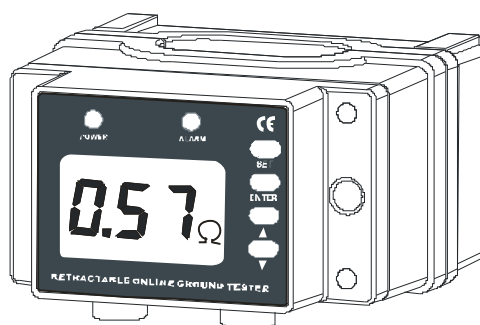


Closed Loop Type Ground resistance on - line detector

KM 1680C



USER MANUAL

CONTENT

Precautions For Use.....	1
1. Introduction.....	1
2. Detector Model Distinction.....	2
3. Technical Specifications	3
4. Detector Structure	4
5. Network Structure.....	6
5.1. Independent installation	6
5.2. Wired network system (Self -Exploitation Software)	6
5.3. Wireless network system (Self -Exploitation Software)	7
6. The Principle and Application	7
6.1. Testing Principle.....	7
6.2. Loop Resistance Definition	8
6.3. Metal Loop Circuit Connection Resistance Testing	8
6.4. Single Point Grounding System	9
6.5. Three-point Method.....	9
6.6. Application	10
7. Wiring Instructions	11
8. Install Size and Caution	12
9. Power Supply Model Selection	13
10. Wire Monitoring software (Self-Exploitation Software).....	14
11. Wireless Monitoring software (Self-Exploitation Software)	14
12. Basic Configuration	14

Precautions For Use

Thank you for purchasing **our Earth Resistance Monitoring Sensor**. In order to better for use of the product, please be certain:

—— **Read this user manual carefully.**

—— **Comply with the operating cautions in this manual.**

- ◆ Apply to loop circuit ground resistance, metallic loop circuit bonding resistance, grounding conditions on-line monitoring.
- ◆ Single point grounding system needs to increase an auxiliary earth pole and forms a loop circuit, then install the detector.
- ◆ Pay attention to the measuring range and operating environment specified by this detector.
- ◆ Detector have split core and closed loop structure, the front and rear device parts of detector were matched pair in the factory, and cannot be replaced with other detectors, otherwise it will seriously affect the test accuracy. Before installation, check the match pair device parts code is consistent or not.
- ◆ When install, please keep the front and rear device parts of detector surface clean, fixation and tighten the screws.
- ◆ When using in hazardous place, the external power supply connect to the detector must go through the safety barrier, and the safety barrier placed in the non-hazardous area.
- ◆ Product shell is non-metallic material; there is potential danger of electrostatic charge! Prevent friction In hazardous area. Clean with a damp cloth.
- ◆ Disassembly, calibration and maintenance of the detector shall be operated by the authorized personnel.
- ◆ Due to the reason of this instrument, if it is dangerous to continue using, should be stopped and sealed immediately ,and handled by an authorized institution.

1.Introduction

Earth Resistance Monitoring Sensor is high-tech product that our company has devoted to "grounding resistance detection technology research" for more than ten years, specialize for online monitoring grounding down lead connection status, circuit grounding resistance and metal circuit connection resistance. It is closed loop structure, need to interrupt the grounding down lead in installation; It is spilt core structure, no need to interrupt the grounding down lead in installation, convenient and efficient. On-line testing, non-contact measurement, grounding wire pass through the perforation of the detector, definitely not influence grounding for lightening effect and normal operation, real time on-line testing. Use by **RS485** wire communication or GPRS wireless communication data transmission, realize remote online monitoring. Detector built-in sensor and circuit board, completely sealed, ensure high-accuracy, high stability and high reliability of long-time on-line monitoring at field and indoors.

Earth Resistance Monitoring Sensor suitable for transmission line tower grounding; Meteorological lightning protection grounding; Petrochemical grounding; Communication grounding; Substation grounding; Railway facilities grounding; Construction warehouse grounding; Metal circuit resistance; Electrical equipment grounding etc.

