

Section 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
Earth voltage measurement
3/4- pole earth resistance measurement
Earth resistivity (ρ) calculation
- Auto-range Function in Resistance Measurement and OL displays for over range.
- 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.
- For comparison test, the limit value 'Pass/Fail(\checkmark / \times)' can be preset to evaluate the measurement result and give an audio alarm.

- Auto-power-off function and auto-backlight-off function with set time.
- 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 5m(black)
- 1 testing wire 5m(green)
- 1 testing wire 15m(red)
- 1 testing wire 10m(yellow)
- 4 auxiliary earth spikes
- 1 user's manual
- 8 1.5V (LR6) Alkaline batteries
- soft carrying bag:C440000
- 1Hand rope

Optional accessories (additional cost required): power adapter (DC12V)(P070000-00)

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, POLLUTION 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, design and manufactures according to ISO 9001

General feature

Display Screen	digit: display in 2000 digits; white backlight
Operation Temperature and Moisture Range	0~40 °C, relative moisture≤85%(no condensation)
Storage Temperature and Moisture Range	--20 °C~60 °C,relative moisture≤90%(no condensation)

Accuracy Required Temperature and Moisture Range	23±5°C, relative moisture≤75% (no condensation)
Ambient Condition for Operation	Indoor, outdoor operation (no waterproof) ,at an altitude of 0~2,000 meter
Indicator for Over-range	Voltage: OL; Earth resistance: > 1999
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	178 (L) ×110 (W) ×59 (D) mm
Weight	about 500g
Calibration Period	One year

Measuring range and accuracy

Accuracy limits are given as: \pm ([% 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)

Earth voltage (*E.V*)

Measuring Range	Resolution	Frequency Range	Accuracy
0.00V~50.00V	0.01V	45~200Hz Sine	2%+5
<ul style="list-style-type: none">● Output impedance: 10MΩ.● Measurement speed rate: about 2 times / s● Max. overload: 250Vrms.			

Measurement for residual resistance of Test Leads (*Rk*)

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

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

Earth resistance *Re* (*Rg at p measurement*)

Range	Measuring Range	Resolution	Accuracy	Remark
20 Ω	0.10 Ω ~19.99 Ω	0.01 Ω	2%+3	When the resistance is less than 2 Ω , the error will increase by 0.2 Ω . RH,RS is 500 Ω Modified Rk data.
200 Ω	20.0 Ω ~199.9 Ω	0.1 Ω	2%+3	
2000 Ω	200 Ω ~1999 Ω	1 Ω	2%+3	

- Use probes conforming to IEC61557-5 when measuring current and voltage.
- Open-circuit voltage U_m : Max. About 50Vpp, rectangle wave.
- Short-circuit current I_m : Max.2.80mA.
- Measuring time: Typical 2 seconds.
- Measuring error for RH, RS: typical (RH+RS+RE) 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 20 Ω range)
- Additional error for 3V series interference voltage:5%+10.

Earth Resistivity (ρ)

Range	Measuring Range	Resolution	Accuracy
20 $\Omega \cdot m$	0 $\Omega \cdot m \sim 19.99\Omega \cdot m$	0.01 $\Omega \cdot m$	depends on RG $\rho = 2 \times \pi \times a \times RG$
200 $\Omega \cdot m$	20.0 $\Omega \cdot m \sim 199.9\Omega \cdot m$	0.1 $\Omega \cdot m$	
2000 $\Omega \cdot m$	200 $\Omega \cdot m \sim 1999\Omega \cdot m$	1 $\Omega \cdot m$	
20K $\Omega \cdot m$	2.00K $\Omega \cdot m \sim 19.99k\Omega \cdot m$	0.01k $\Omega \cdot m$	
200K $\Omega \cdot m$	20.0K $\Omega \cdot m \sim 376.8k\Omega \cdot m$	0.1k $\Omega \cdot m$	

- All technical data are valid listed in earth resistance.
- Interval between earth spikes : a = 1.0m \sim 30.0m.

