xiSection One

Introduction

⚠Warning

Read this Manual carefully before use the Instrument.

Generalization

The instrument is a multifunctional earth resistance/earth resistivity tester equipped with a microcomputer.

The instrument employs digital signal settlement technology, which can draw earth measurement signals, possess features of high frequency, high accuracy and high resistance, and measure earth resistance/ earth resistivity accurately. The instrument can execute standard 3POLE and 4POLE earth resistance measurements and has 2POLE earth resistance measurement and earth resistivity calculation functions as well.

- The Instrument conforms to the following Safety Requirements:
  IEC61010-1（CAT Ⅲ 600V,POLUTION degree Ⅱ）
  IEC61557-1、5（Electronic safety requirements for low voltage distribution system below AC 1000v and DC 1500v ）
- Basic Measurement Function
  2/3/4- pole earth resistance measurement
  Earth resistivity （ρ）calculation
- Earth Resistance Measurement employs AC simulation test, 4-kind of testing frequencies（94Hz、105Hz、111Hz、128Hz）,which are selectable by hand to reduce impacts from low interference sources.
- Auxiliary Earth Resistance Measurement Function
  Testing and displaying auxiliary earth resistance.
- Warning Display Function for auxiliary earth resistance upper-limits
  Displaying warnings for inaccurate measurements due to high auxiliary earth resistances
- Auto-range Function in Resistance Measurement and OL displays for over range.
- Indication Functions for high interference voltage.
- Measurement Function for series interference voltage.

- Backlight Function to view the test results in dimly areas.
- Setting Function to release the residual resistance (Rk) on the test leads.
- Setting Function for auxiliary earth spike interval under earth resistivity measurement, setting range: 1m～30m.
- Auto-power-off function and auto-backlight-off function with set time.
- Easy-for-operation data Store/Recall Function for independent measurement data (Max.100 groups)saving in the internal storage.
- Small and sturdy structure design, easy for operation, adaptable to spot transportation and bad environment.

Open the case

Check the product to see whether it is damaged in the shipment or not. Check the materials to see whether they are the same as shown in the packing list. Keep the packing materials for late delivery.

Standard and chosen accessories supplied are listed as follows. Chosen ones are bought at purchaser's options.

Standard accessories

- 1 testing wire 6m(black)
- 1 testing wire 6m(green)
- 1 testing wire 15m(red)
- 1 testing wire 30m(blue)
- 4 auxiliary earth spikes
- 1 user's manual
- 8 1.5V (LR6)Alkaline batteries
- soft carrying bag: C

Safety warning

This Instrument has been designed, manufactured and tested according to IEC61010-1、IEC61557-1、IEC61557-5 safety requirements. This Manual contains warnings and safety rules which have to be observed by the user to ensure safe operation of the instrument and to maintain it in safe condition .Therefore, read through these operating instructions

before using the instrument.

The mark ⚠ indicated on the instrument, means that the user must refer to the related parts in the manual for safe operation of the instrument.

⚠ **Danger is reserved for conditions and actions that are likely to cause serious or fatal injury.**

⚠ **Warning is reserved for conditions and actions that are likely to cause serious or fatal injury.**

⚠ **Caution is reserved for conditions and actions that can cause injury or instrument damage.**

⚠ **Warning**

- **Read carefully and make sure well understanding of the Manual before using The instrument.**
- **Follow the instructions in the Manual whenever operating, keep the Manual in good condition for reference whenever necessary.**
- **Mis-operation may cause accidents and damages to the Instrument in testing.**

⚠ **Danger**

- **Never make measurement on a circuit in which electrical potentials exceeding AC/DC250V.**
- **Do not attempt to make measurement in the presence of flammable gasses. Otherwise, the use of the instrument may cause sparking, which can lead to an explosion.**
- **Never attempt to use the instrument if its surface or your hands are wet.**
- **Do not exceed the maximum range allowed.**
- **Do not press the PRESS TO Key before connecting the Test Leads.**
- **Never open the Battery cover during a measurement.**
- **Cut off the power and remove any measuring parts connected to the Instrument before opening the battery cover.**

⚠ **Warning**

- **Never attempt to make any measurement if any abnormal conditions, such as a broken cover or exposed metal parts are present on the Instrument and Test Leads.**
- **Replace Test Leads with new one in same specification and same electrical specification when it is broken.**

- **Do not replace batteries if the Instrument is wet.**
- **Ensure that the test leads are firmly inserted into the terminal.**
- **Ensure that the Instrument is powered-off if opening the battery cover.**

⚠ **Caution**

- **Set and ensure the Range switch to the appropriate position before making measurement.**
- **Set the Range switch to" OFF" position after use and remove the test leads.**
- **Remove the batteries if the Instrument is to be stored and will not be in use for a long period.**
- **Do not use the Instrument when mark ▭ displays.**
- **Do not use or keep the Instrument in high-temperature, high-humidity, explosive, strong electromagnetic and dewy environment or expose to direct sunlight.**
- **Do not use abrasives or solvents. Use a damp cloth with neutral detergent for cleaning the instrument.**
- **Do not store the Instrument if it is wet. Store it after it dries.**

Marks and marks

	possible danger of electronic shock
	double insulated
	earth ground

Section Two
Specification
Safety and conformity

Overload Protection	E-S、E-H terminals: AC250V/10 seconds
Legal Conformity	IEC61010-1（CAT Ⅲ 600V, POLUTION degree Ⅱ）