Earth Resistance Monitoring Sensor can install and use singly, and also could set up wired and wireless network system. Wired network system through RS485 communication protocol to transmit data, build up by the detector, 【communicator, monitoring software, power adapter, computer(above equipment need the user provide and secondary development)】 and other components; Suitable for short-distance ground resistance monitoring. Wireless network system through GPRS communication protocol to transmit data, build up by the detector(built-in GPRS transceiver module), 【SIM communication card, monitoring software, power adapter, computer(above equipment need the user provide and secondary development)】 and other components for long-distance ground resistance monitoring. Wired network system is suitable for monitoring within 1,500 meters distance, wireless network system is not subject to distance restrictions.

It type can display the measured data directly through the LCD; the detector could set alarm threshold, with sound and light alarm indication, suitable for independent installation and use no need to set up the network. Our grounding resistance on-line detector has passed the explosion-proof certification and meets the requirements of GB3836-2000 "Electrical Equipment for Explosive Gas Environment".

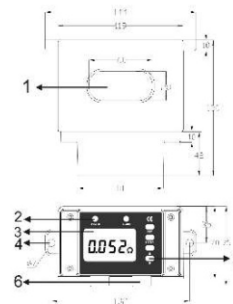
3. Technical Specifications

Function	Loop circuit grounding resistance on-line monitoring, metal loop circuit resistance connection online monitoring, grounding condition monitoring.
CT structure	Closed loop
Power Supply	Detector: 6VDC~12VDC, 50mA Max(GPRS 12VDC 150mA Max). (Ui: 6V; Ii: 50mA; Ci:0μF; Li:0mH; Pi: 0.1W) †User supply) , Instrument and safety barrier matching relation: $U_o \leq U_i$, $I_o \leq I_i$, $P_o \leq P_i$, $C_o \geq C_i$, $L_o \geq L_i$.
Resistance Range	0.01Ω~200Ω
Resolution	0.001Ω
Accuracy	±2%rdg±3dgt(20°C±5°C, below 70%RH)
CT Size	60mmx28mm
Overflow Indication	test data>100Ω, system software or LCD display “OLΩ” symbol;
Connection line	1pcs , 1 meter cord(5 core wire)
Connection Identifier	Red/brown---power supply input anode; Black--- power supply input cathode; Blue---RS485 signal anode; Grey---RS485 signal cathode; White--- grounding wire shield (power supply input cathode can connects with analog grounding by short circuit connection)
Communication Method	Wired network: RS485 communication protocol (support MODBUS) Wireless network: RS485 or GPRS communication protocol (support MODBUS)
Network Points	Wired network: 1 ~ 250 grounding points, scalable Wireless network: 60000 grounding points, can be expanded
Communication distance	Wired network: about 1500m, scalable Wireless network: not limited
	Alarm Indication, Alarm Setting, Data Display functions

LCD size	47mm×28.5mm(only C/KC model)
Dimensions	Detector: 132mm × 130mm × 76mm(B/C model) Detector: 124mm × 118mm × 76mm(KB/KC model)
Weight	Detector: 1KG
Working Temperature And Humidity	-20°C~55°C; 20%RH~90%RH
Humidors Error	Within 5%
Shift	Automatic shift
Grounding Lead Interference Current	Should be avoid
External Magnetic Field	<40A/m
External Electric Field	<1V/m
Single Measurement time	About 0.5 second
Working current	Detector: 50mA Max.(GPRS: 12VDC 150mA Max)
Explosion-proof mark	Ex ia II B T3 Ga
Explosion-proof Certification	CE18.2332X.
Protection Level	IP54
Power Supply Mode	External power supply (Equipped by user)

