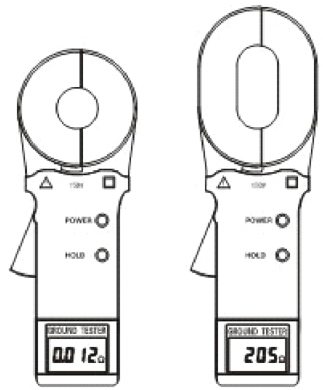
GROUND TESTER



MANUAL

DUOYI®

X. Bill of Loading

Pincer Grounding Tester	1 piece
Test Ring	1 piece
5# Dry Battery	4 pieces
User's Manual	1 pieces
Qualified Certificate	1 piece

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I. Attention

Thank you for purchasing this pincer ground tester of the company.
In order to make better use of the product, please be certain:

---To read this user manual carefully.
---To comply with the operating cautions presented in this manual.

Under any circumstances, pay special attention to safety in the use of the Meter.

Pay attention to the measurement range of the Meter and the using environment provided.

Pay attention to the text labeled on the panel and back plane of the Meter.

Before booting up, the trigger should be pressed for a couple of times to ensure the jaws are well closed.

In the process of auto inspection in booting up, DO NOT press the trigger, nor clamp any wire

The process of auto inspection would display "CAL6, CAL5, CAL4···CAL0, OL □."

Before the auto inspection is completed and the "OL □" symbols are showed, the measured objects cannot be clamped on.

The jaw planes contact must be maintained clean, and should not be polished with corrosive and rough materials.

In the above three steps, the reading measured in each step is the value of the two series grounding resistance. In this way, we can easily calculate the value of each grounding resistance:

From:

$$R_1 \quad R_A \quad R_B$$

$$R_2 \quad R_B \quad R_C$$

$$R_3 \quad R_C \quad R_A$$

We get:

$$R_A \quad \frac{R_1 \quad R_3 \quad R_2}{2}$$

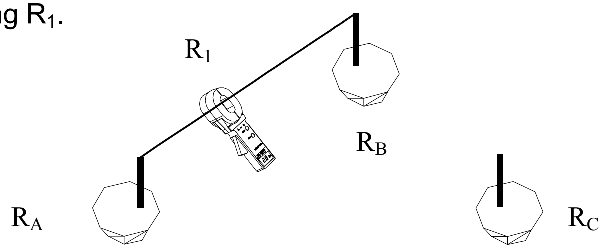
This is the grounding resistance value of the grounding body R_A.To facilitate the memory of the above formula, these three grounding bodies scan be viewed as a triangle; then the measured resistance is equivalent to the value of the resistance values of the adjacent edges plus or minus resistance value of the opposite sides, and divided by 2.

As the reference points, the grounding resistance values of the other two grounding bodies are:

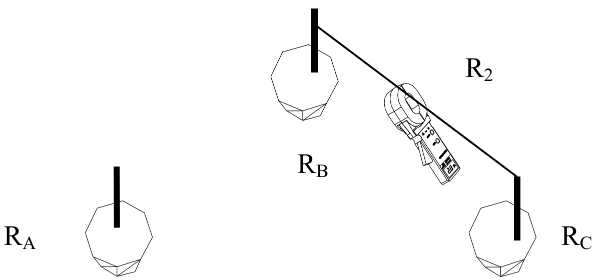
$$R_B \quad R_1 \quad R_A$$

$$R_C \quad R_3 \quad R_A$$

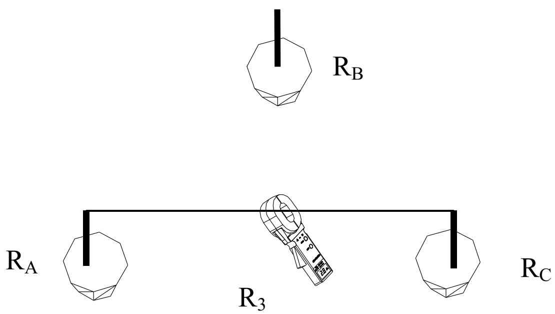
First, link R_A and R_B with a test line; use the Meter to get the first reading R_1.