The maximum operation error within the measurement range should not exceed $\pm 30\%$ 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: $4k\Omega + 100 \times RE \leq 50k\Omega$

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	0°C and 35°C	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	$4k\Omega + 100 RE$ but $\leq 50k\Omega$	E5	4.3 in Section 5	T
Operation error	$B = \pm (A + 1.15 \sqrt{E_2^2 + E_3^2 + E_4^2 + E_5^2})$		4.3 in Section 5	R

A= basic error
En=changing volume
R=routine testing
T=type testing

$$B[\%]=\pm \frac{B}{\text{basic value}} \times 100\%$$

Section Three
Instrument layout
Instrument body

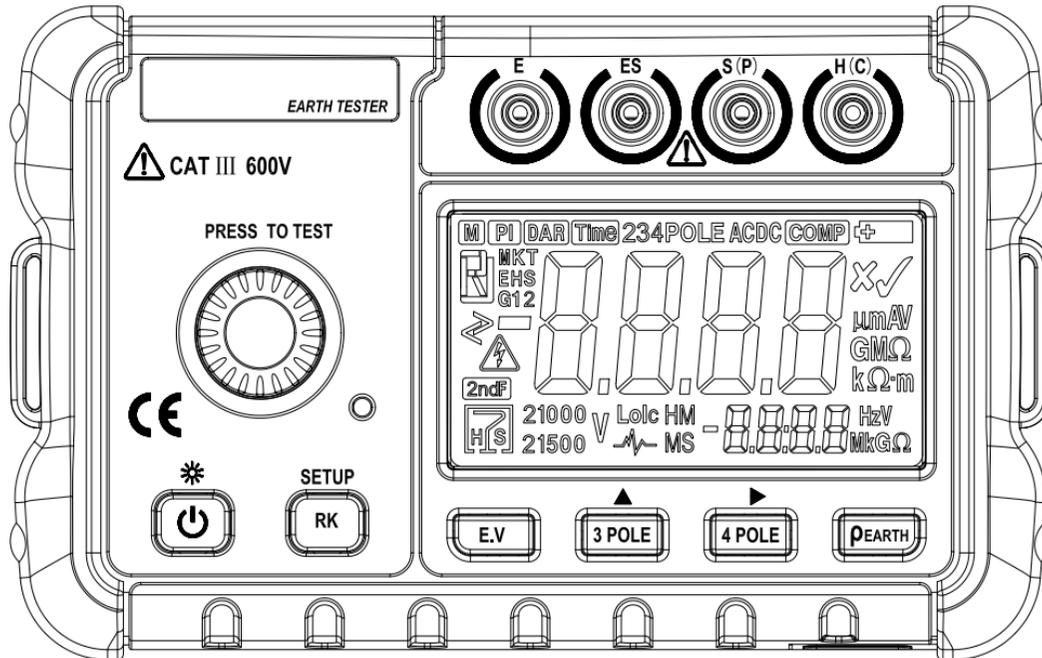


Figure 1

Terminal

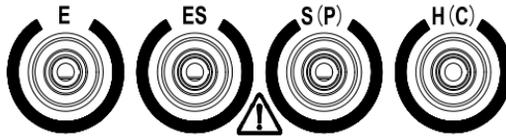


Figure 2

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

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.

