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UNI-T

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UNI-T



UT523A
Earth Resistance
Soil Resistivity
Tester
User Manual

5. Measurement Principle

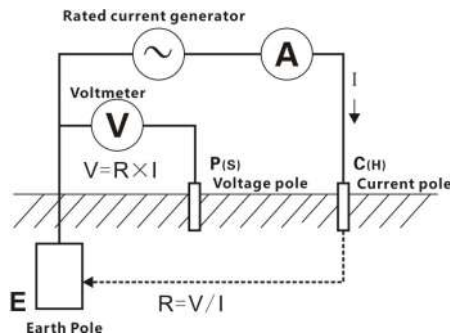
5.1. Earth voltage measurement adopts average value rectification method.

5.2. Earth resistance measurement adopts rated current change-pole method. That is, AC rated current I flows between the earth electrode E and current electrode $C(H)$ of measuring object, the potential difference V between the earth electrode E and voltage electrode $P(S)$ is obtained, and then the earth resistance value R can be calculated according to the formula $R=V/I$.

To ensure the accuracy of the test, the 4-wire method is used to increase the auxiliary earth electrode ES . In actual test, the ES and E are clamped at the same point of the grounding body. The 4-wire method can eliminate influence of contact resistance between the measured grounding body, auxiliary ground rods, test clips, and tester input interfaces (usually with dirt or rust) on the measurement, and can also eliminate influence of line resistance for more precise measurement.

5.3. In the above methods, the working error (B) is the error obtained within the rated working conditions, which is calculated from the intrinsic error (A) and variable error (E_i) of the tester.

$$B = \pm (|A| + 1.15 \times \sqrt{E_2^2 + E_3^2 + E_4^2 + E_5^2})$$



A: Intrinsic error

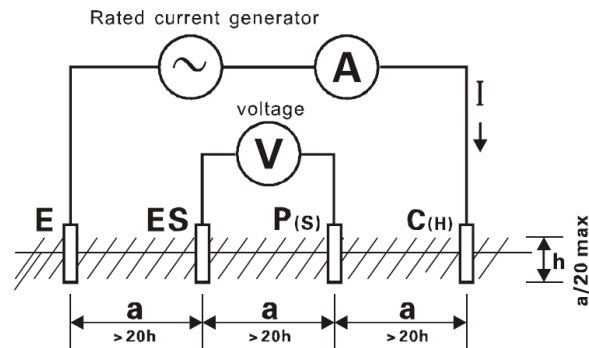
E2: Variation due to power supply voltage

E3: Variation due to temperature change

E4: Variation due to interference voltage change

E5: Variation due to contact electrode resistance

5.4. Soil resistivity (ρ) measurement adopts 4-pole method (Wenner method): AC current I flows between the earth electrode E and current electrode $C(H)$, the potential difference V between the voltage electrode $P(S)$ and auxiliary earth electrode ES is obtained, the potential difference V is divided by AC current I to get the earth resistance value R , the electrode distance is a (m), and then the soil resistivity can be calculated according to the formula $\rho=2\pi aR$ (Ωm). If the electrode distance of $C(H)-P(S)$ is equal to $P(S)-ES$ (both a) it is the Wenner method. For the convenience of calculation, please make electrode distance a far greater than buried depth h , which generally should meet $a>20h$, as shown below.




6. Operation Methods


6.1. Turn On/Off

Use the **FUNCTION** rotary switch to turn on/off the tester. The tester has no auto power-off function. Please place the **FUNCTION** rotary switch in "OFF" position after use to avoid running out of batteries.

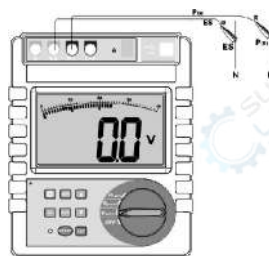
6.2. Battery Voltage Check

After power on, if the LCD displays the low battery symbol "  ", please follow the instructions to replace the batteries. Only sufficient battery power can ensure the accuracy of measurement.


