



MECO®

CLAMP ON GROUND/EARTH RESISTANCE TESTER MODEL : 4680/ 4680B USER MANUAL

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CE EN 61010-2-032
CAT II 600V
CAT III 300V
Pollution Degree 2

Definition of Symbols :



Caution : Refer to Accompanying Documents



Caution : Risk of Electric Shock



Double Insulation

Over-voltage Category I (CAT I) :

Equipment for connection to circuits in which measures are taken to limit the transient over-voltages to an appropriate low level.

Over-voltage Category II (CAT II) :

Energy-consuming equipment to be supplied from the fixed installation.

Over-voltage Category III (CAT III) :

Equipment in fixed installations.

WARNING :

If the clamp meter is used in a manner Not specified by the manufacturer, the protection provided by the clamp meter may be impaired.

If jaws are damaged in any way, please stop operating this clamp, and return it to qualified personnel for repair.

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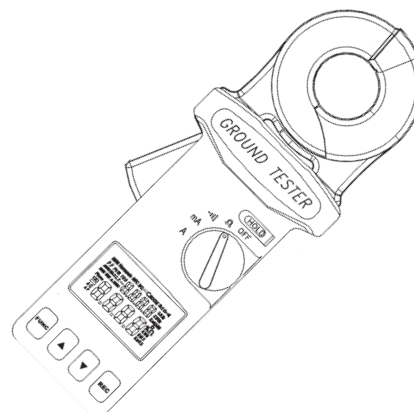
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1. WARNING

1. Use of rubber gloves is a good safety practice even if the equipment is properly operated and grounded.
2. Safety is the responsibility of the operator.
3. Use extreme caution when using the instrument around energized electrical equipment.
4. Do not attempt to use the ground tester to twist or pry the ground electrode or ground wire away from the equipment being grounded.
5. All metal objects or wires connected to the electrical system should be assumed to be lethal until tested. Grounding system is no exception.

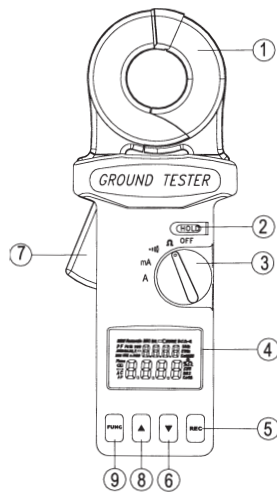
2. FEATURES DESCRIPTION

The clamp-on ground resistance tester enable the users to measure ground resistance of ground rod without the use of auxiliary ground rods. Clamp-on ground resistance tester is used in multi-grounded systems without disconnecting the ground under test.



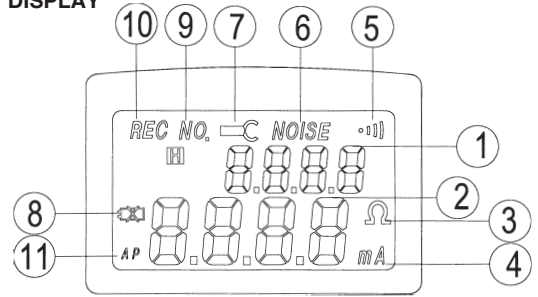
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3. PANEL DESCRIPTION



1. Jaws Assembly : Enclose electrode or ground rod. No air gap is allowed between two half jaws.
2. Hold Button: Press this button to hold the value in LCD.
3. Rotary Switch : Turn power on and select function.
4. LCD
5. REC button : When one of the functions is selected by FUNC button, it is used to increment value. If no function is selected, it is used to start data logging, or record one data.
6. ▼ button : To decrement value, press this Button
7. Jaws Trigger
8. ▲ button : To increment value, press this button
9. FUNC button : Press this button to select function of HI (high alarm,) LO (low alarm), SEC (seconds) or no. (read).

4. LCD DISPLAY



1. Function : Display current selected function or current record number.
2. Digits : Display value from 0 to 9999 with decimal point.
3. Ohm : Symbol will be shown in V and alarm functions.
4. mA : Display ground leakage current in mA or A
5. NOISE : This symbol will be shown if the rotary switch is set at the alarm position.
6. NOISE : When ground resistance tester senses noise existed in the ground electrode or ground rod, this symbol will be shown in LCD.
7. Jaw Open : When the jaw is open during measurement, this symbol and word OPEN will be shown in LCD.
8. Low Battery : When the battery voltage is lower than required this symbol will be shown in LCD.
9. NO. : Indicate the READ function.
10. REC : Indicate data logging is in progress.
11. AP : If this symbol is displayed in LCD, that means the unit will be turned off in 4 to 6 minutes.