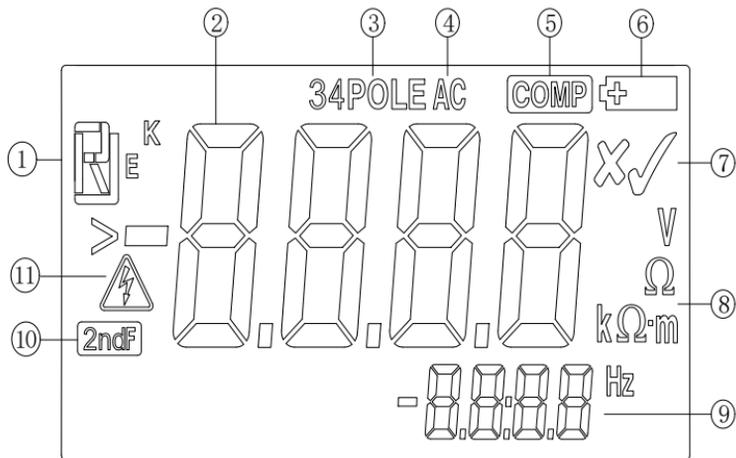


Figure 3

No.	Mark, Information	Illustration
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1		Main display function: RE, RG, RK
2		Main screen
3	34POLE	Earth resistance testing methods: 3POLE,4POLE
4	AC	AC
5	COMP	compare
6		Low battery mark
7		Fail / Pass
8		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)
9		Auxiliary screen
10		Select Yellow Key function
11		High voltage mark , display when $UST \geq 20V$

Press key

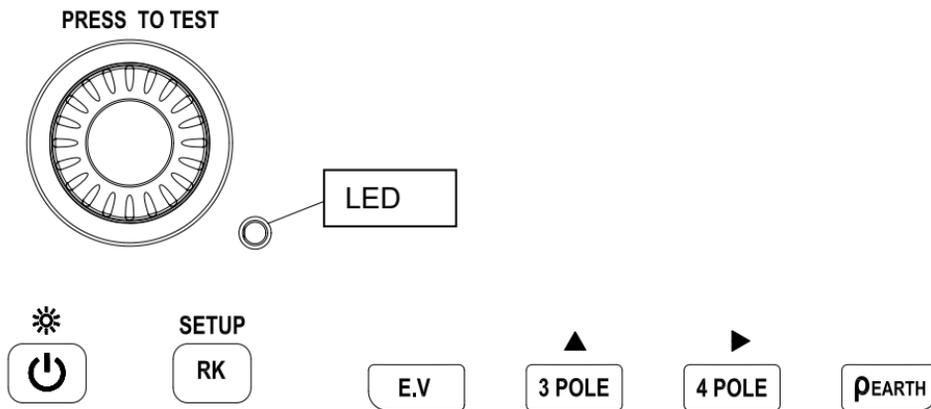


Figure 4

Press Key	Illustration
	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.

	<p>Under earth resistance measurement: press to enter into /exit from RK function; Under Setting function: press for more than 2 seconds to enter/short press this key to exit the instrument setting function</p>
	<p>Press this button to select the ground voltage measurement function. Under Setting function: Press this button to change the settings.</p>
	<p>Press this button to select the measurement function of 3-pole method. Under Setting function: Press this button to change the setting value;</p>
	<p>Press this button to select the measurement function of 4-pole method. Under Setting function: Press this button to set the bit to move to the right.</p>
	<p>Press this button to select the soil resistivity measurement function. Under Setting function: press to save setting data.</p>
	<p>Press to start measurement once.</p>

Use the power adapter

Open the soft rubber door on the side of the instrument, and insert the special power adapter of the instrument into the power socket (the instrument must be turned off when inserting or pulling out the special power adapter; It is best to remove the battery when using a special power adapter).

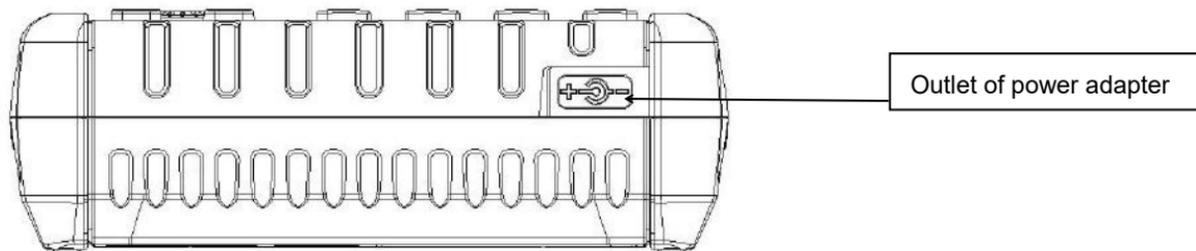


Figure 5

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 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   or   key to select testing method: 3- pole or 4-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 6

Step four: press TEST Key to measure Rk;

Step five: Press  key to save the Rk value and exit the Rk function.

