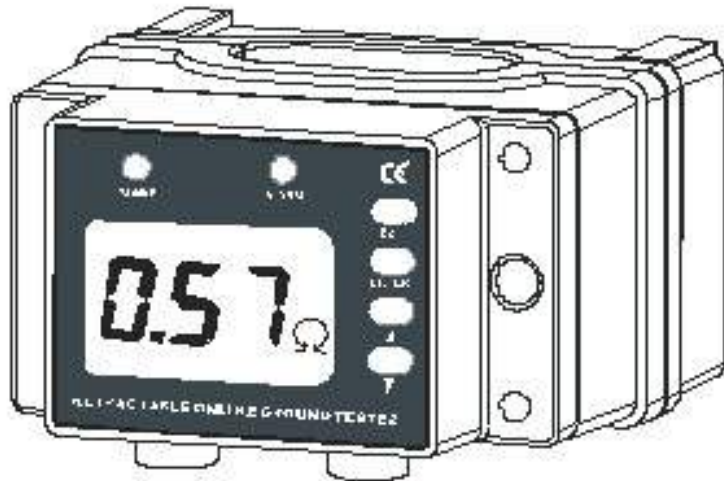




AN ISO 9001:2015 COMPANY

## NON-CONTACT GROUND RESISTANCE ONLINE DETECTOR

### MODEL - 2800B / 2800C



## OPERATION MANUAL

### MUMBAI TEST CERTIFICATE

#### NON-CONTACT GROUND RESISTANCE ONLINE DETECTOR

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

MODEL NO. **2800B / 2800C**

SERIAL NO. \_\_\_\_\_

DATE: \_\_\_\_\_

ISO 9001  
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.



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### Attention Items:

Thank you for purchasing 2800C series products Non-Contact Ground Resistance Online Detector 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.

- Apply to return circuit ground resistance, metallic return connection resistance, grounding conditions on-line monitoring.
- Single point grounding system, needs to increase assistance after the ends of the earth form a loop, then install detector.
- Note that this detector specified measuring range and using the environment.
- Protection against rain shower and water logging of installation.
- Install waterproof and rainproof of device at outdoors.
- Detector signal line connected port towards the ground.
- The dismantling, calibration and maintenance the Detector shall be operated by the authorized staff.
- If the continuing use of it would be dangerous, the Detector should be stopped using immediately, and immediately sealed for the treatment by the authorized agencies.

### I. Brief Introduction

**Non-Contact Grounding Resistance Online Detector** is our company devotes ourselves to Grounding resistance test technical research's another new high-tech product for more than ten years, built for Online testing, non-contact measurement, grounding through, no impact on lightning protection grounding and normal operation of the facility, no need for self-test, real-time detection, RS232, RS485 wired communication or GSM wireless communication to transmit data for remote online monitoring. The built-in sensor and circuit board of the detector are protected against rain and dust, ensuring high precision, high stability and high reliability for long-term online monitoring in the field, underground, and indoor.

The 2800B and 2800C grounding resistance on-line detectors can be used in a single installation or in a wired network system or a wireless network system. The wired network system transmits data through RS232 and RS485 communication methods. It consists of a main communicator (concentrator), monitoring software, power adapter, computer, etc. It is suitable for close-range or mine grounding resistance monitoring. The wireless network system transmits data through RS232, RS485, GSM/GPRS communication methods, and is composed of a main communication device (concentrator), GSM/GPRS transceiver module, a SIM communication card, a monitoring software, a power adapter, a computer, etc., and is suitable for long distance or Grounding resistance monitoring under the mine. The wired network system is suitable for monitoring within 1500 meters, and the wireless network system is not limited by distance.

The monitoring software can display the measured grounding resistance value from time to time. It can set the automatic monitoring recording time. The interval recording time is 1 to 200 hours. The recorded data is automatically stored in the report, which is convenient for historical query and analysis of the change of the grounding resistance of the monitoring point.

The 2800C can directly display the measured value through the LCD. It can also set the alarm threshold value through the detector. It has an audible and visual alarm indication, which is very suitable for independent installation without setting up the network.

## II. Model Difference

Model	Difference Explanation
2800B	Detector without LCD has an audible and visual alarm indication. It needs to be set up for network use.
2800C	The detector comes with LCD display, alarm setting, and sound and light alarm indication. Can be installed independently or set up for network use.

