INSTRUCTION MANUAL

MT332

EARTH RESISTANCE CLAMP METER

Contents

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1. INTRODUCTION

The MT332 Earth Resistance Clamp meter features a sleek black screen design, this device displays resistance current on the same screen, along with convenient functions such as data storage, data review, alarm, and automatic shutdown. With a wide range and high resolution, the MT332 ensures accurate measurements. Its user-friendly interface and convenient carry case make it a practical choice for various applications. The instrument is known for its stable performance and strong anti-interference ability.

Built with a shock-proof, dust-proof, and moisture-proof structure, the MT332 is well-suited for demanding environments. It is an essential tool in telecommunications, electricity, metrology, computer rooms, oil fields, and electromechanical installation and maintenance within industrial enterprises utilizing electricity as power or energy source. Controlled by a microprocessor, the Clamp-On Earth Resistance Tester employs advanced fast filtering techniques to minimize interference, ensuring precise and reliable results. Additionally, it offers simultaneous data storage and upload functions for enhanced efficiency in testing procedures.

2. SAFETY RULES AND PRECAUTIONS

The instruction manual must be read and the safety rules and precautions listed in this manual must be strictly observed. Strict attention must be given before you use this instrument in order to avoid possible electric shock or personal injury.

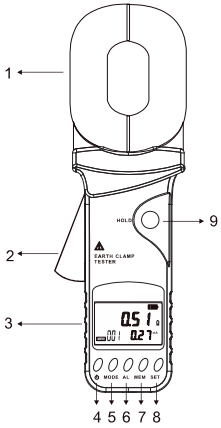
When using this instrument please pay special attention to safety

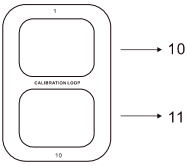
- The instrument is designed, produced, and inspected according to IEC61010 safety specifications.
- To avoid errors during measuring, do not use high-frequency signal generators like mobile phones etc.
- Pay attention to the text & symbols on the label of the instrument body.
- Ensure that the tester and accessories are in good condition before use. There should be no damages or broken parts in the test leads or insulation.
- Before using the tester, squeeze the trigger once or twice to ensure that the jaws are well closed.
- Do not measure in flammable or gaseous areas.
- When the tester is turned on, do not hold the trigger, or clamp any wires.
- The object to be measured can only be clamped after the "OL Ω" symbol is displayed after the tester is turned on.
- Do not keep or store the tester in an area with high-temperature, moisture, or condensation, or under direct daylight radiation for a long

period of time.

- When the meter displays battery low voltage symbol "▭" put the meter on charge immediately, otherwise it will lead to measurement errors.
- Turn off the meter when replacing the battery.
- The contact surface of the jaws must be kept clean and cannot be wiped with corrosives and rough objects.
- When opening the trigger, avoid contact to live cables especially the clamp jaw interface.
- When the clamp meter is measuring resistance, the clamp head will make a slight noise, which is normal.
- Pay attention to the intermittent beep sound to distinguish the alarm.
- Pay attention to the measurement range and operating environment specified by this instrument.
- Do not measure current exceeding the range, it will damage the tester
- Do not measure in flammable or gaseous areas.
- This meter is only to be used, disassembled, adjusted, and repaired by a qualified and authorized personnel
- If the tester is damaged during usage, it may be removed from site and sent away to an authorized personnel for repairs or disposal
- For the safety warning signs "⚠" on the instrument, the user must strictly follow the contents of this manual for safe operation.

