10.1	9	10.1	9	10.1
10	11.2	10	11.2	10	11.2
20	22.2	20	22.2	20	22.2
30	33.2	30	33.2	30	33.2
40	44.2	40	44.2	40	44.2
50	55.2	50	55.2	50	55.2
60	66.2	60	66.2	60	66.2
70	77.2	70	77.2	70	77.2
80	88.2	80	88.2	80	88.2
90	99.2	90	99.2	90	99.2
100	110.2	100	110.2	100	110.2
200	220.2	200	220.2	200	220.2
		300	347	300	345
		400	462	400	460
		500	577	500	575
				600	690
				700	805
				800	920
				900	1035
				1000	1150

Continuity (R_{LO})

Limit Value	Maximum Display Value	Limit Value	Maximum Display Value
0.2	0.16	3	2.68
0.3	0.25	4	3.58
0.4	0.34	5	4.48
0.5	0.43	6	5.38
0.6	0.52	7	6.28
0.7	0.61	8	7.18
0.8	0.7	9	8.08
0.9	0.79	10	8.98
1	0.88	20	17.98
2	1.78	30	26.8

Loop Tests (Z_I)

Loop Z_I Hi Current		Loop Z_I No Trip		Loop Z_I		Loop R_E	
Limit Value	Maximum Display Value	Limit Value	Maximum Display Value	Limit Value	Maximum Display Value	Limit Value	Maximum Display Value
0.20	0.14	-	-	3	2.53	3	2.72
0.30	0.23	-	-	4	3.38	4	3.62
0.40	0.32	0.40	0.28	5	4.23	5	4.52
0.50	0.41	0.50	0.37	6	5.08	6	5.42
0.60	0.50	0.60	0.45	7	5.93	7	6.32
0.70	0.59	0.70	0.54	8	6.78	8	7.22
0.80	0.68	0.80	0.62	9	7.63	9	8.12
0.90	0.77	0.90	0.71	10	8.48	10	9.02
1.00	0.86	1.00	0.79	20	16.98	20	18.02
1.10	0.95	1.10	0.88	30	25.3	30	27.2
1.20	1.04	1.20	0.96	40	33.8	40	36.2
1.30	1.13	1.30	1.05	50	42.3	50	45.2
1.40	1.22	1.40	1.13	60	50.8	60	54.2
1.50	1.31	1.50	1.22	70	59.3	70	63.2
1.60	1.40	1.60	1.30	80	67.8	80	72.2
1.70	1.49	1.70	1.39	90	76.3	90	81.2
1.80	1.58	1.80	1.47	100	84.8	100	90.2
1.90	1.67	1.90	1.56	200	169.8	200	180.2
2.00	1.76	2.00	1.64	300	253	300	272
-	-	-	-	400	338	400	362
-	-	-	-	500	423	500	452
-	-	-	-	600	508	600	542

Loop Tests (Z_l) (cont.)

-	-	-	-	700	593	700	632
-	-	-	-	800	678	800	722
-	-	-	-	900	763	900	812
-	-	-	-	1000	848	1000	902

RCD/FI Tests (ΔT, IΔN)

RCD/FI Time		RCD/FI Current	
Limit Value	**Maximum Display Value**	**Limit Value**	**Maximum Display Value**
20	18.1	0.5	0.43
30	27.1	0.6	0.52
40	36.1	0.7	0.61
50	45.1	0.8	0.7
60	54.1	0.9	0.79
70	63.1	1	0.88
80	72.1	2	1.78
90	81.1	3	2.68
100	90.1	4	3.58
200	180.1	5	4.48
300	271	6	5.38
400	361	7	6.28
500	451	8	7.18
600	541	9	8.08
700	631	10	8.98
800	721	20	17.98
900	811	30	26.8
1000	901	40	35.8
2000	1801	50	44.8
		60	53.8
		70	62.8
		80	71.8
		90	80.8
		100	89.8
		200	179.8
		300	268
		400	358
		500	448

AC Voltage Measurement (V)

