SMART SENSOR®

Model：AR5406

Digital RCD(ELCB) Tester
User's Manual

Foreword

- Thank you for purchasing our company's Digital RCD(ELCB) Tester.
- This manual provides relative information on how to use this product and measurement functions of it as well as warnings on its use. To make the best use of this product's functions, read this manual thoroughly before use. Please keep this manual handy for ease of reference.
- Please do some test make sure the products is performing properly before measurement.

Specific Declarations:

We reserve the rights to update and/or amend the products design and specifications contained in the manual without further notification.

IntelliSafe CE

Contents

1. Before use notice

Check-up

Carefully unpack your kit and ensure that you have the following items. Incase that any item is missing or if you find any mismatch or damage, promptly contact your dealer.

➢ Digital RCD(ELCB) Tester	1PCS
➢ English user's manual	1PCS
➢ Warranty card	1PCS
➢ Test lead	1PCS
➢ PP packing box	1PCS

4.Other items

Maintenance and warranty

Maintenance:

1). Do not store or use the unit in following locations where the unit may be subject to:
   a. Splashes of water or high levels of dust.
   b. Air with high salt or sulphur content.
   c. Air with other gases or chemical materials.
   d. High temperature or humidity (above50℃, 90%,) or direct sunlight.
2). Do not disassemble the unit or attempt internal alterations.
3). Never use alcohol or thinner to clean the unit casing that will especially erode the LCD surface; just clean the unit lightly as needed with little clean water.

Warranty

1). About relative warranties please read provided warranty card.
2). We disclaim any liability due to: transportation damages; incorrect use or operation; manipulation, alterations or repair attempts; without warranty card, invoice.

⚠ Caution

- If the RCD does not trip, the tester will supply the test current for a maximum of 1000ms on the x1/2 and x1 ranges. The fact that the RCD has not tripped will be evident because the P- N and P-E LEDs will still be on.

- If a voltage exists between the protective conductor and earth, it may influence the measurements.

- If a voltage exists between neutral and earth, it may influence the measurements, therefore. The connection between neutral point of the distribution system and earth should be checked before testing.

- If leakage currents flow in the circuit following the RCD, it may influence the measurements.

Safety rules

Applied Standards

- Instrument operation: IEC/EN 61557-1, IEC/EN 61557-6.
- Safety:IEC/EN 61010-1 CAT III (300V) - instrument.
- IEC/EN 61010-2-31 CAT III (600V) test lead
- Protection degree:IEC60529 (IP54)

⚠ Safety precautions:

Electricity is dangerous and can cause injury and death. Always treat it with the greatest of respect and care. If you are not quite sure how to proceed, stop and take advice from a qualified person. This instruction manual contains warning and safety rules which user be observed by the user.

The symbol ⚠ indicated on the instrument means that the user must refer to the related sections in the manual for safe operation of the instrument. Be sure to carefully read instructions following each symbol ⚠ in the manual.

⚠Danger is reserved for conditions and actions that are likely to cause serious or fatal injury
⚠Warning is reserved for conditions and actions that can cause serious or fatal injury.
⚠Caution is reserved for conditions and cautions that can cause a minor injury or instrument damage.

⚠ DANGER

- This instrument is intended only for use in single phase operation at 230V +10% -15% AC phase to earth or phase to neutral operation or for use in OLD- TT system.
- Do not use the instrument in any inflammable situation, the instrument testing may cause spark result in inflammable object explosion.
- Never attempt to use the instrument if the instrument or your hand is wet.
- When conducting tests do not touch any exposed metalwork associated with the installation. Such metalwork may become live for the duration of the test.
- Be sure to remove the test leads from the main power supply promptly after measurement. Do not leave them connected to the main power supply for a long time.

⚠ WARNING

- This instrument must use by technician who pass the standard related training, and following the manual procedure.
- Never open the instrument case- there are dangerous voltages present. If a fault develops return the instrument to your distributor for inspection and repair.
- If the overheat symbol appears on the display disconnect the instrument from the mains supply and allow to cool down.
- Always check the instrument, If abnormal conditions of any sort are noted (such as a faulty display, unexpected readings, broken case, cracked test leads, ets.) do not use the tester.
- Do not change the product any accessories or components, return the instrument to your distributor for inspection and repair.