3. INSTRUMENT STRUCTURE

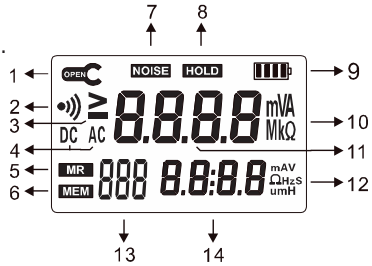




1 - Clamp Jaw
2 - Jaw open and close trigger
3 - LCD display
4 - Power key
5 - MODE key
6 - AL alarm key
7 - MEM memory key
8 - SET key
9 - HOLD key
10 - Calibration 1Ω loop
11 - Calibration 10Ω loop

4. LCD

1 - Clamp head open symbol.
2 - Alarm indication symbol
3 - Greater than symbol
4 - AC and DC indication symbols
5 - Data access symbols
6 - Data storage symbols
7 - Noise indicator symbol
8 - Data lock symbol
9 - Battery level indicator
10 - Unit indication
11 - Four-digit resistance data
12 - Unit indication



13 - Number of storage groups
14 - Four digits indicate current lead

4.1. Description of special symbols:

1. The " OPEN " is displayed when the jaw is opened. When this symbol is displayed the trigger may be squeezed artificially; or the jaws are seriously polluted, and the measurement cannot be continued.
2. "**Er**" is displayed when the trigger was pressed, or the jaws were opened when starting up.
3. Low battery voltage symbol " ▭ ", is displayed when the battery voltage is lower than 5.0V. When this symbol is displayed, the measurement accuracy cannot be guaranteed, and the battery should be replaced.
4. The "**OL Ω**" symbol indicates that the measured resistance exceeds the upper limit of the clamp meter.
5. The "**L0.01Ω**" symbol indicates that the measured resistance exceeds the lower limit of the clamp meter.
6. "**OL A**" symbol indicate that the measured current exceeds the upper limit of the clamp meter.
7. Alarm symbol "•))) " is displayed when the measured value is greater than the set alarm threshold, the symbol will flash, display, and the instrument will emit intermittent beep sound.
8. Memory symbol "**MEM**" flashes when data is being saved.
9. Referencing data symbol "**MR**" is displayed when referenced data, and the number of the stored data is displayed at the same time.
10. "**NOISE**" symbol is displayed when the earth loop under test has a large interference current, this symbol will flash, display, and the instrument emits an intermittent beep sound. The accuracy of the test cannot be guaranteed at this time.

5. PRINCIPLE OF RESISTANCE MEASUREMENT

The basic principle of the Clamp-On Earth Resistance Tester is to measure earth resistance and the leakage current in the loop. (**See below figure 1**). The clamp jaw is composed of a voltage coil and a current coil. The voltage coil provides the excitation signal and induces a potential voltage (**V**) on the loop under test. Under the action of the potential voltage (**V**), a current (**I**) will be generated in the circuit under test. The clamp meter measures **V** and **I**, and the measured resistance (**R**) can be obtained by the following formula: **R=V/I**

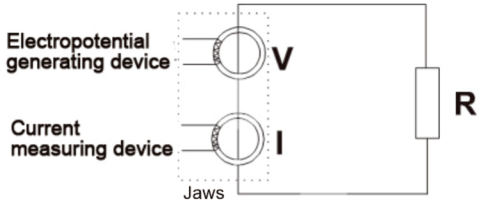


Figure 1

6. OPERATION

6.1. Power Function

⚠	**WARNING:** When switching the clamp meter on, **do not depress the trigger, open the jaws, or clamp any wires.**
⚠	After the boot is completed and "**OL Ω**" is displayed, the trigger can be pulled, the jaws opened, and the conductor under test can be clamped.
⚠	Before switching the clamp meter on, squeeze the trigger once or twice to make sure the jaws are well closed.
⚠	When switching on the clamp meter, keep the clamp meter in a natural static state, **do not turn the clamp meter over and do not apply external force to the jaws**, otherwise the measurement accuracy cannot be guaranteed.

Press the power button to switch the clamp meter on and off. The meter automatically calibrates and will display "**OL Ω**" after it is powered on. The meter automatically enters the resistance measurement mode. If there is no normal boot-up self-calibration, the meter will display the "**Er**" symbol, indicating a power-on error. Common reasons for power-on errors are that the jaws are not closed well, Clamp wires etc. when starting up.

