Overcurrent Protection - Tester

Operating Instructions

Overcurrent Protection - Tester
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# 1. ORDER REFERENCE

## 1.1. Standard set

Code Nr: xxxxxxxxx consists of the following items

<table>
<thead>
<tr>
<th>1.</th>
<th>1 Test instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>1 Mains cord Euro Shuko</td>
</tr>
<tr>
<td>3.</td>
<td>2 Current/Trigger/Polarity test leads 2,5 mm², with safety banana, 2 m, red</td>
</tr>
<tr>
<td>4.</td>
<td>2 Current/Trigger/Polarity test leads 2,5 mm², with safety banana, 2 m, black</td>
</tr>
<tr>
<td>5.</td>
<td>2 High-current test leads 16 mm², with d = 6 mm hole terminal, 2 m, red</td>
</tr>
<tr>
<td>6.</td>
<td>2 High-current test adapters 16 mm², with d = 4 mm terminal, 0.2 m, red</td>
</tr>
<tr>
<td>7.</td>
<td>2 Current test adapters 4 mm², with d = 4 mm terminal, 0.2 m, red</td>
</tr>
<tr>
<td>8.</td>
<td>2 Banana – banana adapters</td>
</tr>
<tr>
<td>9.</td>
<td>2 Safety alligators, 32 A, CAT III, 1000 V, red</td>
</tr>
</tbody>
</table>
1.2. Options

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 Polarity test lead, 10 m, red / black</td>
<td>10 m</td>
</tr>
<tr>
<td></td>
<td>Cone Nr. xx</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1 START/STOP Pedal</td>
<td>2 m</td>
</tr>
<tr>
<td></td>
<td>Cone Nr. xx</td>
<td></td>
</tr>
</tbody>
</table>
2. INTRODUCTION

Congratulations on your purchase of the Overcurrent Protection - Tester. It was developed to offer actual testing of Overcurrent Protection Devices like Motor Protection Switches, Automatic Fuses etc. within the most often used current range.

2.1. General description

The Overcurrent Protection - Tester is intended to test all kinds of Overcurrent Protection Devices that operate on either thermal or electromagnetic principle. Electrical installers for example usually test three-phase Motor Protection Switches by disconnecting one phase and waiting for trip-out. It is important to be aware that this is not a correct test as the current through the motor and thus through tested protection device depends on how much the motor is loaded.

The only actual test of Overcurrent Protection Devices can be done by driving appropriate current through the tested device and measuring reaction time. This is exactly what it is offered by the Overcurrent Protection - Tester.

The test instrument can drive a test current within a wide range from 2 up to 160 A. Pre-set test current is automatically controlled and maintained during the test is going on regardless of test device characteristics (internal impedance).

As there is a high-current generator available in the instrument and as the installers often have to connect measurement current transformers e.g. to measurement equipment, the Polarity of Current Transformers function is incorporated to the instrument too. Correct polarity is important when connecting e.g. kW-meters, kWh-meters or Mains Voltage/Current Analysers.

2.2. Standards applied

IEC/EN 61010-1 ......................... Basic safety standard
IEC/EN 61326-1 ......................... EMC standard (noise and immunity)
3. SAFETY MEASURES

The operator is not allowed to apply any external voltage between the two current test terminals! Test terminals are practically short-circuited inside the instrument – no fuse inserted!
The current output is galvanic separated against all other circuitry and ground!

- This measuring device is only to be installed and operated by qualified personnel and according to the technical data in compliance with the safety precautions and regulations set forth below. Additionally, the use of this equipment requires compliance with all legal and safety regulations pertaining to each specific application. Similar regulations apply to the use of accessories.

- It can be assumed that safe operation is no longer possible if the device
  - show visible damage,
  - has been exposed to unfavourable conditions (e.g. storage beyond the permissible climatic limits without adaptation to the ambient climate, dewing.) or
  - has been exposed to major strain transport (e.g. been dropped from some height) even without visible external damage etc.

