Megger

LCB2000/2 & LCB2500/2
RCD & Loop Testers

User Guide

Dear Customer,

Thank you for purchasing one of the new premium range of Combinations products from Megger Limited. The Combinations concept was created after listening to the views of many users, and combine quality and versatile features with the reliability and dependability you expect from Megger products. Every instrument is designed and manufactured to exacting standards and as such is guaranteed for a full three years.

The Megger LCB2000/2 and LCB2500/2 are part of an advanced range of combined loop and circuit breaker testers designed to fully test RCDs and measure loop impedance and prospective short circuit current, (PSCC), on single and three phase systems rated up to 300V ac r.m.s. to earth. Designed to comply with all relevant wiring regulations, the units feature both standard and low current loop test ranges guaranteed not to trip RCDs rated at 30mA and above. A comprehensive range of RCD test facilities is provided to cater for the most demanding situations whilst ingenius facilities such as ramp and auto-sequence tests provide diagnostics for troubleshooting nuisance tripping and reduce the time taken for a series of tests considerably.

Results are clearly indicated on a large backlit liquid crystal display. The LCB2500/2 also allows results to be stored against specific circuit and distribution board references. This instrument is directly compatible with PowerSuite™ for Windows™, PowerSuite XPress and NICEone™ software and stored data may be quickly downloaded for creation of professional installation test certificates. Alternatively direct connection to a serial printer is possible.

Contents

Symbols used on the instrument are:

Caution: Refer to accompanying notes

Maximum nominal system voltage of 440V

Maximum 300V a.c. CATIII to Earth

SAFETY WARNINGS

- ★ **Safety Warnings** and **Precautions** must be read and understood before the instrument is used. They **must** be observed during use.
- ★ 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, or RCD test.
- ★ Do not leave the instrument connected to the mains supply and switched to a loop impedance range when a loop impedance test is not being performed.
- ★ Circuit connections and exposed metalwork of an installation or equipment under test must not be touched.
- ★ **Do not move** the rotary selector switch position while a test is in progress.
- ★ The LCD 'neon' voltage indicators **cannot** reveal a Neutral-Earth reversal.
- ★ The instrument should **not** be used if any part of it is damaged.
- ★ Test leads, probes and crocodile clips must be in good order, clean and with no broken or cracked insulation.

NOTE

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

Function Keys and Warning Symbols

KEYS:

Primary function	Secondary function
ENTER	SAVE
BACKLIGHT	
RCD TEST TYPE	DOWN
RCD TYPE	UP
TEST	EXIT

Note: *On LCB2000/2 storage and download functions are not available and are not marked on the keys*

Condition	Display	Cause	Action
System error	E01	Hardware or software fault*	Switch 'Off', then 'On' and attempt re-test.
Low battery		Battery voltage too low.	Replace battery.
Touch pad >100V		Earth voltage too high.	Check installation or wiring to the instrument.
Supply voltage and frequency out of range	> or < and limit value	Supply voltage or frequency too high or low for test.	—
Thermal trip operated		Too rapid testing with no pauses for heat dissipation.	Pause between tests to allow cooling.
Supply interrupted during test	no	RCD tripped or supply failure.	Confirm RCD rating and check for excess earth leakage current.
Noise		Excessive external supply noise during earth loop or RCD test.	Identify and rectify, or wait and re-test.
Fuse ruptured	FUS	Blown fuse.	Return instrument for repair.
Memory full	FULL	Results memory full.	Download results and clear memory.
Memory corrupted	Cor	Results memory unintelligible.	Press TEST to attempt recovery.

**See page 27 for list of error codes*

Initial Setup

Instrument Setting
The instrument setting modifies the way the instrument behaves, shown in the following table.

Setting A (Europe)	Setting b (UK)
Line and Neutral Swap allowed.	Line and neutral swap not allowed.
Auto Sequence RCD does 5**I** test.	Auto Sequence RCD does 150mA test.
After RCD trip test, contact voltage displayed first.	After RCD trip test, trip time or current displayed first.
2s ½**I** no trip RCD test not performed.	2s ½**I** no trip RCD test performed.

To change the setting:
1. Press and hold the Backlight key, then turn the rotary selector switch from the OFF position to the RCD 150mA 40ms position. The current setting will be displayed.
2. To change the setting, toggle the I key until the required setting is displayed.
3. To save the new setting, press the ENTER key. The bleeper sounds and **Std** is displayed. To leave the setting as it was, press the EXIT key.

Reset Factory Default Settings
The instrument will remember certain values such as the VAR range RCD test current, even if the instrument is switched off and the battery removed.These can be reset to factory default settings as follows:

1. Press and hold the Backlight key, then turn the rotary selector switch from the OFF position to the RCD 150mA 40ms position. The current setting will be displayed. Release the backlight key.
2. Press the UP and DOWN keys together. The code **Clr** is displayed.
3. Confirm the operation by pressing the ENTER key, or abort by pressing any other key. The current setting will be displayed.

General Description

This instrument has been designed to fully test RCDs and measure loop impedance and PSCC on single and three phase systems with a rated voltage up to 300V a.c. r.m.s. to earth. It has been designed to comply with U.K., European and other international wiring regulations and standards.
Measured values are displayed on a large backlit digital LCD. With the LCB2500/2 these values may also be stored in internal memory for later recall to display, direct printing to a standard serial printer, or downloaded to a PC for storage, analysis and report generation.

Key Features
Storage of test results in memory (LCB2500/2 only)
Selectable backlight
Large clear liquid crystal display
Operates regardless of mains polarity
Automatic test start on voltage detection

Loop Tests
Direct indication of short circuit current
Phase-phase (up to 480V), phase-neutral and phase-earth tests
No trip loop impedance tests with a resolution down to 0,01Ω
No neutral needed for line to earth testing (except for No Trip Loop L-PE xtra)
Storage of Distribution Circuit or distribution board incoming loop impedances (LCB2500/2 only)
Final Circuit R1+R2 display (LCB2500/2 only)

RCD tests
Tests selective (delayed), general and d.c. sensitive RCDs
Contact voltage and loop resistance displayed
Selectable test current for programmable devices
Auto sequence test
Ramp test

General
Supply voltage and frequency measurement
Three Phase sequence indication
Mains outlet polarity indication

Application
The instrument may be connected live to earth or between live conductors of systems that have a rated voltage of 300V a.c. rms to earth and an Installation (Overvoltage) Category III or lower. This means that the instrument may be connected to any fixed wiring of a building installation, but not to primary supply circuits such as overhead cables. To maintain user safety and ensure accurate measurements, only use the test leads supplied or recommended for use with this instrument.

The instrument is fuse protected to 440V 10kA. The maximum current which could flow through this fuse in the case of a fault is limited to 10 kA by the impedance of the test leads.

When the low battery symbol appears, the cells are nearly exhausted and should be replaced as soon as possible. When the battery is exhausted, the instrument will not perform tests and the cells must be replaced. Use alkaline cells IEC LR6 (AA) or 1,5V nickel cadmium, (NiCd) or Nickel Metal Hydride, (NiMH), cells only.

To install or replace the cells, disconnect the test leads, switch the instrument off and loosen the captive screws holding the battery compartment cover in place. Remove the cover, lift out and disconnect the battery holder to access the cells. Replace the cells, ensuring that correct polarity is observed (shown on battery holder moulding).

Carefully re-connect the battery holder to the

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

connector, replace the battery holder in the compartment, and re-secure the cover. Remove the cells if the instrument is not going to be used for any extended period of time. Stored results are retained when the battery is disconnected.