Second, have R_B and R_C linked up, as shown in the following figure. Use the Meter to get the second reading R_2.



Third, have R_C and R_A linked up, as shown in the following figure. Use the Meter to get the third reading R_3.



Avoid any impact onto this Meter, especially the jaw contact planes.

This Meter will have some buzzing sound in measurement process, and it is normal.

Please take out the batteries in the case of the Meter being idle for a long time.

Respect the polarity when connecting.

The dismantling, calibration and maintenance the Meter shall be operated by the authorized staff.

If the continuing use of it would be dangerous, the Meter should be stopped using immediately, and immediately sealed for the treatment by the authorized agencies.

II. Brief Introduction

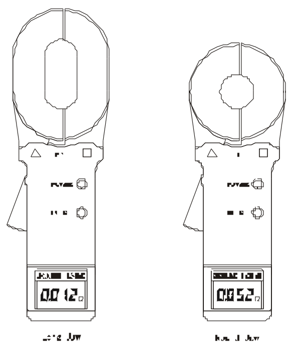
DY1100/DY1000 series of Pincer Ground Tester is a major breakthrough in traditional grounding resistance measurement. It is widely used in the grounding resistance measurement of the power telecommunications, meteorology, oilfield, construction and the industrial and electrical equipment.

DY1100/DY1000 series of Pincer Ground Tester, in the measurement of a grounding system with loop, does not require breaking down the grounding wire, and need no auxiliary electrode It is safe, fast and simple in use.

DY1100/DY1000 series of Pincer Ground Tester can measure out the faults beyond the reach of the traditional methods, and can be applied in the occasions not in the range of the traditional methods.

DY1100/DY1000 series of Pincer Ground can measure the integrated value of the grounding body resistance and the grounding lead resistance.

DY1100/DY1000 series of Pincer Ground Tester is equipped with either a long jaw or a short jaw, as indicated in the figure below. A long jaw is particularly suitable for the occasion of grounding with the flat steel.



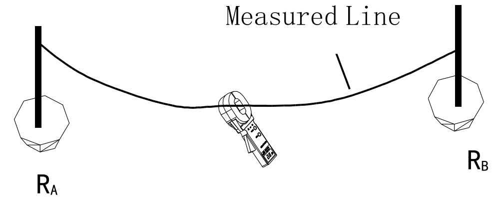
III. Specification

1. Model of Series

Model	**Jaw specification(mm)**	**Range of Measurement (Ω)**
DY1100/DY1000 （Long Jaw）	65×32	0.01-1000

(1). **Two-Point Method**

As shown in the figure below, in the vicinity of the measured grounding body $R_{A,}$ find an independent grounding body of better grounding state R_B (for example, near a water pipe or a building). R_A and R_B line will connect to each other using a single testing line.



As the resistance value measured by the Meter is the value of the series resistance from the testing line and two grounding resistances.

$$R_T=R_A + R_B + R_L$$

Where: R_T is the resistance value measured with the Meter.

R_L is the resistance value of the testing line. Meter can measure out the resistance value by connecting the test lines with both ends.

So, if the measurement value of the Meter is smaller than the allowable value of the grounding resistance, then the two grounding bodies are qualified for grounding resistance.

(2) Three-Point Method

As shown in the figure below, in the vicinity of the measured grounding body $R_{A,}$ find two independent grounding bodies of better grounding state R_B and $R_{C.}$

Meter in the different grounding branches.

It is nonlinear equations with N unknown numbers and N equations It indeed has a definite solution, but it is very difficult to solve the issue artificially, even impossible when N is larger.

Therefore, you□re expected to buy the Limited-Point Grounding System Solution software produced by this Company. Users can use the office computer or notebook computer to carry out solutions.

In principle, in addition to ignoring the mutual resistance, this method does not have the measurement error caused by neglecting R_0.

However, users need to pay attention to that: in response to the number of the grounding bodies mutually linked in your grounding system, it is necessary to measure the same number of the testing values for calculating of the program, not more or less. And the program would output the same number of grounding resistance values.