It will automatically shut down after 5 minutes of being switched on. Before the automatic shutdown, the meter will flash for 30 seconds. Pressing the power button again will delay the on-off time for 5 minutes.

6.2. Battery Voltage Check

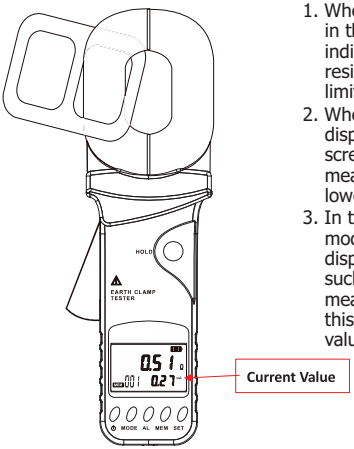
When switching on the clamp meter and the LCD displays the low battery voltage symbol "▭", it means the battery is low, **please replace the battery**. The battery power must be sufficient to ensure the accuracy of the measurement.

6.3. Earth Resistance and Leakage Current Test

> ⚠ **WARNING:** When the user thinks that the earth value is not in line with the normal range, you can use the calibration ring to check whether the clamp meter is in normal range. The check loop has two resistance values of 1Ω and 10Ω respectively.

After the power-on self-test is completed, the large number in the middle will display "**OLΩ**", and the resistance measurement can be performed. Squeeze the trigger, open the jaws, clamp the circuit to be tested, and read the resistance value.

Resistance and Leakage Current can be measured at the same time. Press the "**MODE**" button to switch between "**Resistance + Current**" and "**Resistance**" modes after power on.



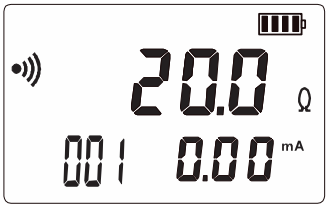
1. When "**OLΩ**" is being displayed in the middle of the screen it indicates that the measured resistance exceeds the upper limit of the clamp meter.
2. When "**L0.01Ω**" is being displayed in the middle of the screen it indicated that the measured resistance exceeds the lower limit of the clamp meter.
3. In the "**Resistance + Current**" mode, the lower right of the display shows the current value, such as "0.00mA", if you need to measure the current, switch to this mode to read the current value directly.

Resistance + Current Mode:

The measured resistance value is 0.51Ω, the number of saved groups is 1 group, and the measured loop current is 0.00mA

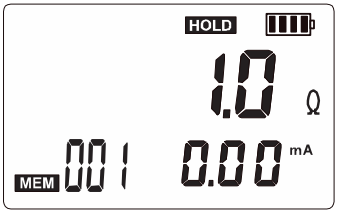
6.4. Alarm System

When switching on the clamp meter, short press the "**AL**" key to turn the alarm function on or off. Long press the "**SET**" key to set the resistance, current, and voltage alarm values. To change the current number, press the "**AL**" key and "**MEM**" key. Short press the "**MODE**" key to switch the alarm mode, then long press the "**SET**" key to save and exit. When the measured resistance value is greater than the alarm critical set value and the alarm function is turned on, the meter flashes the "•)))" symbol and emits an intermittent beep sound. The maximum value of the earth resistance alarm setting is 200Ω. As shown below:



6.5. Data Hold

When the measurement is stable after switching on the clamp meter, short press the "**HOLD**" key to lock the current data displayed and save the data, then short press the "**HOLD**" key to exit the lock mode. As shown below:



6.6. Data Storage / Review / Deletion

When the measurement is completed after switching on the clamp meter, short press the "**HOLD**" key to store the data. The "**MEM**" symbol will flash and automatically number. If the storage is full, the meter will flash the "**MEM**" symbol. Take note, the interface "**MR**" symbol will display. Press the "**AL**" or "**SET**" key to select the data corresponding to the array number with a step value of 1, then short press the "**MEM**" key to exit the search.

