

# BST-ET14

## WIRING POLARITY CHECKER, MAINS ADAPTOR, ELCB (RCD) and APPLIANCE TESTER.

---

---



## INSTRUCTION MANUAL

<b>Index</b>	<b>Page</b>
1. Safety Rules.....	1-2
2. Safety Checks .....	2-3
3. General Description.....	3-5
4. Product Description - Features - Overview....	6
5. Product Description - Features - Details.....	7-8
6. Front Labels.....	9
7. Instruction Labels ( Back of Instrument).....	10-11
8. Preparation for use.....	11-12
9. Operating Instructions.....	12
(1) Verifying Wiring Integrity.....	12-14
(2) Testing ELCB/RCD (Protection device)....	14-15
(3) Using the Universal test Sockets.....	16
(4) Testing Appliance.....	17
(5) Calculating Power Consumption of Appliance.....	18
(6) Calculating Insulation resistance of Appliance.....	19
10. Very important features.....	20
(1) Checking Circuit Breaker Integrity.....	20
(2) Finding Standing leakage in an installation.....	20
11. Specifications.....	21-22
12. Environmental.....	22
13. Cleaning.....	22
14. Legal Matters & Intellectual Property.....	23
15. Checking and Changing the Fuse.....	23
16. Limited Warranty.....	24-25
17. Notes.....	25

## 1. Safety Rules

**CAUTION**



**RISK OF ELECTRIC SHOCK**

This tester has been designed with your safety in mind. However, no design can completely protect against incorrect use. Electrical circuits can be dangerous and/or lethal when lack of caution or poor safety practices are used.

Do not carry out field measurements on either the power system grounding, during periods of forecast lightning activity, in areas that encompass the station being measured or of the power network connected to the station being measured. In the event that lightning occurs, stop all testing and isolate any temporarily installed test spikes.

Preparations for testing of power system grounding can leave personnel vulnerable to exposure caused by faults at or fed from the system under test, transferred potentials from remote test grounds, and inadvertent line energisations.

While the probability of the occurrence of one of these events is low, personnel safety will, nevertheless, be enhanced by the following:

When working near high tension systems, rubber gloves and shoes should be worn.

Work on clean, dry crushed rock or an insulating blanket.

-1-

Avoid bare hand to hand contact between the tester and extended test leads.

When using the tester with test leads, ensure that they are safe and properly authorized. Always prepare any test in advance and understand everything about it.

Disconnect the tester from any external circuit when checking or changing the Fuse and/or batteries.

**CAUTION**  **READ THE MANUAL**

Follow the instructions in the Manual for every measurement. Read and understand the general instructions before attempting to use this tester.

## 2. Safety Check

Before using the tester, check the condition of the test leads, the fuse, and general appearance.

The leads must be free of cracks or any damages and must be insulated as when they were new.

Fuse replacement is described later in this user's manual.

Before replacing the fuse, always disconnect all leads and then remove the cover to access the internal circuitry.

When replacing the fuse, use only the type specified (HRC fuse), and insert correctly into the fuse holder.

Always double check the lead connections before making any measurements.

### **DON'T TOUCH**

Don't touch exposed wiring, connections or other "Live" parts of an electrical circuit. If in doubt, check the circuit first for voltage before touching it.

Do not use cracked or broken test leads.

**THIS INSTRUMENT SHOULD ONLY BE USED BY A COMPETENT, SUITABLY TRAINED PERSON.**

**REMEMBER  
SAFETY IS NO ACCIDENT**



**CAUTION RISK OF ELECTRIC SHOCK**



**CAUTION READ THE MANUAL**

### **3. General Description**

The tester is multi purpose test tool enclosed in a attractive rugged and convenient package which has some unique features.

The current leakage of an appliance can be measured while in-circuit as well as its current consumption.

The tester can check the mains wiring integrity and report on its polarity condition by showing the results on three bright neon lamps.