⚠ WARNING

➢ Voltage overload protection:
If the voltage between phase and earth exceeds approx 260V, “VL-PE” is shown on the LCD when the test button is pressed and the measurement will be halted. Disconnect the instrument form the main supply and check the voltage between phase and earth if “VL-PE Hi” appears on the LCD.
Overheat protection:
If the overheat symbol appears on the display, the instrument has automatic cut-out, please disconnect form the main supply allow the unit to cool down.
Wiring error notice:
When making a test with overlarge trip current or improper wiring will active the RCD with the symbol “NO” shown on the display.
Malfunction protection:
➢ When the Uf voltage rises to UL value or greater, the measurement is automatically suspended and “Uf Hi” is displayed on the LCD.

⚠ Do not touch any earth metalwork during the operation of these tets.

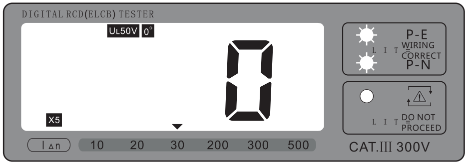
- Set the test parameter:

  Press “ ” key to select the trip-off current you need, for example 30mA (this means the max trip off current is 30X5=150mA);

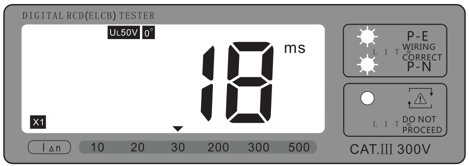
  Press “ ” key to select the trip-off voltage you need, for example UL50V;

  Press “ ” key to select the phase you need, for example 0°;

  The LCD displayed like the following picture:



- Press the red test button, if there is touch off during the process (RCD action), LCD will display touch-off time: 18ms (the touch-off time in the example), the value will flicker 3 seconds. The LCD displayed like following picture at this time:



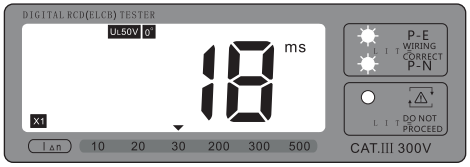
⚠ CAUTION

- Do not expose the instrument on sunlight, and do not place on a high temperature or damp environment.
- Use a damp cloth and neutral detergent for cleaning the instrument. Do not use abrasives or solvents.

Feature and function

- This instrument is not battery- operated, but powered by the voltage supplied form the electricity system.
- LCD display measurement result and condition directly.
- Wiring check
- Self-detecting overheating of the internal resistor and of the current control MOS FET by a warning symbol and automatically halting further measurements.
- Voltage overload indication: when VL- PE HI display, instrument will automatically halting the measure between phase and ground voltage to prevent damage.
- Selective phase angle.
- Auto data hold: The LCD reading is automatically frozen for a short time after measurement.
- UL and UF measurement selection.

➢ Press the red test button, if there is touch off during the process (RCD works), LCD will display trip-off time: 18ms (the trip-off time in the example), the reading will hold 3 seconds. The LCD displayed like following picture:



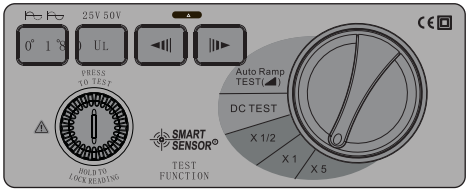
X 5

X5 is quick trip off test:

a. the max trip off time: 200ms

b. the circuit breaker should trip off

➢ Connect the test lead, make sure the connection and the LED indication is correct, and then turn the function switch to “X 5” position, like the following picture:



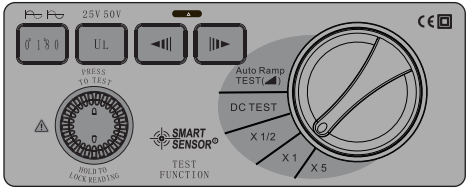
X 1

X1 is trip off test:

a. the max trip off time: 1000ms

b. the circuit breaker should trip off

➢ Connect the test lead, make sure the connection and the LED indication is correct, and then turn the function switch to “X 1” position, like the following picture:



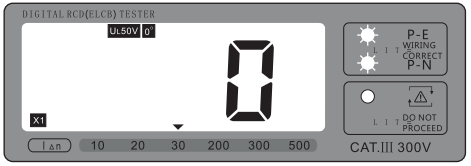
➢ Set the test parameter:

Press “◄II II►” key to select the trip-off current you need, for example 30mA ;

Press “ UL ” key to select the trip-off voltage you need, for example U150V;

Press “ 0° 180° 0 ” key to select the phase you need, for example 0°;

The LCD displayed like the following picture:



Specification

➢ Accuracy of trip current (IEC/EN 61557-6):

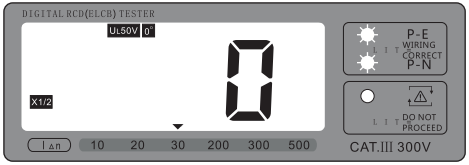
Function	Accuracy of trip current
x 1/2	-10% ~0
x 10	0 ~ 10%
x 5	
AUTO RAMP	-10 ~ 10%

➢ Measurement Specification:

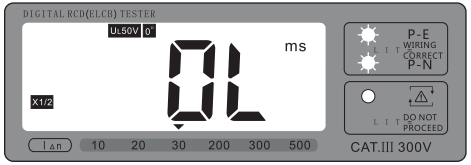
	Rated voltage (AC)	Trip Current Settings (I⊿n)	Trip time	Accuracy	
X1/2	230V +10% -15% 50Hz	10/20/30/ 200/300/ 500mA	1000ms	-8%~-2%	0.6% ±4dgt
X1			1000ms	+2%~+8%	
X5			200ms		
DC Test		(10/20/30/ 200/300/ 500mA) +6mA dc	1000ms	-10%~+10%	
AUTO RAMP Test		10/20/30/ 200/300/ 500mA	Goes up by 10% from 20% to 110% of I⊿n. 300ms X 10	-8%~+8%	

Technical Specification:

Technical parameter	Technical index
Operating temperature/humidity:	0~40℃ ≤80%RH
Storage temperature/humidity:	-20℃~60℃ ≤75%RH
Allowable altitude height :	≤2000m
LCD display :	3.5 figuers display
Operating voltage :	230V 50Hz +10% -15%
Grounding resistance :	Maximum 50Ω
LED indication :	P-E/ P-N LED green light on mean wiring correct. Red light on mean wiring wrong.
Product Size:	165x140x80mm
Product net Weight:	575G (Without test lead)



Press the red test button, the circuit breaker should not trip off. The LCD displayed like following picture:



That indicate the trip-off current is low, not trip off.

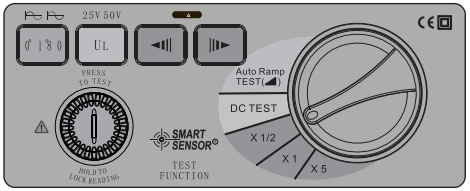
X1/2

X 1/2 is the non-trip-off tests:

a. the max time: 1000ms

b. the circuit breaker should not trip off

➢ Connect the test lead, make sure the connection and the LED indication is correct, and then turn the function switch to “X 1/2” position, like the following picture:



➢ Set the test parameter：

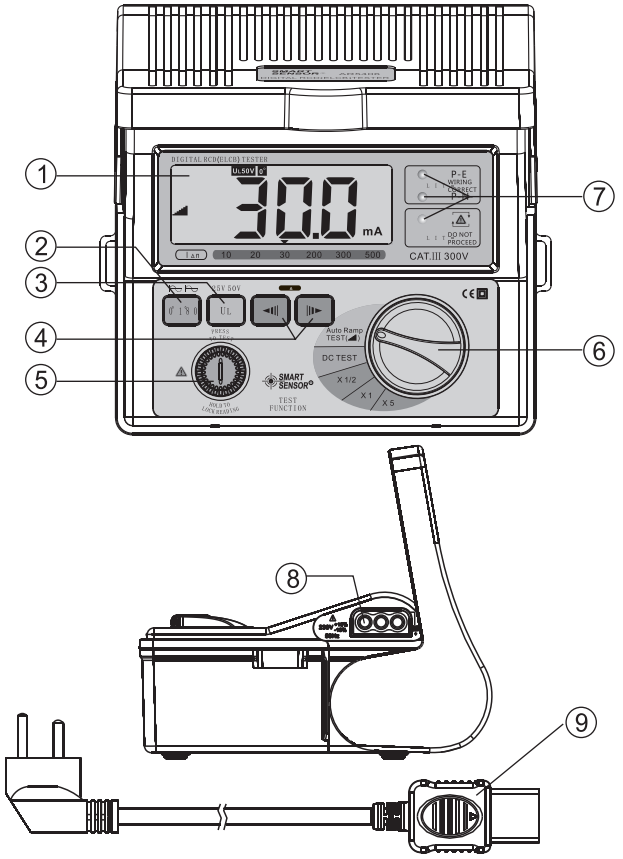
Press “◄||| |►” key to select the trip-off current you need, for example 300mA，(The selection indicates that the max trip-off current is: 30*1/2=15mA)；