Test Leads

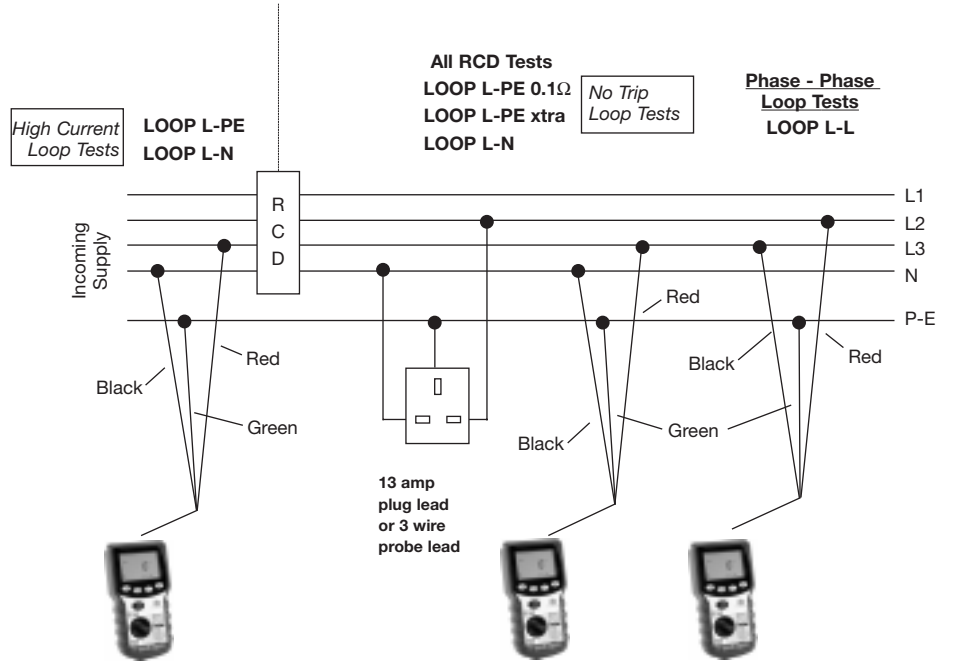
All test leads form part of the measuring circuit of the instrument and must not be modified or changed in any way, or be used with any other electrical instrument or appliance. The power cord supplied with the Installation Testers is a test lead that forms part of the measuring circuit of the instrument. The overall length of this lead must not be altered. 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**

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

System Diagram - Where To Use Each Test



Operation - General

Backlight
The display backlight gives a clear display of measurements in poor lighting conditions. The backlight will briefly operate when the instrument is switched on. To switch the backlight on, press the backlight key (see key on page 5). Press the key again to switch the backlight off.

To conserve battery power, the backlight will automatically switch off after about 15 seconds (if the battery voltage is low, this period is automatically reduced).

Auto Shut-off
To extend battery life, after a period of instrument inactivity the instrument will switch itself off, preceded by a series of bleeps. To switch the instrument back on, press any key other than the **TEST** key.

Switched Probe SP2
This accessory can be used anywhere that the 2-wire lead set is specified in this User Guide. The press switch on the probe duplicates the function of the **TEST** key on the instrument, allowing quick and easy testing.

Checking Earth Potential
To quickly distinguish live and earth, this feature provides display indication if a voltage greater than 100V exists between the earth connection and your finger.

1. In any switch position except **OFF** and **RCL** (LCB2500/2 only), connect the earth connection (black for the 2-wire lead set, green for the 3-wire lead set) to earth.
2. Touch a finger to the metal pad on the top. This is safe and will not endanger you.
3. If a voltage greater than 100V exists between the finger (normally at earth potential) and the earth wire, the warning symbol is displayed.

Voltage and Frequency Measurement
This instrument will display the supply voltage and frequency in all switch positions except **RCL** and **OFF**. The **ENTER** key will alternate between voltage and frequency.

Power plug connection

1. Insert the power cord plug into an installation socket.
2. Supply voltage and polarity are displayed.
3. Press **ENTER** to alternate between supply voltage and frequency.

3-Wire Lead Set Connection
If an installation socket is not available and it is necessary to connect to all three conductors, use the 3-wire lead set.

1. On a single phase system connect the red lead to phase, the black to neutral and the green to earth.
2. Supply voltage and polarity are displayed.
3. Press **ENTER** to alternate between supply voltage and frequency.

Note: *For connection to a three phase system, see 'Determining Phase Sequence'.*

Operation - General

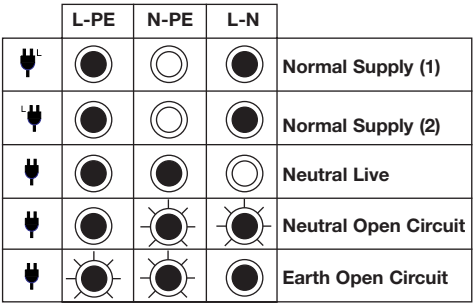
When connected the instrument will display the Line to Earth voltage except on the **loop L-N** switch position when the line to neutral voltage is displayed.

Polarity Indication
If connected to a single phase power supply by a plug or by the 3-wire lead set, three LCD 'neons' marked L-PE, N-PE and L-N respectively will indicate supply polarity. If a voltage is detected between their respective two wires, the 'neon(s)' will activate. A 'neon' will usually flash if one connection is open circuit.

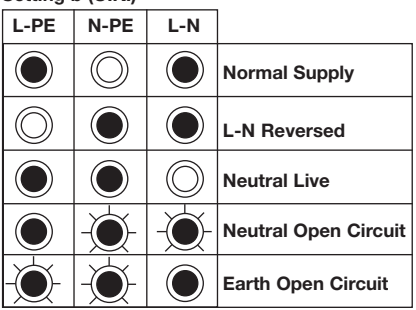
Note: *The presence of a voltage between phase and earth does not prove earth continuity, as the earth could have a high resistance and a voltage would still be measured. To test earth continuity refer to the sections on loop resistance or RCD testing.*

If **Setting A** (see page 4) is set, the instrument will automatically switch Line and Neutral as appropriate. This enables a test to be performed without inverting the plug connections. The live terminal of the wall socket is identified by the addition of a separate symbol adjacent to the 'neons'.

Setting A (Europe)



Setting b (U.K.)



Operation - General

Determining Phase Sequence
When connected to all conductors of a three phase system, the instrument automatically displays the sequence of phase rotation.

Connect the the Installation Testers as follows:-

Line 1	**Red phase**	**Red lead**
Line 2	**Yellow phase**	**Green lead**
Line 3	**Blue phase**	**Black lead**

If connected as above, the ↻ symbol is displayed when the sequence is 1:2:3, or Red-Yellow-Blue. The ↺ symbol is displayed when the sequence is 1:3:2, or Red-Blue-Yellow. If one of the lines is faulty, neither of the symbols is displayed and the normal 'neon' polarity indication is shown.

In the **Loop L-N** switch position the voltage between the red and black leads is displayed. In other switch positions the voltage between the red and green leads is measured and displayed.

Operation - Loop Testing

Loop Impedance measurement
Loop impedance measurement of 0,01Ω up to 3,00kΩ can be made via installation sockets using the plug terminated test lead, or at any other convenient point on the installation using the two wire lead set. If **Setting A** (see page 4) is selected when using the plug terminated lead set, the polarity of the mains socket is immaterial. Line and Neutral will be swapped if necessary, and an indication given on the display. **Setting b** requires Line and Neutral to be fixed.

Test results may be adversely affected by supply voltage fluctuations or electrical noise during measurement. It is recommended that tests are repeated and the results verified, if measurment results are considered abnormal.

The Installation Testers will measure the loop resistance from the supply end of the standard test leads, allowing for their resistance.

Operation - Loop Testing

Automatic Derivation of R1+R2 Values (LCB2500/2 only, L-PE and L-PE xtra ranges)
The LCB2500/2 is able to derive the R1+R2 circuit continuity reading from tests made on a live installation. There is no need to make the system dead in order to carry out actual continuity tests. The way in which this is done is to make one measurement of the line-earth loop resistance at a reference point, such as the incoming supply to a distribution board, and another measurement at a distant point. The instrument can then subtract out the reference value to give the final circuit R1+R2 value.

NOTE: *Care should be taken as any parallel earth paths may effect this result.*

To make use of this feature, the reference/distribution result must be stored in the instrument's memory, but first a Distribution Board (DB) number must be assigned. This serves as an identifier for the reference result. Thus, when data for several different Distribution Boards has been accumulated in the memory, the instrument is able to use the appropriate distribution result for the R1+R2 calculations.

To enter a Distribution Board number, see page 28 '*Changing Distribution Boards*'.

All test results saved to memory are now associated with this DB number. It is, in effect, the top level of the hierarchy for result storage. The Distribution Board number can be changed again at any time.

To save a result to the memory, see page 28, '*Saving a result*'.

Storing a distribution result is very similar. See page 29 '*Saving a Zd (distribution) result*'.

