

Megger[®]

**LTW300 Series
Earth Loop testers**

User Guide

Safety warnings:

- **Safety Warnings** and **Precautions** must be read and understood before the instrument is used. They **must** be observed during use.
- The earth loop impedance test creates a temporary low resistance path between live and earth for the duration of the test. This is particularly hazardous with both an instrument fault and an installation fault.

Working practice and hazard avoidance **must** take care of this risk.

- Continuity of protective conductors and earthed equipotential bonding of new or modified installations **must** be verified **before** carrying out an earth fault loop impedance test.
- Circuit connections and exposed metalwork of an installation or equipment under test **must** not be touched.
- **Do not** leave the instrument connected to the mains supply when not in use.
- **Do not** leave the instrument connected to the mains supply when performing data download to a PC.
- Ensure that hands remain behind guards of probes/clips when testing.
- The instrument should **not** be used if any part of it is damaged.
- The battery cover **must** be in place whilst conducting tests.
- Test leads, probes and crocodile clips **must** be in good order, clean and with no broken or cracked insulation.
- On test leads fitted with a outlet plug and flying leads, never connect test probes, clips, pins or other objects to the 3 lead plugs because of the danger of electrocution. These leads should only be used by a suitably trained, and competent person.
- Some national safety authorities recommend the use of fused leads for voltage measurement on high energy systems. If loop tests are made it may cause the fuse to rupture, and so they must be used with caution on voltage testing.

NOTE **THE INSTRUMENTS MUST ONLY BE USED BY SUITABLY TRAINED AND COMPETENT PERSONS.**

Users of this equipment and/or their employers are reminded that Health and Safety Legislation requires them to carry out valid risk assessments of all electrical work so as to identify potential sources of electrical danger and risk of electrical injury such as inadvertent short circuits.

Symbols used on the instrument:

-  Caution: refer to accompanying notes
-  Equipment protected throughout by Double Insulation (Class II)
-  Equipment complies with relevant EU Directives
-  **N13117**
-  Equipment complies with Australian and New Zealand C Tick requirements

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1. Introduction

Thank you for purchasing the Megger Earth Loop impedance tester.

For your own safety and to get the maximum benefit from your instrument, please ensure that you read and understand the following safety warnings and instructions before attempting to use the instruments.

This user guide describes the operation and functions of the following LTW300 series of loop impedance testers:

- LTW315
- LTW325
- LTW335
- LTW425

These instruments are designed and manufactured by:

Megger Limited
Archcliffe Road
Dover Kent
CT17 9EN
England

Megger reserves the right to change the specification of these instruments at any time without prior notice.

2. General description

The LTW300 series loop testers are designed for the measurement of loop resistance (Impedance) of fixed electrical installations on single and 3 phase systems.