Press “UL” key to select the trip-off voltage you need, for example U150V；

Press “0° 180°” key to select the phase you need, for example 0°;

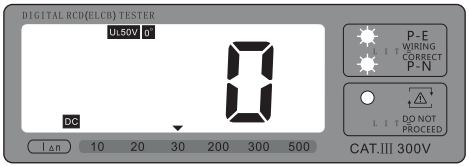
The LCD displayed like the following picture:

Diagram of the unit

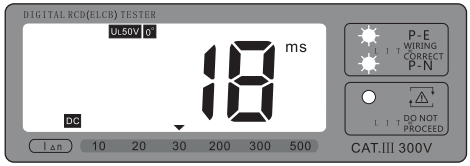


1. LCD display
2. [0° 180°] : 0° / 180° phase-shift switch
3. [UL] : UL switch (25V/50V)
4. [◄] [►] :I⊿n auto-ramp current set switch
5. test button
6. Function switch
7. LED: indicate the test lead connection
8. test lead interface
9. test lead

Note:
Above description to button is a simple instruction.
Read the operation to get a detail operation guidance.



➢ Press the red test button, if there is trip off during the process (RCD works), LCD will display trip-off time: 18ms (the trip-off time in the example), the reading will hold 3 seconds. The LCD displayed as following picture:



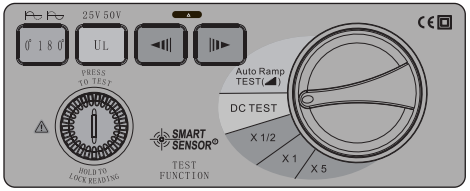
DC TEST

DC test is the direct pulsant voltage trip-off test

a. the max trip off time: 1000ms

b. the circuit breaker should trip off

➢ Connect the test lead, make sure the connection and the LED indication is correct, and then turn the function switch to “DC TEST” position, like the following picture:



➢ Set the test parameter:

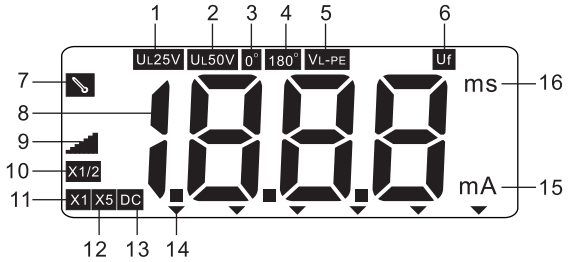
Press “ ◄||| |||► ” key to select the trip-off current you need, for example 30mA ;

Press “ UL ” key to select the trip-off voltage you need, for example U150V;

Press “ 0 180 ” key to select the phase you need, for example 0°;

The LCD displayed like the following picture:

LCD Display



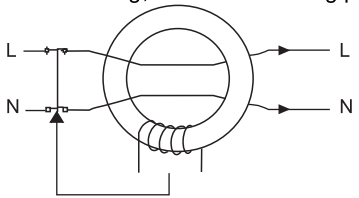
1. UL25V : set the UL voltage to 25v
2. UL50V : set the UL voltage to 50v
3. 0° : phase 0°
4. 180° : phase 180°
5. VL-PE : over-voltage indication
6. Uf : trouble-voltage indication
7. : over- high temperature indication
8. Measured value display section
9. : Auto Ramp test
10. X1/2 : non-trip-off tests
11. X1 : trip off test
12. X5 : fast trip off test
13. DC : DC voltage trip-off test
14. ▼ : switch different current level
15. mA : display trip current
16. ms : display trip time

2. Residual Current Protective device (RCD) test

RCD test knowledge

RCD, a set of switch equipment, is designed to interdict current when the leak currents reaches to a special value. Its basic act is determined by the current dispersion between phase currents which take different load and backtrack current which flow though the neutral lead.