4. Detector Structure

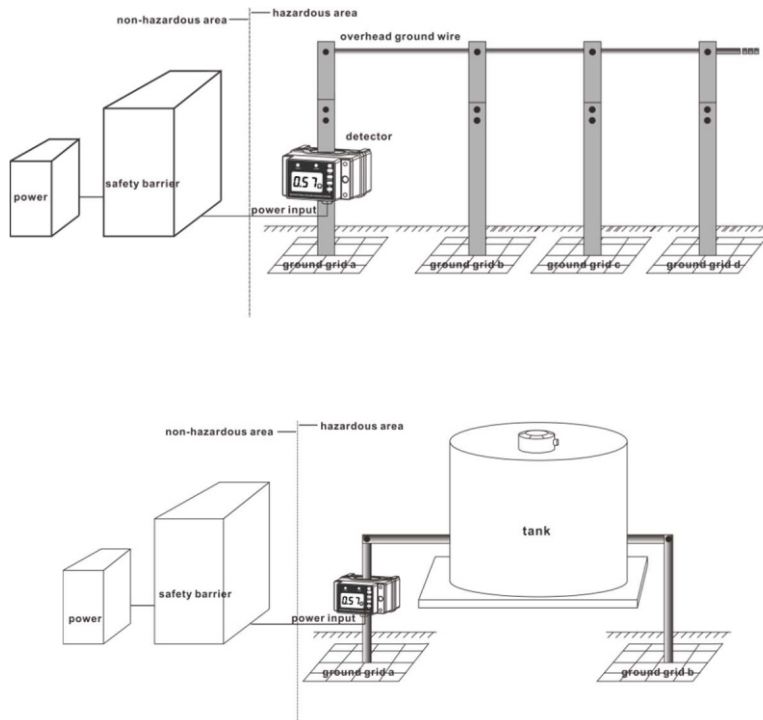
- 4.1.1. Clamp tester size: 60mm*28mm
- 4.1.2. Indicator light
- 4.1.3. LCD display
- 4.1.4. Mounting screws Φ7mm
- 4.1.5. Button
- 4.1.6. Power supply, RS485 interface



POWER indicator	Power indicator, power on and display
ALARM indicator	Alarm indicator, the test value is bigger than the set threshold value will flashes
SET key	Enter settings
Up and down keys	Press the SET button to enter the alarm settings, press the up and down keys to change data
ENTER Key	After the alarm threshold is set, press ENTER to save

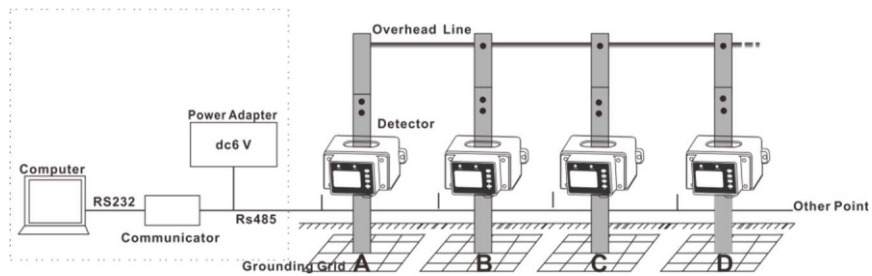
5. Network Structure

5.1. Independent installation



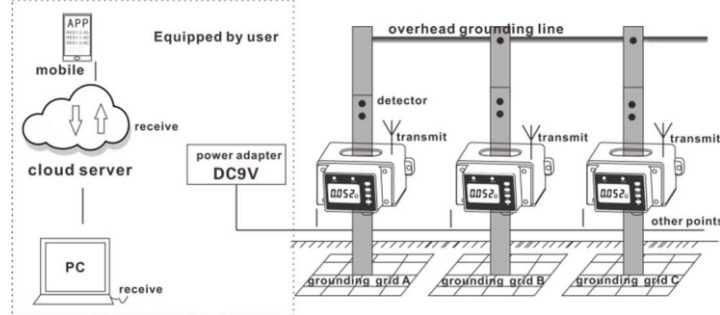
It can be installed independently; you can also set up the network. LCD display the measured value directly, you can set the alarm threshold by the detector, could have sound and light alarm function.