Once a Zd result has been stored, the warning triangle symbol, ⚠ , shows on the display as a reminder. The determination and display of R1+R2 is then automatic on any subsequent line-earth loop measurements made using the **L-PE** or **L-PE xtra** switch positions.

Immediately after a test, the line-earth loop resistance is displayed by default. Press the ENTER button to step through the PFC result(s) until the R1+R2 value appears. It is identified by the label '1-2' on the display. The warning triangle also flashes, to show that this is a derived value, and not an absolute (total) result.

If the test just performed is a L-PE xtra measurement, (see page 17), impedance values back to the origin of the supply are also available for the Live, Earth and Neutral conductors separately. To access these results, which are labelled '1', '2' and 'N', press the ENTER and BACKLIGHT buttons together. A long beep sounds. Press the ENTER button repeatedly to cycle through the readings.

Operation - Loop Testing

If the test just performed is a **L-PE xtra** measurement, *and* the reference result is also a **L-PE xtra** measurement, then there is enough information available to derive final circuit values for the individual conductor impedances of the loop to be displayed. This is often useful in diagnosing the cause of an abnormally high measurement. (see Page 18) The warning triangle symbol flashes to show that these are derived results.

When retrieving or printing stored results (see pages 31 and 32, all data which was available at the actual time of testing is reproduced, including R1+R2 values and loop resistance component values. During retrieval to display, the warning triangle symbol shows to identify the derived results. On the printout, exclamation marks are used.

Automatic Testing

To aid rapid testing, the instruments can be set to start a test automatically when connected to the supply. This may be of use for example, when using a clip and a probe. Select the range required and press the test key without the supply present. The instrument will display **<100V** for approximately 30 seconds. Apply the supply voltage within this time and the instrument will pause before performing one test automatically.

Phase to Neutral or Earth loop impedance measurement (at a power socket):

1. Select Loop L-PE or L-N as required.
2. Insert the plug into an installation socket.
3. Supply voltage and polarity are displayed.
4. Press the TEST key.
5. Measured loop value is displayed.

On completion of this test, prospective fault current can be displayed by pressing the ENTER key.

The R1+ R2 value for the circuit may be available (LCB2500/2 only). See page 18

If desired the test can be repeated by pressing TEST again.

Operation - Loop Testing

Phase-Earth loop impedance measurement (not at a power socket):

If an installation socket is not available, use the 3-wire lead set.

1. Select Loop L-PE.
2. Connect the red lead to phase and the green lead to earth. No connection to neutral is required.
3. Supply voltage is displayed.

Note: *When black lead is not connected to neutral, although displayed, the polarity indications are invalid.*

4. Press the TEST key.
5. Measured loop value is displayed.

On completion of this test, the prospective fault current can be displayed by pressing the ENTER key.

The R1+ R2 value for the circuit may be available (LCB2500/2 only). See page 18

If desired the test can be repeated by pressing TEST again.

Bonded Metalwork Testing (1)

This test is performed using the three wire lead set.

1. Connect the green lead to the bonded metalwork.
2. Connect the red lead to phase.
3. Select Loop L-PE.
4. Supply voltage is displayed.
5. Press the TEST key.
6. Measured resistance value is displayed.

Bonded Metalwork Testing (2)

This test can also be performed using the optional earth bond test lead, allowing connection to an installation socket.

1. Connect the black flying test lead to the bonded metalwork.
2. Insert the power plug test lead into a socket (receptacle).
3. Select Loop L-PE.
4. Supply voltage is displayed.
5. Press the TEST key.
6. Measured resistance value is displayed.

Operation - Loop Testing

Phase-Neutral or Phase-Phase loop resistance measurement
To measure the loop resistance of a circuit

Phase-Neutral, or between two phases of a multi-phase system, connect using the 3-wire lead set.

1. Connect the red lead to phase and the black lead to neutral or the other phase. There is no need to connect the green lead.
2. Select Loop L-N/L-L.
3. The supply voltage is displayed. The polarity indications are invalid and should be ignored.
4. Press the TEST button.
5. Measured loop resistance is displayed.

The prospective fault current may be displayed by pressing the Enter key.

Prospective Short Circuit Current measurement (PSCC)
The PSCC of a circuit is the largest Prospective Fault Current (PFC). In a single phase system, this would be the larger of the earth loop PFC and the neutral loop PFC. In a multi-phase system phase-phase loops also need to be considered and these can be measured using the Loop L-L switch position.

When the instrument measures the loop resistance, it also calculates the PFC. After any loop test, this may be displayed by pressing the ENTER key.

The PFC is calculated by using the sum:-

$$\frac{\textbf{Nominal supply voltage}}{\textbf{Loop resistance}}$$

The supply voltage used in the calculation depends on the measured voltage and the configuration of the instrument. As supplied, the instruments are configured as follows:-

Actual Measured Voltage	Assumed Nominal Voltage
150V	110V
>150V and <300V	230V
>300V	400V

Operation - Loop Testing

PFC measurement accuracy
An accurate PFC measurement requires an accurate measurement of the loop resistance. The difference of a few digits in the loop resistance measured will have large effect on the PFC displayed.

Errors can be reduced by:-

- Using the 3 wire lead set with prods and making a firm connection to clean conductors.
- Making several tests and taking the average.
- Ensuring that potential sources of noise in the installation are isolated (switched off), e.g.: automatically switched loads or motor controllers
- Ensuring that the instrument is calibrated at the appropriate intervals (12months recommended).

No trip loop-testing -
The LCB2000/2 ad LCB2500/2 have two loop impedance ranges guaranteed not to trip any RCD rated at 30mA or above - L-PE 0.1Ω and L-PE Xtra. These ranges are denoted by the symbol on the range label.

L-PE 0.1Ω
(Use only where no neutral connection is available)
The Loop L-PE 0.1Ω range is a low test current, (15mA), earth loop impedance measurement range. This range has the advantage of only requiring two connections to the circuit being tested and is useful where a neutral is not available. Because the entire test is conducted at low current, measurements can be adversely effected by noise on the supply. For this reason it is preferable to use the L-PE xtra range for all instances where a connection to the neutral conductor is possible. Tests may be made via installation sockets with the plug terminated test lead, or at any other point using either the 2 or 3-wire lead set. Connections are required to Live and Earth only.

L-PE xtra (Use this range whenever a connection to neutral is possible)
The Loop L-PE xtra range is a high resolution, (0,01Ω), low test current earth loop resistance measurement range. It requires a connection to neutral, but allows quick and accurate measurement of the earth loop resistance without tripping all RCDs with a rated current 30mA or higher. During the L-PE xtra test the instrument automatically gathers a considerable amount of information regarding the circuit being tested along with the loop impedance measurement. This information, shown below is presented for viewing at the end of the test.

Operation - Loop Testing

Loop L-PE Live - Earth Loop Impedance in Ohms

PFC L-PE Prospective Fault Current Live - Earth in Amps

Loop L-N Live – Neutral Loop Impedance in Ohms

PFC L-N Prospective Fault Current Live - Neutral in Amps

R1+R2 Live – Earth resistance of final circuit from a chosen point of reference (LCB 2500/2 only).

Note: *The R1+ R2 result is only available if a value of distribution circuit impedance, (Zd), has been stored for the given distribution board. In many systems this will be the measurement of Ze, the external earth fault loop impedance.*

Since an installation can only have one value of Ze and the point of reference may be at the end of a submain supplied from an earlier distribution board, the LCB2500/2 uses the term 'Zd'. Where Zd is the impedance of the 'distribution circuit' supplying the point of test.

The following additional diagnostic information may be recalled after a test to help establish the cause of any unacceptable loop impedance value: See diagram on page 19.

Resistance of Live conductor back to origin of supply

Resistance of Earth Conductor back to origin of supply

Resistance of Neutral conductor back to origin of supply

Note: *It is usual to measure Zd using a high current loop test if the incoming supply is not RCD protected. If however an L-PE xtra measurement has been used to store the value of Zd, then it is the* ***final circuit*** *impedances which will be displayed for the Live, Earth and Neutral conductors and not those of the conductors back to the origin of the supply..*

Note: *If a neutral connection is not possible, then the Loop L–PE 0.1Ω must be used.*

Warning: *Connecting the black lead to earth and performing the Loop L-PE xtra range will cause an RCD to trip.*

Procedure for using the No-trip ranges

Measurement (at a power socket)

1. Select Loop L-PE 0.1Ω or L-PE xtra as appropriate.
2. Insert the plug into an installation socket.
3. Supply voltage and polarity are displayed.
4. Press the TEST key. Test progress is dis played.
5. Measured loop value is displayed

If desired the test can be repeated by pressing TEST again.