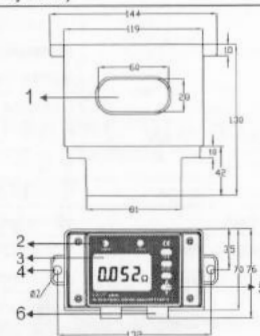
## III. Technical Specifications

Function	Return circuit grounding resistance on-line monitoring, metal return resistance connection online monitoring, grounding condition monitoring.
Power Supply	Detector: DC6V~DC9V,50ma Max.
Resistance Range	0.01Ω~200Ω
Resolution	0.001Ω
Indication Range	0.00Ω~500Ω
Accuracy	±2%rdg±3dgt(20℃±5℃, below 70%RH)
Grounding Wire Perforation Size	60mm×28mm, closed mode (60mm×4mm steel flat or external diameterΦ30mm electric cable)
Overflow Indication	When show value is beyond 200Ω, systems software and LCD show "OLΩ" sign.
Connecting Line	1pcs/M(5cores wire)
Connection Identifier	Red/brown---power supply input anode; Black--- power supply input cathode; Blue---RS485 signal anode; Grey---RS485 signal cathode; White--- analog grounding (power supply input cathode can connects with analog grounding by short circuit connection)
Protocol Standard	RS485 standard MODBUS-RTU communication protocol
Alarm Indication	2800C :Detector Audible and visual alarm instructions
Alarm Setting	2800C :Detector panel setting
Data Display	2800C :4digits LCD direct indication
LCD Dimensions	47mm×28.5mm
Detector Dimensions	132mm×130mm×76mm
Installing Screw Hole Size	Φ7mm
Quality	Detector: 960g
Working Temperature And Humidity	-20℃~55℃;20%RH~90%RH
Humiture Error	Within 5%
Shift	Automatic shift
GND Interference Current	Prohibited

External Magnetic Field	< 40A/m
External Electric Field	< 1V/m
Single Measurement Of Time	About 0.5 second
Power Consumption	Detector: 50ma Max.
Installation	Grounding wire through Detector centre bore
Level Of Protection	IP65
Installation Requirements	Avoid rain and water logging
Power Supply Mode	External power supply (Equipped by user)

## IV. Detector Structure

1. CT size: 60mmx28mm
2. Indicator light
3. LCD display
4. Installation screw hole Φ7mm
5. Button
6. power supply, RS485 communication interface

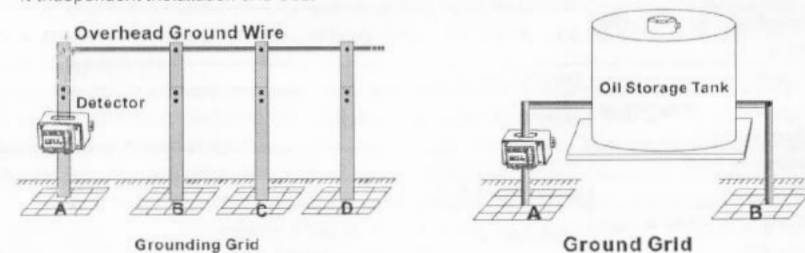


Power Supply Indicator Light	Working indication when power supply switches on.
Alarm Indicator Light	Alarm light switches on when measured value is beyond pre-set critical value.
SET Key	Enter setup
Up and Down Arrow Key	Press SET key to enter the alarm setting, press up and down arrow key to set value.
Enter Key	After setting up alarm critical value, press ENTER key to ensure saving.

Note : 2800B mode without LCD display and press key function.

## V. Network Structure

### 1. Independent Installation and Use.

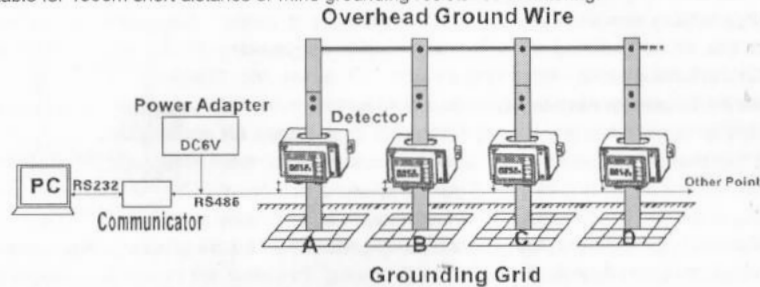


2800C can be installed independently or in a network. The LCD directly displays the

measured value, and the alarm threshold can be set by the detector. It also has an audible and visual alarm function.