3. Single-Point Grounding System

From the measuring principle, **DY1100/DY1000** series Meter can only measure the loop resistance, and the single-point grounding is not measured. However, users will be able to use a testing line very near to the earth electrode of the grounding system to artificially create a loop for testing. The following presented is two kinds of methods for the single-point grounding measurement by use of the Meter. These two methods can be applied to the occasions beyond the reach of the traditional voltage-current testing methods.

2. Ranges and Accuracy of Measurement

Range	Resolution	Auuracy
0.010-0.099Ω	0.001Ω	±(1%+0.01Ω)
0.10-0.99Ω	0.01Ω	±(1%+0.01Ω)
1.0-49.9Ω	0.1Ω	±(1.5%+0.1Ω)
50.0-99.5Ω	0.5Ω	±(2%+0.5Ω)
100-199Ω	1Ω	±(3%+1Ω)
200-395Ω	5Ω	±(6%+5Ω)
400-590Ω	10Ω	±(10%+10Ω)
600-1000Ω	20Ω	±(20%+20Ω)

3. Technical Specifications

Power Source: 6VDC (4 □5# alkaline battery)

Working Temperature: -10 □-55 □C

Relative Humidity: 10%-90%

LCD: 4-digital LCD, 47 □28.5mm in length

Span of Jaw: 28mm for a long jaw; 32mm for a round jaw

Meter Quality (including batteries): 1320g for a long jaw; 1120g for a round jaw

Meter Size: a long jaw is 293mm long and 90 mm wide, 66mm thick; a round jaw is 260mm long, 90 mm wide and 66mm thick

Protection Level: Double insulation

Structural Feature: In the jaw way

Range Shift: Automatic

External Magnetic Field: ＜40A/m

External Electric Field: ＜1V/m

Single Measuring Time: 1 second

Maximum Resistance Measurement Resolution: 0.001 □

Resistance Measurement Range: 0.01-1000 □

4. Reference conditions

Conditions	Reference conditions
Ambient temperature	(20±3)℃
Relative humidity	50%RH±10%
Battery voltage	6V±0.5V
External magnetic field	＜40A/m
External electric field	＜1V/m
Operating position	Clamp horizontal
Position of conductor in the clamp	Centred
Proximity to metallic mass	＞10cm
Loop resistance	Non choke resistance
Rate of distorsion	＜0.5%
Interference current on measurement of loop resistance	Nil

5. Variations in the nominal working range

Distortion quantity	Limit of operating range	Distortion
Temperature	-10℃ to 55℃	1.5 class of accuracy per 10℃
Relative humidity	10%RH to 90%RH	1.5 calss
Battery voltage	5.5V to 6.5V	0.25 calss
Conductor position	From edge to centre	0.1 calss
Clamp position	±180°	0.5 calss
Rroximity of magnetic mass	1mm steel plate against jaw face	0.25 calss
Magnetic field 50…60Hz	400A/m	0.25 calss
Electric field 50…60Hz	0…10KV/m	0.25 calss

towers are linked with each other through overhead ground wire; Besides, the grounding of some of the buildings is not an independent grounding grid, but several grounding bodies connected with each other through the wire.

Under such circumstances, the above R_0 regarded as 0, will yield more error on the results of the measurement.

Due to the same reasons mentioned above, we may ignore the impact of the mutual resistance; and the equivalent resistance of the grounding resistance paralleled is calculated by the usual sense. Thus, for the grounding system of N (N is smaller, but larger than 2) grounding bodies, it can offer N equations:

$$R_1 \quad \frac{1}{\frac{1}{R_2} \quad \frac{1}{R_3} \quad \cdots\cdots \quad \frac{1}{R_N}} \quad R_{1T}$$

$$R_2 \quad \frac{1}{\frac{1}{R_1} \quad \frac{1}{R_3} \quad \cdots\cdots \quad \frac{1}{R_N}} \quad R_{2T}$$

.

.