6.3. AC Voltage Measurement

	AC voltage measurement should not exceed 600 V.
	Connect P(S) and ES interfaces to test commercial AC voltage. No need to connect C(H) or E interface.

For AC voltage test, which refers to the general commercial AC voltage test, users should pay attention to distinguish the earth voltage. The tester can be used to test AC voltage below 600V. As shown below, firstly connect test wires with **P(S)** and **ES** interfaces, secondly connect test wires with tested line, and then turn the **FUNCTION** rotary switch to "**EARTH VOLTAGE**" position and start testing. LCD will display the test results.

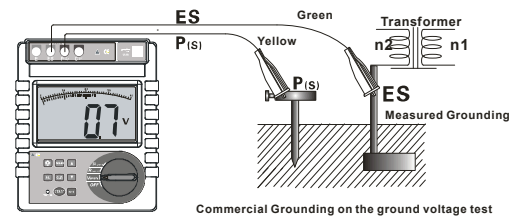


6.4. Earth Voltage Measurement

	Voltage measurement is strictly prohibited when the tester is charged, connected to a computer, or supplied with external power.
	Earth voltage measurement needs an auxiliary ground rod.
	Connect the tester with earth only by test wires and auxiliary ground rods. Other test wires of the tester interface cannot be connected with the commercial power line L or N. Otherwise, current leakage may occur and the circuit breaker may start, posing a hazard.
	Earth voltage measurement should not exceed 600 V.

Earth voltage: the potential difference between grounding device outer shell, grounding wire, grounding body, etc. and the zero potential point, when an earth fault occurs in electrical equipment. The earth voltage is the potential difference from the earth, with the earth as the reference point. The earth is zero potential point.

Earth voltage measurement needs one auxiliary ground rod. Please pay attention to the difference from commercial AC voltage measurement. As shown below, connect the tester, auxiliary ground rods, and test wires well, turn the **FUNCTION** rotary switch to "**EARTH VOLTAGE**" position and start testing. LCD will display the test results.



6.5. 4-Wire Precise Earth Resistance Measurement



In the testing of earth resistance, firstly confirm the earth voltage value of the grounding wire, that is, the voltage value of C(H) and E or P(S) and ES must be below 20V. If the earth voltage is higher than 5V, the tester displays the **NOISE** symbol, and the measured value of the earth resistance may be in error. At this time, power off the grounding device under test, and test the earth resistance again after the earth voltage is lowered.

4-wire measurement: The 4-wire measurement can eliminate influence of contact resistance between the measured grounding body, auxiliary on the measurement, and can also eliminate influence of line resistance on the measurement. It is better than the 3-wire measurement.

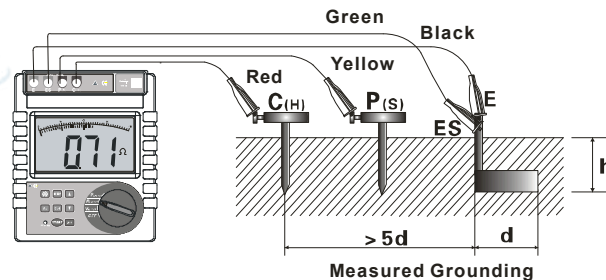
As shown below, starting from the measured object, the general interval is 5-20m. Bury the **P(S)** and **C(H)** auxiliary ground rods in the ground in a straight line, and connect the **E**, **ES**, **P(S)** and **C(H)** interfaces of the tester with the measured earth electrode **E**, auxiliary voltage electrode **P(S)** and auxiliary current electrode **C(H)** correspondingly by the grounding test wires (black, green, yellow, red).