Operation - Loop Testing

Measurement where connection is not at a Power Socket

1. Select Loop L-PE 0.1Ω or L-PE xtra as appropriate.
2. Firmly connect the red lead to phase and the green lead to earth. Connection to neutral with the black lead is only required for the Loop L-PE xtra range.
3. Supply voltage is displayed.
4. Press the TEST key. Test progress is displayed.
5. Measured loop value is displayed.

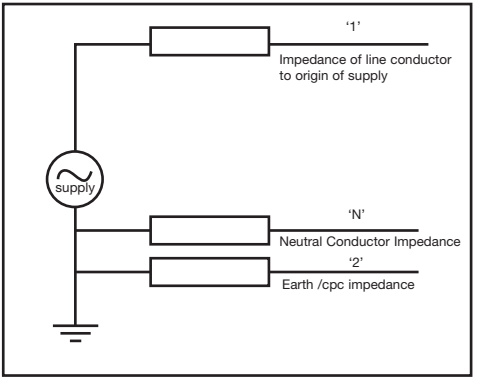
If desired the test can be repeated by pressing TEST again.

After a Loop L-PE xtra 0,01Ω test, the additional parameters above may be stepped through by repeatedly pressing the enter key.

The results of the L-PE xtra test will be shown in the following order:

Main Results	Auxillary Results
LOOP L-PE	1
PFC L-PE	2
LOOP L-N	N
PFC L-N	
R1 + R2 (LCB2500/2 ONLY)	

To access the individual Live, Earth and Neutral resistances 1, 2 and N for the circuit press the enter and the backlight keys together, (a long beep will sound). The results can be stepped through using the enter key. Press the enter and backlight key together again to return operation to the previous mode.



All results may be stored under a single circuit reference. See 'Test Result Storage'.

Operation - Loop Testing

Method of measurement
The phase-earth, phase-neutral or phase-phase loop resistance can be measured. The instrument takes a current from the supply and measures the difference between the unloaded and loaded supply voltages. From this difference it is possible to calculate the loop resistance. The test current will vary from 15mA to 40A, depending on supply voltage and the loop resistance value. The test duration will depend on the loop resistance value.

The Loop L-PE xtra range performs a test with acurrent up to 25A flowing Line to Neutral and the resistance of the source and line wires are measured. This is followed by a current of 15mA flowing Line to Earth and the resistance of the earth wires are measured.

Possible sources of error
The reading depends on a measurement of the supply voltage and therefore noise or transients caused by other equipment during the test could cause an error in the reading. One way to check for these is to do two tests and look for any difference in value. The instrument will detect some sources of noise and warn the user, where other instruments may give an incorrect reading. Any leakage current as a consequence of other appliances connected to the supply under test may affect the reading. If the Phase-Earth loop is being measured, this leakage may be due to filter capacitors, etc.

Operation - RCD Testing

RCD Testing
The instrument can test the operation of a variety of types of Residual Current Devices (RCD), measure the phase to earth loop resistance, and the contact voltage of the installation. If Setting A (see page 4) is selected when using the plug terminated lead set, the polarity of the mains socket is immaterial. Line and Neutral will be swapped if necessary, and an indication given on the display. Setting b requires Line and Neutral to be fixed.

Pre-Test Configuration
Before performing an RCD test it is necessary to ensure that the instrument is correctly configured for the rated current and the specific type of RCD to be tested, and for the type of test to be performed.

RCD Current Rating
From information given on the RCD to be tested, select the RCD current rating on the rotary switch.

RCD VAR switch position
This position enables any RCD with a non standard rated current between 10 mA and 1000 mA to be tested.The test is performed at the selected current, taking the 5I multiplier into consideration

1. Select (RCD) VAR.
2. Press the ENTER key twice to display the test current.

Operation - RCD Testing

3. Press the UP and DOWN keys until the required test current is displayed. Hold a key down to auto-repeat.
4. Press the ENTER key. The Supply Voltage, Test Type and RCD Type are shown. These may be set up as given in the following sections.

Setting precision:

10-50mA	**1mA steps**
50-500mA	**5mA steps**
500mA-1000mA	**10mA steps**

RCD Type
Pressing the key displays the RCD type symbols. From information given on the RCD to be tested, select and set the type of RCD, as shown in the table.

Symbol	Test
	General
	**Selective (delayed)**
	**D.C. sensitive**

D.C. Sensitive RCDs
Some RCDs are electromechanical devices which can be saturated by the presence of d.c. Therefore if a d.c. fault occurs, or an a.c. fault occurs in the presence of quite a small direct current, the RCD may not trip. In this way the RCD is disabled and this becomes a potential hazard. Because of this, 'd.c. sensitive' RCDs are available.

Selective or Time delayed RCDs
In some cases it may be necessary to have an RCD protecting an individual circuit or group of circuits. If a fault occurs, the RCD nearest to the fault should trip to clear it, maintaining supplies to the other circuits. Selective RCDs (normal symbol) are used to discriminate faults occurring on circuits, and these have a minimum as well as a maximum trip time.

Operation - RCD Testing

Type of Test

Display	Type of Test	Description
½I	No Trip	Performs a no-trip test at half the rated current of the selected RCD. The test measures the earth loop resistance and contact voltage.
0°	Trip Test	Trip test at the rated current of the selected RCD. A ½I test is carried out before this, and the resistance and voltage are available after the test. The test is always started on a zero crossing when the instantaneous voltage is on the rise.
180°	Trip Test	As above, but the test is always started on a zero crossing when the voltage is on the fall.
	Ramp Test	Test current increases from half the rated current of the RCD. The result is the current at which the trip opens.
5I	Trip Test	Trip test at 5 x the rated current of the selected RCD. The choice of 0° or 180° gives greater accuracy of measurement. A ½I test is carried out before this, and the resistance and voltage are available after the test.

Pressing the I key displays the Type of Test symbols individually in sequence. Select the type of the test to be performed.

No Trip RCD Tests
When an 1⁄2I (or No Trip) test is performed, the loop or earth resistance is measured, and in Setting b, a two second No Trip test follows.

Loop resistance approximation - (During RCD Test)
During the RCD test and approximation of the circuit loop impedance is possible. In this case the loop resistance is measured at half the rated RCD current selected. Contact voltage is also displayed which is the loop resistance multiplied by the rated RCD current. A high loop resistance will cause the instrument to display >90V, and safely abort the test.

2 second No Trip test (Setting B only)
This tests that the RCD does not trip when half the rated operating current of the RCD is drawn for 2 seconds. Tripping of the RCD will indicate that it is over sensitive, or that excessive earth leakage current is being drawn in the system. The load put onto the circuit is resistive and therefore the test current is sinusoidal if the supply is sinusoidal.

No Trip testing
The test is the same for all RCD types. Select the Rated Current, the RCD Type and 1⁄2I. Connect to the installation and press the TEST key. If the settings are correct, and the RCD is in order, the RCD trip should not operate and the contact voltage will be displayed. If the RCD trip does operate during the test, the message no is displayed. This could be due to incorrect current rating selection, excessive leakage current in the circuit,

Operation - RCD Testing

or a faulty RCD. If the problem is excessive leakage current, the source of the problem must be located and rectified before a trip test is performed, otherwise the result of the trip test will be invalid. Loop resistance can be shown by pressing the ENTER key.

Trip Tests

The instrument will measure the trip time or trip current of common, selective (time delayed) and d.c. sensitive RCDs. The trip time is measured by timing the period from the application of a resistive load to when the supply fails.

Some RCDs are sensitive to the polarity of the supply, i.e. whether the test current is applied with the instantaneous rising or falling. Tests should therefore be performed with the polarity 0° and 180° and the maximum time taken.

D.C. sensitive RCDs are tested with a pulsed waveform. The rms current is $\sqrt{2}$ x the rated operating current of the RCD. As with the normal RCDs, these should be tested with 0° and 180° polarity.