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 7);

At this time, press  key to exit the Rk function without saving the Rk value.



Figure 7

To clear the saved Rk value, please restore the factory settings (see 'Instrument Settings'). The cleared Rk value is

'0.00Ω'.

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 5-10m between earth electrode, auxiliary earth electrode and auxiliary earth spikes can satisfy the requirement.)

Use the COMPARE (comp) function

Start the comparison test function to preset the limit 'pass/fail (✓/✗)' to evaluate the measurement results and give an audio alarm.

The function of comparison test is only valid for grounding resistance test of 3-pole method and 4-pole method.

The **COMP** symbol will be displayed on the screen after the comparison function is started.

Step 1: Enable the comparison function(**COMP**): select 'ON' to start the comparison function; Select 'OFF' to turn off the comparison function.

Step 2: Select the comparison audio alarm mode(**Comp**): select '**Lt**' to give an audio alarm whose test value is less than the preset limit; If you select '**gt**', the test value is greater than the preset value Set limit audio alarm.

Step 3: Set the comparison limit range(**RELr**): 20.00Ω, 200.0Ω or 2000Ω.

Step 4: Set the comparison limit(**REL"**): with the setting range from 00.00Ω to 1999Ω.

Refer to Chapter 6 'Instrument Settings' for the detailed settings of the above four steps.

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 **3 POLE** key to select measurement method: 3 Pole (the Main Screen displays 3POLE in the upper part);

(2) 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".

(3) Connection of Auxiliary Earth Spikes and Test Leads(See figure 8)

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.

(4) Test of ground voltage

After the wiring is completed, please press the key to select the ground voltage measurement. Please confirm that the ground voltage must be $\leq 10V$. If this voltage is $> 10V$, it will lead to wrong results. At this time, the equipment using this measured grounding body will be powered off to reduce the ground voltage before conducting the grounding resistance test.

(5) Earth resistance measurement

▲
Press **3 POLE** key to select measurement method: 3 Pole
Press TEST key after connecting the Test Leads;
The Main Screen displays '---' message;
The measured earth resistances RE value

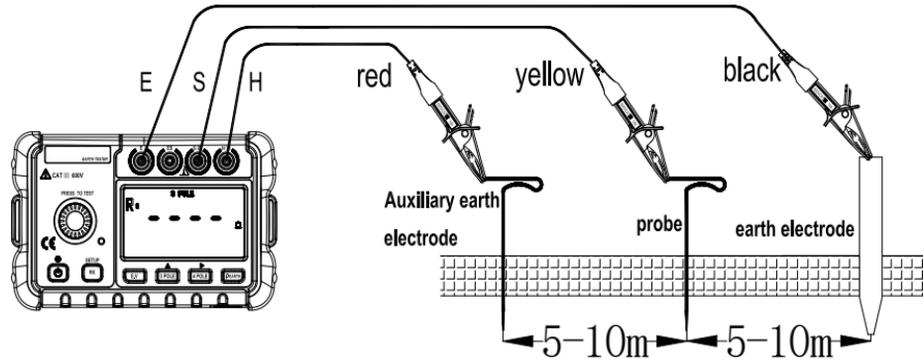


Figure 8

▲ 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.