The user can cross-reference which neon light is lit up or not to a condition table and quickly establish the wiring polarity condition.

The tester also tests the tripping sensitivity of ELCBs / RCDs or can be utilized as a fault finding tool in case of standing leakage current.

In this case, the user can quickly find which breaker supplies the faulty circuit that causes the ELCB / RCD to have a standing current leakage fault.

The tester has a universal fused test socket that can be utilized to connect any test equipment that needs to be connected to the mains or to the appliance under test.

This is very useful in case recording the mains voltage is needed or recording the appliance voltage of a power consumption test.

The internal fuse is a HRC type.

For example, some of the applications to use the Universal Test Sockets can be to connect a voltmeter or a recorder, or to measure the voltage when doing a power measurement, while the current coil can be clipped around the ear.

The tester can be utilized to check appliances, ascertain its leakage current or calculate its insulation resistance or even measure the consumption current and voltage input and, calculate its power consumption.

The Appliance socket is protected by the same HRC fuse as the universal test sockets.

## 4. Product Description - Features - Overview

**INTERNAL HRC FUSE**

**MAINS CONNECTIONS** is established by using a computer lead, "IEC Lead".

**WIRING POLARITY CHECK CONDITION** can be cross-referenced to this Condition Table.

**NEON LIGHTS A, B, C** Cross REFERENCE. To the Condition table.

**A, B, C HIGH BRIGHT NEON LAMPS FOR WIRING TABLE CROSS REFERENCING**

**TEST BUTTON.** Injects  $I_L$  into earthing system when pressed.

**$I_L$  ON,  $I_L$  Flowing LED** indicates when current is injected into the earth system.  $I_L$  confirm that current is flowing to Earth.

Universal Adaptor is Connected to the Mains Connection via a HRC Fuse and is color coded.

**Current Selection Rotary Switch**

**Universal Mains Adaptor** uses 4mm compatible sockets.

**EARTH CURRENT EAR,** to measure the Leakage Current of the Appliance under test and calculate its Insulation Resistance.

**Appliance socket.** Appliance under test must be plugged here.

**LINE CURRENT EAR,** to measure the Line Current Consumption of the Appliance under test.

**COLOR CODED EARTH CURRENT MEASUREMENT EAR.**

**COLOR CODED LINE CURRENT MEASUREMENT EAR.**

**APPLIANCE LEAKAGE CURRENT** helps calculating Insulation of Appliance and help verifying if Appliance add standing leakage current onto your system.

**APPLIANCE LINE CURRENT** helps calculate Power of Appliance and helps verify if Appliance is within specifications.

**MAINS WIRING POLARITY CHECK**

**EARTH LEAKAGE TESTER**

**FUSED MAINS ADAPTOR**

**APPLIANCE TESTER**

## **5. Product Description - Features Details**

### Mains Connector

The main connector of the tester is connected to the power outlet by using a computer type lead, or also sometimes called a IEC lead or a kettle lead. This is an universal type lead and is supplied with the tester for the country where the tester is sold.

### Internal HRC Fuse

The tester is equipped with a High Rupture Capacity fuse, of 10A/250V.

The fuse is connected to the Incoming Line wire, from the wall socket and protect the entire circuitry, including the universal test sockets and the appliance socket.

### Wiring Conditions Test

An internal circuitry test for wiring condition and report onto the neon lamps. Please note that a short circuit between Neutral and Earth cannot be detected by this circuitry.

### Neon Lamps Reporting

These high bright neon lamps report the wiring condition detected by the circuitry. Always refer to the condition table to check that the wiring is correct or not.

### ELCB / RCD Test

The circuitry of the tester has been designed to test domestic leakage detecting circuit breakers. For this reason, current from 10mA up to 35mA is generated. This can also be utilized for fault finding standing leakage faults after having checked the integrity of the breaker itself.

### Universal Test Sockets

These 4mm socket help you connect test equipment to the mains or the appliance without complicated wiring.