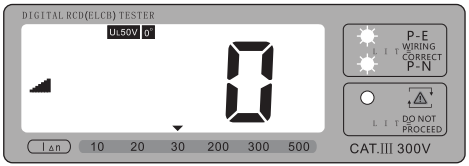
If the current dispersion higher than RCD current value, must separate main voltage when the equipment is working, like the following picture:



RCD generally have two sorts:

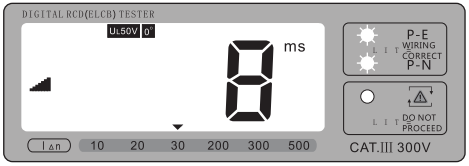
1>: in accordance with sensitivity demand to leak current wave (type: AC&A)

- Type AC: RCD works to trip off residual current in form of sine wave alternating current.
- Type A: RCD works to trip off residual current in form of sine wave alternating current (like AC) and residual direct current (DC)

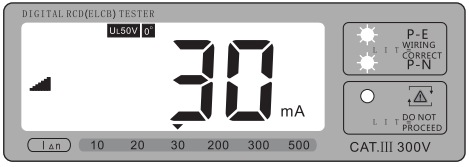


➢ Press the red test button, the trip-off current vary from 6mA to 30mA, if there is touch off during the process (RCD works), LCD will display trip-off time: 8ms (the trip-off time in the example), trip-off current: 30mA (the trip-off current in the example), the reading will blinks 3 seconds. The LCD displayed like following picture:

The trip-off time display picture:



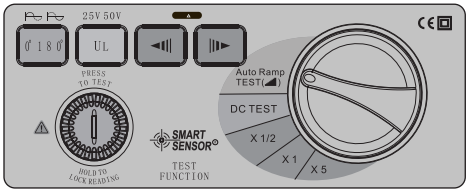
The trip-off current display picture:



Auto Ramp test

a. 20%-110% rating trip-off current (I⊿n)
b. the max trip-off time: 300msx10
c. the circuit breaker should trip off: can test trip-off time and trip-off current

➢ Connect the test lead, make sure the connection and the green LED indication is correct, and then turn the function switch to "AUTO RAMP TEST" position, like the following picture:



➢ Set the test parameter:
Press "◄|| ||►" key to select the touch-off current you need, for example 30mA ;
Press " UL " key to select the touch-off voltage you need, for example U150V ‘
Press " 0° 120° 180° " key to select the phase you need, for example 0°;
The LCD displayed like the following picture:

2>: classified in working time (type: G&S)
Type G is a general type (without obvious working time delay) for general use and application;
Type S is a selective tape (with obvious working time delay), this RCD is special designed for some electriferous equipment which must choose temporary characteristic Using RCD can make sure the equipment working normally and can protect some electriferous equipment.
They will be tested as following:

- 1 trip off time t⊿
- 2 it can also trip off current under some condition the trip-off time t⊿ is the time between RCD begin to account the trip off current I⊿n value to trip off.

RCD design the working rank of trip current as following:10mA, 20mA, 30mA, 200mA, 300mA, 500mA.

The detailed description of the standard value about the trip off time is listed in the table as following though IEC 61009(EN61009) and IEC61008 (EN 61008):

RCD TAPE	I⊿n	5 I⊿n
G	300mS (max)	40mS (max)
S	500mS (max)	150mS (max)
	130mS (min)	50mS (min)

Trip off test or fast trip off test: RCD test equipment measure the current continuously until RCD is

trip off or reach the max trip time.

⚠Caution:
There is special protect equipment that is called "adjustable RCD", the trip-off current is adjustable. The above table does not list this condition.

There is another tape of RCD that is called "tape B", it make sure trip off residual sine wave alternating current (like AC), residual direct current (DC) and sterling or close to sterling direct current. Those types are not used usually because they are exiguous or the price is very high at the market.

The trip off current I⊿n is the minimum leak current that trip off the RCD.

Auto ramp test can make sure the range which the leak current or trouble current has flowed.

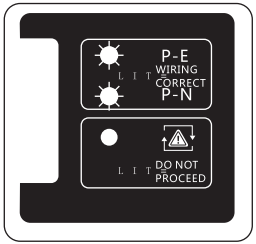
RCD detect implement startup the test current from 20% I⊿n,and then increasing it until it reach the RCD trip-off point or it reach 110% I⊿n.