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 4 POLE key to select measurement method: 4 Pole (the Main Screen displays 4POLE in the upper part);
- (2) Residual resistance of Rk
 - ① Firmly insert each plug of 4 test leads (black, green, red, YELLOW) to the corresponding terminals E, ES, S and H on the instrument respectively.
 - ② Engage 4 Alligator clips to short-circuit all of them.
 - ③ Save the Rk values with reference to 'the residual resistance on the Test Leads'.
- (3) 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. Connect the green wire from ES terminal and the black wire from E terminal to the same earthed equipment.

- (4) Test of ground voltage

After the wiring is completed, please press the key to select the ground voltage measurement. Please confirm that the ground voltage must be $\leq 10V$. If this voltage is $> 10V$, it will lead to wrong results. At this time, the equipment using this measured grounding body will be powered off to reduce the ground voltage before conducting the grounding

resistance test.

(5) Earth resistance measurement

Press **4 POLE** key to select measurement method: 4 Pole
Press TEST key after connecting the Test Leads;
The Main Screen displays ' - - - 'message;
The measured earth resistances RE value

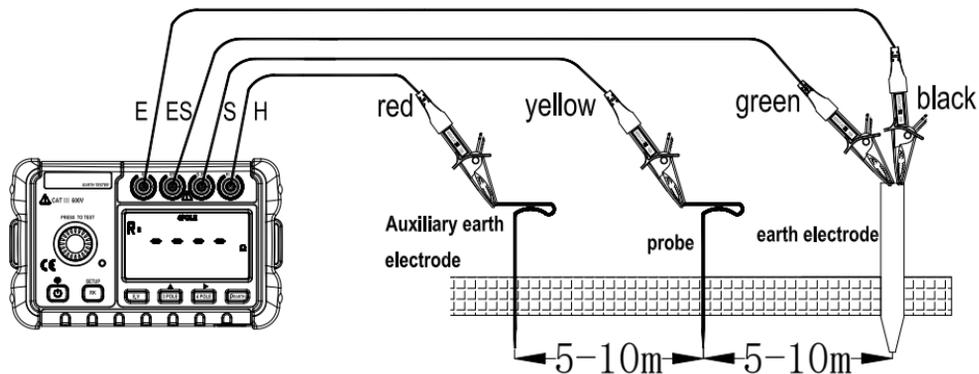


Figure 9

⚠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.

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 ($\Omega \cdot m$) .

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  key to select measurement method: Earth Resistivity;
- (2) Connection of Auxiliary Earth Spikes and Test Leads(See figure 10)

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) (yellow) (red) in sequence of with the Earth Spike.

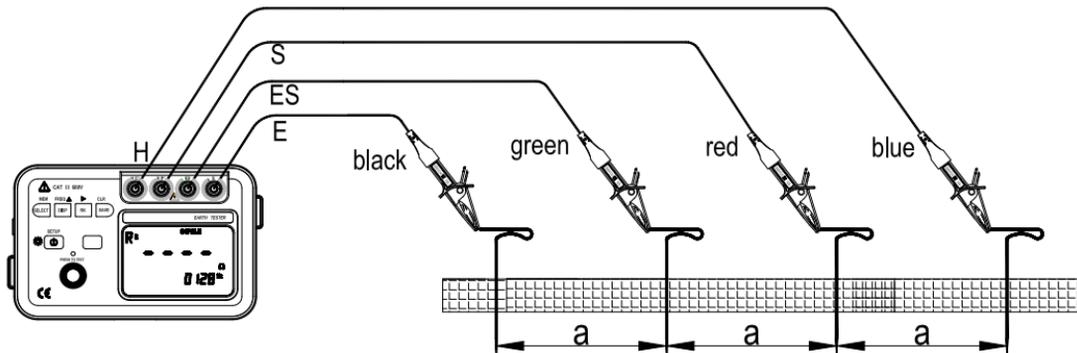


Figure 10

- (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 are displayed on the Main Screen when the measurement is finished.

Section Six

Instrument setting

Press the  key for more than 2 seconds to enter the instrument setting function. Press the  key again to exit the setup function.