	IE C61010-2-032 (special requirements for hand- held current Probes) IEC61557-1 ， 5(electronic safety requirement for low voltage distribution system below AC 1000v and DC 1500v
Electromagnetic Compatibility	conforms to IEC61326-1，Group 1、Class B conforms to EC61326-1，Group 1、Class B conforms to IEC61326-1，Group 1、Class B
Surge Protection	6kV (according to IEC61010.1-2001)
Identification Mark	CE
Quality Standard	develops , designs and manufactures according to ISO 9001

General feature

Display Screen	digit: display in 2000 digits; white backlight
Operation Temperature and Moisture Range	0～40 ºC, relative moisture≤85%(no condensation)
Storage Temperature and Moisture Range	--20 ºC～60 ºC、relative moisture≤90%(no condensation)
Accuracy Required Temperature and Moisture Range	23±5ºC、relative moisture≤75%(no condensation)
Ambient Condition for Operation	Indoor, outdoor operation（no waterproof），at an altitude of 0～2,000 meter
Stored Data	100 groups
Indicator for Over-range	OL
Battery Type	eight AA 1.5V Alkaline (LR6) batteries

Low Battery	displays battery mark
Automatic Power-off	The default value is 5 minutes if no operation which is adjustable.
Closed – case Calibration	no internal adjustments needed
Battery Access Door	Battery or fuse replaceable without voiding calibration
Measurement	175（L）×110（W）×70（D）mm
Weight	about 500g
Calibration Period	One year

Measuring range and accuracy

Accuracy limits are given as:± ([% of reading] + [number of least significant digits]), warranty for one year. (Note: “number of least significant digits” means the digits increased or decreased in least significant digits)

Series interference voltage (UST)

Measuring Range	Resolution	Frequency Range	Accuracy
0.0V～20.0V	0.1V	45～400Hz Sine	5%+5

- Output Resistance about 32V.
- Measuring speed: twice every second.
- Max. overload: 250Vrms.

Measurement for residual resistance of Test Leads (Rk)

This function can be activated in 20Ω position. Range: 0.00Ω～5.00Ω.

RK value saved in 20Ω position is still valid for measuring range over 200.

Earth resistance Re (Rg at ρ measurement)

Range	Measuring Range	Resolution	Accuracy	Remark
20Ω	0.10Ω～19.99Ω	0.01Ω	2%+15	RH、RS is 500Ω Modified Rk data
200Ω	20.0Ω～199.9Ω	0.1Ω	2%+5	
2000Ω	200Ω～1999Ω	1Ω	3%+5	
20kΩ	2.00kΩ～19.99kΩ	0.01kΩ		

- Use probes conforming to IEC61557-5 when measuring current and voltage.
- Open-circuit voltage Um: Max. About 50Vpp, rectangle wave.
- Short-circuit current Im: Max.20mA, but Im×（RH +RE）< Um
- Measuring frequency : 94Hz、105Hz、111Hz、128Hz, manual selection.
- Measuring time: Typical 12 seconds.
- Measuring error for RH, RS : typical (RH+RS+RE) 10%
- Additional error for RH MAX or RS MAX: 3%+10
- Series interference voltage: in 400 Hz、60 Hz、50 Hz、$16\frac{2}{3}$ Hz system frequency or input series interference voltage by DC voltage through E and S terminals. The mean square root value of r.m.s. in series interference voltage is 3V. (DC is excluded in 20Ω range)
- Additional error for 3V series interference voltage:5%+10.
- After measuring the probe resistance, auxiliary earth resistance and earth resistance, the Instrument will display a Warning notice to indicate over high RS or RH value if the measurement error is higher than 30% when considering impacting conditions.

Earth Resistivity (ρ)

Range	Measuring Range	Resolution	Accuracy
20Ω·m	0Ω·m～19.99Ω·m	0.01Ω·m	depends on RG **ρ**＝2×π×a×RG
200Ω·m	20.0Ω·m～199.9Ω·m	0.1Ω·m	
2000Ω·m	200Ω·m～1999Ω·m	1Ω·m	

20KΩ·m	2.00KΩ·m～19.99KΩ·m	0.01KΩ·m	
200KΩ·m	20.0KΩ·m～199.9KΩ·m	0.1KΩ·m	
2000KΩ·m	200KΩ·m～3768KΩ·m	1KΩ·m	
● All technical data are valid listed in earth resistance. ● Interval between earth spikes : a＝1.0m～30.0m.			

The maximum operation error within the measurement range should not exceed ±30% of the measured basic value, which is shown in the following table. The operation errors are available for specified operation conditions designated in IEC61557-1 and the following conditions:

- Series interference voltage: in 400 Hz、60 Hz、50 Hz、$16\frac{2}{3}$ Hz system frequency or input series interference voltage by DC voltage through E （ES）and S terminals. The mean square root value of r.m.s. in series interference voltage is 3V.
- Resistance of auxiliary earth electrode and probe: 4kΩ+100×RE≤50kΩ

Basic Error or Impact Volume	**Reference Range Specified Working Range**	**Mark**	**Related Requirements and Tests in IEC61557**	**Testing Type**
basic error	Reference range	A	6.1 in Section 5	R
power voltage	Limit value specified by the Manufacture	E2	4.2 and 4.3 in Section 1	R
temperature	0ºC and 35ºC	E3	4.2 in Section 1	T
Series interference voltage	See 4.2 and 4.3	E4	4.2 and 4.3 in Section 5	T

Resistance of auxiliary earth electrode and probe	4kΩ+100 RE but≤50kΩ	E5	4.3 in Section 5	T
Operation error	$B=\pm(\lvert A \rvert +1.15\sqrt{E_2^2+E_3^2+E_4^2+E_5^2})$		4.3 in Section 5	R
A= basic error En＝changing volume R＝routine testing T＝type testing		$B[\%]=\pm\frac{B}{\text{基值 basic value}}\times 100\%$		