5.2. Wired network system (Self-Exploitation Software)



Wired network system through RS485 communication protocol to transmit data, build up by the detector, 【communicator, monitoring software, power adapter, computer(above equipment need the user provide and secondary development) 】 and so on, suitable for short-distance 1500 meters ground resistance monitoring.

5.3. Wireless network system (Self -Exploitation Software)



Wireless network system through GPRS communication protocol to transmit data ,build up by the detector(built-in GPRS transceiver module), 【SIM communication card, monitoring software, power adapter, computer(above equipment need the user provide and secondary development)】 and other components for long-distance ground resistance monitoring., distance is not limited.

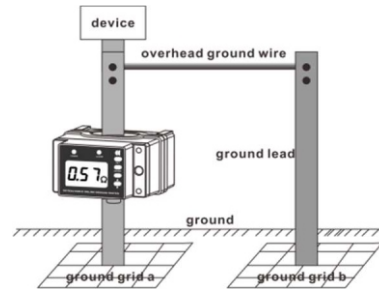
6. The Principle and Application

6.1. Testing Principle

Earth Resistance Monitoring Sensor the basic principle of measuring the grounding resistance is to measure the loop resistance. Firstly sensor send out a drive pulse signal to the measured ground loop circuit, then measured ground loop circuit responses a pulse electromotive force E, under the influence of electromotive force E will generate current I in the be measured ground loop circuit. Sensor measures E and I value, and gets resistance value of be measured ground loop circuit through the formula: $R=E/I$.

6.2. Loop Resistance Definition

As figure: Loop resistance is a composite value includes A point grounding resistance value, grounding down lead metallic conductor's resistance value, metal overhead line's resistance value, connection resistance value (contact resistance) between grounding down lead and metal overhead line, B point grounding resistance value. For the formative loop

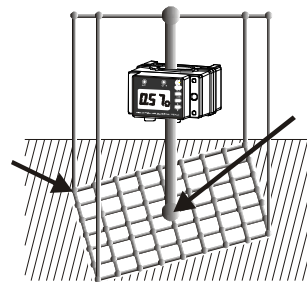


grounding system above-mentioned, detector can be installed directly for monitoring, if not form a loop grounding system, it need to add auxiliary grounding electrode to form a loop circuit, and then install the detector, please check the after-mentioned single point grounding system introduce.

If the detector measured out the loop circuit's composite value of grounding grid A and grounding grid B is 5.0Ω , the actual grounding resistance value of the grounding grid A parallel connection with grounding grid B must be less than or equal to 2.5Ω 【 according the formular $R = R_A * R_B / (R_A + R_B)$ 】 , and then can judge the actual grounding resistance value of grounding grid A parallel connection with grounding grid B is qualified or not. If the grounding resistance value of grounding grid A add grounding B is less than engineering(project) standard required value, then can judge grounding grid A and grounding grid B are all qualified.

6.3. Metal Circuit Connection Resistance Testing

If grounding network A and grounding network B up and down are connected together on the ground, Detector measures out the resistance value of metal loop circuit is very small in general situation, only few of and less than one Ohm, this is the connection resistance of metal loop circuit, as a equipotential resistance, but not grounding resistance. Therefore, the Detector is much convenient to test metal loop circuit connection resistance.



In the large-scale grounding grid, such as converting station ground connection, oil depot ground connection, building construction ground connection and so on, they are all an integral large-scale grounding grid under the ground, meanwhile there are many grounding down leads extend to the ground, and connect together, as the following picture. To such large-scale grounding grid, its grounding grid's maximum diagonal distance is about a few hundred meters to thousands of meters, testing the grounding resistance is very difficult and troublesome. If it exist unqualified grounding resistance, that problem is appearing at the connection position of grounding down lead and grounding grid (direction of arrow of the welding position in the picture), engineering reform is to excavate the position of grounding down lead, then weld grounding down lead again. Actually it's

impossible to reform the whole grounding grid, or the whole grounding grid and surface facilities need to pull down and rebuild, this is impossible.