2.1 Unpacking the carton

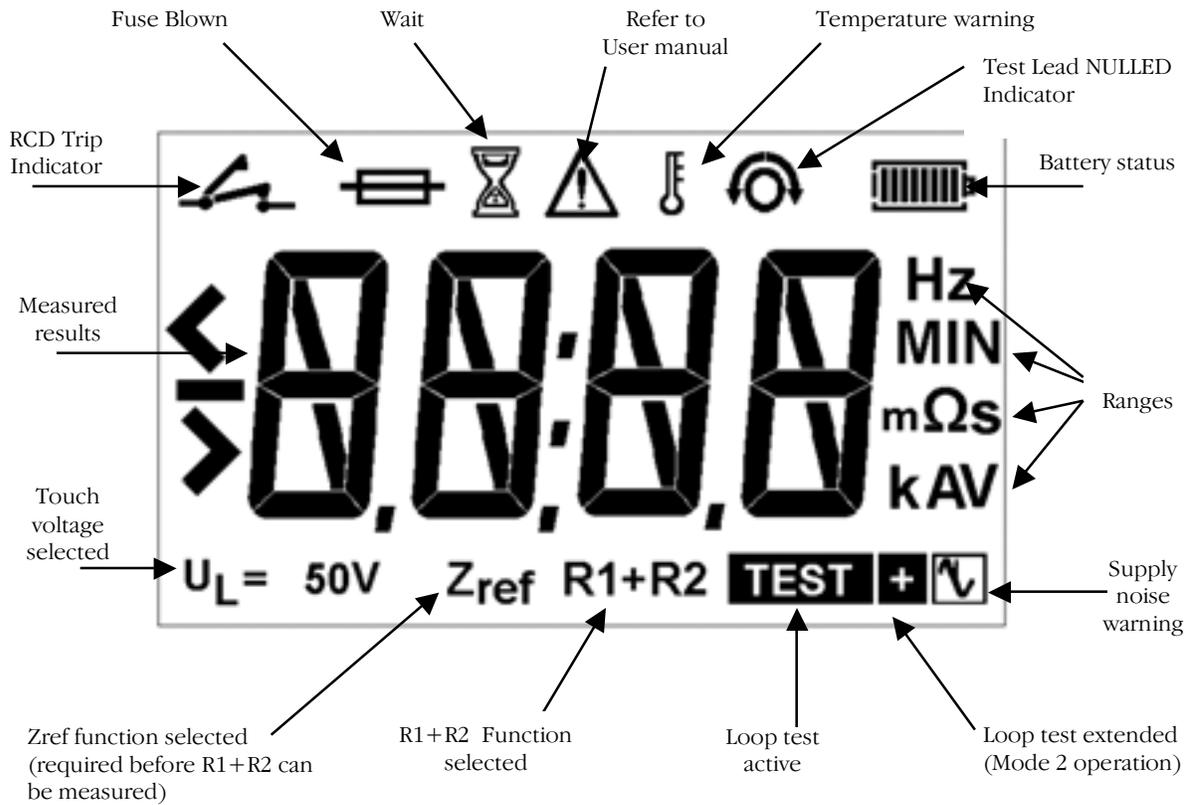
Unpack the carton contents carefully. There are important documents that you should keep for future reference.

Please complete the pre-paid warranty card and return it to Megger as soon as possible to help us reduce any delays in supporting you should the need arise.

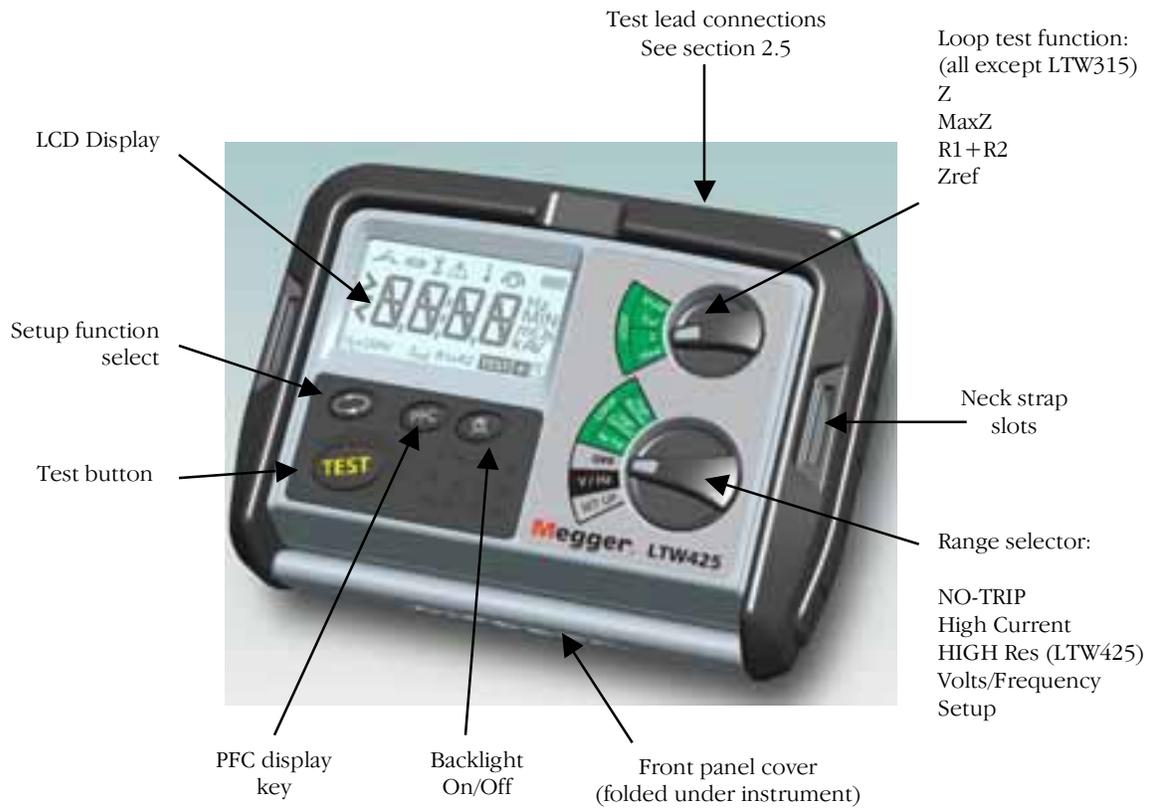
Carton contents for the LTW315, LTW325, LTW335 and LTW425