Section Three
Instrument layout
Instrument body

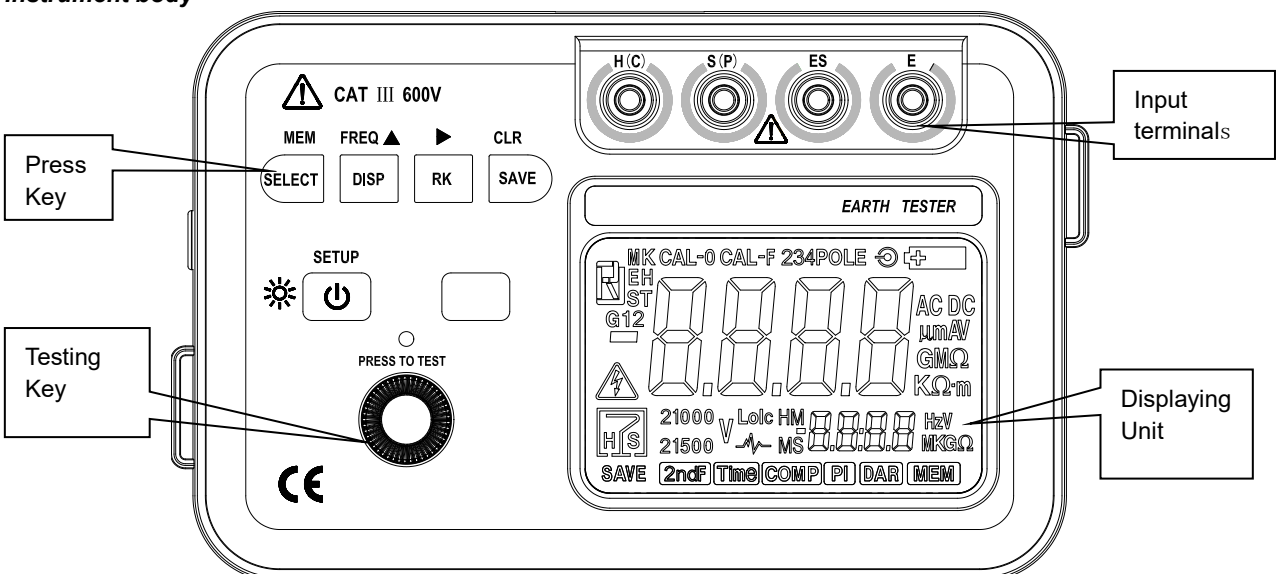


Figure 1

Terminal

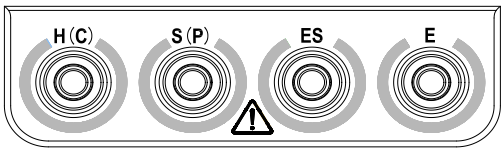


Figure 2

Terminals	Function Illustration
H(C)	H terminals (C terminals) - Blue
S(P)	S terminal (P terminal)- red
ES	ES terminal - green
E	E terminal - black

Press key

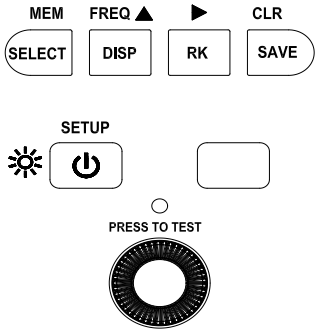
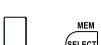


Figure 3

Press Key	Illustration
SETUP ☼ ⏻	Power-on or turning on the backlight. Press for less than 2 seconds to turn on or off the backlights; press for more than 2 seconds to power off.
MEM SELECT	Press to select testing functions: 4 Pole, 3 Pole, 2 Pole, earth resistivity (ρ); Default Mode: 4 -Pole method.
FREQ▲ DISP	Under earth resistance measurement / earth resistivity measurement function. Press to select displayed data in Main Display Screen: Under 4 Pole mode: RE→RH→RS→UST→RK→RE, default display RE; Under 3 Pole mode: RE→RH→RS→UST→RK→RE, default display RE; Under 2 Pole mode: RE→UST→RK→RE, default display RE;

	Under earth resistivity ρ : ρ→RG（RE)→RH→RS→UST→RK→IH (earth spike interval) →ρ; Default setting displays ρ; Under Setting function: alter the setting value.
	Under earth resistance measurement: press to enter into /exit from RK function; Under MEN : press to next data; Under Setting function: right shifts of setting position.
	Under earth resistance measurement / earth resistivity measurement function: press to save data; Under RK function: press to save data; clean RK value for 0.00Ω when pressing for more than 2 seconds; Under MEN : press to delete data; Under Setting function: press to save setting data.
	Press to start measurement once.
	Press to select “Yellow Key” function, the Screen displays  in the left corner. Yellow Key functions are illustrated in the following part.
	Enter into/ exit from the Instrument Setting function
	Recall/ exit from data in the saving part
	alter testing frequency: 128Hz→111Hz→105Hz→94Hz→128Hz, default value: 128Hz.

Display Unit

The Notes and Warnings for the Instrument operation are displayed in all kinds of marks and information. Here is the detailed illustration for Marks and Information.