Under setting mode, the Auxiliary Screen displays set items; the Main Screen shows factory default value. Press

E.V key to alter setting; press **PEARTH** key to save set value (SAVE is displayed on the screen, indicating that the setting item has been saved).

Setting Items		Function	Default Value
AP_{OFF}	auto-power-off	Setting range is 0 ~ 90 minutes, press 4 POLE key to select blinking position, press 3 POLE key to set flicker digits; Setting as 0 indicates canceling auto- power- off function.	5 minutes
bLoF	backlight time setting	Setting range is 0 ~ 90 minutes, press 4 POLE key to select blinking position, press 3 POLE key to set flicker digits, Setting as 0 indicates canceling automatic backlight turning off function.	5 minutes
LE_{INT}	earth spike interval	Setting range is 1.0 ~ 30.0m, press 4 POLE key to select blinking position, press 3 POLE key to set flicker digits.	10.0 meters
bEEP	beeper	ON or OFF, press 3 POLE key to select	ON

COIP	Compare enable	ON or OFF , press  key to select	OFF
COBB	Compare ringing modes	 (Sound below the set value) or  (Sound above the set value) ,press  key to select.	
RELr	Compare the limit range	20.00Ω,200.0Ω,2000Ω,press  key to select.	2000Ω
REL!	Compare limit values	The set range is 00.00Ω ~ 1999Ω,press  key to select blinking position , press  key to set flicker digits.The range and unit depend on the set range.	1999
FACT	Back to factory default setting	Press  key, the Main Screen displays SAVE in the lower left part, the Instrument return back to default setting.	-----

Section Seven 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 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 Instrument will not be used for a long time.
- Dirt or moisture in the terminals can affect readings.

Clean the terminals as follows:

- (1) Turn the Instrument 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

This Instrument is powered by eight AA batteries (IEC LR6).

⚠ Warning

To avoid electrical shock or personal injury:

- Remove Test Leads from the Instrument before opening the battery door.
- Close and latch the Battery Cover before using the meter.

⚠ Note

- The new and old Batteries cannot 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 will not be used for a long time.
- Dispose the old batteries in accordance with the local law.

Replace the batteries as follows.(See Figure 8):

- (1) turn off the Instrument and remove all Test Leads from the Terminals;
- (2) take off the protector of the Instrument , remove the battery cover by using a standard-blade screwdriver to turn the battery door fasteners, and then take of the battery case;
- (3) replace with new batteries;
- (4) reinstall the battery case and tighten screws.

Appendix

Principle of Earth Resistance Measurements

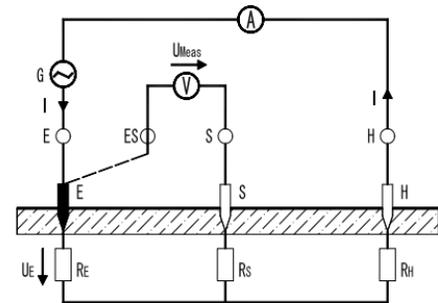
This instrument makes earth resistance measurements with fall-of-potential method.

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

Voltage U_E goes through earth resistance R_E , 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 R_S 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 R_H . 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.

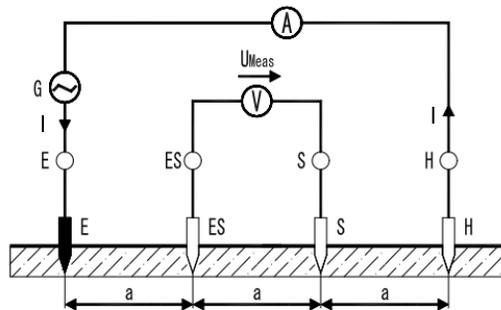
Earth resistivity is calculated according to the following formula:

$$\rho = 2\pi a R$$

ρ : mean value of earth resistivity ($\Omega \cdot m$).

a : intervals between earth spikes (m)

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



- 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.