- If the test instrument is used in manner not specified in this manual the protection provided by the instrument may be impaired!

- Do not use the instrument in explosive atmosphere!

- In case of blown fuse, follow the instructions in this manual to replace it!

- Service intervention or calibration procedure is allowed to be carried out only by a competent authorised person!
4. INSTRUMENT DESCRIPTION

4.1. Front panel

1. Euro mains socket 230 V / 50 Hz, 700 VA.
2. General fuse T 4 A / 250 V (5 × 20 mm).
3. ON / OFF switch.
4. TEST rotary switch. It selects one of three available tests.
5. Test Current Range rotary switch. It selects test current range i.e. “2 up to 16 A” or “16 up to 160 A”.
6. OVERRANGE yellow LED lamp. It lights if set test current can not be maintained.
7. Test Current potentiometer. It sets test current within selected current range.
8. 4 mm safety banana socket for Polarity (K) or Trigger test lead.
10. 4 mm safety banana socket for Polarity (L) or Trigger test lead.
12. START / STOP key.
13. ON red LED lamp. It indicates any test is running on.
14. PEDAL connector (same function as START / STOP key).
15. DISPLAY key. It selects parameter to be displayed.
16. t (time) unit.
17. A (current) unit.
18. hot indication. The lamp flashes when temperature is close to limit one and it lights continuously when the test instrument is overheated.
19. LED Display.
4.2. Accessory compartment and short instruction panel

All required test accessories are kept in appropriate accessory compartment under the casing cover. There is also an instruction panel with short instructions how to connect test leads for a certain test. The instruction panel is both side printed (English on one side and German on the other). The user can simply swap it to change the language.

**How to swap the instruction panel?**

The panel is placed behind transparent foil, that is why it is necessary to remove black leather holder at least at the upper side, then the panel can be pulled out and swapped. See the figure below.

![Instruction panel diagram](image)

**Fig. 2.** Instruction panel
5. THEORY

5.1. Theory of Overcurrent Protection Devices

The Overcurrent Protection Devices in general are used to protect either electrical installations including the elements incircuited into the installations (transformers, switches, measurement devices, etc.) or various loads (three-phase motors, single-phase loads etc.) connected to the installation. Not functioning protection devices can cause often trip-out of connected loads, burning-out motors and other loads or even fires.

There are different Overcurrent Protection Devices used in practice like:

Motor Protection Switches with and without electromagnetic protection.

Thermal Relays.

Automatic Fuses with and without electromagnetic protection.

When should the Overcurrent Protection Devices be tested:
There are several reasons that require Overcurrent Protection Devices to be tested:
- Often trip-out of Overcurrent Protection Devices due to unknown reason.
- Burning-out motors or other loads.
- The Overcurrent Protection Devices are exposed to unfavorable climatic conditions.
- The Overcurrent Protection Devices are exposed to aggressive environment.
- Regular inspection to assure proper operation of Overcurrent Protection Devices.

Test principle used by the test instrument:
Test current is pushed into tested Overcurrent Protection Devices i.e. O.U.T. (Object Under Test) by secondary voltage of galvanic separated transformer. The current is measured on secondary side and controlled on transformer's primary side by triac switch. Shape of test current is thus not pure sine wave but just an
approximation (depends on value of test current and on impedance of O.U.T.). Effective value of actual test current is equal to set test value. Test current can be modified even during the test is running on.

Reaction time measurement starts to run simultaneously with test current and stops as soon as the current is interrupted (current switch is incorporated to O.U.T., see fig. 3) or as soon as any change is detected at the Trigger Input (current switch is not incorporated in O.U.T., see fig. 4). The change means alternation from short circuit to open loop or 230 V to 0V and vice versa.

Fig. 3. Test principle (current switch is incorporated in O.U.T.)

Fig. 4. Test principle (current switch is not incorporated in O.U.T.)