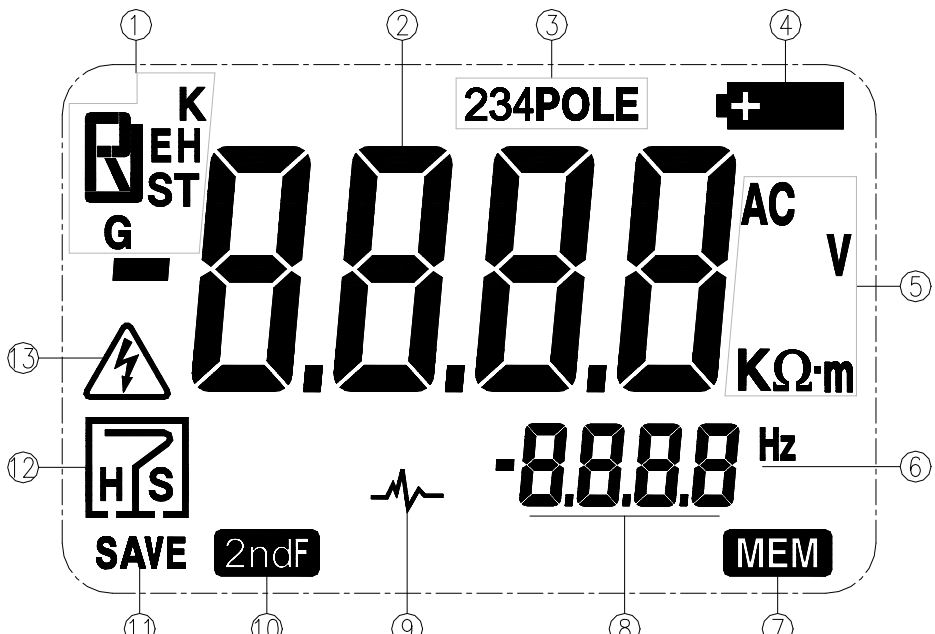


Figure 4

No.	Mark, Information	Illustration
1		Main display function: RE、RH、RS、RG、RK、UST
2		Main screen
3	234POLE	Earth resistance testing methods: 2POLE、3POLE、4POLE
4		Low battery mark
5	AC V KΩ·m	Unit in the Main Display Screen AC voltage : V Resistance unit: Ω（ohm）、KΩ（thousand ohms ） Resistance rate unit: Ω·m（ohm·meter）、KΩ·m（thousand ohms· meter）
6	Hz	Auxiliary display unit : hertz
7		Recall/delete saving data
8		Auxiliary screen

9		Noise mark : display when UST⩾5V
10		Select Yellow Key function
11	SAVE	Data saving
12		RH is higher than limits
		RS is higher than limits
		Both RH and RS are higher than limits
13		High voltage mark , display when UST⩾20V

Section Four
Preparation for testing
Power-on

To turn on the Instrument, press  key to connect with the power.

To turn off the Instrument, press  key for more than 2 seconds to cut the power.

When being powered-on, the Instrument starts inner-self diagnose and displays power-on mark firstly, and then

undertakes relevant operations.

⚠ Note

Power-on: to guarantee correct power-on operation, cut off the power for 5 seconds before restarting.

Auto- power- off

The factory default sets that the Instrument will automatically power off if no operation is conducted within 5 minutes.

Automatically power off function can be set by Users. (See “Instrument Settings”)

Turn on the backlight

After powering on, press 

key for once to turn on the backlight, repress 

key to turn off the backlight.

Auto-turn-off backlight

Users can set backlight time (See “Instrument Settings”)

The default value is 30 seconds; the instrument will turn off the backlight if Users does not turn off the backlight within 30 seconds.

The auto-turn- off function is prohibited if the setting is 0.

Low battery display

Mark  displays in the upper-left Main Screen after power-on means low battery, please replace with new ones (recharge if the batteries are chargeable)and then use.

⚠Warning

To avoid electrical shock hazard or personnel injury due to wrong readings, replace the batteries as soon as possible if the LED displays  mark; or charge the batteries if they are chargeable.

Do not start testing function in low battery state.

Residual resistance （Rk）on the Test Leads

Composition of the measurement value: R display = R measurement - RK

The Rk default value is 0.00Ω, and can be adjusted between 0.00～5.00Ω through measurement.

Rk residual sequence undertakes as follows:

Step one: press key to select testing method: four- pole, three-pole, or 2- pole.

Step two: connect the Test Leads;

See relevant part for different measurement methods for test leads connections.

Rk residuals can not be obtained when mark displays.

Step three: press Key to enter into Rk residual resistance mode, the Main Screen displays Rk mark in the upper-left part, and in the lower-right part.

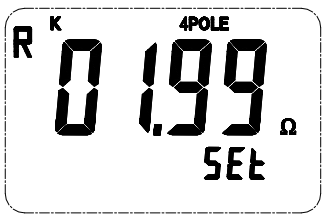


Figure 5

Step four: press TEST Key to measure Rk;

Step five: press CLR SAVE Key to save Rk value, and the Main Screen displays SAVE mark in the lower-left part.

Note: the Rk value will be saved in the Instrument after powering off.

The residual resistance value is valid in all resistance range;

The Main Screen displays OL if Rk is more than 5.00Ω (see figure 6);

At this time, press CLR SAVE Key to display "L inE" mark indicating no saving.

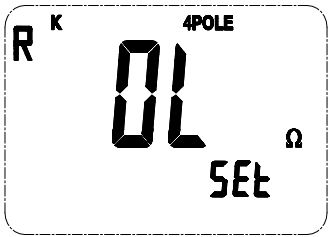


Figure 6

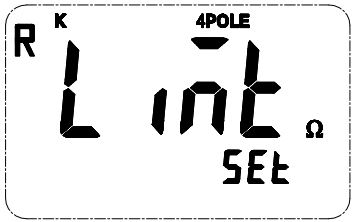


Figure 7

To clean the saved Rk value, press CLR SAVE Key for more than 2 seconds in Rk compensation interface, and the Main Screen displays "CLr"mark, repress to clean the Rk compensation value.