### Appliance Socket

The protected appliance socket can supply up to 10A maximum to the appliance under test

### Current Line Coil

This coil is utilized to check the line current by clipping the clamp meter around it.

### Current Earth Coil

This coil is utilized to check the earth current by clipping the peakage clamp meter around it.

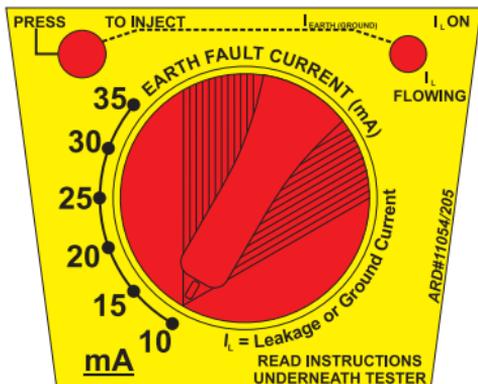
## 6. Front Labels

● = ON      MAINS      ○ = OFF

A	B	C	CONDITION
●	●	●	WIRING OK
●	●	○	NO EARTH (GROUND)
○	●	●	NO NEUTRAL
○	○	○	NO LINE
○	○	●	REVERSED LINE / EARTH
●	○	○	REVERSED LINE / NEUTRAL

DOES NOT DETECT N-E SWAPPED

**A                      B                      C**



**APPLIANCE**

## 7. Instruction Label (Back of instrument)

This label is located underneath the instrument.

Turn the instrument on its back to check it.

It should be fixed properly and be the same as this below. If it is damaged, contact your nearest distributor and order a replacement instruction label.

### **INSTRUCTIONS**

Before using this instrument, ensure the main power cord (IEC LEAD) connecting the Instrument to the mains power socket is in good condition.

Read the User's Manual and understand all the features of this Instrument before proceeding. Only to be used by a trained person.

#### **MAINS WIRING POLARITY CHECK**

Ensure nothing is plugged into the Universal Test Socket and Appliance Socket of this Instrument. Plug the main power cord (IEC LEAD) into the mains socket outlet to check its wiring polarity. Check A, B and C Lamps and Lamp check conditions. Cross-reference to table to ascertain wiring condition. Do not proceed to any other testing if wiring condition is not OK. Please note that Neutral/Earth reversed or joined is not detected.

#### **TESTING EARTH LEAKAGE CIRCUIT BREAKER (RCD)**

Rotate Current Rotary Switch Selector to the desired Earth Fault Current to be injected by the Instrument. For example, first try a non tripping value (10mA), press the Red Button to inject the selected current, the breaker should not trip, then try a second non tripping value (15mA) to ascertain that no standing leakage exist, press the Red Button to inject the selected current, the breaker should not trip, then try a tripping value, for example 30mA or 35mA to trip the breaker. Press the Red Button to inject the selected current, the breaker should trip.

#### **FUSED UNIVERSAL TEST SOCKETS**

Use only 4mm safety leads which are rated to at least 240Vac. Ensure to prepare what you want to do with the Universal Test Sockets, by drafting a sketch of the electrical circuit you want to measure or connect to the Universal Test Sockets.

The mains adaptor is connected to the Mains input power cord (IEC LEAD) by internal HRC fuse. Ensure you don't draw more current than the Internal Fuse. Consult user's manual for examples of utilization.

#### **TESTING APPLIANCE**

Prepare your measurements. Connect the appliance into the Appliance Socket, on the Instrument. Switch the appliance ON using its switch. With the Leakage clamp, measure the Appliance Earth leakage Current by clamping it onto the Green ear. Write the result down. Now, with the Leakage clamp on a higher range, measure the Appliance Line Current by clamping it onto the Red ear. Write the result down. Switch the appliance OFF and remove it from the socket. Consult the user's manual to quickly calculate the power consumption or the Insulation resistance.

**240Vac**

- Note: 4 voltage available depending on country review: 240Vac, 230Vac, 220Vac, 110Vac.