Maintaining test current:
Correct and stable test current is maintained automatically regardless of potential variation of external impedance (test lead’s impedance, contact resistance or internal impedance of O.U.T.). If the actual test current can not be maintained any
longer (increased set test current value or too high test loop impedance) then OVERCURRENT information is given (red LED lamp). In that case higher cross section test leads are to be used or lower test current is to be selected.

Standards dealing with Reaction Time of Overcurrent Prot. Devices:

**Motor Protection Switches**
IEC/EN 60947-4-1 (symmetrically loaded Motor Protection Switch)
- $I_{\text{TEST}} = 1.05 \, I_N \Rightarrow \text{no trip-out within 2 hours}$
- $I_{\text{TEST}} = 1.2 \, I_N \Rightarrow \text{trip-out within 2 hours}$

**Automatic fuses**
IEC/EN 60878
- $I_{\text{TEST}} = 1.13 \, I_N \Rightarrow \text{no trip-out within 1 hour}$
- $I_{\text{TEST}} = 1.45 \, I_N \Rightarrow \text{trip-out within 1 hour}$
VDE0636
- $I_{\text{TEST}} = 5 \, I_N \Rightarrow \text{trip-out within 0.2 s (B type)}$
- $I_{\text{TEST}} = 10 \, I_N \Rightarrow \text{trip-out within 0.2 s (C type)}$
- $I_{\text{TEST}} = 15 \, I_N \Rightarrow \text{trip-out within 0.2 s (K type)}$

**Melting fuses**
VDE0636
- $I_{\text{TEST}} = 10 \, I_N \Rightarrow \text{trip-out within 0.2 s (gL type)}$
- $I_{\text{TEST}} \cong 5 \, I_N \Rightarrow \text{trip-out within 5 s (gL type)}$

**How to select test current:**
It is important to define test current correctly, otherwise test result has no practical value. Test current depends on nominal current of the device to be tested and on type of protection to be tested (electromagnetic or thermal). Above mentioned standards present a bases for selecting appropriate test current. The standards may be used in combination with practical experience. It is important to be aware of purpose of the concrete protection switch when checking or adjusting it. See the example below:

There is a Motor to be protected by a Motor Protection Switch.
Phase current when the motor is maximally loaded (measured value) $I_{\text{MAX}} = 6 \, \text{A}$.
Start-up current (measured value) $I_{\text{START}} = 32 \, \text{A}$.
Start-up time (measured value) $t_{\text{START}} = 3 \, \text{s}$.

Select, adjust and check the Overcurrent Protection Device?

a) Select a Motor Protection Switch with current range around 6 A e.g. $I_N = 5$ up to 8 A.
b) Adjust the protection switch to the value just above measured maximal phase current e.g. to 6.5 A.
c) Test thermal protection of so adjusted protection device at test current of 6.5 A for approx. 20 minutes (practical value). The device should not trip.
d) Test thermal protection of so adjusted protection device at test current of approx. double adjusted value (practical value) i.e. at 13 A for approx. 20 minutes (practical value). The device should trip.
THEORY

e) Test electromagnetic and thermal protection against trip-out due to motor’s start-up current. So test the protection device at test current a bit above start-up current value e.g. at 34 A (practical value). The device should not trip within 3 s.

f) Test electromagnetic protection that usually starts to act at the current value of approx. 10 up to 15 times above nominal value. So test protection device at test current of 100 A. The device should trip within approx. 0.2 s (practical value).

Each pole should be tested to be sure of correct operation. So adjusted and tested Motor Protection Device should operate and protect the motor correctly.
5.2. Theory of Current Transformer Polarity

It is often highly important that primary and secondary terminals of current transformer are connected correctly (correct polarity). **Polarity of Current Transformer** function enables correct connection of Current Transformer terminals to kWh-meter, kW-meter, Mains Voltage/Current Analyser etc., especially when secondary conductors are wrapped up. If the terminals are connected reversed way then power, energy, \( \cos \varphi \) etc. may not be measured correctly.