As the No Trip test can affect the trip time of some selective RCDs, there is a 30 second delay before activation of the trip test. It is possible to override this delay by pressing the TEST button when the instrument is counting (1...2...3...).

Note: *Significant operating errors can occur if loads, particularly rotating machinery and capacitive loads are left connected during tests.*

RCD Rating	D.C. sensitive RMS currents
10mA	14,1mA
30mA	42,4mA
100mA	141mA
300mA	424mA†
500mA	Not available
1000mA	Not available

† For supply voltages above 200V only.

Trip Testing (measuring the trip time)

1. Select the RCD rated current on the rotary switch.
2. Connect to the supply as detailed below.
3. Select the required test using the TEST TYPE key – 0° or 180° for the normal trip tests, or 5I together with 0° or 180° for a 5I test.
4. Select the RCD type using the TYPE key.
5. Press the TEST button.

If the RCD trips, the first display depends upon the Setting selected.

Operation - RCD Testing

Setting A: The contact or fault voltage is displayed with the Loop or earth resistance and trip time available by pressing the ENTER key.

Setting b: The trip time is displayed with the contact/fault voltage and Loop/earth resistance available by pressing the ENTER key.

150mA 40ms test

When an RCD is fitted for personal protection, a test current of 150mA must cause the RCD to trip in less than 40ms.

1. Select 150mA 40ms on the rotary switch.
2. Connect to the supply as detailed below.
3. Select and set the Trip Test to 0° or 180° using the TEST TYPE key.
4. Press the TEST key.

If the RCD trips within 40ms, the trip time is displayed.

Ramp Test (measuring the trip current)
The trip current is measured by applying a test current of half the rated trip current and increasing this every 200 ms. When the supply is cut, the current flowing is recorded and displayed.

A low trip current could be due to an overly sensitive RCD, or to leakage currents in the supply.

To determine the trip current of an RCD.

1. Select an appropriate RCD rated current on the rotary switch.
2. Connect to the supply as detailed on the next page.
3. Select the Ramp test using the TEST TYPE key.
4. Select the RCD type using the TYPE key.
5. Press and hold the Test button.

If the RCD trips, the first displayed result depends upon the Setting selected.

RCD Rating	Current Range	Step Value
10mA	5..15mA	1mA
30mA	15..50mA	1mA
100mA	50..150mA	2mA
300mA	150..300mA	6mA
500mA	250..500mA	10mA
1000mA	500..1040mA	52mA

Operation - RCD Testing

Setting A (Non UK Countries):
The contact or fault voltage is displayed with the Loop resistance, trip current and trip resistance available by pressing the ENTER key.

Setting b (UK):
The trip time is displayed with the trip resistance, contact voltage and loop resistance available by pressing the ENTER key. The trip current and the trip resistance values are displayed with the TEST TYPE symbol. The Trip resistance is the fault required to trip the RCD.

Auto Sequence RCD Test
If the RCD is not located near a convenient installation socket, it could mean walking back and forward between the RCD and the instrument to reset the RCD each time it trips out. To simplify and speed up sequence testing, the instrument can be set to automatically perform each subsequent test in the sequence each time that the power is restored. This test depends upon whether Setting A or Setting b is selected. The Overcurrent or Fast Trip is 150mA if Setting b is selected, and 5 x I if Setting A is selected. The display shows 150mA or 5I symbols as appropriate.

The test procedure is as follows:-

1. Connect to the supply as detailed on the next page.
2. Select the RCD rated current on the rotary switch.
3. Select Auto RCD test sequence by pressing the TEST TYPE key until the 1⁄2I; 0°; 180° and Fast trip symbols are displayed in sequence. Auto test is only applicable to a.c. sensitive non delayed RCDs, therefore Type segments are not displayed.
4. Press and release the Test button.
5. Reset the RCD within 30 seconds after each trip test.
6. Tests will be carried out in the sequence 1⁄2I, 0°, 180°, Fast Trip 0° and 180°. After each trip test, the instrument will wait for up to 30 seconds for the supply to be switched back on before continuing with the next test. The test sequence will abort if any of the tests fail, or if the RCD is not reset within the time limit.

On completion, the result of the last Fast trip test is displayed. Press the ENTER key to sequentially display:-

Supply voltage
Supply Frequency
Contact voltage
Earth Loop Resistance (approximation)
0° trip test time
180° trip test time
0° Fast trip test time
180° Fast trip test time

All results can be stored under a single circuit reference. See ‘Test Result Storage, Deletion and Retrieval’.

Operation - RCD Testing

Connecting to the Supply

At a power socket

The simplest way of connecting to the installation is by inserting the power plug into a convenient installation socket. If Setting A is selected when using the plug terminated lead set, the polarity of the mains socket is immaterial. Line and Neutral will be swapped internally if necessary, and an indication given on the display. Setting b requires Line and Neutral to be fixed.

1. Insert the power plug into an installation socket.
2. Select and set the rated current, RCD type and the test type.
3. Supply voltage, configuration symbols and polarity are displayed.
4. Press the TEST key.
5. See previous notes for type of test.

If desired the test can be repeated by pressing TEST again.

Not at a power socket

If an installation socket is not available use the 3-wire lead set

1. Connect the red lead to phase and the green lead to earth. No connection to neutral is needed.
2. Select and set the rated current, RCD type and the test type.
3. Supply voltage and polarity are displayed prior to the test.
4. Press the TEST key.
5. See previous notes for type of test.

If desired the test can be repeated by pressing TEST key again.

Automatic Testing

To aid rapid testing, the instruments can be set to start a test automatically when connected to the supply. This may be of use for example, when using a clip and a probe. Select the range required and press the test key without the supply present. The instrument will display **<100V** for approximately 30 seconds. Apply the supply voltage within this time and the instrument will pause before performing one test automatically.

Error Numbers

In the unlikely event of a hardware or software fault or error the display will show an error number in the form of a digital 'E' together with an identifying 2-digit number. If such an error number is displayed, switch the instrument off and back on again. Then repeat the test that was originally being carried out, or as given in the following table:

If the error number is again displayed, switch the instrument to off, and return the instrument to the manufacturer for service, together with a description of the events leading to the message display. See 'Returning an Instrument for Repair'.

LCB2000/2 and LCB2500/2

Error 1	Number to be displayed is too large
Error 4	Event buffer overflow
Error 6	Rotary switch error, unstable output code
Error 7	Rotary switch error, invalid output code
Error 10	Zero cross error - fuse blown during test
Error 12	7109 a/d converter failed
Error 15	H8 a/d converter failed
Error 16	Loop test ranging error
Error 22	EEPROM failure, no acknowledge signal
Error 23	EEPROM data fault, serial number checksum error
Error 24	EEPROM corrupted, end of data marker not found
Error 33	PLD 'status' error
Error 34	False RCD trip
Error 35	EEPROM data fault, result checksum error
Error 48	EEPROM data fault, calibration constant checksum error
Error 63	PLD 'status' timing error
Error 81	EEPROM data fault, error in stored foreign language
Error 95	Low current loop test failed - PLD sequence did not finish

LCB2500/2 only

Error 11	RS232 transmit data string too long
Error 17	RS232 transmit error
Error 31	RS232 receive error

Operation - Additional Instructions for LCB2500/2 only

Saving Results (LCB2500/2 only)
After a test, the result is displayed on the screen and this may be saved with additional information. A circuit number (1-99) may be assigned, and when moving site or building, circuits may be grouped using the distribution board feature. In this way, when downloading to PC software such as AVO® PowerSuite™, PowerSuite XPress or NICEone™, the results can be easily split into different test schedules. When the results are displayed or printed, a change in the distribution board is indicated.

Changing Distribution Boards (DB)
Before a test, the Distribution Board number may be changed, as follows:

1. Move the rotary selector switch to the RCL position. The code rcl is displayed.
2. Press the ENTER key. The currently selected DB code is displayed, e.g. **d01**. If no DB number has yet been entered, the code is **d--**. This occurs with a new instrument, or if the results memory has been cleared.
3. The DB may be changed using the UP and DOWN buttons to display the required number.

