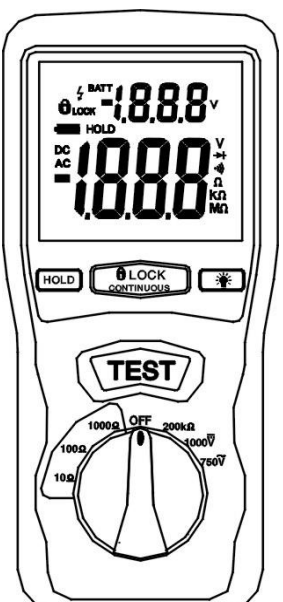
DIGITAL EARTH RESISTANCE TESTER

INSTRUCTION MANUAL

MODEL 5300/5300A



Electronic Digital Earth Resistance Tester is direct replacement of the conventional hand generator type tester. It is designed for measurement of the resistance of earthing used in the electrical equipment as well as for measurement of ground resistivity. It can be used for measurements of the other low regular and liquid resistances. It can also be used for measurement of voltage AC, voltage DC and resistance.

This instrument finds wide application for testing earthing installation in power based industries, telecommunication networks and electrical traction systems etc.

I. **SAFETY INFORMATION**

- Read the following safety information carefully before attempting to operate or service the meter.
- To avoid damages to the instrument do not apply the signals which exceed the maximum

limits shown in the technical specifications tables.

- Do not use the meter or test leads if they look damaged. Use extreme caution when working around bare conductors or bus bars.
- Accidental contact with the conductor could result in electric shock.
- Use the meter only as specified in this manual; otherwise, the protection provided by the meter may be impaired.
- Read the operating instructions before use and follow all safety Information.
- Caution when working with voltages above 60V DC or 30V AC RMS. Such voltages pose a shock hazard.
- Before taking resistance measurements or testing acoustic continuity, disconnect circuit from main power supply and all loads from the circuit.

Safety symbols:


Caution refer to this manual before using the meter.


Dangerous voltages.


Meter is protected throughout by double insulation or reinforced insulation.

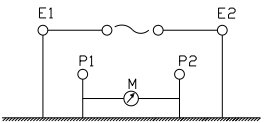
When servicing, use only specified replacement parts.

CE Comply with EN-61010-1

II. OPERATING PRINCIPLE

The principle used in measuring the earth resistance is based on simple Ohm's law. Four Electrodes E1,P1,P2,E2 are buried in the earth the

resistance of which is to be tested at a distance of 20 meters from each other as shown in Fig.below.



AC signal is applied to electrodes E1 and E2 and voltage developed across electrodes P1 and P2 due to flow of current through the earth is measured by ammeter M. If the current is constant the voltage measured will be directly proportional to the earth resistance. To eliminate the error due to other signals, the meter reading is sampled at the same frequency as that of the applied signal. Accordingly the frequency selected is of an odd value around 300 Hz thus eliminating any chances of error due to harmonics of 50 Hz. The sampling is done by having a FET across the meter and

switching the Field Effect transistor at the selected frequency only. The metering is also isolated from DC source.

The maximum value being measured in a range decides the value of the swamping resistance and also the series resistance. The function of series resistance is to ensure that the current through the earth is kept essentially constant.

Because of very wide coverage of earth resistance measurement involved, it was not possible to work with only one value of AC signal without adversely affecting the power consumption. Hence different values of AC signal voltage and current are chosen for different ranges. The AC signals are generated by built-in inverter.

III. FEATURES

Earth resistance range: 0~1000Ω (5300)
0~2000Ω (5300A)

Display: Large LCD with dual display

Multimeter function Range: 200kΩ, 750VAC,

1000VDC.

Sampling Rate: 2.5 times per second.

Zero Adjustment: Automatic adjustment.

Over Range Indicator: Number 1 of highest digit is displayed.

Low Battery Indication: The  displayed when the battery Voltage drop below the operating voltage.

Auto Power Off

To conserve battery life, the meter will automatically turn off after approx. 15 minutes of non-use. To turn the meter back on, turn the rotary switch to OFF, then to the desired function.

Operating Temperature: 0ºC to 40ºC (32ºF to 104ºF)
and Humidity below 80% RH

Storage Temperature: -10ºC to 60ºC (14ºF to 140ºF)
and Humidity below 70% RH

Power source: 6x1.5V Size “AA” battery or Equivalent (DC9V)

Dimensions: 200(L) x 92(W) x 50(H) mm

Weight: Approx 700g include battery

Accessories: 4 sets Test kits, 4pcs iron rods, 6pcs battery, Carrying case, manual.

IV. Electrical Specifications

Accuracies are specified in the way:

±(…% of reading +…digits) at 23ºC±5ºC,below 80% RH.