## **8. Preparation for use**

### Cleaning.

Use a slightly damp cloth to clean the case. Do not use chemicals.

All the instructions should be readable. If this is not the case, send your tester for servicing. A new case can be purchased as a spare part.

### Check for cracks in wires and sign of damages.

Visually check for cracks or damage in the casing and accessories. Do not operate this instrument if it is not in perfect condition.

### Remove all leads from the tester.

Before proceeding with the use of the tester, remove all leads which could have been connected from a previous test. Start a new test.

Rotate the rotary switch to 10mA position.

Always start by the lowest position. Rotate the rotary switch to the 10mA position so that the tester is always in the known position before proceeding with any new test.

### Prepare your test.

Before connecting anything to or from the mains, always prepare your test and understand what you are going to do.

Do not proceed with any testing if you are unsure.

### Connecting the Universal IEC main lead to the tester

Select the main lead which will connect the tester to the main power outlet socket.

Ensure the lead is in perfect condition.



## 9. Operating Instructions

### (1) Verifying Wiring Integrity.

Plug the tester into the Mains power socket (wall) and check the neon lamps. When the wiring is correct, all the neon lamps will lit together.

			MAINS	O= OFF
A	B	C	CONDITION	
●	●	●	WIRING OK	

If there is no earth connection to the tester, only the neon lamps A and B will light up. The C neon lamp will not be lit.

			MAINS			
			● = ON	O = OFF		
A	B	C	CONDITION			
●	●	O	NO EARTH (GROUND)			

If the neutral wire is not connected to the tester, only the neon lamps B and C will light up. Neon lamp A will be off.

			MAINS			
			● = ON	O = OFF		
A	B	C	CONDITION			
O	●	●	NO NEUTRAL			

When there is no line connected to the tester, all the neon lamps will be off as if nothing would be connected.

			MAINS			
			● = ON	O = OFF		
A	B	C	CONDITION			
O	O	O	NO LINE			

If only the C neon lamp is lit, this means that the line and earth wires connecting to the tester are reversed (swapped).

			MAINS			
			● = ON	O = OFF		
A	B	C	CONDITION			
O	O	●	REVERSED LINE / EARTH			

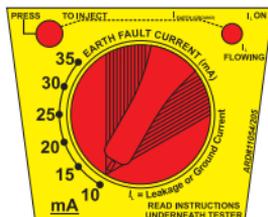
If only the A neon lamp is lit, this means that the line and neutral wires connecting to the tester are reversed (swapped).

● = ON			MAINS		○ = OFF	
A	B	C	CONDITION			
●	○	○	REVERSED LINE / NEUTRAL			

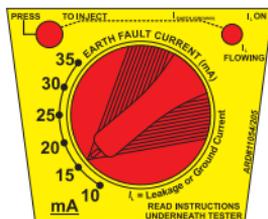
## (2) Testing ELCB/RCD (protection device).

Disconnect all breakers and circuits which are not to be tested but which are in circuit as they may bring standing leakage which can complicate testing. Insulate these circuits. In the case of testing a domestic breaker, begin test by starting with a non tripping value (10mA).

Plug the tester into the outlet. Ensure the wiring is correct. Then press the red button to inject the fault current of 10mA. The red led  $I_L$  ON ( $I_L$  flowing) should be lit, indicating that current is flowing into the earth wire. The breaker should not trip.



Stop depressing the red button and rotate rotary switch to 15mA. Repeat the procedure as per the previous test. The breaker should still not trip.