It is necessary to be cautious with DB numbers because all results associated with a given Distribution Board share a common reference result for deriving the R1+R2 values. (See page 13, 'Automatic Derivation of R1+R2 Values'). Therefore, a warning is given upon selection of a DB number which has already been 'used' - i.e. has results already saved to it in the memory. The DB number flashes, along with the triangle symbol, and the beeper sounds If the selected DB already has an associated reference result, the warning is slightly different, with a flashing '**Zd**' message.

There is no reason why the same DB number cannot be entered many times while working on the same system, but it would be advisable to use a different set of DB numbers for each new installation.

4. To accept and save the Distribution Board number, press the SAVE button. To abort, press the EXIT button.
5. When the number is saved, the code **Std** is displayed and a long bleep sounds. This confirms that the data has been stored.

Testing may now continue with all subsequent results which are stored being associated with the new distribution board number.

Operation - Additional Instructions for LCB2500/2 only

How to save a result

On completion and display of the measurement:

1. Press and hold the SAVE key. After about 1 second, a bleep will be heard. If the L-L L-N range has been used for the test you will be prompted confirm which connection you have been measuring. 'Live-neutral', Live-Live' or Live-Earth. A code, as given in the following table is displayed.For a (Loop) L-N test, a code, as given in the following table is displayed.

L-N	**Live-Neutral Test**
L-L	**Live-Live (across Phases Test)**
L-PE	**Live-Earth Test**

The code is used to describe the circuit tested and can be modified by the user. For all other tests, a circuit number code is displayed, and you should proceed directly to step 4.

2. The code may be changed by pressing the DOWN key
3. The code may be accepted by pressing the SAVE key, or aborted by pressing the EXIT key.
4. The circuit number is displayed as 2 digits, e.g. c01. If this is the first LOOP result, you have stored for the chosen distribution board the Code 'Zd' will be displayed. Use this if you are measuring the distribution circuit impedance or external fault loop impedance for the board. If this is not the case change the circuit number as in Step 5.

Note: *Many different tests may be saved under the same circuit number*.

5. The circuit number may be changed by pressing the UP and DOWN keys to display an appropriate number. Hold the key down to step through the circuit numbers.
6. The number can be accepted and the results saved by pressing the SAVE key, or the procedure aborted by pressing the EXIT key.
7. When the result is saved, the code Std is displayed (accompanied by a long bleep) to confirm that the data has been saved. The display of FULL indicates that there is no more test storage.

Saving a Zd (distribution) result.
(L-PE and L-PE xtra ranges only).

In order to measure final circuit R1 + R2 values, a loop test must be conducted at the incoming supply to the distribution board. The LCB2500/2 refers to this as the distribution circuit impedance 'Zd'.

If the distribution board is the first in a system and receives its supply from the suppliers facility this value will also be known as 'Ze', the external earth fault loop impedance.

Once 'Zd' has been stored the warning triangle ⚠ will illuminate on the display. This indicates that the instrument will subtract this value from measured loop impedance in order to display results for R1 + R2.

Saving is very similar to saving a normal result, as above. Steps 2 and 3 do not apply.

On completion and display of the measurement:

1. Press and hold the SAVE key for about 1 second. A long bleep sounds.

Operation - Additional Instructions for LCB2500/2 only

2. N/A
3. N/A
4. The circuit number is displayed.
5. Use the UP and DOWN buttons to reduce the circuit number below 1 or increase it beyond 99.

The display shows 'Zd', which is the code for the reference result.

Note: *Only one Zd result can be stored for each Distribution Board number. If such a result already exists, a warning will be given. The 'Zd' code flashes along with the triangle symbol, and the bleeper sounds. The new result can still be saved if desired, but it will overwrite the old one.*

6. To accept and save the result, press the SAVE button. To abort, press the EXIT button.
7. When the result is saved, the code Std is displayed and a long bleep sounds. This confirms that the data has been stored.

Delete all data [NB] –
It is not possible to delete individual results

1. Move the rotary selector switch to the RCL position. The code **rcl** is displayed.
2. Press the UP and DOWN keys together. The code **dEL** is displayed.
3. Confirm that the data is no longer required by pressing the SAVE key or abort by pressing any other key. The code **rcl** is displayed.

Note: *Once deleted, test data cannot be recovered*

Print Results

1. Connect printer and the instrument with a serial printer lead.
2. Move the rotary selector switch to the RCL position. The code **rcl** is displayed.
3. Commence the printout by pressing the TEST key. '**Prn**' is displayed Abort at any time by pressing and holding the ENTER key. The code rcl is displayed.

Printer Set-up Mode

The instrument cannot respond to a busy signal given by a printer, and therefore waits at the end of each line. This wait time and the printer report language can be changed.

1. Press and hold the backlight key then turn the rotary selector switch from the OFF position to the RCL position. The code **Pdt** is displayed.
2. Release the backlight key.

To change the Printer wait time

1. Toggle the TEST TYPE key to scroll through and display the code Pdt.
2. Press the ENTER key. The current setting is displayed.
3. Toggle the UP and DOWN keys until the required setting is displayed.
4. To save the new setting, press the SAVE key. The bleeper sounds and Std is displayed. To abort the new setting, press the EXIT key.

Operation - Additional Instructions for LCB2500/2 only

To select the printer language

1. Toggle the TEST TYPE key to scroll though and display the code lng.
2. Press the ENTER key. The current printer report language is displayed as 1 (English) or 2 (as given on the type label on the User Guide cover). AVO Download Manager supplied with your instrument enables the second printer language to be changed. Refer to the instructions supplied with the disk.
3. Toggle the TEST TYPE key until the required language setting is displayed.
4. To save the new setting, press the SAVE key. The bleeper sounds and Std is displayed. To abort the new setting, press the EXIT key.

Retrieval of Stored Results

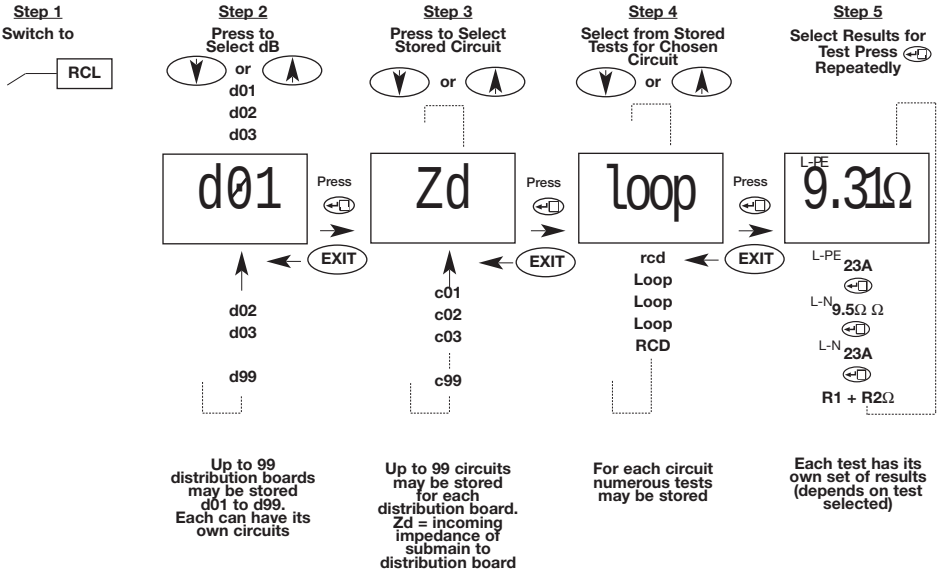
It is possible to view previously stored test results as follows:

1. Move the rotary selector switch to the RCL position. The code rcl is displayed.
2. Select the required distribution board by pressing the UP and DOWN keys. The distribution board numbers are shown in order that the results were stored. A long bleep is sounded when the end of the list is reached.
3. Press the ENTER key to list the circuit numbers used in the currently displayed distribution board or press the EXIT key to return to the RCL display

loop	**Loop Test except L-PE xtra**
L-N-PE loop	**Loop Test L-PE xtra**
rcd	**RCD Test**

4. Select the required circuit number by pressing the UP and DOWN keys. The circuit numbers are shown in numerical order. A long bleep is sounded when the end of the list is reached.
5. Press the ENTER key to show the stored test codes or press the EXIT key to return to the distribution board selection screen. The following codes are used to identify test results:-
6. Select the required test by pressing the UP and DOWN keys. The tests are shown in the above order. Hold a key down to auto-repeat. A long bleep is sounded when the end of the list is reached.
7. Press the ENTER key to scroll through the stored test results, together with any additional connection information or press the EXIT key to return to the circuit number selection screen.
8. While reviewing loop L-PE results, the R1+R2 value may appear in addition to the normal loop and PFC readings. The warning triangle symbol will also show, to denote that this is a derived reading.