.

$$R_N \quad \frac{1}{\frac{1}{R_1} \quad \frac{1}{R_2} \quad \cdots\cdots \quad \frac{1}{R_{(N \quad 1)}}} \quad R_{NT}$$

Where: R1, R2, □ □ R_N are grounding resistances of N grounding bodies.

R_{1T},R_{2T},□ □ R_{NT} are the resistances measured with the

As the Me nt electric circuit is sh

Where: R_1 is the target grounding resistance.

R_0 is the equivalent resistance of the other entire tower grounding resistances paralleled.

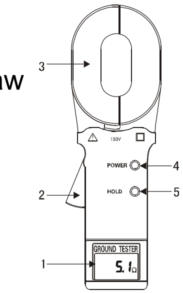
Although strictly on the theoretical grounding, because of the existence of so-called "mutual resistance□, R_0 is not the usual parallel value in the sense of electrical engineering (slightly higher than its IEC parallel output value). But because a tower-grounding hemisphere was much smaller than the distance between the towers, and with a great number of locations after all, R_0 is much smaller than R_1. Therefore, it can be justified to assume R_0=0 from an engineering perspective. In this way, the resistance we measured should be R1.

Times of comparing tests in different environments and different occasions with the traditional method proved that the above assumption is entirely reasonable.

2. Limited Point Grounding System

This is also quite common. For example, in some towers, five

IV. Structure of Meter



1. Liquid Crystal Display (LCD)

2. Trigger: to control opening and closing of jaw

3. Pincer Jaw: Long jaw 65 x 32mm;

round jaw □ 32mm

4. POWER Key: Boot Up / Shutdown /∗Quit

5. HOLD Key: lock / Release display

V. Crystal Display

1. LCD Screen

(1). Sign of low battery voltage

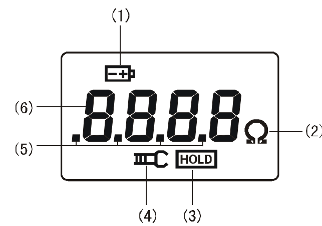
(2). Resistance unit

(3). Data lock symbol

(4). Symbol of an open jaw

(5). Metrication decimal point

(6). 4-digital LCD figures display



2. Description of Special Symbols

(1). Symbol of an open jaw: As a jaw is in the open state, the symbol shows. At this point, trigger may be artificially pressed, or the jaws have been seriously polluted, and can no longer continue to measure.

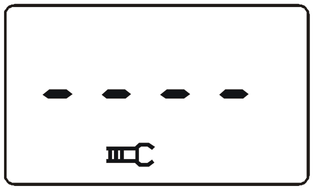
(2). Symbol of low battery voltage: when the battery voltage is lower than 5.3V, the symbol shows. At this time, it cannot guarantee accuracy of the measurements. Batteries should be replaced.

⑶. "**OL** □" symbol indicates that the measured resistance has exceeded the upper limit of the Meter.

⑷. "**L0.01**□" symbol indicates that the measured resistance has exceeded the lower limit of the Meter.

3. Examples of displays

⑴. ---Jaw is in open state, and cannot measure



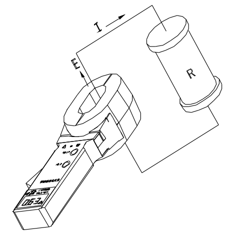
⑵. ---Measured loop resistance is less than 0.01 □

⑶. ---Measured loop resistance is 5.1 □

⑷. ---Measured loop resistance is 2.1 □

the following formula.

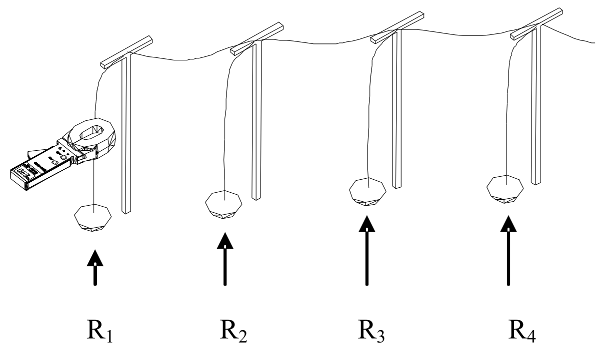
$$R = \frac{E}{I}$$



IX. Measurement Method of Grounding Resistance

1. Multi-Point Grounding System

As for the multi-point grounding system (such as electricity transmission tower grounding system, grounding cable communications systems, certain buildings, etc.), They usually pass the overhead ground wire (cable shielding layer) connected to form a grounding system.