Range	Resolution	Accuracy 50 Hz – 60 Hz	Input Impedance	Overload Protection
500 V	0.1 V	0.8 % + 3 digits	3.3 MΩ	660 V rms

Continuity Testing (R_{LO})

Range (Autoranging)	Resolution	Open Circuit Voltage	Accuracy
20 Ω	0.01 Ω	>4 V	±(1.5 % + 3 digits)
200 Ω	0.1 Ω	>4 V	±(1.5 % + 3 digits)
2000 Ω	1 Ω	>4 V	±(1.5 % + 3 digits)
Note: The number of possible continuity tests with a fresh set of batteries is 3000.			

Range R_{LO}	Test Current
7.5 Ω	210 mA
35 Ω	100 mA
240 Ω	20 mA
2000 Ω	2 mA

Test Probe Zeroing	Press the (ZERO) to zero the test. Can subtract up to 3 Ω of lead resistance. Error message for >3 Ω.
Live Circuit Detection	Inhibits test if terminal voltage >10 V ac detected prior to initiation of test.

Insulation Resistance Measurement (R_{ISO})

Test Voltages	250-500-1000 V
Accuracy of Test Voltage (at rated test current)	+10 %, -0 %

Test Voltage	Insulation Resistance Range	Resolution	Test Current	Accuracy
250 V	10 kΩ to 20 MΩ	0.01 MΩ	1 mA @ 250 kΩ	±(1.5 % + 3 digits)
	20 MΩ to 200 MΩ	0.1 MΩ		±(1.5 % + 3 digits)
500 V	10 kΩ to 20 MΩ	0.01 MΩ	1 mA @ 500 kΩ	±(1.5 % + 3 digits)
	20 MΩ to 200 MΩ	0.1 MΩ		±(1.5 % + 3 digits)
	200 MΩ to 500 MΩ	1 MΩ		±10 %
1000 V	100 kΩ to 200 MΩ	0.1 MΩ	1 mA @ 1 MΩ	±(1.5 % + 3 digits)
	200 MΩ to 1000 MΩ	1 MΩ		±10 %
Note: The number of possible insulation tests with a fresh set of batteries is 2000.				

Auto Discharge	Discharge time constant <0.5 second for C = 1 µF or less.
Live Circuit Detection	Inhibits test if terminal voltage >30 V prior to initiation of test.
Maximum Capacitive Load	Operable with up the 5 µF load.

Loop/Line Impedance: No Trip and Hi Current Modes

Mains Input Voltage Range	100 - 500 V ac (50/60 Hz)
Input Connection (soft key selection)	Loop Impedance: phase to earth
	Line impedance: phase to neutral
Limit on Consecutive Tests	Automatic shutdown when internal components are too hot. There is also a thermal shutdown for RCD tests.
Maximum Test Current @ 400 V	20 A sinusoidal for 10 ms
Maximum Test Current @ 230 V	12 A sinusoidal for 10 ms

Range	**Resolution**	**Accuracy [1]**
20 Ω	0.01 Ω	No Trip mode: ±(3 % + 6 digits)
		Hi Current mode: ±(2 % + 4 digits)
200 Ω	0.1 Ω	No Trip mode: ±(3 %)
		Hi Current mode: ±(2 %)
2000 Ω	1 Ω	±6 %[2]

Note:
[1] Valid for resistance of neutral circuit <20 Ω and up to a system phase angle of 30 °. Test leads must be zeroed before testing.
[2] Valid for mains voltage >200 V.

Prospective Short Circuit Current Test (PSC/I_K)
Prospective Earth Fault Current (PEFC)

Computation	Prospective Earth Fault Current (PSC/I_K) or Prospective Short Circuit Current (PSC/I_K) determined by dividing measured mains voltage by measured loop (L-PE) resistance or line (L-N) resistance, respectively.	
Range	0 to 10 kA or 0 to 50 kA (See Power-On Options earlier in this manual)	
Resolution and Units	Resolution	Units
	I_K <1000 A	1 A
	I_K >1000 A	0.1 kA
Accuracy	Determined by accuracy of loop resistance and mains voltage measurements.	