- 1 x LTW series loop tester
- 1 x 2 wire test lead with prods with clips (Red/Green)
- 1 x Mains lead set (UK, Schuko or Australian, depending on instrument supplied)
- 8 x AA (LR6) batteries (fitted in instrument)
- 1 x Warranty card
- 1 x Certificate of test
- 1 x Calibration certificate
- 1 x Owners CD manual
- 1 x Hard carry case
- 1 x USB cable (LTW335 only)
- 1 x PC software CD (LTW335 only)
- 1 x Warning sheet (5172-238)

2.2 LCD display

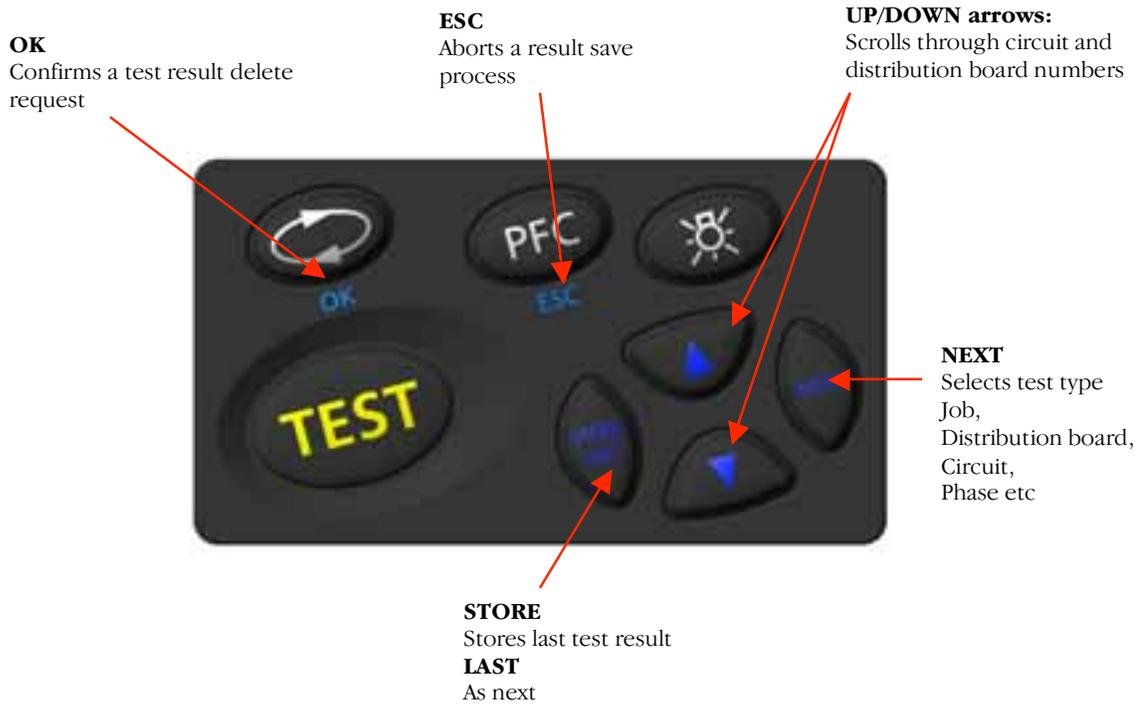


2.3 Top panels

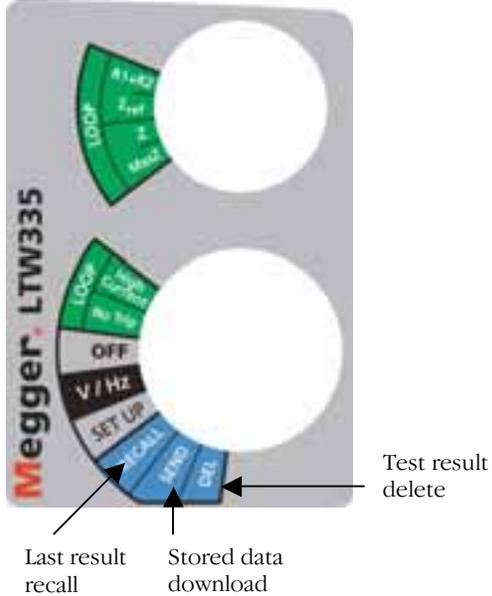


2.4 Additional controls on the LTW335 (storage and downloading instrument):

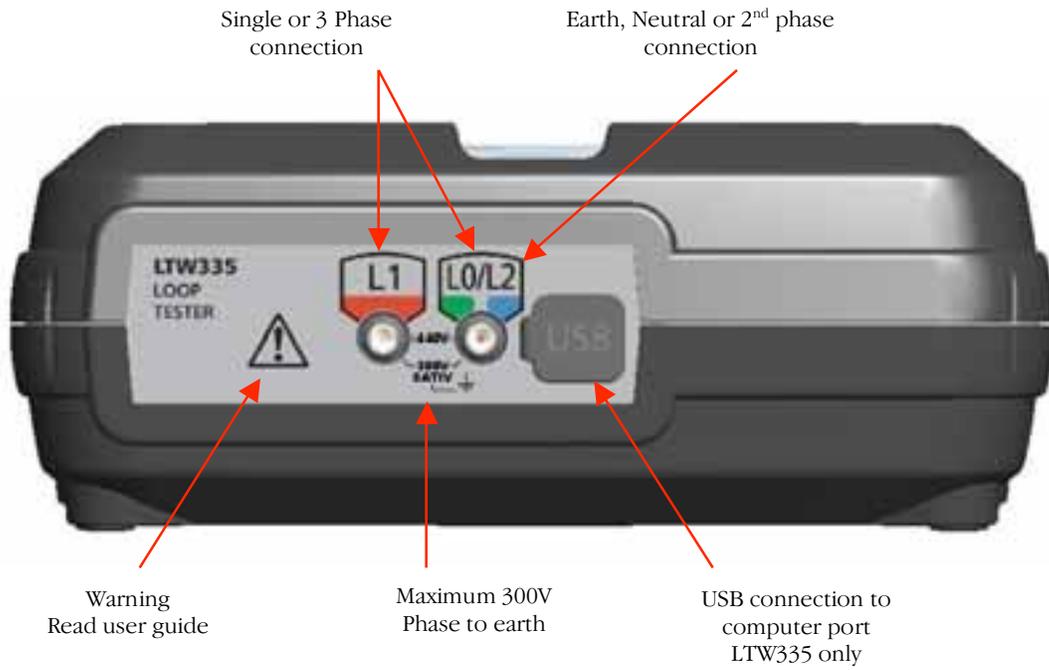
2.4.1 Keypad controls



2.4.2 Range knob controls

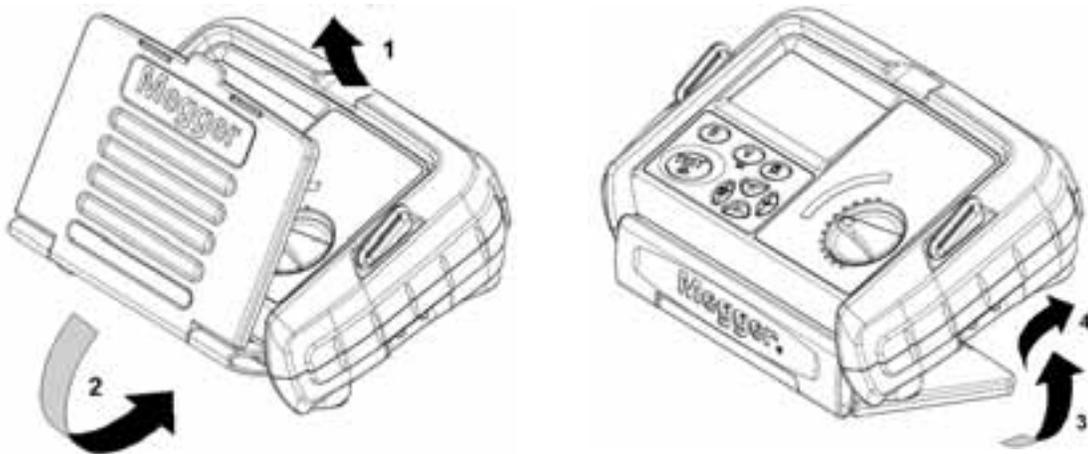


2.5 Connection panel



2.6 Lid open/closure

1. Open lid by lifting up front panel tab (1).
2. Foldaway underneath instrument (2 & 3) and push into retaining slot (4).