Recalling Stored Results to the Display



Operation - Additional Instructions for LCB2500/2 only

In the case of L-PE xtra results, the R1, R2 and RN loop resistance components are also available and can be accessed by pressing the ENTER and BACKLIGHT buttons together. A double beep sounds. Press the ENTER key to scroll through the readings.

Downloading to a PC

Normally, a double-ended 9-way 'D' female socket lead suitable for connecting PC to PC is required. This lead should not exceed 3m in length. A lead is available as an accessory, or one can be made up as follows:-

Signal	Installation Tester	PC	
		9-way 'D'	25-way 'D'
Rx	2	3	2
Tx	3	2	3
DTR*	4	6	
DSR	6	4	20
GND	5	5	7

The CD-ROM supplied with the instrument includes AVO Download Manager which will allow you to retrieve and edit saved results, and export into other Microsoft Windows™ packages. Follow instructions supplied with the disk for further information. The LCB 2500/2 is also fully compatible with AVO PowerSuite, PowerSuite XPress and NICEone certification software.

Printing test results using a serial printer

Normally, a 9-way 'D' female socket to a 25-way 'D' female socket lead suitable for connecting PC to printer is required. This lead should not exceed 3m in length. A lead is available as an optional accessory, or one can be made up as follows:-

Signal	LCB2500	Printer 25-way 'D'
Tx	2	2
DSR	6	20
GND	5	7

The printer should be set to 9600 baud, 8 bits data, no parity and 1 stop bit. This instrument uses a special isolated serial interface which is powered from the PC or printer. In the unlikely event that your PC or printer is not able to power the interface, it will be necessary to provide an additional supply. Contact Megger Product Support for details.

Specifications

Supply Voltage Measurement

25-500V Intrinsic accuracy ±2% ±2 digits

Supply Frequency Measurement

d.c., 16-460Hz
Intrinsic accuracy ±0,1% ±1 digit

Loop Resistance Measurement (to EN 61557-3)

Line/Earth Loop

Displayed Range: 0,01Ω to 3,00kΩ

Nominal Supply: 230V, 50Hz

EN61557

Operating Range: 0,25Ω to 3,00kΩ

Intrinsic accuracy:

0,01Ω-9,99Ω	±4% ±0,03Ω
10,0Ω-89,9Ω	±5% ±0,5Ω
90Ω-899Ω	±5% ±5Ω
900Ω-3,00Ω	±5% ±20Ω

Line-Line (Phase/Phase) Loop Resistance measurement (to EN 61557-3)

Displayed Range: 0,01Ω to 19,99Ω

Intrinsic accuracy: ±5% ±0,03Ω

Nominal Supply: 230V, 50Hz

EN61557

Operating Range: 0,25Ω to 19,99Ω

Prospective Fault Current

$$\text{Prospective fault current} = \frac{\text{Nominal voltage}}{\text{Loop resistance}}$$

Measured Voltage	Nominal Voltage
>150V	110V
150V-300V	230V
>300V	400V

Prospective Fault Current is calculated from the respective loop resistance. Ranges and accuracies are therefore derived from the previous section.

Specifications

Line Earth Loop Resistance Measurement at 15mA (to EN 61557-2)

Loop L-PE 0.1Ω

Displayed Range:	0,1Ω to 2,00kΩ
Intrinsic accuracy:	up to 200Ω ±3% ±0,3Ω over 200Ω ±5% ±5Ω
Noise Immunity:	1∂ of reading within 0,3Ω on a normal domestic supply
Nominal Supply:	230V 50Hz

EN61557

Operating Range:	5,0Ω to 2,00kΩ

Loop L-PE xtra

Displayed Range:	0,01Ω to 10,00Ω
Intrinsic accuracy:	±5% ±0,05Ω
Noise Immunity:	1∂ of reading within 0,05Ω on a normal domestic supply
Nominal Supply:	230V 50Hz

EN61557

Operating Range:	0,5Ω to 10,00Ω

RCD Testing (to EN61557-6 up to 500mA)

Selectable Ranges:	30mA, 100mA, 300mA, 500mA, 1000mA

Variable 10mA to 1000mA

Test Facilities:	Contact voltage tests at 1⁄2IΔn

Loop resistance tests at 1⁄2IΔn

No Trip tests at 1⁄2IΔn

Trip tests at IΔn, 5IΔn

Fast Trip test at 150mA

Ramp tests

RCD Types:	General purpose, delayed (Selective) and d.c. Sensitive
Nominal Supply:	230V, 50Hz
Supply Range:	100-280V, 45-65Hz

Note: *The maximum possible test current (including the 5I multiplier) is 1000mA/300mA for d.c. sensitive RCDs. These limits are halved if the supply voltage is less than 200V.*

Specifications

1/2I∆n Test

Contact Voltage
Displayed range: 0V to 90V

Measurement range: 5V to 90V

Intrinsic error: +5%/+15%±0.5V

Loop resistance (measured at 1/2I∆n)

I∆n	Resolution
10	0,5Ω to 9kΩ
30	170Ω to 3kΩ
100	50Ω to 900Ω
300	17Ω to 300Ω
500	10Ω to 180Ω
1000	5Ω to 90Ω

2 second No Trip test at 1/2I∆n (optional)

The test current flows for 2 seconds. A tripped RCD will result in a display of <1999ms

Intrinsic Test Current accuracy: -8% to -2%

Trip Tests

I∆n Trip Test
This test will perform a short automatic 1/2I∆n test, followed by a 30 second delay (Selective type only) then execute a Trip test.

General purpose Test I∆n test for up to 300ms

Selective Test I∆n test for up to 2000ms

Timed Trip Tests

Trip time
displayed Range 0,1ms to test time limit

Intrinsic Trip time accuracy ±1% ±1ms

Intrinsic Test Current accuracy +2% to +8%

Ramp Test (Trip current measurement)
This test will perform an automatic 1/2I∆n test followed by a 30 second delay (Selective type RCD only) and then execute an incremental ramp test.

Intrinsic Ramp Test Current accuracy ±3%

I∆n	Ramp Range	Increment
10	5-15mA	1mA
30	15-50mA	1mA
100	50-150mA	2mA
300	150-300mA	6mA
500	250-500mA	10mA
1000	500-1020mA	52mA

150mA 40ms Trip Test
This is a stand alone test at 150mA for 40ms

Displayed Range 0,1ms to 40ms

Specifications

There is no associated 1/2I∆n test or Delay.

Power Supply
6 x 1,5V Alkaline cells type LR6 or 1,5V nickel cadmium, (NiCd) or nickel metal hydride, (NiMH)

Fuses
Non replaceable 2 x 7A (SIBA 70-065-63)

The 7A fuses protect the instrument and are not replaceable by the user.

Safety
Meets the requirements for double insulation to IEC61010-1 (1995), EN61010-1 (1995) Installation Category III***, up to 300V to earth and 400V phase to phase, without the need for separately fused test leads. If required, fused test leads are available as an optional accessory.

Complies with the relevant parts of EN 61557:1997-02 as detailed below.

*** Relates to the transient overvoltages likely to be met in fixed wiring installations. E.M.C.Meets EN61326-1 (1997)

Environmental Protection

IP54	The instrument is designed for indoor and outdoor use.
Temperature Range:	
Operating	-5°C to +40°C up to 90% RH
Storage	-25°C to +65°C up to 90% RH

General

Dimensions	230mm x 114mm x 62mm
Weight	920g with battery but without leads and test & carry case
Cleaning	Wipe the disconnected instrument with a clean cloth dampened with soapy water or Isopropyl Alcohol (IPA).