5. OPERATION INSTRUCTION

5-1. Ground Resistance Measurement :

1. Open the jaws and make sure the jaws mating surfaces are clean and free of dust, dirt or any foreign substance.
2. Snap the jaws few times to let the jaws sit on the best mating position
3. Turn the power on, set the rotary switch at V position. **Do not clamp on to any conductor or open the jaws at this moment or during self-calibration.**
4. At powering on, clamp-on ground resistance tester will do the self-calibration for better accuracy. Users should wait for self-calibration to be complete. During the self-calibration, LCD will show CAL5, CAL4, CAL 3, CAL2 and CAL1.
5. When the ground tester is ready, a beep sound will be heard.
6. Clamp on to the electrode or ground rod to be measured. Snap the jaws few times for better accuracy.
7. Read the value of R_g (ground resistance) from LCD.

Note : For better measurement,

1. Must snap the jaws few times before powering on.
2. Do not clamp on to any conductor at the moment of powering on.
3. Snap the jaws few times after clamping on to ground electrode.

Note : If self-calibration does not stop,

1. That is because the self-calibration is not complete Ground tester will continue the process until a proper self-calibration is done.
2. Check the jaw mating surfaces. If there is any dirt, dust or any foreign substance, clean the surface.

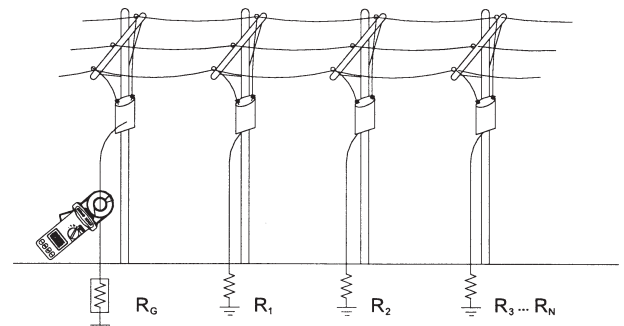
3. Do not open the jaws during self-calibration.

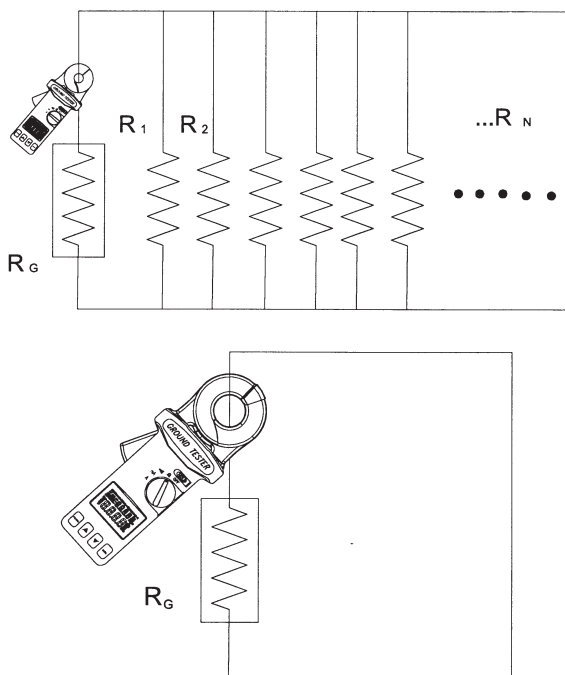
Note : Noise present in the electrode or ground rod.

If there exists over excessive current or 30V in ground rod, a symbol of NOISE will be shown in LCD. Under the presence of noise the reading is no longer accurate.

Note :

If jaw is open during measurement, a symbol of OPEN will be displayed in LCD.

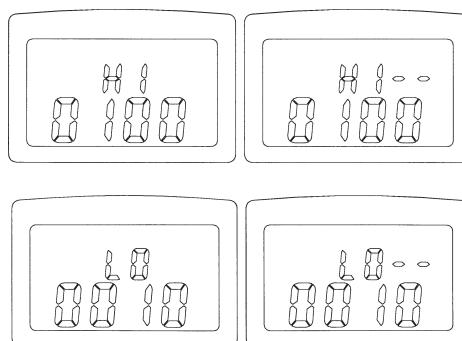




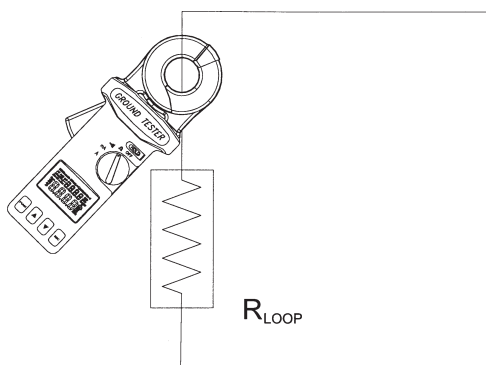
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5-2. High and Low alarm ($\bullet\bullet$)