3. Preparations for use

The instrument is supplied with batteries already fitted. However when fitting replacement batteries, refer to section 10.2:

WARNING: -

Never use the instrument with the battery cover removed.

Incorrect battery cell polarity can cause electrolyte leakage, resulting in damage to the instrument.

Always fit a complete new set of batteries, never mix old and new cells.

Check that the Battery level indicator displays a full charge before using the instrument. A low battery charge may indicate a reversed cell.

Note: Battery cells should not be left in an instrument, which may remain unused, for an extended period of time.

3.1 Preliminary test lead check

Before each use of the instrument, visually inspect the test leads, prods and crocodile clips to confirm that their condition is good, with no damaged or broken insulation.

3.2 Ingress of moisture

If it is suspected that moisture has entered the instrument, such as extended periods of cold and wet conditions, the instrument should be dried out prior to use. This can be accelerated by removing the battery cover to assist drying.

4. General operating instructions

4.1 Backlight operation

Pressing the BACKLIGHT [] button will toggle the backlight on and off.

The backlight will automatically switch on at the start and end of a test. It will switch off 5 seconds after the end of the test.

Backlight brightness can be adjusted whilst in SETUP mode, see SETUP section 8.

4.2 Test leads

All test leads form part of the measuring circuit of the instrument and must not be modified or changed in any way, or be used with any other electrical instrument or appliance.

The mains plug test lead supplied with the Megger Tester is a test lead that forms part of the measuring circuit of the instrument. The overall length of this lead should not be altered. However if the power cord plug is not suitable for your type of socket outlets, do not use an adapter. You may change the plug once only, by cutting the cord as close to the plug as possible and fitting a suitable plug.

The colour code of the cord is:

Earth (Ground)	Yellow/Green
Neutral	Blue
Phase (Line)	Brown

Non-standard test leads

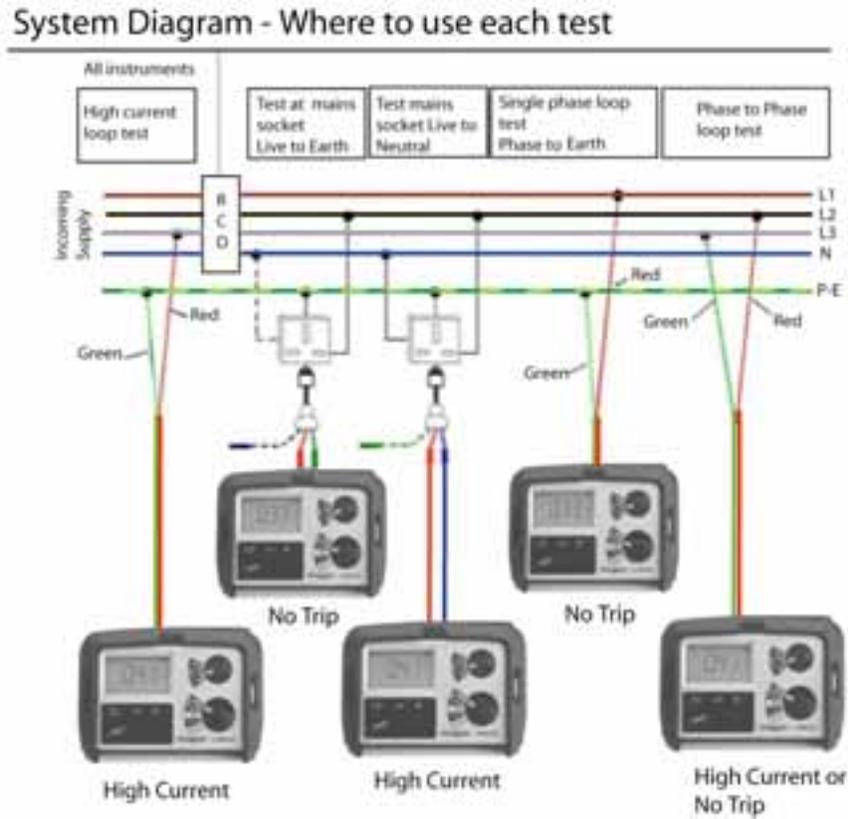
Where fused or longer length leads may be used, the lead resistance will be higher than the value to which the instrument is calibrated. To add additional offset in the loop measurement, refer to section 8, instrument setup procedure.