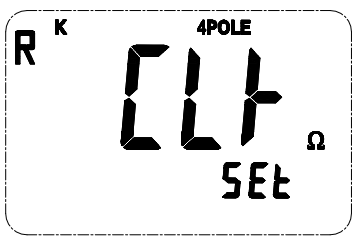


Figure 8

Rk value is "0.00Ω" after cleaning.

Step six: press RK key to exit from Rk compensation interface.

Series interference voltage testing function

This measurement function detects the possible interference voltage and its frequency

Before undertaking earth resistance measurement, the function is automatically activated in every testing method. If

exceeding the preset limit value which indicates over-high interference voltage, the measurement will be automatically prohibited

When Ust≥20V, the testing result interface displays "⚠" warning, and prohibits measurement. When Ust>50V, the testing result interface displays "OL" as well.

Auxiliary earth resistance testing Function

Auxiliary earth resistance （Rh、Rs）value measurement and display function.

When Rh or Rs value exceeds 4kΩ+100×RE or 50kΩ(no matter higher than anyone) , the Main Screen displays or  or warning message.

When Rh or Rs value exceeds 50kΩ, the result "OL" displayed on the Main Screen.

These parameters are measured automatically at auxiliary earth resistance measurements, and can be recalled on the Main Screen.

Note: Rh and Rs stand for Auxiliary Earth Pole H(C) and the Auxiliary Earth Resistance of S(P) respectively.

Connection of Earth Test Leads and Auxiliary Earth Spikes

Connect the Earth Test Leads to the connectors on the instrument firmly. Otherwise, a contact failure occurs may result in measurement error. See individual measurement for detailed connection methods for reference.

(Make sure the auxiliary earth spike goes beyond the fall-of-potential range of earthed electrode and auxiliary earth electrode. Leave 20m or more intervals between earth electrode, auxiliary earth electrode and auxiliary earth spikes can satisfy the requirement.)

Section Five

Starting measurement

⚠ **Danger**

No voltage should be applied between the measuring terminals at earth resistance measurements!

Earth Resistance Measurement

Precise measurement (3 pole)

This is a standard method to measure earth resistances. The measured earth resistances exclude auxiliary earth resistances but the resistances on the E terminal are contained. Terminals: E、S、H terminals.

Test leads are connected to the E, S and H terminals respectively.

Auxiliary Earth Spike: 2 pcs, connect to the S , H terminals respectively.

（1）Press MEM SELECT key to select measurement method: 3 Pole (the Main Screen displays 3POLE in the upper part);

（2）Press FREQ▲ DISP key to select measurement frequency (display in auxiliary display part)

（3）Residual resistance of Rk

① Firmly insert each plug of 3 test leads (black, red, blue) to the corresponding terminals E,S and H on the instrument respectively.

② Engage 3 Alligator clips to short-circuit all of them.

③ Save the Rk values with reference to“ the residual resistance on the Test Leads”.

（4） Connection of Auxiliary Earth Spikes and Test Leads(See figure 9)

Stick the Auxiliary Earth Spikes S and H into the ground deeply which should be aligned from the earthed equipment under test. Connect the black Test Lead to the earthed equipment under test, the red Test Lead to the Auxiliary Earth Spike S and the blue Test Lead to the Auxiliary Earth Spike H in sequence.

（5） Earth resistance measurement

Press TEST key after connecting the Test Leads;

The Main Screen displays “- - - -” message;

The measured earth resistances RE value and related information are displayed on the Main Screen when the measurement is finished;

Press FREQ▲ DISP key to read RH, RS, UST and RK values.

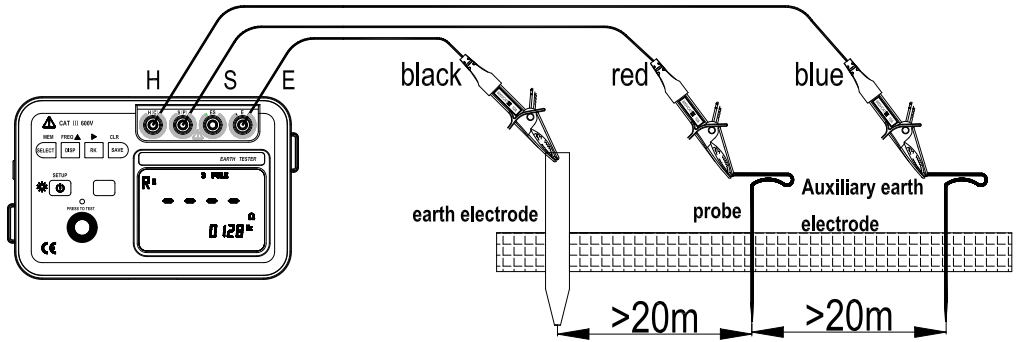


Figure 9

（6）Press CLR SAVE Key to save measurement results (see section six “saving and reading of the measurement results”)

⚠ Note

- The readings may not correct when the auxiliary earth resistance is too high. Stick the Auxiliary Earth Spikes S and H in the moist part of the soil. Ensure that all parts are well connected.
- *Give enough water where the spikes have to be stuck into the dry, stony or sandy part of the earth so that it may become moist.*
- *In case of concrete, lay the Auxiliary Earth Spike down and water it, or put a wet cloth etc. on the spike when making measurements.*
- The measurement result may be incorrect if interference voltage is higher than 5v, and the noise mark “ ” displays.
- When message or or is displayed, it means bad connection of the Test Leads, or warnings for failure

of correct measurement due to high value of earth resistance compared with auxiliary earth resistance.