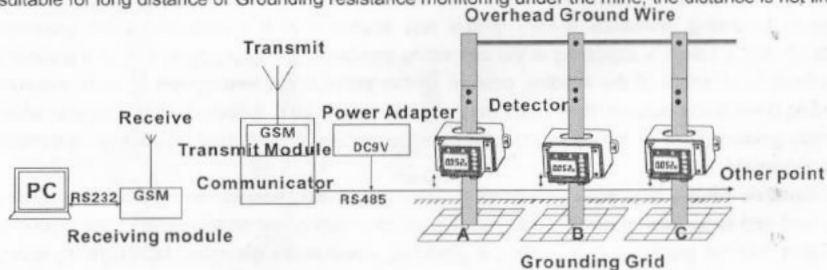
### 2. Wired network system

The wired network system transmits data through RS232 and RS485 communication methods. It consists of main communicator (concentrator), monitoring software, power adapter, computer, etc. It is suitable for 1500m short distance or mine grounding resistance monitoring.



### 3. Wireless network system

The wireless network system transmits data through RS232, RS485, GSM/GPRS communication methods, and is composed of a main communication device (concentrator), a GSM/GPRS transceiver module, a SIM communication card, a monitoring software, a power adapter, a computer, etc., and is suitable for long distance or Grounding resistance monitoring under the mine, the distance is not limited.



## VI. The Principle and Application of Detection

### 1. Testing Principle.

**Non-Contact Grounding Resistance Online Detector's** fundamental is measuring return circuit resistance. firstly Sensor send out a drive pulse signal to be measured ground return circuit, then measured ground return circuit responses a pulse electromotive force  $E$ , under the influence of electromotive force  $E$  there will generate current  $I$  in the be measured ground return circuit. Sensor measures  $E$  and  $I$ , and immediately gets resistance of be measured ground return circuit through the formula:  $R=E/I$ .

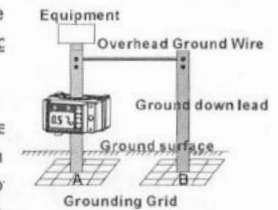
### 2. Return Circuit Resistance Definition.

As picture: return circuit is a composite value includes A spot grounding resistance, grounding down lead metallic conductor's resistance, metal overhead line's resistance, connection resistance(contact resistance)between grounding down lead and metal overhead line, B spot grounding resistance. For the formative above-mentioned return circuit's grounding system, Detector can be installed directly for monitoring, if the grounding system not form a return circuit, it need adding auxiliary grounding electrode

to form a return circuit, further install the Detector, see the after-mentioned single point grounding system. If the Detector measured out return circuit's composite value of grounding network A and grounding network B is  $5.0\Omega$ , that is:  $R_A+R_B+R_C+R_D=5.0\Omega$  ( $R_C$  and  $R_D$  respectively represent resistance of metal overhead line and grounding down lead), actual grounding resistance value of grounding network A and grounding network B's in parallel resistances less than or equal to  $2.5\Omega$ , accordingly judge actual grounding resistance value of grounding network A and grounding network B parallel connection whether qualified. If grounding network A and grounding network B's in parallel resistances less than engineering standard required value, so grounding network A and grounding network B are all qualified.

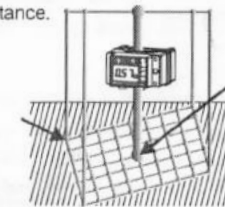
### 3. Metal Return Circuit Connection Resistance Testing.

If grounding network A and grounding network B up and down are connected together on the ground, then Detector measures out metal return circuit resistance's value is very small general speaking, only few or an Ohm, this is the connection resistance of metal return circuit, namely equipotential resistance, isn't grounding resistance. Therefore the Detector is also convenient to test metal return circuit's 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 lead extends to the ground, and connects the other on the ground, 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 its 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 grounding down lead's position, then again weld grounding down lead. 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 primary grounding down lead and secondary grounding down lead to monitor connection status between the grounding down lead and the grounding grid, judge the grounding down lead's grounding conditions by testing metal return circuit connection resistance.



### 4. Single Point Grounding System.

If grounding network A and grounding network B is without overhead line, and doesn't connect together on the ground, then grounding network A and grounding network B can regard as standalone single point grounding connection. Detector cannot test single point grounding system's grounding resistance directly. This moment it needs adding one or more auxiliary grounding electrode, to form multipoint return circuit, then to install 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 return circuit, then install the Detector to monitor.