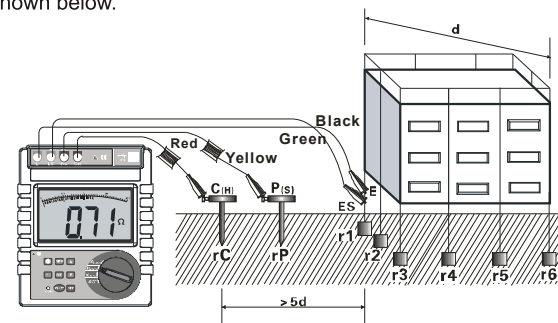
The distance from the measured grounding body E to the current electrode C(H) should be at least 5 times the buried depth (h) of the measured grounding body or the buried electrode length (d) of the measured grounding body.

In measurement of the total earth resistance of a complex grounding system, the (d) should be the maximum diagonal distance of the grounding system.

The test wires cannot be entangled with each other in the test; otherwise the test accuracy may be affected.



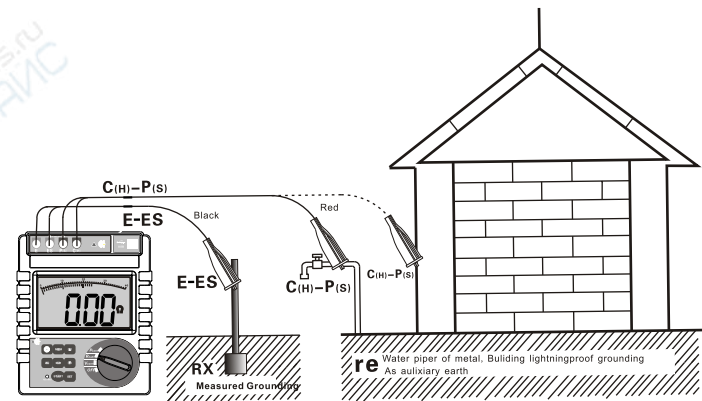
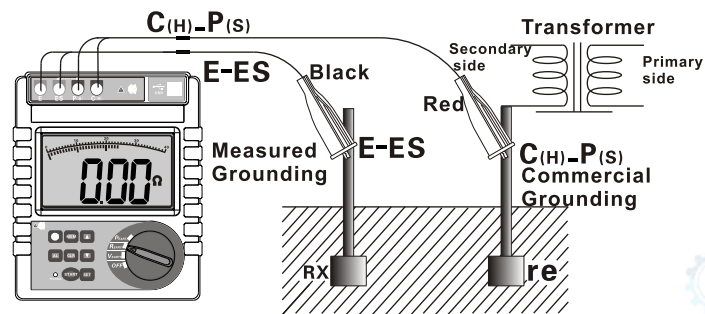
For multi-point independent grounding systems or grounding grids, users can select longer test wires, as long as the electrode distance is 5 times greater than the maximum diagonal length of the measured grounding grid, as shown below.





When using the commercial power system grounding as the auxiliary earth electrode for measurement, confirm it is the earth electrode of the commercial power system. Otherwise, the circuit breaker may start, posing a hazard.

In measuring earth resistance by 2-wire method, try to select the grounding body with a small R_e value as the auxiliary earth electrode, so that the tester reading is closer to the true value. Please choose the metal water pipe and metal fire hydrant as the auxiliary earth electrode first.



For 2-wire measurement, the tester reading is the sum of the earth resistance of the measured grounding body and the earth resistance of the commercial grounding body.

$$R = RX + re$$

R — Reading

RX — The earth resistance of measured grounding body

re — The earth resistance of a common grounding body such as a commercial power system

Then, the earth resistance value of the measured grounding body is: $RX = R - re$

6.9. Backlight Control

After startup, press "☀" button to turn on/off the backlight. The backlight function is suitable for dim environments. Working current of the backlight is about 25mA. The backlight is off by default each time the tester is turned on.