1. Set the rotary switch at the $\bullet\bullet$ position.
2. Press the FUNC button to select "HI" or "LO" alarm. The current value of High or Low alarm will be shown in the upper row of LCD.
3. Press the \blacktriangle or \blacktriangledown button to increment or decrement the value by 1 ohm. As users hold the button longer, the speed of incrementing or decrementing will become faster. The value can be increment from 0 ohm to 1510 ohm and then OL. The value will roll over to 0 if the current value shows OL.
4. Once the value is set, press the FUNC button several times until the upper row LCD show no letters.
5. When the rotary switch is set at the $\bullet\bullet$ position. The unit will compare the current value with the high and low values. If the current measurement is larger than HI value, the unit will beep and show HI in the upper row of LCD. If the current measurement is smaller than the LO value, the unit will beep and show LO in the upper row of LCD.



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NOTE :

If the HI value is set at OL, or the LO value is set at 0, the ALARM function will not be performed. So they are method to disable one of the HI or LO alarm.

NOTE :

The HI value can't be smaller than the low value. And the LO value can't be larger than the HI value. HI value will be adjusted to LO value plus 1 when roll-over occurs. The maximum value of LO value is HI value minus 1.

NOTE :

If data logging is progressing, sound of beeping will be disabled to save battery power. But the LCD still shows the warning letters of "HI -" or "LO -".

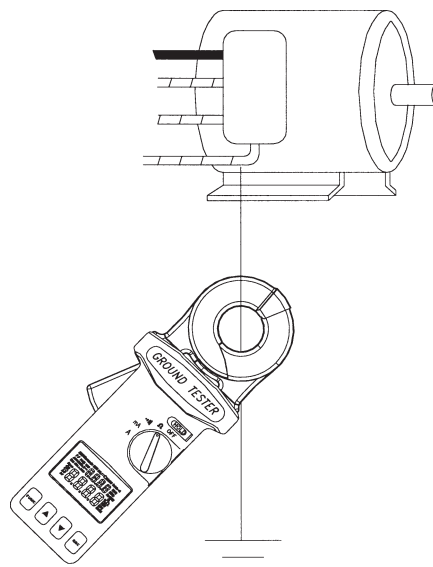
NOTE :

The values for the high and low alarm are stored in the memory. They are restored when the power is turned on.

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5-3. Ground/Leakage Current Measurement

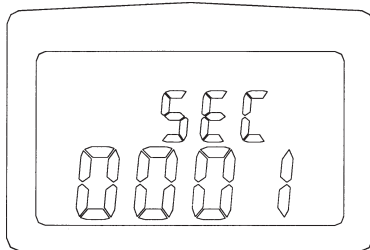
1. Turn the power on and set the rotary switch at the mA or A position.
2. Clamp on to the electrode or ground rod.
3. Read the value of leakage current displayed in LCD.



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5-4. Setting the Sampling Interval

1. Press the FUNC button until letters of "SEC" are shown in the upper row of LCD.
2. The unit shows the current sampling interval in seconds.
3. Press the ▲ or ▼ button to increment / decrement the value by 1 second. As users hold the button longer, the speed of incrementing / decrementing will become faster. The value can be incremented / decremented from 0 to 255 / 255 to 0 seconds. Value will roll over when the value of maximum 255 / minimum 0 seconds is reached.
4. Press the FUNC button several times until the upper row LCD show no letters.



NOTE : The sampling interval is used for data logging.

5-5. Data Logging

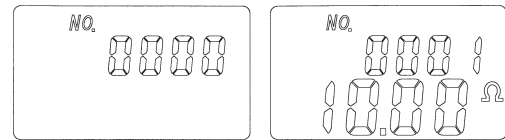
The unit will start data logging if the REC button is pressed, and a symbol of REC will be shown in LCD. Data will be recorded at the specified sampling interval. Data logging will be stopped if the memory is full, or the unit detects the condition of low battery, or the REC button is pressed again.