WARNING: A plug severed from the power cord must be destroyed, as a plug with bare conductors is hazardous in a live socket outlet.

4.3 Test lead connection

The supplied test leads should be connected to the appropriate sockets on the rear of the instrument marked L0/L2 and L1.

Standard test probes and crocodile clips and mains socket test lead are supplied for connection to the circuit under test.



5. Loop testing

Different loop testing options are available depending on the instrument used as below:

Instrument	NO-TRIP	High Current	MaxZ R1+R2	HIGH Resolution	Result storage and download.	50 V - 440V	100 V - 280 V
LTW315	■	■					■
LTW325	■	■	■			■	■
LTW335	■	■	■		■	■	■
LTW425	■	■	■	■		■	■

5.1 Description of test methods

5.1.1 No trip test - (All instruments)

Designed not to trip circuits protected by an RCD $\geq 30\text{mA}$.

Description:

A resistive load (15 K Ω) switched and rectified at Mains Frequency ± 6 , in order to produce a test current at the same frequency. The voltage produced by this test current is then used to calculate the loop resistance. If the loop contains inductance, the inductive reactance will be largely ignored.

When testing in close proximity to the sourcing transformer, a system phase angle of 18° will cause an additional error of 5%.

5.1.1.1 No-trip test modes

Two test modes are available in the [No Trip] loop test mode, providing:

Mode 1 = 10s

Mode 1 performs a 10 second loop test only. At the end of the test a result is displayed. If the noise symbol  is displayed at the end of a test the test should be repeated, or the test mode changed to mode 2, refer to section 8 SETUP procedure.

Mode 2 = AUTO (Default setting)

In Mode 2 the LTW loop tester can detect noise on an electrical supply that could affect the measurement accuracy, and automatically extend the loop test from 10 seconds up to 20 seconds as necessary. The  symbol is displayed to indicate an extended test is running.

If the noise symbol  is displayed at the end of the extended test it is recommended the test be repeated.

The instrument is shipped with mode 2 selected.

To change the test modes, refer to the SETUP procedure, section 8.

5.1.1.2 Symbols used during a normal loop test:

The  symbol is displayed for the duration of an active loop test.

If electrical noise is detected during the loop test that could affect the accuracy of the answer, the following additional symbols may appear:

 If a low level of electrical noise is detected in mode 2, the  will be displayed to the right of the  symbol. The test time will be extended up to a further 10 seconds to improve the accuracy of the test results. This only applies if the tester, is running in mode 2, see section 5.2.1.



If a high level of electrical noise is detected the symbol  will be displayed. This indicates that excessive noise was detected during the test. If this remains displayed at the end of the test it is recommended the test is repeated.

5.1.1.3 High current test - (All instruments)

Performs a very fast loop test at a nominal 4A test current.

Description:

A resistive load (59 Ω) is used to measure voltage drop and calculate the loop resistance. If the loop contains inductance, the inductive reactance will be largely ignored. The loading current duration varies from 10 milliseconds to 640 milliseconds depending on the test condition.

When testing in close proximity to the sourcing transformer, a system phase angle of 18° will cause an additional error of 5%.

5.1.1.4 High resolution test - (LTW425 only)

Performs a sequence of many high current loop tests to calculate a loop test result to three decimal places.

Description:

Alternate voltage measurements on loaded and unloaded half cycles using a load resistor of approximately 59 Ω , as with the High Current test. The number of test cycles will be adjusted to obtain the optimum performance.

When testing in close proximity to the sourcing transformer, a system phase angle of 18° will cause an additional error of 5%.

**ALL TESTS WILL OPERATE PHASE TO EARTH, PHASE TO NEUTRAL AND PHASE TO PHASE.
NOTE: THE LTW315 IS NOT RATED FOR PHASE TO PHASE MEASUREMENTS ON 240 VOLTS TO EARTH SYSTEMS**

5.2 Performing a loop test

Note: Factory settings for the instrument are:

AUTO START	enabled
Mode 2 (extended testing)	enabled

5.2.1 Non-tripping loop test [No Trip]

The [No Trip] range is a 0,01 Ω resolution, low test current earth loop resistance measurement.