Earth resistance

Range	Resolution	Accuracy
10Ω	0.01Ω	±(3%+100d)
100Ω	0.1Ω	±(3%+3d)
1000Ω	1Ω	±(3%+3d)

(Earth resistance for 5300A: 20Ω,200Ω,2000Ω)

OHMS

Range	Resolution	Accuracy	Overload Protection

200kΩ	0.1kΩ	±(1%+2d)	250Vrms

Range	Resolution	Accuracy	Input Impedance	Overload Protection
1000V	1V	±(0.8%+3d)	10MΩ	1000Vrms

DC Voltage

AC Voltage (40Hz~400Hz)

	Resolution	Accuracy	Input Impedance	Overload Protection
750V	1V	±(1.2%+10d)	10MΩ	750Vrms

V. PARTS & CONTROLS

① Digital Display
② Data Hold Button
③ Lock Button
④ Backlight Button
⑤ Test Button

⑥ Rotary Function switch

⑦ V Ω E2 Jack

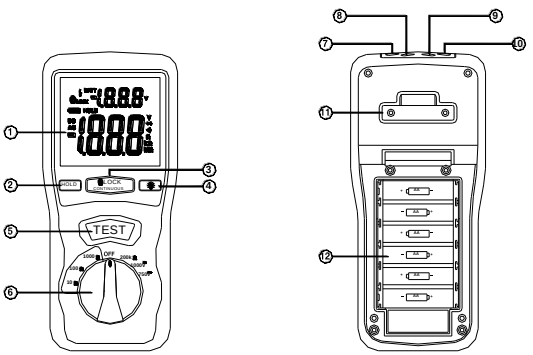
⑧ P2 Jack

⑨ P1 Jack

⑩ COM E1 jack

11, Pothook

12, Battery Cover



Button Function Operation

Lock Function

For hands-free operation, use the LOCK feature.

1. With the test leads connected to the equipment under test, simultaneously press the TEST and LOCK keys.
2. The LOCK icon"LOCK" will appear on the display. A beeper will sound every 2 seconds to indicate that the meter is in Lock mode.

Press the LOCK key to disable the Lock function and end the test

Hold Function

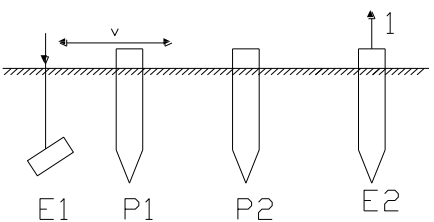
The hold function freezes the reading in the display. Press the HOLD key momentarily to activate or to exit the hold function

Backlight

Press the key for to turn on the display backlight function. The backlight will automatically turn off after 15 seconds.

VI. Measurement of effective resistance of earth electrodes

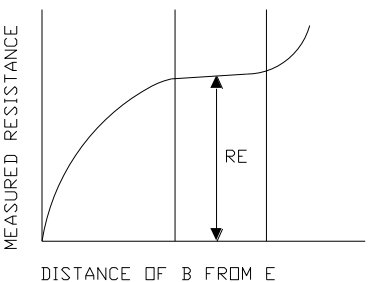
1, To find our resistance of earth connection three terminal method is used.



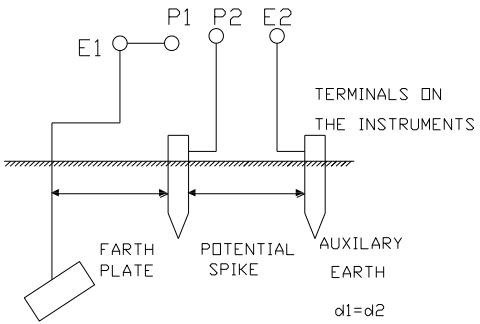
A current is passed through the plate E(which is earthing plate) to an auxiliary electrode A(E2) in the earth at a distance away from plate.

A second auxiliary electrode B(P2) is inserted between E(E1,P1) & A (E2), and the potential difference V between E(E1,P1) and B(E2)is measured for a give current I so that the resistance of earth connection is V/I. The placing of he

auxiliary electrode is however important. Following is the carve which given a plot of distance of B (E1,P1) from E(P2) verses measured resista



When earthing resistance is low, the spacing between the earth plate and auxiliary electrode may need to be 20 to 30 meters. The exact value can be decided by actual experiment. From the above discussion the principle of measurement is clear.



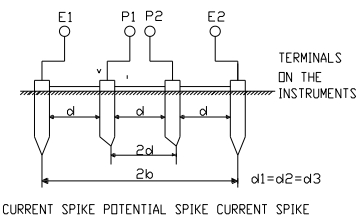
2, The Digital Earth Resistance Test has four terminals. If it has to be used for above application then terminals A and B may be shorted and connected to the earth connection whose resistance has to be found.

Terminal C has to be connected to potential spikes and terminal D to the auxiliary earth as shown in Fig. Under this condition meter will give the resistance of the earthing connection and the earth. To avoid error due to the wire resistance first short

the wires and note down the meter reading. Then connect the wires to the different electrodes as explained above. This reading minus the reading with wire shorted will give actual value of resistance. The distance d1 and d2 may range from 20 to 30 meters depending upon the soil.