⚠ Danger

The measurement cannot be made when a warning message ⚠ appears on the Main Screen. Voltages more than 20V exist between the instrument terminals.

Precise measurement (4 POLE)

The“ ES” Terminal is also used with the other terminals used at the 3-pole Precise measurements. In this case, more precise results can be obtained because auxiliary earth resistances of the measured earth resistances are excluded; moreover, resistance of the Test Leads connected to the E Terminal can be canceled.

Terminals to be used: E, ES, S, H Terminals

Test Leads: connect to the E, ES, S, H Terminals (the alligator clip of ES Test Lead should be connected to the same part of the alligator clip of earthed equipment under test where the E Test Lead is connected.)

Auxiliary Earth Spike: 2 pcs connect to S and H Terminals respectively

（1）Press MEM SELECT key to select measurement method: 4-Pole (the Main Screen displays 4POLE in the upper part);

（2）Press FREQ▲ DISP Key to select measurement frequency(display in auxiliary display part);

（3）Residual resistance of Rk

① Firmly insert each plug of 4 test leads (black, green, red and blue) to the corresponding terminals E, ES, S and H on the instrument respectively;

②Engage 4 Alligator clips to short-circuit all of them;

③Save the Rk values with reference to “the residual resistance on the Test Leads”.

Note: the residual value is valid in earth resistivity measurement.

（4） Connection of Auxiliary Earth Spikes and Test Leads(See figure 10)

Stick the Auxiliary Earth Spikes S and H into the ground deeply which should be aligned from the earthed equipment under test. Connect the black Test Lead to the earthed equipment under test, the red Test Lead to the Auxiliary Earth Spike S and the blue Test Lead to the Auxiliary Earth Spike H in sequence. Connect the green wire from ES terminal and the black wire from E terminal to the same earthed equipment.

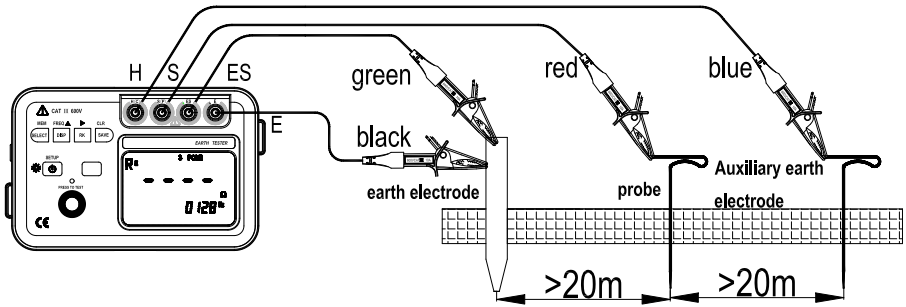


Figure 10

（5）Earth resistance measurement

Press TEST Key after connecting the Test Leads.

The Main Screen displays "- - - -" message.

The measured earth resistances RE value and related information are displayed on the Main Screen when the measurement is finished.

Press FREQ DISP Key to read RH, RS, UST and RK values.

（6） Press CLR SAVE Key to save measurement results (see section six "saving and reading of the measurement results")

⚠Notes

- The readings may not correct when the auxiliary earth resistance is too high. Stick the Auxiliary Earth Spikes S and H in the moist part of the soil. Ensure that all parts are well connected.
- Give enough water where the spikes have to be stuck into the dry, stony or sandy part of the earth so that it may become moist.

- In case of concrete, lay the Auxiliary Earth Spike down and water it, or put a wet cloth etc. on the spike when making measurements.
- The measurement result may be incorrect if interference voltage is higher than 5v, and the noise mark "⚡ "displays.
- When message or or is displayed, it means bad connection of the Test Leads, or warnings for failure of correct measurement due to high value of earth resistance compared with auxiliary earth resistance.

⚠ Danger

The measurement cannot be made when a warning message ⚠ appears on the Main Screen. Voltages more than 20V exist between the instrument terminals.

Simplified measurement (2-pole)

Use this method when the Auxiliary Earth Spike cannot be stuck.

In this method, an existing Earth Electrode with a low earth resistance, such as a metal water pipe, a common earth of a commercial power supply and an earth terminal of a building, can be used with the 2-Pole method.

Terminals to be used: E and H Terminals

Test Leads: E and H Terminals respectively

Auxiliary Earth Spike: None is used

（1）Press MEM SELECT key to select measurement method: 2-Pole (the Main Screen displays 2POLE in the upper part);

（2）Press FREQ▲ DISP key to select measurement frequency (display in auxiliary display part);

（3）Residual resistance of Rk

①Firmly insert each plug of 2 test leads (black and blue) to the corresponding terminals E and H on the instrument respectively;

②Engage 2 Alligator clips to short-circuit all of them;

③Save the Rk values with reference to "the residual resistance on the Test Leads".

（4）Connection of Auxiliary Earth Spikes and Test Leads(See figure 11)

The E and H terminals are connected to earthed equipment under test and auxiliary earth equipment respectively.

（5）Measurement for earth resistance

Press TEST key after connecting the Test Leads.

The Main Screen displays “- - - -” message.

The measured earth resistances RE value and related information are displayed on the Main Screen when the measurement is finished.

Press key to read RH, RS, UST and RK values.

Note: the residual value is valid in earth resistivity measurement.