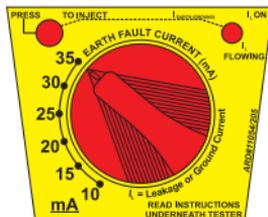
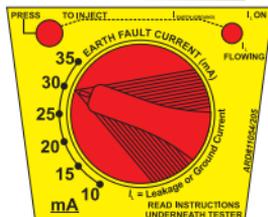
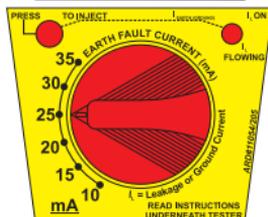
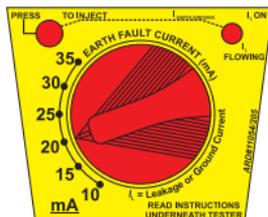


Stop depressing the red button and rotate rotary switch to 20mA. Repeat the procedure as per the previous test. The breaker could trip.

Stop depressing the red button and rotate rotary switch to 25mA. Repeat the procedure as per the previous test. The breaker must trip.

Stop depressing the red button and rotate rotary switch to 30mA. Repeat the procedure as per the previous test. The breaker must trip.

Stop depressing the red button and rotate rotary switch to 35mA. Repeat the procedure as per the previous test. The breaker must trip.



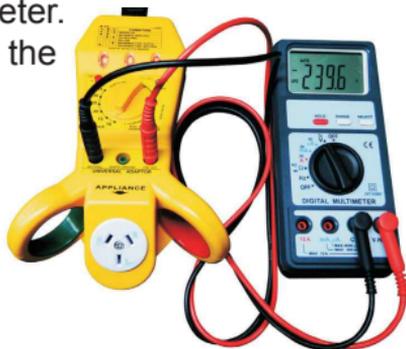
### (3) Using the Universal Test Sockets.

#### Measuring the voltage with a Multimeter

Select Vac on your multimeter.

Connect the red lead from the multimeter to the red test socket on the tester.

Connect the black lead from the multimeter to the black test socket on the tester.



#### Connecting a Logger

The connection is similar to the previous example. If you wish to record other voltage like Neutral-Earth, then use the appropriate sockets.

#### Connecting a Power Quality Analyzer

To measure power, you will need to measure voltage and current.

The power meter provides you with voltage leads and a current clamp.

The appliance on which you measure the power will be connected to the appliance socket.

The voltage measurement will be connected to the test sockets and The current clamp for the current measurement will be clipped onto the red ear coil.

(4) Testing Appliance Power Consumption/Leakage.  
Connect the appliance into the appliance socket of the tester. Connect the tester to the mains outlet. Connect a multimeter as per the "measuring voltage with a multimeter". Switch ON appliance using its own switch. The multimeter displays  $V_{L-N}$ . Now, you have  $V_{L-N}$  of appliance. Take the clamp meter and measure line current of appliance by clipping it around the red ear. Write down the value for reference. Now, you have  $I_L$  of appliance. Take the clamp meter and measure earth current of appliance by clipping it around the green ear. Write down the value for reference. Now, you have  $I_{L-E}$  of appliance.

\*For leakage measurement, clamp around green ear.

 Warning  
Please choose the clamp meter with a proper resolution



Photo of power consumption measurement.

Appliance  
Under Test

-17-

### (5) Calculating Power Consumption of Appliance.

$V_{L-N}$  = measured through the test sockets.

$I_L$  = measured through the clamp meter and Red ear.

$$P = V_{L-N} \times I_L$$

Connect a DMM onto the L and N test sockets to measure  $V_{L-N}$ .

Clip clamp meter around the red ear to measure  $I_L$ .

Connect appliance to the appliance socket of the tester. Switch appliance ON.

Write down  $V_{L-N}$  from the multimeter.

Write down  $I_L$  from the clamp meter.