Therefore, for the large-scale grounding grid, we can install detector on the main grounding down lead and secondary grounding down lead to monitor connection status between the grounding down lead and the grounding grid, judge grounding conditions of the grounding down lead by test metalloop circuit connection resistance.

6.4. Single Point Grounding System

If between grounding network A and grounding network B haven't overhead line, and not connect together on the ground, then grounding network A and grounding network B can regard as standalone single point grounding connection. Detector cannot test the grounding resistance of single point grounding system directly, will display "OL" overload symbol. Therefore it needs adding one or more auxiliary grounding electrode, to form multipoint loop circuit, and then install the detector. In the small range, if there are two or more single point grounding system, it can use metallic conductor to connect all single point grounding system's grounding down lead together on the ground, to form a loop circuit, then install the detector to monitor.

6.5. Three-point Method

In the following figure, the tested ground pole is A and the other two auxiliary ground pole is B and C. The poles A, B, C are connected together on the ground. In the three ground poles grounding down leads were installed on a detector, can accurately test the ground point A resistance value. Calculated as follows:

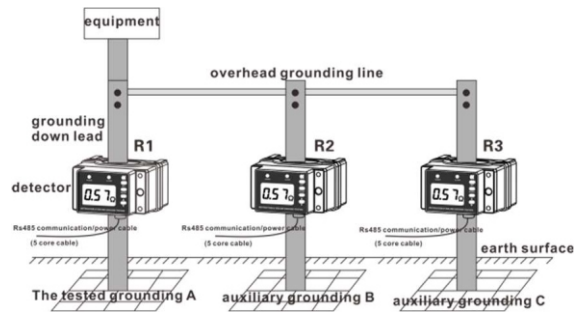
$$R1=RA+RB\parallel RC\text{-----} (1);$$

$$R2=RB+RA\parallel RC\text{-----} (2);$$

$$R3=RC+RA\parallel RB\text{-----} (3).$$

R1, R2, R3 are test results of the detector; RA, RB, RC are grounding resistance value of the three grounding pole. By solving the above three ternary equations, the grounding resistance of the measured grounding pole RA can be accurately obtained, and the grounding resistance of the auxiliary grounding pole RB and RC as well as the grounding resistance of RA, RB and RC in parallel connection are known value.

Three-point detection has another advantage: due to increasing the auxiliary pole B, C are parallel connecting to the measured ground pole A, therefore the actual grounding resistance will be less than RA, to improve effective of the measured ground pole. $RA \parallel RB \parallel RC < RA$. In actual construction, the auxiliary grounding pole B, C grounding resistance requirements under the control of the grounding system to be tested within 10 times the engineering standard requirements, if the project requires the grounding resistance cannot over 4Ω , then $RC < 40\Omega$, $RB < 40\Omega$, of course RB, RC smaller is better, can improve more for the measured grounding system



6.6. Application

6.6.1. Power Transmission System Pole Ground Connection.

It forms multipoint grounding system through overhead ground wire connection and will test conveniently, its equivalent circuit as follow:

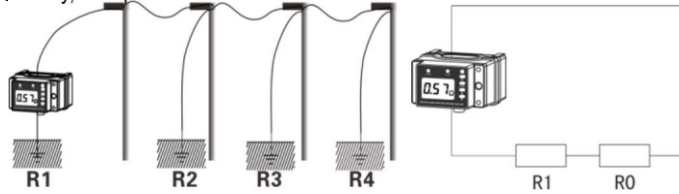
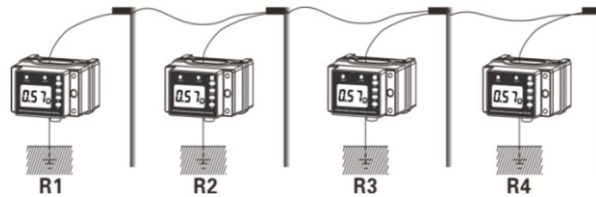
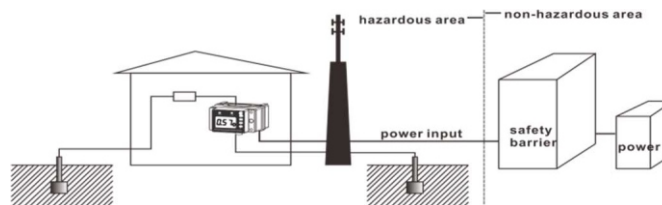


Illustration: R_1 is predicted grounding resistance, R_0 is the parallel connection equivalent resistance of all the other poles grounding resistance, that is $R_0 = R_2 \parallel R_3 \parallel R_4 \parallel \dots \parallel R_n$, if the greater n is (the more grounding pole), the closer R_0 gets to 0, much smaller than R_1 , from engineering point of view, $R_0 = 0$, then the data from detector receives should be the value of R_1 . Each tower can be installed detector, testing the tower grounding resistance at the same time.



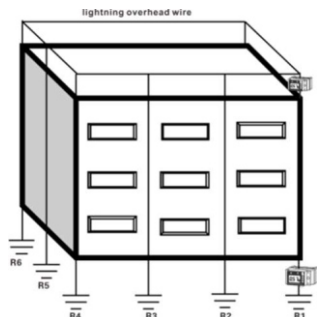
6.6.2. Generator Room and Launch Tower Grounding

Engine room, tower grounding are generally independent in the field, connected them together to form a two-point circuit, and then install the detector as follow. Or can also make other two auxiliary grounding poles, form three points monitoring.



6.6.3. Building ground

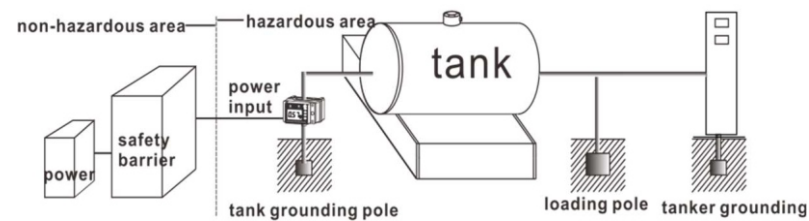
If $R_1 \sim R_6 \dots R_n$ is a independent grounding body under the ground, and not connect together as a multipoint grounding system, will convenient to test grounding resistance. If $R_1 \sim R_6 \dots R_n$ are connected together under the ground, as the single point grounding system, it could according to single point grounding system to test the grounding resistance, install directly and test metal loop circuit resistance, can judge grounding connection condition.



For the large-scale construction grounding grid, it could monitor equipotential value of grounding condition between grounding down lead and grounding network. If problems occur, it would be the connection point between grounding down lead and grounding network, therefore just test and judge whether the equipotential value qualified or not.

6.6.4. Oil Storage Tank:’ loading and Unloading Point Grounding

According to JJF2-2003 "ground-based anti-static device testing norms", the gas stations need to test the main facilities grounding resistance and connection resistance.



7.Wiring Instructions

Equipment	Wire Color	Connection instructions
Detector	Red/Brown	Power Supply Anode
	black	Power Supply Cathode ‘GND’
	blue	RS485 Signal Positive Electrode
	grey	RS485 Signal Negative Electrode
	white	Signal grounding electrode can short connect GND.

When setting up the network, connect the tester, communicator and power according to the color of the wire.

Detector connected to the power and start to work, the installation of external power supply should install power switch.