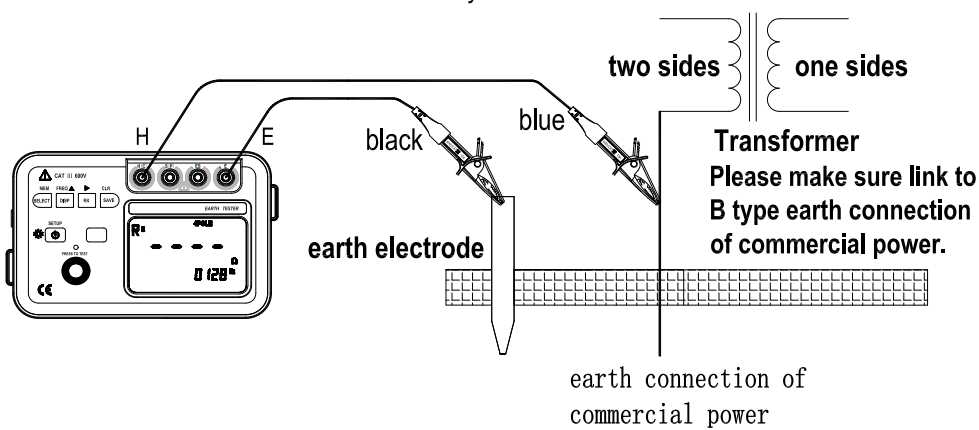


Figure 11

⚠ Note

- The results in simplified measurement include auxiliary earth resistance. Thus, the displayed value may cause error if the auxiliary earth resistance is over high.
- The measurement result may be incorrect if interference voltage is higher than 5v, and the noise mark

“ ”displays.

⚠ Danger

The measurement cannot be made when a warning message ⚠ appears on the Main Screen. Voltages more than 20V exist between the instrument terminals.

Earth resistivity（ρ）measurement

Earth resistivity indicates the geology and physical quantity of the calculated and designed earthed system. The following measurement procedure employed is developed by F.Wenner used to measuring earth resistivity.

Earth resistivity is calculated according to the following formula:

$\rho = 2\pi aR$

ρ：mean value of earth resistivity （Ω · m）.

a：intervals between earth spikes （m）.

R：measured resistance（Ω）

Terminals to be used: E, ES, S, H Terminals

Test Leads: connect to the E, ES, S, H Terminals.

Auxiliary Earth Spike: 4 pcs

Measurement method is shown as follows:

（1）Press SELECT key to select measurement method: Earth Resistivity;

（2）Press DISP key to select measurement frequency (display in auxiliary display part);

（3）Connection of Auxiliary Earth Spikes and Test Leads(See figure 12)

Stick the four Auxiliary Earth Spikes into the ground deeply. They should be aligned at the same interval of “a”. The depth should be 5% or less of the interval “a” between the spikes (e.g. when the earth spike interval is 5 meters, the earthed depth should be less than 25cm). If the Spikes stuck too deep, it may result in inaccurate earth resistivity measurement. The interval “a” should fall within the scope of 1.0m～30.0m.

Starting from the E,ES,S,H terminals of the Instrument, connect the Test Leads （black）（green）（red）（blue）in sequence of with the Earth Spike.

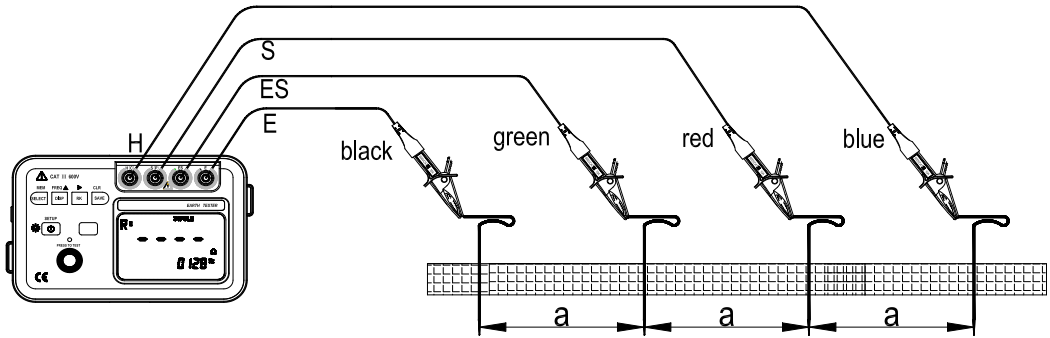


Figure 12

（4）Setting for the Auxiliary Earth Spike

See “Instrument Settings” for detailed settings.

（5）Press TEST key to restart measurement.

The Main Screen displays “- - - -” message.

The measured earth resistivity value and related information are displayed on the Main Screen when the measurement is finished.

Press key to read RH, RS, UST and RK values.

⚠ Note

- The measurement result may be incorrect if interference voltage is higher than 5v, and the noise mark “ ” displays.
- When message or or is displayed, it means bad connection of the Test Leads, or warnings for failure of correct measurement due to high value of earth resistance compared with auxiliary earth resistance.

⚠ Danger

The measurement cannot be made when a warning message ⚠ appear on the Main Screen. Voltages more

than 20V exist between the instrument terminals.

Section Six

Store/recall the measurement results

The instrument can store xx measurement results.

How to save the data

When an earth resistance measurement is finished, press the“ CLR SAVE ” key. Then the Main Screen displays”SAVE” in the lower left part, the memory number in the auxiliary part add one automatically, and the measurement result is saved successfully. The stored dada are parameters of all measurement.

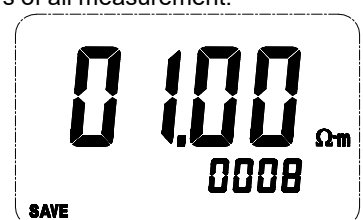


Figure 13

⚠ Note

- Please undertake “cancel data” operation for first use of storing function.
- Data cannot be saved while the Low Battery Mark is displayed on the Main Screen.
- When the saved data reaches to the max limit of the capacity, Full” is displayed on the auxiliary part of the Main Screen and no more data can be saved.