**Note!**
By the Overcurrent Protection - Tester it is possible to test only unloaded transformers (no load current through primary conductor) at obligatory open secondary side.

**Test principle:**
After pressing the START/STOP key the instrument triggers a current test pulse and detects the voltage response at the secondary side. Then polarity result is displayed (Cor - Correct) or (Re - Reversed). See the test procedure on the figure below.

![Fig. 5. Polarity determination test principle](image)

It is possible to use START / STOP pedal (an optional accessory) to start / stop the test, when two hands are occupied with two test leads (Current or Polarity test leads).

There are different signs used in practice to define current transformer’s terminals:
**Fig. 6.** Current transformer terminals’ signs
6. CARRYING OUT TESTS

6.1. Connection of the Tester to mains voltage

The Overcurrent Protection – Tester is to be connected to schuko mains outlet with rated output voltage of 230 V / 50 Hz. Take care the outlet is equipped with undamaged ground terminal (Tester is protected with Class I meaning accessible conductive parts are connected to ground terminal).

It is important the supplying socket to be protected with a fuse of at least B10 A (melting or automatic), otherwise the Tester may cause tripping out the fuse even during normal operation under certain circumstances.

6.2. Generally about available test leads

There are more available test leads and other accessories in standard set to be used:
- Current test leads. The test leads lead test current through tested object (Reaction Time measurement) or through primary conductor of tested Current Transformer (Polarity measurement).
- Current / Trigger / Polarity test leads. The test leads can be used either as Current test leads (see the description above), as Trigger test leads - they give an information about when the O.U.T. (without current switch) tripped out or as Polarity test leads -they are connected to secondary side when checking polarity of current transformer.

How to select appropriate Current test leads for a specific Reaction Time measurement

In order to carry out a specific test, it is advisable to select the lowest cross-section test leads that can still carry planned test current for expected test time. Test leads and connection contacts (test terminals at the instrument and connection terminals at tested object) should not get too hot during the test is going on (practical evaluation).

If selected test leads are too week with respect to test current then they will get too hot or the test instrument may even not be able to drive set test current (due to too high test lead's resistance). On the other hand too high Current test leads may be too rigid or unpractical in case of low test current.

Let's see available Current test leads and their current capacities:
Fig. 7. Available Current test lead combinations

Ver. 1: Two Current/Trigger/Polarity test leads (black + red) used as Current test leads.
Current capacity up to 30 A continuously, short term test over 30 A.

Ver. 2: Two + Two Current/Trigger/Polarity test leads connected in parallel used as Current test leads.
Current capacity up to 30 A continuously (limited by test terminals), short term test over 30 A, low internal resistance.

Ver. 3: Two High-current test leads in combination with High-current test adapter.
Current capacity up to 100 A continuously, short term test up to 160 A.

6.3. Reaction Time measurement of Overcurrent Protection Devices

Overcurrent Protection Devices in general can be sorted out into two groups:
• Devices with incorporated current switch (Motor Protection Switches, Automatic Fuses etc.).
• Devices without incorporated current switch but with incorporated control switch (Thermal Relays etc.)
Test procedure for all devices inside each group is the same.

Warnings!
When testing installed devices, the operator is to assure all loads connected to tested protection device to be switched off before connecting test leads!

In order to avoid possible short circuits across mains voltage done by mistake when connecting current test leads, it is important to disconnect mains voltage (main switch or main fuse) before connecting test leads!

Notes!

Three-phase protection devices only: For practical reasons, the tester is constructed to test each pole separately! There may be too low test voltage available at test terminals for serial connection of all three poles (Err1 displayed after pressing the START/STOP key)!

It is important to take into account that start temperature of the second and especially of the third pole is already increased due to previously carried out tests.

Err1 message is displayed after pressing the START/STOP key if the impedance of measured object is too high or if current test leads are not connected (open test loop)!