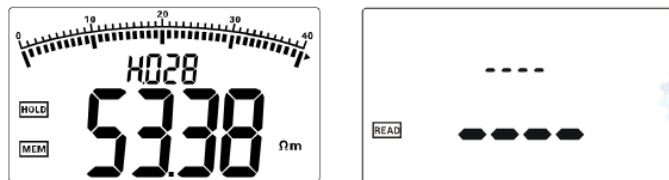
6.10. Alarm Setting

After startup, turn the **FUNCTION** rotary switch to corresponding position, short press "AL" button to turn on/off the alarm function, and long press "AL" button (about 3 seconds) to enter alarm limit value setting. Press "▲" or "▼" button to change current data value, short press "AL" button to move the cursor, and long press "AL" button to save and exit. When measurement value is greater than set alarm limit value and the alarm function is on, the tester will flash to display the "••)" symbol and sound "toot-toot-toot--" alarming hint.

6.11. Data Hold/Storage

In test mode, short press "MEM" button to hold the current display data. The tester will display "HOLD" and "MEM" symbols and automatically store the data with serial numbers. If storage is full, the tester will display "FULL" symbol. Short press "MEM" button again to exit.

As shown on the left below, the held soil resistivity is 53.38Ωm, which is stored as the 28th set of data.



6.12. Data Reading/Deletion

In test mode, long press "MEM" button (over 3 seconds) to enter data reading. Press "▲" or "▼" button to select group number of reading data by step value 1, and press "▲" or "▼" button constantly to select group number of reading data by step value 10. When the current data set is earth resistance or soil resistivity value, press "SET" button to read data value of **rC**, **rP** and **a**. Long press "MEM" button to exit.

In reading if there is no storage data, LCD will display "- - -", as shown at the bottom left.

In data reading status, press "CLR" button to enter data deletion. Press "▲" or "▼" to select "NO" or "YES". Select "NO" and press "CLR" button for not deleting and returning to data reading status, while select "YES" and press "CLR" button for deleting stored data. After deletion, LCD will display "- - -", as shown at the bottom left.

Note: Data deletion function is used to delete all stored data at one time, which cannot be restored after deletion. Please be cautious.


at the bottom left

6.13. Data Upload

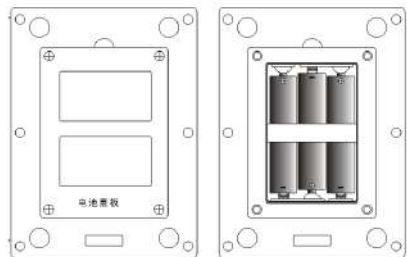
The stored data can be uploaded to a computer. Connect the USB communication wire from the tester to the computer, switch on the tester, and run the monitoring software. If the software shows that the serial port is open and connected successfully, then it can read the stored historical data and upload them to computer for saving.

The monitoring software has online real-time monitoring and historical inquiry functions. It also comes with dynamic display, alarm indication, and the functions like historical data access, reading, preservation, statement, and printing.

7. Battery Replacement

	Please do not replace batteries in flammable spots.
	Please do not replace batteries during measurement.
	Pay attention to battery polarity and specification, and do not mix used and new batteries to avoid damage to the tester.
	When the outer shell of the tester is wet, please do not open the battery cover.
	Please put the used batteries in a designated collection place.

- 7.1. Switch off and make sure the tester is in switch-off state.
- 7.2. Loosen the four screws on battery cover at the bottom of the tester, and open battery cover.
- 7.3. Replace new batteries, pay attention to battery polarity and specification, close battery cover, and fasten screws.
- 7.4. Switch on the tester for verification.



8. Accessories

Tester	1 pc
Tester Bag	1 pc
Auxiliary Ground Rod	4 pcs
Standard Test Wire	4 pcs: 20m red, 20m black, 10m yellow, 10m green (1 each)
Simple Test Wire	2 pcs: 1.6m red, 1.6m black (1 each)
Alkaline Battery	6 pcs (LR14 1.5V)
Monitoring Software Disk	1 pc
USB Communication Cable	1 pc
User Manual	1 pc

Uni-Trend is not responsible for other losses caused by use.
The contents of this manual cannot be used as a reason to use the product for special purposes.
Uni-Trend reserves the right to modify the contents of this manual. If there are any changes,
no further notice will be given.

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СУПЕРАЙС

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