See below **Figure 2 and 3**. In figure 2 "**MEM**" symbol is flashing when data is stored, and the current storage group number is 1. In Figure 3 the data review mode is entered, and the "**MR**" symbol is displayed, and the current reference group number is 1.

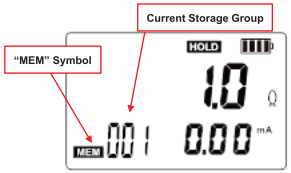


Figure 2

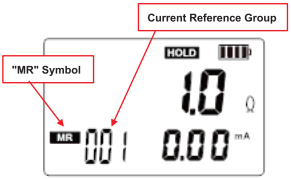


Figure 3

In the data review mode long press the "**MEM**" button and then press the "**Power button**" to delete the stored data.

7. BATTERY DESCRIPTION

When the voltage drops to 5.0V, the LCD will display the low battery voltage symbol "▭". Please replace the battery. Low battery voltage affects measurement accuracy.

8. LIVE APPLICATION

8.1. Multipoint Earthing System

Multi-point earthing systems (such as transmission system tower earthing, communication cable earthing systems, certain buildings, etc.), are connected through overhead earth wires (the shielding layer of communication cables) to form a n earthing system. **See below figures 4 and 5.**

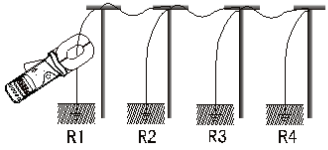


Figure 4

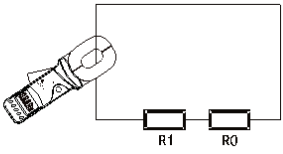


Figure 5

When measured with a clamp meter, its equivalent circuit is as follows: "**R1**" is the predicted earth resistance. "**R0**" is the equivalent resistance of the earthing resistances of all other towers in parallel. Although, from the strict earthing theory, due to the existence of the so-called "mutual resistance", "**R0**" is not a parallel value in the usual electrotechnical sense (it will be slightly larger than the parallel value in the electrotechnical sense), since the earthing hemisphere of each tower is much smaller than the distance between towers, and the number of earthing points is large, "**R0**" is much smaller than "**R1**". Therefore, it is reasonable to assume "**R0**" = 0 from an engineering point of view. In this way, the resistance we measure should be "**R1**". Contrasting experiments with traditional methods in different environments and occasions have proved that the above assumptions are completely reasonable.

8.2. Limited Point Earthing System

This situation is also more common. For example, in some towers, five towers are connected to each other through overhead earth wires; for example, the earthing of some buildings is not an independent earthing network, but several earthing bodies are connected to each other through wires. In this case, if the "**R0**" in the above figure is regarded as 0, it will bring a large error to the measurement result. For the same reason as above, we ignore the influence of mutual resistance, and calculate the equivalent resistance of the earthing resistance in parallel with the calculation method in the usual sense. In this way, for an earthing system with "**N**" (smaller, but greater than 2 earthing bodies), "**N**" equations can be listed:

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

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

$$R_N + \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \cdots\cdots + \frac{1}{R_{(N-1)}}} = R_{NT}$$

Among them "**R1**", "**R2**", "**RN**" is the earthing resistance of the "**N**" earthing bodies we require. "**R1T**", "**R2T**", "**RNT**" are the resistances measured by the clamp meter in each earthing branch.

This is a nonlinear system of equations with "**N**" unknowns, "**N**" equations. It has a definite solution, but it is very difficult to solve it

manually, and it is even impossible when "**N**" is large. In addition to ignoring mutual resistance, this method does not have the measurement error caused by ignoring "**R0**".

However, users need to pay attention to this, in your earthing system, there are several earthing bodies connected to each other, and the same number of test values must be measured for the program to solve, not more or less. The program also outputs the same number of earthing resistance values.