### 5. Three-point method

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

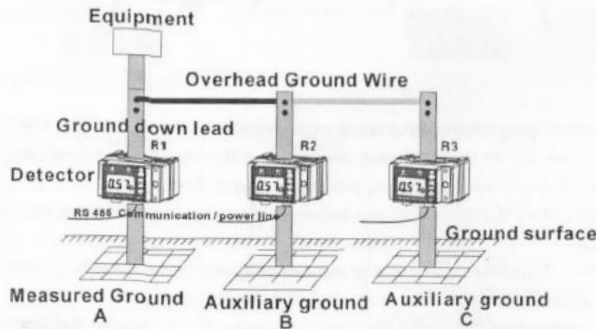
$$R_1 = R_A + R_B // R_C \quad (1);$$

$$R_2 = R_B + R_A // R_C \quad (2);$$

$$R_3 = R_C + R_A // R_B \quad (3).$$

$R_1, R_2, R_3$  for the detector test results;  $R_A, R_B, R_C$  for the grounding of the three grounding resistance value. By solving the above three ternary equations, the grounding resistance of the measured grounding electrode  $R_A$  can be accurately obtained, and the grounding resistance of the auxiliary grounding electrodes  $R_B$  and  $R_C$  and the grounding resistance of  $R_A, R_B$  and  $R_C$  in parallel after three points are known value.

Three-point detection also brings another advantage: due to the increase of the auxiliary pole B, C is parallel to the measured ground A, so that the actual grounding resistance in parallel will be less than  $R_A$ , to improve the role of the measured ground.  $R_A // R_B // R_C < R_A$ . 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 exceed  $4\Omega$ , then  $R_C < 40\Omega, R_B < 40\Omega$ , of course  $R_B, R_C$  smaller is better, can improve the ground system under test.



### 6. Application.

#### (1). Power Transmission System Pole Ground Connection.

It forms multipoint grounding system through overhead ground wire connection; test conveniently, its equivalent circuit as the following picture.

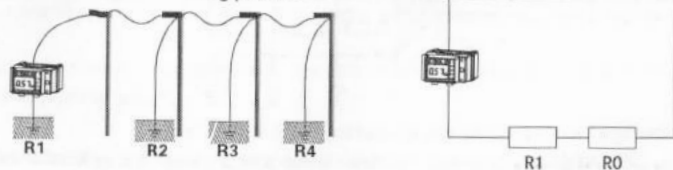
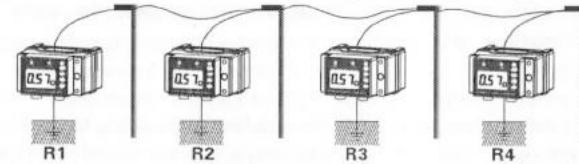


illustration:  $R_1$  is predicted grounding resistance,  $R_0$  is the equivalent resistance of all the other

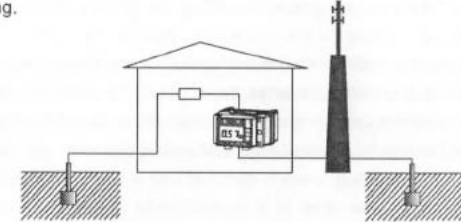
pole's grounding resistance parallel connection, that is  $R_0 = R_2 // R_3 // R_4 // \dots // R_n$ , if the greater n is (the more grounded junction), the closer  $R_0$  gets to 0, far smaller than  $R_1$ , from engineering point of view,  $R_0 = 0$ , so, the data Detector receives should be  $R_1$ 's value.

Each tower can be installed detector, while testing the tower grounding resistance.



#### (2). Generator Room and Launch Tower Grounding

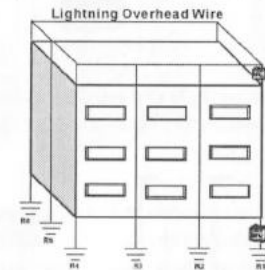
Engine room, tower grounding in the field are generally independent, the two connected together to form a two-point circuit, and then install the detector, as shown below. Can also do another two auxiliary grounding, with three points monitoring.



#### (3). Building ground

If  $R_1 \sim R_6 \dots R_n$  is a independent grounding body under the ground, don't connect together, are multipoint grounding system, convenient to test grounding resistance. If  $R_1 \sim R_6 \dots R_n$  are connected together under the ground, for the single point grounding system, testing grounding resistance in accordance with single point grounding system, direct installation test return circuit resistance, can judge grounding connection condition.