Checking leak and trouble though the leak current clamp meter.

This instrument can test trip-off time t⊿ and trip-off current I⊿n.

Connect lead checking

➢Connect the instrument to the power supply, and then the green LED of P-E and P-N will light. The⚠red LED is not light, like the following picture:

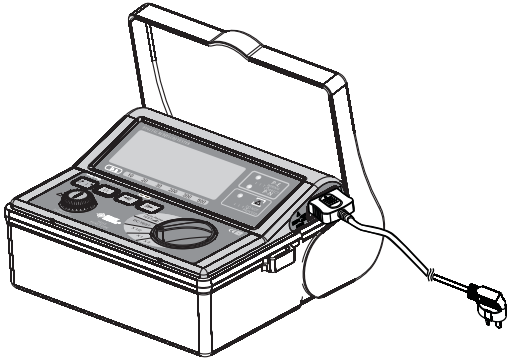


➢If the green CORRECT WIRING LED not turn on, please disconnect the test lead when the red DO NOT PROCESS LED is light, and then check if the L and N lead also the ground lead is properly connected.

3. Operation instruction

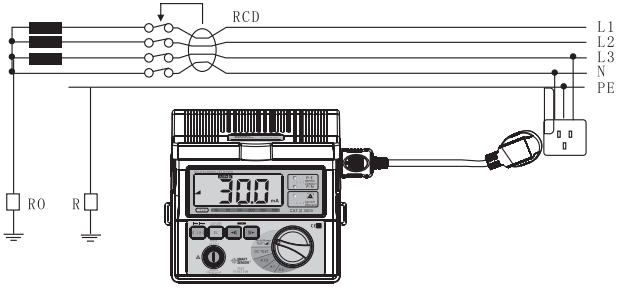
Preparation

➢ Connect the test lead to the reciprocal position at the instrument, like the following picture:

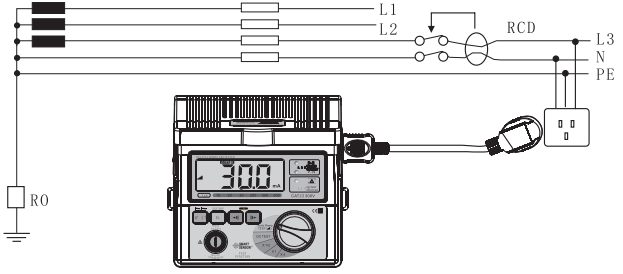


➢ Connect the test lead to the power supply socket. (The instrument is opened at this time, and the LCD begin to display).

3-phase + neutral RCD test used in the TT system, like the following picture:



Single phase RCD test used in the TN system, like the following picture:



RCD test at the OLD-TT system

⚠ Caution:

This instrument only runs the following I⊿n, but it can not make sure the veracity. The instrument dose not run other I⊿n.

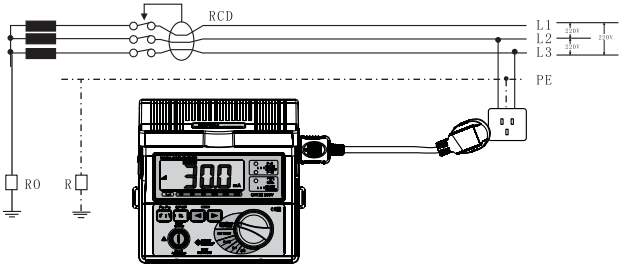
1. Position choose: AUTO RAMP test , DC test, x1/2, x1
   The selection of the reciprocal trip-off current I⊿n: 10mA, 20mA, 30mA, 200mA, 300mA, 500mA
2. Position chooses: x5
   The selection of the reciprocal trip-off current I⊿n: 10mA, 20mA, 30mA, 200mA

Old-TT system is a TT system in which the voltage between phase and phase is 220v (not 400v), the voltage between phase and ground is 127v (not 230v) and neutral lead is not used usually.

Before connecting the instrument to test, please test the voltage between phase and ground by DMM or Volmeter to make sure it is 127v (+/-10%).

⚠ Warning

If the value of the volmeter is 220v, please do not press the test button.



Connect the instrument to the system, and then check all the three lead, the CORRECT WIRE LED should light on.