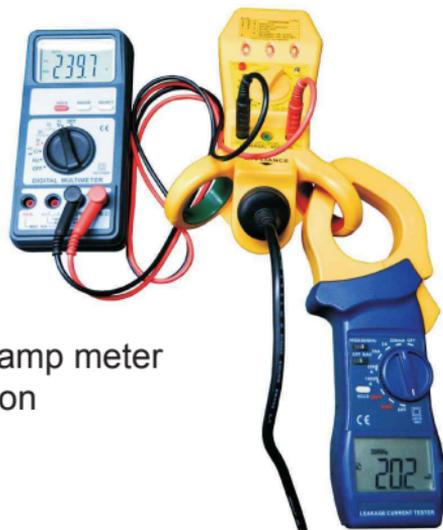
Switch appliance OFF and disconnect tester from mains. Calculate Power of Appliance.

$$P_{\text{appliance}} = V_{L-N} \times I_L$$



Warning

Please choose the clamp meter with a proper resolution



## (6) Calculating Insulation Impedance of Appliance.

In this example, we assume that there is not voltage between neutral and earth and that neutral and earth are tied together at the transformer point.

$V_{L-N}$  = measured through the test sockets.

$I_{L-E}$  = measured through the clamp meter and Green ear.

$$R_{\text{Insulation Appliance}} = \frac{V_{L-N}}{I_{L-E}}$$

Connect a DMM onto the L and N test sockets to measure  $V_{L-N}$ .

Clip clamp meter around the Green ear to measure  $I_{L-E}$ .

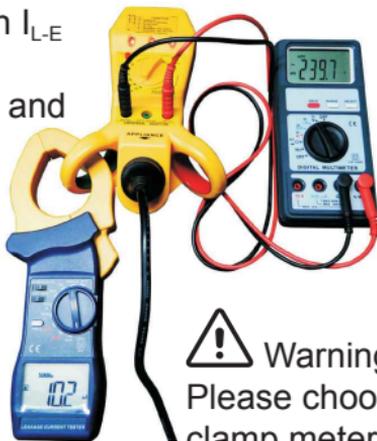
Connect appliance to the appliance socket of the tester. Switch appliance ON.

Write down  $V_{L-N}$  from the multimeter. Write down  $I_{L-E}$  from the clamp meter.

Switch appliance OFF and disconnect the tester from mains.

Calculate Insulation Resistance of appliance.

$$R_{\text{Insulation Appliance}} = \frac{V_{L-N}}{I_{L-E}}$$



**Warning**  
Please choose the clamp meter with a proper resolution

## 10. Very Important Features

### (1) Checking Circuit Breaker Integrity

To ensure proper diagnostic is done, it is very important to check the ELCB/RCD as a component before testing an installation which has wiring connected to it.

Wiring could be faulty and may cause an insulation fault. Therefore, it is important to ensure that the ELCB/RCD is tested alone first to ascertain that the ELCB/RCD is in proper working condition.

Only after having done so, should you test wiring in-circuit.

### (2) Finding Standing Leakage in an installation

To find a standing fault, always check one circuit at a time to find the faulty circuit easily.

Disconnect all the circuits by switching all the insulators OFF.

The ELCB/RCD must be checked individually before proceeding (see above), for its integrity.

Once you know for sure that the ELCB/RCD is ok, then proceed to test one circuit at a time and write down the results at which the ELCB/RCD trips. This should give you a very good idea which circuit is faulty which circuit has standing leakage current.

## 11. Specifications

<b>TECHNICAL SPECIFICATIONS</b>	
<b>VOLTAGE / POWER INPUT</b>	
UNIVERSAL IEC LEAD	240V/10A
<b>WIRING POLARITY CHECK</b>	
NOMINAL VOLTAGE	240Vac
FREQUENCY	50/60Hz
MAINS VOLTAGE TOLERANCE	±10%
<b>ELCB / RCD TESTER</b>	
NOMINAL VOLTAGE	240Vac
FREQUENCY	50/60Hz
CURRENT TOLERANCE (Current Proportional to Line to Earth Voltage)	Proportional
<b>UNIVERSAL TEST SOCKETS</b>	
NOMINAL VOLTAGE	240Vac
FREQUENCY	50/60Hz
MAINS VOLTAGE TOLERANCE	±10%
FUSED	10A
<b>APPLIANCE TESTER</b>	
NOMINAL VOLTAGE	240Vac
FREQUENCY	50/60Hz
MAINS VOLTAGE TOLERANCE	±10%
FUSED	10A
<b>APPLIANCE LINE CURRENT COIL</b>	
Protection Relies on the LINE CURRENT FUSED TYPE	10A HRC
<b>APPLIANCE EARTH CURRENT COIL</b>	
Protection Relies on the LINE CURRENT FUSE TYPE	10A HRC