How to recall the saved data

The saved data can be read on the Main Screen according to following sequence.

⚠ Warning

To avoid electrical shock, remove the Test Leads off in MEN function.

（1）Remove the Test Leads.

（2）Press  key to enter into MEM function. When the Main Screen displays MEM in the lower right part, the Instrument will read the last record in default setting.

（3）Press  key to recall next data; press  key to recall the remain contents of present data.

Note: when no data saved, the Main Screen displays ————, the memory number in the auxiliary part is 0.

（4）Press  key to exit from the MEM function.

How to delete the data

The saved data can be ***delete*** on the Main Screen according to following sequence.

⚠ Warning

To avoid electrical shock, remove the Test Leads off in MEN function.

（1）Remove the Test Leads.

（2）Press  key to enter into MEM function. When the Main Screen displays MEM in the lower right part, the Instrument will read the last record in default setting.

（3）Press  key, the Main Screen displays mark I to enquire whether to delete data or not. For YES, repress  key, and the Main Screen displays I mark to ensure deleting data in this part. The Main Screen shows mark “----” after 1 second, and the buzzer beeps a sound to indicate finishing deletion; For NO, press any other key to cancel deletion work.

（4）Press  key to exit from the MEM function.

Section Seven

Instrument setting

To enter into instrument setting function, please power on the Instrument first and then press ☐✱ SETUP key.

Under setting mode, the Auxiliary Screen displays set items; the Main Screen shows factory default value. Press MEM SELECT key to alter setting; press CLR SAVE key to save set value (mark SAVE displays in the lower left part, indicating the set item has been saved)

When selecting the last item, repress ☐✱ SETUP key to exit setting mode.

Setting Items		Function	Default Value
APoF	auto-power-off	Setting range is 0～90 minutes, press RK key to select blinking position , press RK key to set flicker bit, press key to set flicker digits; Setting as 0 indicating cancel auto- power- off function.	5 minutes
bLoF	backlight time setting	Setting range is 0～90 minutes, press RK key to select blinking position , press RK key to set flicker bit, press key to set flicker digits; Setting as 0 indicating cancel auto- power- off function.	5 minutes
LEnJ	earth spike interval	Setting range is 1.0～30.0m, press RK key to select blinking position , press RK key to set flicker bit, press FREQ DISP key to set flicker digits.	10.0m 10.0 meters
bEEP	beeper	ON or OFF , press FREQ DISP key to select	ON
FACt	Back to factory default setting	Press CLR SAVE key, the Main Screen displays SAVE in the lower left part, the Instrument return back to default setting.	- - - - -

Section Eight

Instrument maintenance

This section provides some basic maintenance procedures. Repair, calibration, and servicing not covered in this manual must be performed by qualified personnel. For maintenance procedures not described in this manual, contact a Victor's Service Center.

General maintenance

Periodically wipe the case with a damp cloth and detergent; do not use abrasives or solvents.

- Take out the batteries if the meter won't be used for a long time.
- Dirt or moisture in the terminals can affect readings.

Clean the terminals as follows:

（1）Turn the Meter off and remove all test leads.

（2）Shake out any dirt that may be in terminals.

（3）Soak a new swab with alcohol. Clean each terminal with the swab.

Replacing the batteries

The Meter is powered by eight AA batteries (IEC LR6).

⚠ Warning

To avoid electrical shock or personal injury:

- Remove test leads from the meter before opening the battery door.
- Close and latch the battery door before using the meter.

⚠ Note

- The new and old Batteries can not be mixed.
- Make sure the battery's odes are in accordance with the marks illustrated in battery pool when replacing them.
- Take out the batteries if the meter won't be used for a long time.
- Dispose the old batteries in accordance with the local law.

Appendix

Principle of Earth Resistance Measurements

This instrument makes earth resistance measurements with fall-of-potential method.

AC generator G generates current I through earth electrode E (earth resistance RE) and auxiliary earth electrode (auxiliary earth electrode RH).

Voltage UE goes through earth resistance RE, the voltage inspects and measures by Spike S. In the 3-wired circuit, the Instrument Plug E and Es are interlinked together. In 4-wired circuit, use another cable to connect Plug Es with earth electrode. The voltage drop of the cable between Plug E and earth electrode is not used for measurement in this method. The impact of probe resistance RS is negligible within certain limit range due to high impedance in the voltage measurement circuit.

Thus, the earth resistance can be calculated by:

$$R_E = \frac{U_{Meas}}{I}$$

And it is irrelevant with auxiliary earth electrode resistance RH. The Generator runs in frequency between 70-140Hz.

It should keep intervals for less than 5Hz with 16 2/3、50 or 60Hz and some standard frequency of their harmonic.

Principle of Earth Resistivity (ρ) Measurements

Earth resistivity indicates the geology and physical quantity of the calculated and designed earthed system. The following measurement procedure employed is developed by F.Wenner used to measuring earth resistivity.

Earth resistivity is calculated according to the following formula:

$\rho = 2\pi aR$

ρ：mean value of earth resistivity （Ω · m）.

a： intervals between earth spikes （m）

R： $R = \frac{U_{Meas}}{I}$ measured resistance（Ω）

Notice of the Manual

- The present operation instruction is subject to change without notice.
- The content of the operation instruction is regarded as correct. Whenever any user finds its mistakes, omission,

etc., he or she is requested to contact the manufacturer.

- The present manufacturer is not liable for any accident and hazard arising from the customer misuse or inadvertent operation.
- The functions described in this operation instruction should not be used as grounds to apply this product to a particular purpose.