RCD TESTING

RCD Types Tested

RCD Type[5]		
AC[1]	G[2]	√
AC	S[3]	√
A[4]	G	√
A	S	√

Note:
[1] AC – Responds to ac
[2] G – General, no delay
[3] S – Time delay
[4] A – Responds to pulsed signal
[5] RCD test inhibited for V >265 ac
RCD tests permitted only if the selected current, multiplied by earthing resistance, is <50V.

Test Signals

RCD Type	**Test Signal Description**
AC (sinusoidal)	The waveform is a sinewave starting at zero crossing, polarity determined by phase selection (0 ° phase starts with low to high zero crossing, 180 ° phase starts with high to low zero crossing). The magnitude of the test current is $I_{\Delta}n$ x Multiplier for all tests.
A (half wave)	The waveform is a half wave rectified sinewave starting at zero, polarity determined by phase selection (0 ° phase starts with low to high zero crossing, 180 ° phase starts with high to low zero crossing). The magnitude of the test current is 2.0 x $I_{\Delta}n$ (rms) x Multiplier for all tests for $I_{\Delta}n$ = 0.01A. The magnitude of the test current is 1.4 x $I_{\Delta}n$ (rms) x Multiplier for all tests for all other $I_{\Delta}n$ ratings.

RCD Types Tested (ΔT)

Test Function	**RCD Current Selection**						
	10 mA	**30 mA**	**100 mA**	**300 mA**	**500 mA**	**1000 mA**[1]	**var**[2]
X ½, 1	√	√	√	√	√	√	√
X 5	√	√	√				
Ramp	√	√	√	√	√	√	√
Auto	√	√	√				

Note:
Mains voltage 100 V – 265 V ac, 50/60 Hz
[1] Type AC RCDs only.
[2] Type A RCDs are limited to 700 mA, not available for Type B RCDs.

Current Multiplier	*RCD Type	Measurement Range		Trip Time Accuracy
		Europe	UK	
X ½	G	310 ms	2000 ms	± (1% Reading + 1ms)
X ½	S	510 ms	2000 ms	± (1% Reading + 1ms)
X 1	G	310 ms	310 ms	± (1% Reading + 1ms)
X 1	S	510 ms	510 ms	± (1% Reading + 1ms)
X 5	G	50 ms	50 ms	± (1% Reading + 1ms)
X 5	S	160 ms	160 ms	± (1% Reading + 1ms)
Note: *G – General, no delay *S – Time delay				

Maximum Trip Time

The RCD √ symbol switches on when testing the RCD trip time if the trip time meets the following conditions:

RCD	$I_{\Delta N}$	Trip Time Limits
AC G, A	X 1	Less than 300 ms
AC G-S, A-S	X 1	Between 130 ms and 500 ms
AC G, A	X 5	Less than 40 ms
AC G-S, A-S	X 5	Between 50 ms and 150 ms

RCD/FI-Tripping Current Measurement/Ramp Test ($I_{\Delta N}$)

Current Range	Step Size	Measurement Range		Measurement Accuracy
		Type G	Type S	
30 % to 110 % of RCD rated current[1]	10 % of $I_{\Delta N}$	300 ms/step	500 ms/step	±5 %
Notes [1] 30 % to 150 % for Type A $I_{\Delta N}$ >10 mA 30 % to 210 % for Type A $I_{\Delta N}$ = 10 mA Specified trip current ranges (EN 61008-1): 50 % to 100 % for Type AC 35 % to 140 % for Type A (>10 mA) 35 % to 200 % for Type A (≤10 mA)				

Phase Sequence Indication

Icon	icon Phase Sequence indicator is active.
Display of Phase Sequence	Displays “1-2-3” in digital display field for correct sequence. Displays “3-2-1” for incorrect phase. Dashes in place of a number indicate a valid determination could not be made.
Mains Input Voltage Range (phase-to-phase)	100 to 500 V

MAINS WIRING TEST

Icons ( ,  , ) indicate if L-PE or L-N terminals are reversed. Instrument operation is inhibited and an error code is generated if the input voltage is not between 100 V and 500 V. The UK Loop and RCD tests are inhibited if the L-PE or the L-N terminals are reversed.