8. KM 1680C Install Size and Caution

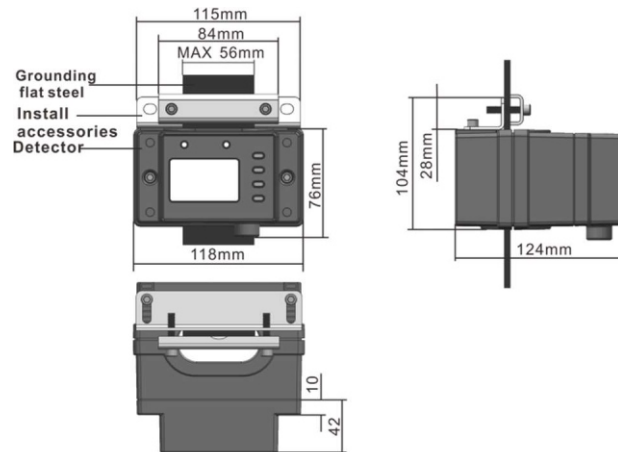
8.1. installation method

Install the closed loop grounding resistance on-line detector need to interrupt the ground down lead and can be installed on the ground flat steel or on the backplane directly.

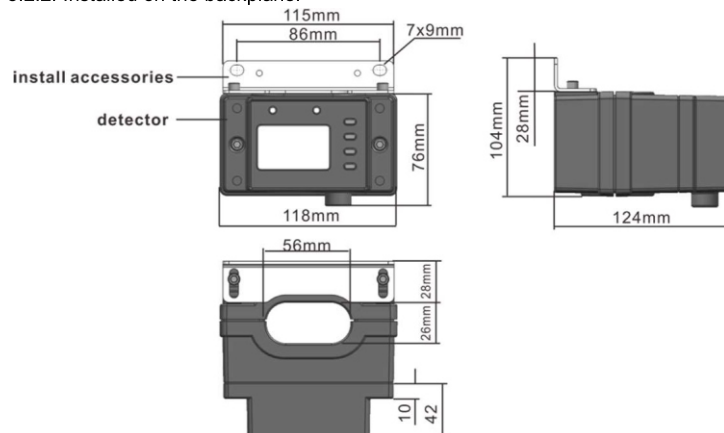
Install the split core grounding resistance on-line detector does not need interrupt the grounding down lead, Detector with hardware mounting parts, there are 2 kinds of installation, Can be installed on the ground flat steel or on the backplane directly. When installation, first determine the installation, the hardware assemble and fixable in the back part. Then loosen the core fastening screws, put the grounding lead wire into the tester, and then tighten the core fastening screws.

8.2. Installation dimensions

8.2.1. Installed on the ground flat steel.



8.2.2. Installed on the backplane.



8.1. Installation Caution

- 8.3.1. During installation, keep clean the upper and lower magnetic rings. The upper and lower fixing screws of the detector must be locked tightly.
- 8.3.2. The upper and lower assembly parts of each detector are matched pair at the factory and cannot exchange with other detectors during installation. The match pair device parts of the detector have codes respectively. Check whether the code is consistent during installation.
- 8.3.3. Special Note: Only the grounding system that forms the loop can be installed and used directly. For the grounding system without loops, the auxiliary ground pole must be set up near the tested ground pole, and connect from the loop of the tested grounding pole and auxiliary ground pole, and then install the detector.
- 8.3.4. According to the site distance, with power and communication lines, corresponding to connect Communicator, detector and power supply.
- 8.3.5. Communicator and detector wiring must correspondence, the power cord is prohibited access RS485 signal line, or burn out the instrument.
- 8.3.6. Communicator and detector connection distance cannot exceed 1.5Km.
- 8.3.7. The positive and negative of the power cord cannot be reversed, otherwise it cannot work.
- 8.3.8. The antenna of the wireless communicator needs to set outside and cannot be placed in the shielding box.
- 8.3.9. SIM communication card installation: Before using, please install the SIM communication card, cannot installation with charge, it need operated for professional engineering and technical personnel. Since the GPRS transmitter module is built into the communicator, you need to open the communicator to install the SIM communication card.(only for the GPRS model)