Practical reasons for testing each pole separately:
- Only the most sensitive pole is tested when testing protection device with three poles connected in series.
- It is not practically to do some additional wiring (serial connection) before carrying out the test, especially when protection device to be tested is already incircuited.

6.3.1. Devices with incorporated current switch

How to carry out the test

STEP 1. Prepare the device to be tested and potential electrical installation.

- Disconnect mains voltage before device to be tested in order to avoid possible short circuit done across mains voltage by mistake. Take into account there is practically a short circuit inside the instrument between current test terminals (K and L) – no fuse incorporated.

- Disconnect load supplied through the device to be tested (turn off mains switch) in order to avoid possible influence to test result (Disconnection Time).

- Turn on the protection device to be tested (close current or control switch).

- Remove input and output conductors from the first pole to be tested preparing free terminals for connection of test leads.
STEP 2. **Prepare the Overcurrent Protection - Tester.**

- Select appropriate test function by means of TEST rotary switch. **5s** position shall be selected when testing electromagnetic protection (fast trip-out), and **100 min** position when testing thermal protection (slow trip-out). Usually protection devices contain both electromagnetic and thermal protections.

- Adjust test current value by means of TEST CURRENT rotary switch (range) and potentiometer (value). The value is displayed for a while (approx. 3 s) after pressing the DISPLAY key or after changing TEST CURRENT rotary switch / potentiometer position. After displaying set test current value, the display turns to last test result if any unless cleared by changing the TEST rotary switch position. See instructions how to select test current on page 10.

- Connect appropriate test leads to current test terminals. See available test leads and current capacities on page 13.

STEP 3. **Carry out the test.**

- Connect test leads via appropriate adapter / accessory to one pole of protection device to be tested. See the figure below for correct connection. See available test adapters on page 2. Assure reliable contact.

- Press the **START/STOP** key, test current starts to flow and time starts to run (displayed). After tripping-out O.U.T., final result i.e. Reaction Time in seconds or in minutes is displayed.

- Test current can be checked again by pressing the DISPLAY key.

- Repeat the tests for another two poles if three-pole protection device is tested.
Fig. 8. Connection of the Overcurrent Protection - Tester to protection device to be tested (current switch is incorporated)
6.3.2. Devices without incorporated current switch

How to carry out the test

STEP 1. See STEP 1 on page 14.

STEP 2. See STEP 2 on page 14. In addition connect two Trigger test leads to TRIGGER input of the Overcurrent Protection – Tester. See the figure below.

STEP 3. Carry out the test.
- Connect current test leads via appropriate adapter / accessory to one pole of protection device to be tested. See the figure below for correct connection. See available test adapters on page 2. Assure reliable contact.
- Connect Trigger test leads to control contact of protection device to be tested. Polarity of the test leads has no meaning. See the figure below for correct connection. Make sure to re-trigger the control contact.
- Press the START/STOP key, test current starts to flow and time starts to run (displayed). After tripping-out O.U.T. test current stops to flow and final result i.e. Reaction Time is displayed.
- Test current can be checked again by pressing the DISPLAY key.
- Repeat the tests for another two poles if three-pole protection device is tested.

![Diagram](image)

Fig. 9. Connection of the Overcurrent Protection - Tester to protection device to be tested (current switch is not incorporated).
**Note!**
If the protection devices to be tested (without incorporated current switch) and Relay are placed close to each other and if connection terminals of both devices are accessible, then test leads can be connected the same way as to Devices with incorporated current switch without using Trigger test leads. See the next figure.

![Fig. 10. Connection of the Overcurrent Protection - Tester to protection device to be tested (current switch is not incorporated, Relay terminals accessible).](image)

**How to judge test results**

The **Overcurrent Protection – Tester** is a test instrument intended to offer **practical evaluation** of operation of Overcurrent Protection Devices. The evaluation shall be done on bases of appropriate standard (see some standards on page 10) and/or on practical experience.