OPERATING RANGES AND UNCERTAINTIES PER EN 61557

Function	Display Range	EN 61557 Measurement Range Operating Error	Nominal Values
V EN 61557-1	0.0 V ac – 500 V ac	50 V ac – 500 V ac ±(2% + 2 dgt)	U_N = 230/400 V ac f = 50/60 Hz
R_{LO} EN 61557-4	0.00 Ω - 2000 Ω	0.2 Ω - 2000 Ω ± (10% + 2 dgt)	4,0 VDC < U_Q < 24 VDC R_{LO} ≤ 2.00 Ω I_N ≥ 200 mA
R_{ISO} EN 61557-2	0.00 MΩ - 1000 MΩ	1 MΩ - 200 MΩ ± (10% + 2 dgt) 200 MΩ - 1000 MΩ ± (15% + 2 dgt)	U_N = 250 / 500 / 1000 V dc I_N = 1,0 mA
Z_I EN 61557-3	Z_I (NO TRIP) 0.00 Ω - 2000 Ω	0.4 Ω - 2000 Ω ± (15% + 6 dgt)	U_N = 230 / 400 Vac f = 50 / 60 Hz I_K = 0 A - 10.0 kA
	Z_I (HI CURRENT) 0.00 Ω - 2000 Ω	0.2 Ω - 200 Ω ± (10% + 4 dgt)	
	RE 0.0 Ω - 2000 Ω	10 Ω - 1000 Ω ±(10 % + 2 dgt)	
ΔT, $I_{\Delta N}$ EN 61557-6	ΔT 0.0 ms - 2000 ms	25 ms - 2000 ms ± (10% + 1 dgt)	ΔT@ 10 / 30 / 100 / 300 / 500 / 1000 / VAR mA
	$I_{\Delta N}$ 3 mA - 550 mA (VAR 3 mA – 700 mA)	3 mA - 550 mA ± (10% + 1 dgt)	$I_{\Delta N}$ = 10 / 30 / 100 / 300 / 500 / VAR mA
Phase EN 61557-7			1 : 2 : 3

Operating Uncertainties per EN 61557

The Operating Uncertainty shows the maximum possible uncertainty when all influence factors E1-E10 are counted.

	Volts	R_{LO} EN 61557-4	R_{ISO} EN 61557-2	Z_I EN 61557-3	ΔT EN 61557-6	$I_{\Delta N}$ EN 61557-6
Intrinsic Uncertainty A	**0.80 %**	**1.50 %**	**10.00 %**	**6.00 %**	**1.00 %**	**5.00 %**

Influence Quantity	**Volts**	**R_{LO} EN 61557-4**	**R_{ISO} EN 61557-2**	**Z_I EN 61557-3**	**ΔT EN 61557-6**	**$I_{\Delta N}$ EN 61557-6**
E1 - Position	0.00 %	0.00 %	0.00 %	0.00 %	0.00 %	0.00 %
E2 - Supply Voltage	0.50 %	3.00 %	3.00 %	3.00 %	3.00 %	2.75 %
E3 - Temperature	0.50 %	3.00 %	3.00 %	3.00 %	3.00 %	2.75 %
E4 - Series Interferences Voltage	-	-	-	-	-	-
E5 - Resistance of the probes and auxiliary earth electrodes	-	-	-	-	-	-
E6.2 - System phase angle	-	-	-	1.00 %	-	-
E7 - System frequency	-	-	-	2.50 %	-	-
E8 - System voltage	-	-	-	2.50 %	2.50 %	2.50 %
E9 - Harmonics	-	-	-	2.00 %	-	-
E10 - D.C. Quantity	-	-	-	2.50 %	-	-

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