5.2.2 No-trip testing using the mains socket test lead:

The instrument is supplied with AUTO START enabled, and in Test Mode 2, which will automatically extend a test if noise is detected.

5.2.2.1 Phase to earth loop test

1. Select the [No Trip] test range on the lower range knob, and [Z] on the upper range knob where present.
2. Connect the RED plug of the mains socket test lead to the instrument.
3. Connect the GREEN plug of the mains socket test lead to the instrument.
4. Insert the plug into the mains outlet socket.
5. Ensure the supply voltage is displayed.

The loop test will automatically start and the  symbol will appear, and remain on, for the duration of the test.

6. After a test period of 10 seconds the measured loop value is displayed and the  symbol will disappear. To repeat the loop test press the [TEST] key.

The symbols  and  may appear during the test. Refer to section 5.1.1.2 (Symbols) for an explanation of their meaning.

5.2.2.2 Phase to neutral loop test

Phase to Neutral testing can be made using the No-Trip test, as described above for the Phase to earth test. However a High Current test will not trip RCDs when making a P-N test and it is recommended that a High Current test is used for this measurement.

5.2.3 No-trip loop testing using the RED/GREEN test leads

The [No-Trip] loop test can be carried out where a power socket is not available using the 2 wire lead set.

5.2.3.1 Phase to earth loop test

1. Select the [No Trip] test range on the lower range knob, and [Z] on the upper range knob where present.
2. Connect the RED and GREEN test leads to the instrument.
3. Connect the RED test lead to the **Phase** conductor and connect the GREEN test lead to the **Earth** conductor.
4. The loop test will automatically start and the [TEST] symbol will appear, and remain on, for the duration of the test.
5. After a test period of 10 seconds the measured loop value is displayed.
6. To repeat the loop test, press the [TEST] key.

The symbols [] and [] may appear during the test. Refer to section 5.1.1.2 (Symbols) for an explanation of their meaning.

5.2.3.2 Phase to Neutral and Phase to Phase loop testing

Both Phase to Neutral and Phase to Phase testing can be made using the No-Trip test, as described above for the Phase to earth test. However a High current test will not trip RCDs when making either a P-N or P-P test, and it is recommended that a High current test is used for both these measurements.

5.2.4 Earth bonded metalwork testing

Repeat the test 5.2.3.1 (Phase to Earth) test above, but with the GREEN lead connected to the exposed metalwork providing the earth return path.

5.3 High current loop test [High Current]

The [High Current] loop test performs a 2-wire high current test at around 4 A on a 230 V supply, providing a very stable and fast loop test.

WARNING: This test is designed for non-RCD protected circuits.

Due to the high currents used the instrument adds a brief pause between tests to prevent

overheating. This is indicated by the [] symbol and appears for a nominal 5 seconds between tests for voltages <260 V and 10 seconds for voltages above 260 V.

5.3.1 High current Phase to Earth loop test

1. Select the [High Current] test range on the lower range knob, and [Z] on the upper range knob where present.
7. Connect the RED and GREEN test leads to the instrument.
8. Connect the RED test lead to the **Phase** conductor.
9. Connect the GREEN test lead to **Earth** conductor.
This test can also be performed using the mains socket test lead, using the RED and GREEN connectors).
10. The loop test will automatically start and the [TEST] symbol will appear, and remain on, for the duration of the test.
11. The measured loop value is displayed.

Note: The AUTO START function will not operate if the instrument is connected to a live supply BEFORE the range knob is moved to [High Current]. This is to prevent tripping of RCDs by accidentally selecting the [High Current] test instead of [No Trip] test, with the leads connected to the supply. In which case pressing the [TEST] button will start a test.

Subsequent connection of test leads will run the AUTO START test.

AUTO START can be disabled in the SETUP procedure as described in section 8.

5.3.2 High current Phase to Neutral loop test

Repeat test 5.3.1 with the Green lead connected to the Neutral conductor.

This test can also be performed using the mains socket test lead, using the RED and BLUE connectors.

5.3.3 High current Phase to Phase loop test

Repeat test 5.3.1 with the Green lead connected to another phase conductor.