The **Overcurrent Protection – Tester** is not a verification test instrument. In case of bad result it is advisable to repeat the test using a verification test instrument that can do the test in whole compliance with standards before refusing the Protection Device (returning it to producer or dealer).

For example: This test instrument may not be able to drive set test current through all three poles connected in series what is required by the IEC/EN 60947-4-1 standard etc.
Over-temperature protection

Temperature of internal components of the Overcurrent Protection – Tester may rise due to flowing high test current. Hot LED lamp (pos. 18, fig. 1) starts to blink when the temperature approaches to limit value. In that case it is advised to finish the test. If the test is not terminated in time the temperature may reach limit value. The test is terminated automatically, Hot LED lamp starts to flash continuously and Hot message is displayed. Press the DISPLAY key to check elapsed test time.
6.4. Polarity of Current Transformers

**Warning!**
- Avoid any touch to secondary terminals of the transformer under test. Dangerous voltage of over 70 Vp may be present during the current pulse is generated!
- In order to avoid possible short circuits across mains voltage done by mistake when connecting current test leads, it is important to disconnect mains voltage (main switch or main fuse) before connecting test leads!

**Notes!**
- By the Overcurrent Protection - Tester it is possible to test only current transformers which are:
  - Unloaded (no current flowing through primary conductor).
  - Open at the secondary side (open 5A or 1A current loop).
  - Hole-through or bar arranged (primary side not wound up – low inductance)
- In order to avoid possible short circuits across mains voltage done by mistake when connecting test leads, it is important to disconnect mains voltage (main switch or main fuse) before connecting test leads!
- **Err1** message will be displayed after pressing the **START/STOP** key if the impedance of primary loop is too high or if current test leads are not shorted (open test loop) or if primary side of tested current transformer is wound-up!
- **Err2** message will be displayed if inducted secondary voltage is too low i.e. lower than approx. 15 V (not open secondary side, not connected polarity leads etc.).

**How to carry out the test**

**STEP 1. Prepare the Current Transformer to be tested.**
- Disconnect mains voltage before the transformer to be tested in order to avoid possible short circuit done across mains voltage by mistake. **Take into account there is a short circuit inside the instrument between current test leads – no fuse incorporated.** It is also important to disconnect mains voltage in order to interrupt potential current through primary conductor.
- Open secondary side of tested Current Transformer (if shorted or if already connected to any other device).

**STEP 2. Prepare the Overcurrent Protection - Tester.**
- Select **POLARITY** test function by means of TEST rotary switch.
- Connect black **Current/Trigger/Polarity** test lead to K current test terminal.
- Connect red **Current/Trigger/Polarity** test lead to L current test terminal.
- Connect black **Current/Trigger/Polarity** test lead to K’ test terminal.
- Connect red **Current/Trigger/Polarity** test lead to L’ test terminal.
**MAINTENANCE**

**STEP 3. Carry out the test.**
- Connect black **Current/Trigger/Polarity** test lead to K terminal of the transformer to be tested (primary side). If the transformer is hole-through arranged then lead the test lead through the hole in direction from K to L.
- Connect red **Current/Trigger/Polarity** test lead to L terminal of the transformer to be tested (primary side). If the transformer is hole-through arranged then connect the test lead to black one, see figure 12.
- Connect black **Current/Trigger/Polarity** test lead to a secondary terminal.
- Connect red **Current/Trigger/Polarity** test lead to the other secondary terminal.
- Press the **START/STOP** key. Current test pulse is triggered into primary side and voltage response is detected at the secondary side. Then polarity information (**Cor** - Correct) or (**Re** - Reversed) is displayed.