IEC 61557/EN 61557

Complies with the following parts of EN 61557, Electrical safety in low voltage systems up to 1000V a.c. and 1500 V d.c. – Equipment for testing, measuring or monitoring of protective measures:-

Part 1 - General requirements

Part 3 - Loop resistance

Part 6 - Residual current devices (RCDs)

Accessories

Supplied as standard:	**Part Number**
User Guide	6172-721
Test and carry case - Allows instrument to be operated without removal. Provides removable lead storage and protects instrument when not in use.	6420-122
3-wire test lead - For three phase sequence testing, including 2 prods and 3 clips.	6231-632
U.K. Mains plug test lead fitted with BS1363 fused plug.	6231-633
Computer Serial lead - To connect the instrument to PC with 9-way 'D' connector, 1,8m long.	25955-025 (LCB2500/2 only)
Printer serial lead - To connect the instrument to serial printer, with 25-way 'D' socket	25955-026 (LCB2500/2 only)
Download Manager - Installation Tester Set-up and simple download software	6111-442 (LCB 2500/2 only)

Optional Accessories		**Part Number**
2-wire Test lead set	With prods and clips.	6231-631
Euro Mains plug test lead	Fitted with CEE7/7 plug.	6231-635
U.K. Earth bond test lead	Fitted with BS1363 fused plug.	6231-634
Switch Probe SP2	2-wire lead set with a 'Test' key in the black probe.	6231-636
2-wire test lead set (5m)	2 wire lead set with 5m long leads.	6231-637

Accessories

Fused probe and clip set - Replace normal probes and clips supplied with 2- and 3-wire test (2 probes and 3 clips) test lead kits. 600V max. 10A fuse.	6180-405
PowerSuite™ XPress Windows™ form filling program for producing Certificates of test	6111-579
PowerSuite™ Windows™ program for Installation Testing Certificate generation etc.	Contact Distributor
NICEone™ Windows™ program for Installation Testing certificate generation etc.	6111-403

Publications	**Part Number**
'Testing Electrical Installations' A detailed account of how to carry out practical testing to BS 7671 (16th Edition IEEE Wiring Regulations).	6231-605
'A Stitch in Time' - The complete guide to electrical installation testing.	AVTM21-P8B
'Getting Down to Earth' - A practical manual on earth resistance testing.	AVTB25-TA

† Available in several languages. Please contact your local distributor for availability.

Loop Resistance Tables

Limit	Min. indicated reading	Limit	Min. indicated reading	Limit	Min. indicated reading	Limit	Min. indicated reading
0,10	0,03	1,50	1,29	20,0	17,0	300	260
0,15	0,08	2,00	1,74	25,0	21,5	350	305
0,20	0,12	2,50	2,19	30,0	26,0	400	350
0,25	0,17	3,00	2,64	35,0	30,5	450	395
0,30	0,21	3,50	3,09	40,0	35,0	500	440
0,35	0,26	4,00	3,54	50,0	44,0	600	530
0,40	0,30	4,50	3,99	60,0	53,0	700	620
0,45	0,35	5,00	4,44	70,0	62,0	800	710
0,50	0,39	6,00	5,34	80,0	71,0	900	800
0,60	0,48	7,00	6,24	60,0	80,0	1,00	0,86
0,70	0,57	8,00	7,14	100	89,0	1,50	1,31
0,80	0,66	9,00	8,04	150	125	2,00	1,76
0,90	0,75	10.0	8,94	200	170	2,50	2,21
1,00	0,84	15,0	12,5	250	215	3,00	2,66

Loop Resistance L-N/L-PE/L-L

Use these tables to determine the lowest allowed reading for a limit, taking into account the maximum service error of the instrument.

Limit	Min. indicated reading	Limit	Min. indicated reading
3,0	1,2	70,0	64,2
3,5	1,7	80,0	73,6
4,0	2,2	90,0	83,0
4,5	2,6	100	92,4
5,0	3,1	150	139
6,0	4,0	200	183
7,0	5,0	250	230
8,0	5,9	300	277
9,0	6,9	350	324
10,0	7,8	400	371
15,0	12,5	450	418
20,0	17,2	500	465
25,0	21,9	600	559
30,0	26,6	700	653
35,0	31,3	800	747
40,0	36,0	900	841
45,0	40,7	1,00k	935
50,0	45,4	1,50k	1,41k
60,0	54,8	2,00k	2,00k

Loop Resistance L-PE 0.1Ω

Repair and Warranty

The instrument circuit contains static sensitive devices, and care must be taken in handling the printed circuit board. If the protection of an instrument has been impaired it should not be used, and be sent for repair by suitably trained and qualified personnel. The protection is likely to be impaired if, for example, the instrument shows visible damage, fails to perform the intended measurements, has been subjected to prolonged storage under unfavourable conditions, or has been exposed to severe transport stresses.

New instruments are guaranteed for 3 year period from the date of purchase by the user.

Note: *Any unauthorised prior repair or adjustment will automatically invalidate the Warranty.*

Instrument Repair and Spare Parts

For service requirements for Megger Instruments contact:-

Megger Limited
Archcliffe Road
Dover
Kent, CT17 9EN.
England.
Tel: +44 (0) 1304 502243
Fax: +44 (0) 1304 207342

or

Megger
Valley Forge Corporate Center
2621 Van Buren Avenue
Norristown, PA 19403
U.S.A.
Tel: (610) 676-8579
Fax:(610) 676-8625

or an approved repair company.

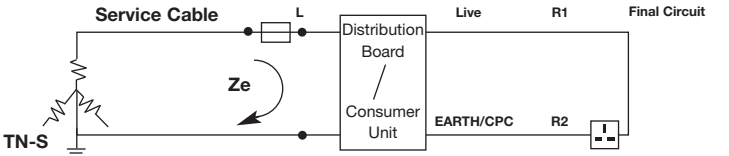
Approved Repair Companies

A number of independent instrument repair companies have been approved for repair work on most Megger instruments, using genuine Megger spare parts. Consult the Appointed Distributor/Agent regarding spare parts, repair facilities and advice on the best course of action to take.

Returning an Instrument for Repair

If returning an instrument to the manufacturer for repair, it should be sent freight pre-paid to the appropriate address. A copy of the Invoice and of the packing note should be sent simultaneously by airmail to expedite clearance through Customs. A repair estimate showing freight return and other charges will be submitted to the sender, if required, before work on the instrument commences.

Appendix 1 - Storing Distribution Circuit Impedances - 1



Single Distribution Board Systems

Store Distribution Circuit Impedance Zd here.

Note: In this case Zd = Ze the external earth fault loop impedance

Measure Zs at end of final circuit. Press ↵ repeatedly to display

L-PE Ω (Zs)

PFC L-E

L-N Ω

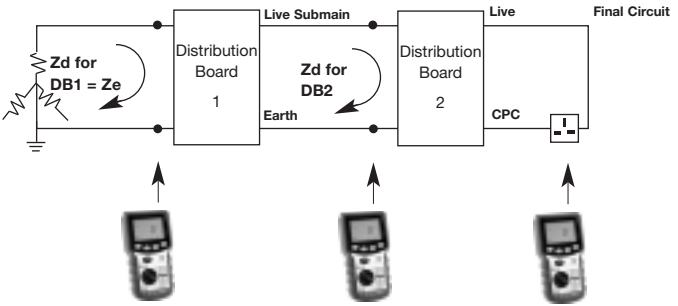
PFC L-N

R1 + R2*

*Where R1 + R2 = Zs - Zd

Appendix 2 - Storing Distribution Circuit Impedances - 2

Multiple Distribution Board Systems



Store Zd for DB1 Here (=Ze in this case)

This measurement can be stored as both a loop impedance for the submain supplied by DB1 and also the distribution circuit impedance for DB2 Zd

Measure Zs for final circuit here. Press ↵ to step through results.

L-PE Ω (Zs)

PFC L-E

L-N Ω

PFC L-N

R1 + R2*

*Where R1 + R2 = Zs - Zd

Notes

Notes

Notes

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OTHER TECHNICAL SALES OFFICES
Toronto CANADA, Sydney AUSTRALIA, Madrid SPAIN, Mumbai INDIA, and the Kingdom of BAHRAIN.

Megger products are distributed in 146 countries worldwide.

This instrument is manufactured in the United Kingdom.
The company reserves the right to change the specification or design without prior notice.

Part No 6172-721 – Edition 5 – Printed in England – 1103
www.megger.com