NOTE : If the sampling interval is set at 0 seconds, only one data is recorded. To record next data, users can press the REC button again. The record number is also displayed for about 1 seconds.

5-6. Read the Data Stored in Memory

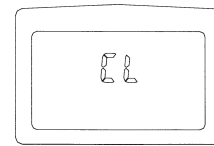
This function allows users to read the stored data at site if no PC is available.

1. Press the FUNC button until a symbol of "NO." is shown in LCD. The current record number is shown in the upper row of LCD. And the data is shown in the lower row of LCD.
2. Press the ▲ or ▼ button to read the next or previous data,
3. If the users hold the ▲ or ▼ button longer, the record number will be incremented / decremented faster. The record number will roll over when the last / first record is reached.



5-7. Clear Data Memory

Press and hold the REC button, then turn the power on. Letters of "CL" will be shown to indicate that memory is cleared.



5-8. Cancel the Auto Power Off

When the unit is turned on, a symbol of AP is displayed in LCD. That means the unit will turn itself off in about 4 to 6 minutes. To cancel this function, user can hold the FUNC button, then turn the power on. Symbol of AP will not be displayed in LCD.

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6. PRINCIPLE OF OPERATION

Below is a simplified typical ground distribution system. Its equivalent circuit is shown in Figure A. If $R_1, R_2, R_3, \dots, R_n$ is combined as R_{eq} then only R_g and R_{eq} are left in the circuit (refer to Figure B). If a constant voltage is applied to the circuit, following equation will be constructed.

$$\frac{V}{I} = R_g + R_{eq}$$

where

$$R_{eq} = \frac{1}{\sum \frac{1}{R_i}}, \quad i = 1, 2, \dots, n$$

if R_g and R_1, R_2, \dots, R_n are about the same, and n is a large number (such as 200), then R_{eq} will be much less than R_g and may be approach zero.

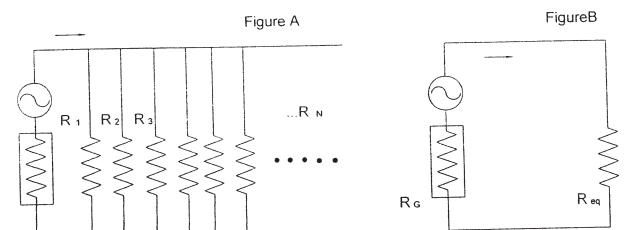
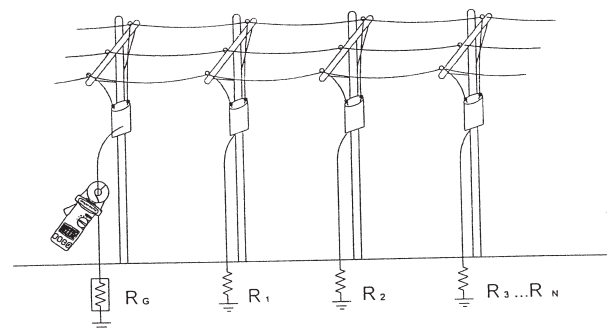
$$R_g \gg R_{eq} \quad (R_{eq} \rightarrow 0)$$

Example : If R_g and R_1, R_2, \dots, R_n are all 10 V, respectively and $n = 200$. Then R_{eq} by calculation equals

$$R_{eq} = \frac{1}{\frac{1}{10} + \frac{1}{10} + \dots + \frac{1}{10}} = 0.05 \text{ V}$$

$$\frac{V}{I} = R_g + R_{eq} = 10 + 0.05 = 10.05 \rightarrow R_g$$

In this example, we can see that as long as the number of multiple electrodes is large enough, the equivalent resistance is negligible with respect to the ground resistance to be measured.



7. ELECTRICAL SPECIFICATION

Ground Resistance (Auto range) :

Range	Resolution	Accuracy of Reading ^{1,2}
0.025 - 0.250 V	0.002 V	± 1.5% ± 0.05 V
0.251 - 1.000 V	0.02 V	± 1.5% ± 0.05 V
1.001 - 10.00 V	0.02 V	± 1.5% ± 0.1 V
10.01 - 50.00 V	0.04 V	± 2.0% ± 0.3 V
50.01 - 100.0 V	0.04 V	± 2.0% ± 0.5 V
100.1 - 200.0 V	0.4 V	± 3.0% ± 1.0 V
200.1 - 400.0 V	2 V	± 5.0% ± 5 V
400.1 - 600.0 V	5 V	± 10% ± 10 V
600.1 - 1500 V	20 V	± 20%

¹Loop resistance noninductive, external field < 50 A/m (4680) or < 200 A/m (4680B), external electrical field < 1 V/m, conductor centered.