![Diagram of the Overcurrent Protection - Tester to Current Transformer for Polarity test](image)

**Fig. 11.** Connection of the Overcurrent Protection - Tester to Current Transformer for Polarity test

The pedal (see the figure above) can be used to start / stop the test instead of START/STOP key on front panel. It is a welcome accessory when both hands are occupied with holding test leads.
Fig. 12. Possible connection of Current and Polarity test leads (hole-through arrangement on the left and bar arrangement on the right side)

Note!
- Test current value has no meaning in this test so there is no need to adjust it before the test is carried out.
MAINTENANCE

7. MAINTENANCE

7.1. Fuse

There is a fuse holder placed at the front panel which carry a fuse M4A / 250V (20 × 5 mm), see pos. 2 at figure 1. It is a general fuse at mains input of the instrument. The fuse may be blown if there is a blank display present after connecting the instrument to mains voltage via a mains cord and switching the instrument ON by the main switch. See pos. 3 at figure 1.

Warning!
Replace blown fuse with new one rated as declared above, otherwise the instrument may be damaged and/or operator’s safety impaired!

7.2. Cleaning

Use soft patch, slightly moistened with soap water or alcohol, to clean the surface of the instrument and leave the instrument to dry totally, before using it.

Notes!
Do not use liquids based on petrol or hydrocarbons!
Do not spill cleaning liquid over the instrument!

7.3. Periodic calibration

It is essential, that all test instruments are regularly calibrated. For occasional daily use, we recommend a calibration to be carried out once per two years. When the instrument is used continuously every day, we recommend the calibration to be carried out once per year.

7.4. Service

Repairs under or out of warranty time: Please contact the producer or your distributor for further information.

Distributor’s address:

Unauthorised person is not allowed to open the instrument. There are no user replaceable components inside the instrument.
8. TECHNICAL SPECIFICATION

Function “Overcurrent Protection Devices”
Test current generator (galvanic separated):
Test current range ................................................................. 2 A up to 160 A eff
Test current settability ......................................................... 0,1A (2 up to 16 A), 1A (16 up to 160 A)
Test current maintenance .................................................... Automatic
Test current stabilization time ............................................. 100 ms max.
Test current accuracy* .................................................... \(\pm (5\% \text{ of set value} + 0.5\text{A})\)
Test current shape ......................................................... AC, not sin wave (triac controlled)
Max. output voltage ........................................................... 9V / 50 Hz
Max. external voltage connected to current test terminals ....... 0V (no internal fuse)
Trip out time measurement range:
Electro-magnetic protection .............................................. 0 up to 5s (res. 0.01s)
Temperature protection .................................................. 0 up to 100min (resolution 1s)
Accuracy ............................................................... \(\pm 0.03\text{s (5s range)}, \pm 1\text{s (100 min range)}\)
Trigger/polarity input:
Max. external voltage connected to test terminals ................. 400V eff

* The accuracy is valid if:
  - Two test leads 2.5 mm² are used for test currents up to 30 A.
  - Test current value is set to a half of nominal current of tested object \(I_N/2\) or higher. If tested device has adjustable test current then \(I_N\) is meant as the lowest settable value.

Function “Current Transformer Polarity”
Test current generator ......................................................... See the data above
Trigger / polarity input ...................................................... See the data above
Test result:
Cor (Correct) ................................................................. Polarity in accordance with indications
rE (Reversed) ............................................................... Polarity not in accordance with indications

General
Power supply ............................................................... 230V / 50Hz, 3,5A max
Display .............................................................................. 3 ½ dig., red LED, character height 20mm
Housing ............................................................................. portable, double wall plastic, black
Dimensions ................................................................. 345 x 170 x 260 mm
Weight ............................................................................. approx. 6 kg
Protection class ............................................................. I (protective conductor)
Over-voltage category ................................................. CAT II / 300 V
Pollution degree .............................................................. 2
Degree of protection ........................................................ IP40
Working temperature range ........................................... 0 up to 40 °C
Nominal temperature range (test current accuracy) ............... 10 up to 30°C
Max. humidity ................................................................. 85 % RH (0 up to 40 °C)
Nominal humidity range .................................................. 40 up to 60 % RH
Standards ............................................................................. EN 61010-1 (safety), EN 61326-1 (EMC)