It shows "OL Ω", indicating that the measured resistance value exceeded the upper limit of Meter, see Figure 3.

It shows "L0.01Ω", indicating that the measured resistance value exceeded the lower limit of Meter, see Figure 5.

Figure 5

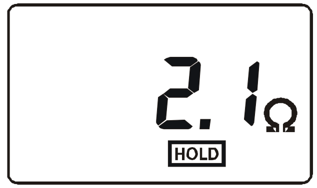
4. Data Lock/Release

In the process of resistance measurement, press **HOLD** key to lock the current show value, displaying **HOLD** symbol. Then press

VIII. Measurement Principle

The basic principle of **DY1100/DY1000** in the measurement of resistance is to measure the loop resistance, as shown in the figure below. The jaw part of the Meter is comprised of voltage coil and current coil. The voltage coil provides excitation signal, and will induce a potential E on the measured loop. Under the effects of the potential E, the current I can generate on the measured loop. The Meter will measure E & I, and the measured resistance R can be obtained by

---Lock the current measurement value: 2.1 Ω



VI. Quick Find Table

Function	Key
Boot Up / Shutdown / Shutdown Delay	**POWER**
Lock / Release Display	**HOLD**

VII. Operating Method

1. Boot Up

Before booting up, the trigger should be pressed for a couple of times to ensure the jaws are well closed.

Press **POWER** key, and it is switched into the boot-up state. First to automatically test LCD display, all its symbols show up, see Figure 1. Then to start the auto inspection; in this process, it will be followed by showing "**CAL6, CAL5, CAL4:CAL0, OL Ω**", see Figure 2. When "OLΩ" appears, auto inspection is completed, and then automatically enter the resistance measurement model, see figure 3.

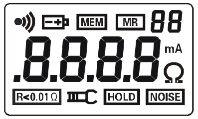


Figure 1

Figure 2

Figure 3

In the process of auto inspection, DO NOT press the trigger, nor open the jaw, nor clamp any wire.

In auto-inspection process, be sure to maintain the natural static state of the Meter; do not overturn the Meter, nor impose any external force on the jaw. Otherwise, the accuracy of measurement cannot be guaranteed.

In auto-inspection process, if the jaws clamped around a conductor loop, the measurement is not accurate. Please remove conductor loop and reboot it up.

If there was not an OL appearing after auto-inspection, but a greater resistance value displayed, as shown in figure 4; But the test loop detection can still give out the correct result. This shows that the Meter has a larger error only in measuring the major resistance (e.g. more than 100Ω), whereas in measuring the small resistance, it can still maintain the original accuracy, users can be rest assured in use.

Figure 4

2. Shutdown

After the Meter is switched on, press **POWER** key to shut it down.

In five minutes after the Meter started up, the LCD screen entered flashing state, and would automatically shut down after the flashing state is sustained for 30 seconds to reduce battery consumption. Press **POWER** key in flashing state may delay the shutdown of the Meter, and keep it working.

In **HOLD** state, it is required to first press **HOLD** key to quit from

3. Resistance Measurement

After the booting auto-inspection is completed, it shows "OL Ω" and will be able to proceed with resistance measurement. At this point, press the trigger and open the jaws, clamp the target loop, reading to get the resistance value.

If the user thinks it necessary, the test can be done with the ring as shown in the following figure. Its show value should be consistent with the normal value on the test ring (5.1 Ω).

The normal value on the test ringis the value at a temperature of 20 °C.

It is normal to find the difference of numerical 1 word between the show value and the nominal value,

For instance: If the nominal value of test ring is 5.1 Ω, it would be normal showing 5.0 Ω or 5.2 Ω.