Measurement of ground resistivity

To find out the ground resistivity for preferred positioning and depth of proposed electrode system four terminal method is used.



Here four electrodes are buried in the ground at a distance of 20 to 30 meter apart. These four electrodes are connected to the A B C D terminals as shown in Fig. Earth resistivity is calculated

according to the following formula.

=2 Â dr

Or Ohm meter

=R Â(1^2 -a^2)/2a

Where

R – resistance in Ohm (as measured above)

2b—is distance between current electrode A (E1) and D (E2).

2d—is distance between potentials electrodes B(P1) and C(P2).

D – is the distance in between Spikes if spikes are placed at equal distances.

The result obtained constitute a mean value of ground resistivity in a area determined usually as a hemisphere of 21 meter in diameter with its centre between the earth electrodes.

The mean resistivity refers to a point being under the centre of this hemisphere at a depth of 0.51.

VII. Operation

To operate the instrument first turn the range selector switch to 1000 Ohm position. The digital

display will come in action and will read zero. Connect the test leads to A B C D terminals as per procedure for testing.

Press the test switch, the LCD display will indicate the resistance. If the reading is too small the range selector switch may be turned to 10 Ohm range.

A 'Lo BAT' indication will appear on the left upper side on display, by pressing the test switch if cells provided require charging adopter to the instrument and charge it for 12 Hrs. before testing.

After completing the testing, the selector knob should be turned to off position and digits over the display will disappear.

Probing

If the measurement of soil resistance described above repeated from the same measuring point but with all distances increased, and if the resistance values thus found are plotted in a chart, conclusions may be drawn about the stratification of subsoil, groundwater or certain inclusions. This method is known as probing.

Plotting

In plotting the electrode distance found advantageous for probing is maintained while the measuring spot Is varied. For this purpose the area to be examined is divided into squares whose side is the favourable electrode distance obtained(see Schematic below). The earthing meter is first connected according to the figure. Measurement is deflected as described above, and the measured value plotted. Now earth spike 1 is displaced to 5, and earthing meter connections are exchanged as required; we connect 1 to A, 2 to B, 3 to C and 4 to D. Thus one measurement after another is taken, and values are plotted. When measuring spots on line I have been covered, measurements are repeated in the same way on the second line II, whose distance from 1 as also d. lines of equal resistance graph. Somewhat resembling topographic contour lines. From this, conclusions about the location of the desired boundary area between two different soil strata may be drawn.

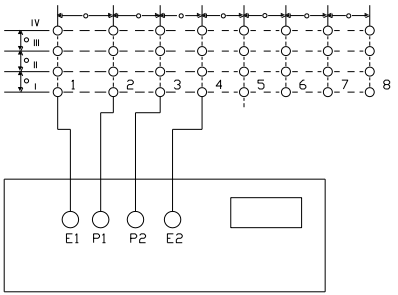
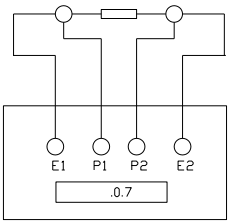


DIAGRAM FOR PLOTTING

Measurement of resistance of other objects

Electronic digital resistance tester can also perform the measurement of resistances up to 1.99 Kilo Ohms. The object under test is connected as shown in Fig. and resistance can be directly read over the meter by pressing the test switch.

Thus the instrument can be used for measurement of resistance of test leads connecting the earthed equipment with the earth electrodes, resistors etc.



VIII. DC/AC VOLTAGE MEASUREMENTS

1, Set the function switch to the highest 1000V DC (⎓) or 750VAV (~) position.

2, Insert the black test lead banana plug into the negative COM jack.

3, Insert the red test lead banana plug into the positive V jack.

4,Touch the black test probe tip to the negative side of the circuit.

5,Touch the red test probe tip to the positive side of the circuit.

6,Read the voltage in the display.

DC/AC VOLTAGE MEASUREMENTS: If the polarity is reversed, the display will show (-) minus before the value

Ⅸ. 200kΩ RESISTANCE MEASUREMENTS

1, Set the function switch to the highest **200kΩ** position.

2, Insert the black test lead banana plug into the negative COM jack

3, Insert the red test lead banana plug into the positive **Ω** jack.

4, Touch the test probe tips across the circuit or part under test. It is best to disconnect one side of the part under test so the rest of the circuit will not interfere with the resistance reading.

5, Read the resistance in the display

X. Battery Replacement

1,When the low battery symbol appears on the LCD,

the six 1.5V ‘AA’ batteries must be replaced.

2, Turn the meter off and remove the test leads

3, Unsnap the tilt stand from the rear of the meter

4, Remove the four Phillips head screws holding the battery cover

5, Remove the battery compartment cover

6, Replace the batteries observing polarity

7, Affix the rear cover and secure the screws.

8, Reattach the tilt stand