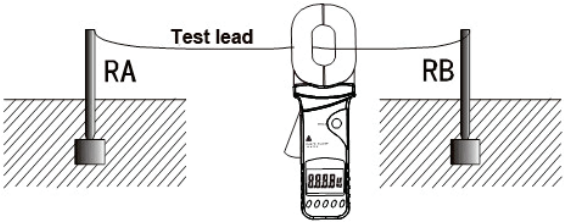
8.3. Single Point Earthing System

From the test principle, the clamp meter can only measure the loop resistance, and cannot measure the single-point earthing. However, users can use a test lead and an earth electrode near the earthing system to artificially create a loop for testing. The following introduces two methods for measuring single-point earthing with a clamp meter.

This method can be applied to occasions that cannot be tested by the traditional voltage-current method.

1. Two Point Method

See the figure below, find an independent earthing body "**RB**" (such as a nearby water pipe, building, etc.) near the earthing body "**RA**" to be tested. Connect "**RA**" and "**RB**" with a test lead.

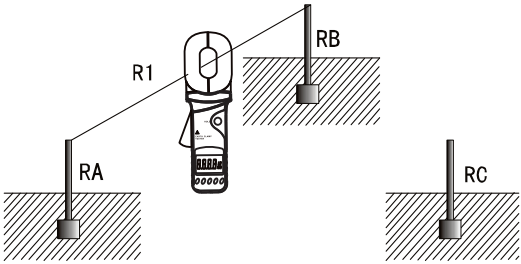


The resistance value measured by the clamp meter is the series value of the two earthing resistances and the resistance value of the test lead. Formula as follows: **RT=RA+RB+RL** .

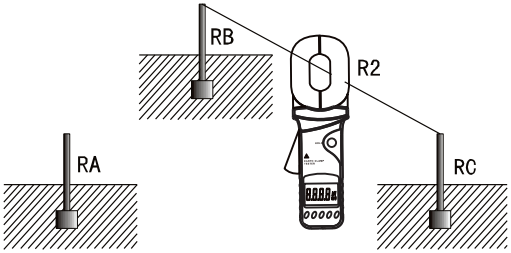
"**RT**" is the resistance value measured by the clamp meter. "**RL**" is the resistance value of the test line. The resistance value "**RL**" can be measured with a clamp meter by connecting the end of the test lead to the end. Therefore, if the measured value of the clamp meter is less than the allowable value of the earthing resistance, then the earthing resistances of the two earthing bodies are qualified.

2. Three Point Method

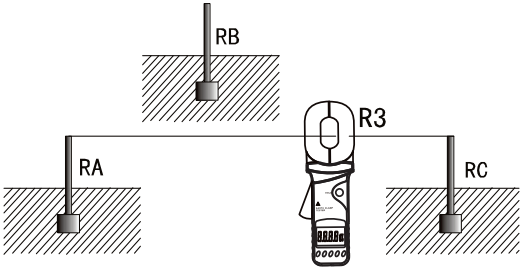
As shown in the figure on page 13, find two independent earthing bodies "**RB**" and "**RC**" near the measured earthing body "**RA**". The first step is to connect "**RA**" and "**RB**" with a test lead, read the first data "**R**" with a clamp meter.



The second step is to connect "**RB**" and "**RC**" as shown in the figure below. Use the clamp meter to read the second data "**R2**".



The third step is to connect "**RC**" and "**RA**" as shown in the figure below. Use the clamp meter to read the third data "**R3**".