- Note : 4 voltage available depending on country review : 240Vac, 230Vac, 220Vac, 110Vac.
- Indoor use
- Altitude : 2000 max
- Humidity : Maximum 80% RH at 31°C decreasing to 50% RH at 40°C
- Pollution Degree : 2
- Safety standard:
  - IEC/EN 61010-1 240Vac 50/60Hz 10A Class1
  - EN 61326 EN 55011
  - EN 61000-3-2 EN 61000-3-3
  - EN 61000-4-2 EN 61000-4-3
  - EN 61000-4-4 EN 61000-4-5
  - EN 61000-4-6 EN 61000-4-11

## 12. Environmental

Operating temperature Range : 1 °C to + 40 °C

Storage Temperature : -20 °C to + 70 °C

## 13. Cleaning

Clean the instrument case with an anti-static cleaner and wipe with dry cloth.

## **14. Legal Matters and Intellectual Property**

Design of Electronic Circuitry, Mechanical Parts and Appearance .

COPYRIGHT 2006 -TOPTRONIC LIMITED ALL RIGHTS RESERVED; NO PART OF THIS DRAWING MAY BE REPRODUCED, MODIFIED OR STORED IN A RETRIEVAL SYSTEM, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC, MECHANICAL, PHOTOCOPYING, RECORDING OR OTHERWISE, WITHOUT THE PRIOR WRITTEN PERMISSION OF TOPTRONIC LIMITED

Design Registration: ARD# 110554/2005

## **15. Checking and Changing the FUSE**

Disconnect everything from the tester.

Make sure there are no leads connected to the tester and that nothing is attached to it.

The tester must be unpowered and free of any potential.

Turn the tester on its back and open the 5 screws.

Now you have access to the PCB.

Check the fuse using an ohm meter.

If the fuse is damaged, then remove the 4 PCB screws.

Now you have access to the fuse itself.

Remove the fuse and replace by the same type(10A HBC).

## 16. Limited Warranty

We warrant the product manufactured by us to be free from defective material or factory workmanship and agree to repair or replace this product which, under normal use and service, disclose the defect to be the fault of our manufacturing, with no charge for parts and service. If we are unable to repair or replace this product, we will make a full refund of the purchase price.

Consult the user's manual for proper instruction regarding use of this instrument.

Our obligation under this warranty is limited to repairing, replacing or making refund of this test equipment which proves to be defective within twenty four months from the date of original purchase.

This warranty does not apply to any of our products which have been repaired or altered by unauthorized persons in any way so as, in our sole judgement, to injure their stability or reliability, or which have been subject to misuse, abuse, misapplication, negligence or accident or which have had the serial numbers altered, defaced or removed.

Accessories, not of our manufacture used with this product, are not covered by this warranty.

All warranties implied by law are hereby limited to a period of twenty four months, and the provisions of the warranty are expressly in lieu of any other warranties expressed or implied.

The purchaser agrees to assume all liability for any damages or bodily injury which may result from the use or misuse of the product by the purchaser, or its user, his employees, or others, and the remedies provided for in this warranty are expressly in lieu of any other liability we may have including incidental or consequential damages.

We reserve the right to discontinue models at any time, or change specification, price or design, without notice and without incurring any obligation.

## **17. Notes**

- CAT IV - Measurements performed at the source of the low-voltage installation.
- CAT III - Measurements performed in the building installation.
- CAT II - Measurements performed on circuits directly connected to the low-voltage installation.
- CAT I - Measurements performed on circuits not directly connected to mains.

Due to our policy of constant improvement and development, we reserve the right to change specifications without notice.