²Resistance Measurement Frequency : 3.333KHz

High and Low Alarm

	Range	Resolution
High Alarm	0 - 1510 V	1 V
Lo Alarm	0 - 1510 V	1 V

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Ground/Leakage Current

Auto range, 50/60 Hz, TRMS, Crest Factor < 3.0 for (4680) or < 3.5 for (4680B)

Range	Resolution	Accuracy of Reading
0.300 - 1.000 mA	0.001 mA	± 2.0% ± 0.05 mA
1.00 - 10.00 mA	0.01 mA	± 2.0% ± 0.03 mA
10.0 - 100.0 mA	0.1 mA	± 2.0% ± 0.3 mA
100 - 1000 mA	1 mA	± 2.0% ± 3 mA
0.200 - 4.000 A	0.001 A	± 2.0% ± 0.03 A
4.00 - 30.00 A (4680)	0.01 A	± 3.0% ± 0.03 A
4.00 - 35.00 A (4680B)	0.01 A	± 3.0% ± 0.03 A

Accuracy of Resistance Calibration Plate : ± 1%

Data Logging Capacity : 116 records

Data Logging Interval : 1 to 255 seconds

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8. GENERAL SPECIFICATIONS

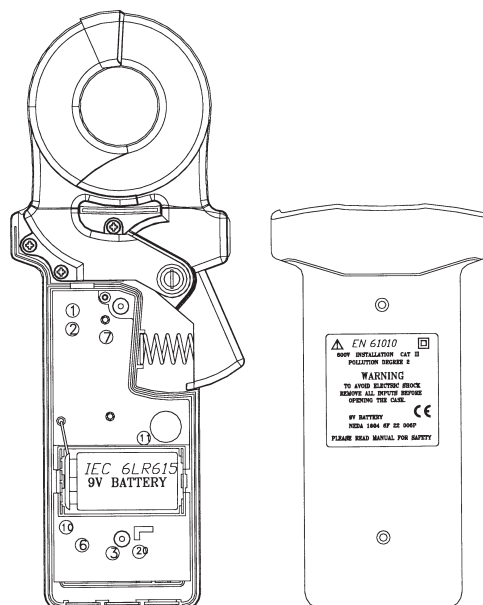
Conductor Size	: 23 mm approx. (4680) 35 mm approx. (4680B)
Jaw Opening	: 27 mm approx. (4680) 38 mm approx. (4680B)
Battery Type	: 9V IEC 6 LR61 (Alkaline)
Display Type	: 4 digits 9999 counts LCD
Range Selection	: Auto
Auto Power Off	: About 4 to 6 minutes
Overload Protection	: 100A (continuous), 200A (5 sec.)
Overload Indication	: OL
Power Consumption	: 40mA (approx.)
Low Battery Indication	: <input type="checkbox"/> B <input type="checkbox"/>
Battery Life	: 3000 measurements
Temperature coefficient	: 0.1% x (specified spec.) / °C (<18°C or >28°C)
Sampling Time	: 0.5 seconds
Operating Temperature	: 0°C to 50°C (14°F to 122°F)
Operating Humidity	: Less than 85% RH
Storage Temperature	: -20 °C to 60°C (-4°F to 122°F)
Storage Humidity	: Less than 75% RH
Dimension	: 257 x 100 x 47mm (approx.) (4680) 276 x 100 x 47mm (approx.) (4680B)
Weight	: 640gms including battery (approx.) (4680) 750gms including battery (approx.) (4680B)
Accessories	: Resistance Calibration Plate x 1 9V Battery Installed x 1 Instruction Manual x 1 Carrying Box x 1 Cleaning Brush x 1

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9. Battery Replacement

When the low battery symbol is displayed in LCD, replace the old battery with new battery.

1. Turn the power off.
2. Remove the screw of the back cover.
3. Lift and remove the back cover.
4. Remove the old battery.
5. Install a new 9V battery.
6. Place the back cover and secure the screw.



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10. Maintenance & Cleaning

Servicing not covered in this manual should only be performed by qualified personnel. Repairs should only be performed by qualified personnel.

Periodically wipe the case with a damp cloth and detergent; do not use abrasives or solvents.



Certificate of Calibration

We hereby certify that this product has been calibrated and found to be in accordance with the applicable SPECIFICATIONS and STANDARDS.

Accuracies of the standard equipment used in this calibration are traceable to the National Standards.

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