9. Power Supply Model Selection

9.1. External power supply (self-provide)

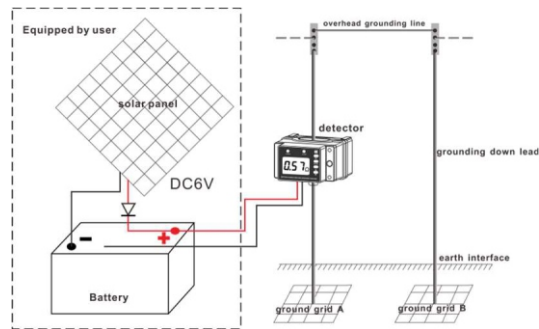
External AC 220V power lead to the detector or communicator nearby the power adapter to the tester and communicator. If the external DC9V power supply, directly lead to detector and communicator.

9.2. Battery powered (self-provide)

Battery powered tester and communicator power supply, the battery can stand-by 2pcs, alternating to use in every time

9.3. Solar panel powered (self-provide)

As shown below, buy solar panels, protective boxes, batteries, suitable for where could not take the power. The battery is placed into a protective box. The positive electrode of the solar cell and the battery needs a positive diode (such as 1N5817) to connect the positive diode fast, which is very convenient for using It independently.



Note	Detector power supply: DC6V ~DC12V
	Wired Network Communicator Power: DC9V。
	Wireless Network Communicator Power: DC12V。

10. Wire Monitoring software (Self-Exploitation Software)

User can use the debug wizard downloaded from the Internet to set the port and address to see if the detector is communicating properly. Also can make secondary development according to the use environment and customize the software.

11. Wireless Monitoring software (Self-Exploitation Software)

Use the detector configuration software to set wireless parameters such as IP and port number. The detector reports data through the GPRS module, and the user can perform secondary development according to the use environment and customize the software

Note: The data receiving end must be a fixed IP computer or server.

12. Standard Accessories

Detector	1pcs
Hardware fixing screws M5*8mm	2pcs
Flat steel compression screw M5*35mm	2pcs
Allen wrench	1pcs
Cable	1pcs
Packing boxes	1set
User manual	1pcs

The company is not responsible for other losses caused by use.

The contents of this user manual cannot be used as a reason to use the product for special purposes.

The company reserves the right to modify the contents of the user manual. If there are any changes, no further notice will be given.

MUMBAI

TEST CERTIFICATE

Closed Loop Type Ground Resistance on-line Detector

This Test Certificate warrants that the product has been inspected and tested
in accordance with the published specifications.

The instrument has been calibrated by using equipment which has already been
calibrated to standards traceable to national standards.

MODEL NO. _____

SERIAL NO. _____

DATE: _____

ISO 9001:2015
REGISTERED



WARRANTY

Each "KUSAM-MECO" product is warranted to be free from defects in material and workmanship under normal use & service. The warranty period is one year (12 months) and begins from the date of despatch of goods. In case any defect occurs in functioning of the instrument, under proper use, within the warranty period, the same will be rectified by us free of charges, provided the to and fro freight charges are borne by you.

This warranty extends only to the original buyer or end-user customer of a "KUSAM-MECO" authorized dealer.

This warranty does not apply for damaged Ic's, fuses, burnt PCB's, disposable batteries, carrying case, test leads, or to any product which in "KUSAM-MECO's" opinion, has been misused, altered, neglected, contaminated or damaged by accident or abnormal conditions of operation or handling.

"KUSAM-MECO" authorized dealer shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of "KUSAM-MECO".

"KUSAM-MECO's" warranty obligation is limited, at option, free of charge repair, or replacement of a defective product which is returned to a "KUSAM-MECO" authorized service center within the warranty period.

THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. "KUSAM-MECO" SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE WHATSOEVER.

All transaction are subject to Mumbai Jurisdiction.



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