In the above three steps, the reading measured in each step is the series value of the two earthing resistances. In this way, each earth resistance

value can be easily calculated as follows:
Since "R1" = "RA" + "RB" (as per step 1)
Since "R2" = "RB" + "RC" (as per step 2)
Since "R3" = "RC" + "RA" (as per step 3)
The RA will be determined as follows:
"RA" = ("R1" + "R3" – "R2") ÷2
This is the earth resistance value of the earthing body "**RA**". In order to facilitate the memorization of the above formula, the three earthing bodies can be regarded as a triangle, and the measured resistance is equal to the adjacent side resistance plus minus the opposite side resistance divided by 2.
The earthing resistance values of the other two earthing bodies as reference objects are:
"RB" = "R1" – "RA"
"RC" = "R3" – "RA"

9. SPECIFICATIONS

9.1. Model parameters

Model	Resistance Range	Current Range
MT332	0.01Ω-1200Ω	0.00mA-20A

9.2. Range and Accuracy

Measuring function	Measuring Range	Resolution	Accuracy
Resistance	0.010Ω - 0.099Ω	0.001Ω	±(1%+0.01Ω)
	0.10Ω - 0.99Ω	0.01Ω	±(1%+0.01Ω)
	1.0Ω - 49.9Ω	0.1Ω	±(1%+0.1Ω)
	50.0Ω - 99.5Ω	0.5Ω	±(1.5%+0.5Ω)
	100Ω - 199Ω	1Ω	±(2%+1Ω)
	200Ω - 395Ω	5Ω	±(5%+5Ω)
	400 - 590Ω	10Ω	±(10%+10Ω)
	600Ω - 880Ω	20Ω	±(20%+20Ω)
	900Ω - 1200Ω	30Ω	±(25%+30Ω)
Current	0.00mA - 9.95mA	0.01mA	±(2.5%+1mA)
	10.0mA - 99.0mA	0.1mA	±(2.5%+5mA)
	100mA - 300mA	1mA	±(2.5%+10mA)
	0.30A - 2.99A	0.01A	±(2.5%+0.1A)
	3.0A - 9.9A	0.1A	±(2.5%+0.3A)
	10.0A - 20.0A	0.1 A	±(2.5%+0.5A)

9.3. Technical Specifications

Function	Earth Resistance Test, Leakage Current Test
Ambient Temperature and Humidity	23°C ± 5°C below 75%RH
Power Supply Measurement Method	DC 6V (4x AA batteries) Mutual Inductance
Resistor Resolution	0.001Ω
Current Resolution	0.01mA
Jaw Size	55mm x 32mm
Ω + A Sync Display	Ω + A sync display
Earth Voltage Measurement Function	None
Display Mode	4-digit LCD display, black screen design
LCD Size	46mm x 29mm
Meter Size	LxWxH:285mm x 85mm x 58mm
Measure Time	2 times/sec
Data Storage	300 groups, "MEM" storage indication, displaying "FULL" symbol means the storage is full
Data Access	"MR" symbol indication when viewing data
Overflow Display	"OL" symbol indication when over range overflow
Interference Test	Automatically identify interference signals, and the "NOISE" symbol indicates when the interference current is large
Alarm Function	When the measured value exceeds the alarm setting value, an alarm prompt will be issued
Battery Voltage	Real-time display of battery power, reminding to charge in time when the battery voltage is low
Automatic Shut-Down	Automatic shutdown after 5 minutes of startup
Power Consumption	50mA Max
Weight	Meter: 1180g (including battery)
Working Temperature and Humidity	-10°C ~ 40°C below 80% RH
Storage Temperature and Tumidity	-20°C ~ 60°C below 70% RH
Insulation Resistance	Above 20MΩ (500V between circuit and case)
Pressure Resistance	AC 3700V/rms (between circuit and case)
External Magnetic Field	<40A/m
External Electric Field	<1V/m
Safety Regulations	IEC61010-1 (CAT III 300V, CAT IV 150V, pollution degree 2) IEC61010-031, IEC61557-1 (Earth resistance)

10. ACCESSORIES

Meter	1 pc
Battery	4 AA Batteries
Calibration Loop	1 pc
Manual, Warranty	1 set

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