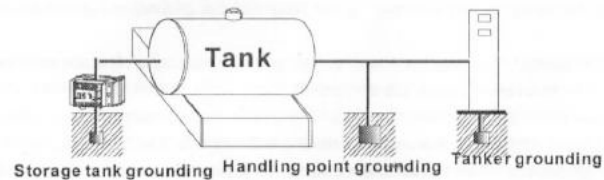
For the large-scale construction grounding grid, it is to monitor its equipotential value of grounding condition between grounding down lead and grounding network. If problems occur, it would be located at the connection point between grounding down lead and grounding network, and judging that whether its equipotential value qualified or not.



#### (4). Oil Storage Tank's loading and Unloading Point Grounding

According to JJF2-2003 "ground-based anti-static device testing norms", the gas station mainly needs to test the following facilities grounding resistance and connection resistance.

N	Test items	Technology demand
1	Tank ground resistance	$\leq 10\Omega$
2	Handling point grounding resistance	$\leq 10\Omega$
3	Tanker grounding resistance	$\leq 4\Omega$
4	Tanker hose connection resistance	$\leq 5\Omega$



## VII. 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.
Communicator	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 line.

Detector connected to the power after the start of work, the installation of external power supply is best to install a power switch.

## VIII. Install Caution

Special Explanation: only if it forms a return circuit grounding connection system, it could directly install and use. Otherwise, firstly it needs to set up an auxiliary grounding connection nearby to form a return circuit, then to install the Detector.

1. Install the detector on the grounding down conductor. The grounding down conductor needs to be unfastened for easy maintenance. Pay attention to waterproof, rainproof, anti-theft, anti-destruction, etc. when installing in the field.
2. Pay attention to the direction when installing the detector. Install it as far as possible, and the end of the outlet is downward.
3. When installing the detector, pay attention to the height of the ground and avoid flooding the instrument.
4. According to the distance of the site, the power supply and communication line are equipped, and the communicator, detector and power supply are connected.
5. The connection between the communicator and the detector must correspond. The power cable must not be connected to the RS485 signal line, otherwise the instrument will be burned out.
6. The connection distance between the communicator and the detector is not more than 1.5Km.
7. The positive and negative of the power cord cannot be reversed, otherwise it will not work.
8. When using the battery, put the battery in the protective box to avoid rain and water immersion.
9. The antenna of the wireless communicator needs to be external and cannot be placed in the shielding box. 1. Install the Detector to grounding down lead, and grounding down lead needs to unbuckle buckle, convenient for product maintenance latterly. Installation must be waterproof, rainproof, anti-theft and breakage-proof and so on in the open air.

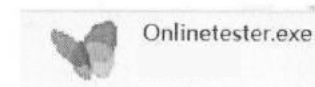
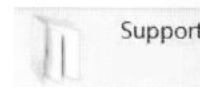
## IX. Power Supply Way Choice

1. External power supply, external AC 220V power supply can be led to the detector or communication device, and the power supply adapter can supply power to the detector and the communicator. If there is DC6V, DC9V power supply externally, it can be directly introduced into the detector and communication device.
2. battery power supply, self-provided battery, the battery is installed in the protective box, and then supply power to the detector and the communicator, the battery can be equipped with 2 pieces, easy to use when charging.

<b>Note</b>	Detector power supply: DC6V ~ DC9V
	Wired network communicator power supply: DC6V.
	Wireless network communicator power supply: DC9V.

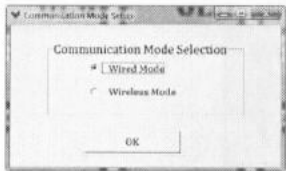
## X. Monitoring Software

1. Enter the SUPPORT document, click the Onlinetester icon to run the software, enter the main interface.



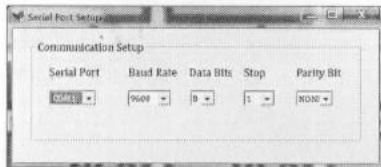
2. Communication settings.

Choose the communication method according to the actual system.



3. Serial communication settings

Click the menu "Edit \ Serial Communication Settings" to enter, according to the actual connection to select the computer serial port number (COM1 ~ COM16), the computer port status, see the software interface, see the lower left corner. Other parameters of the serial communication settings the following figure default value shall prevail.



4. Auxiliary grounding resistance setting:

Click the menu "Edit \ Auxiliary Ground Resistance Settings" to enter the settings.

If the ground point to be monitored is the ground network A and the auxiliary ground point is the ground network B, other instruments may be used to measure the value of the auxiliary ground point RB during construction, and input the RB value to the corresponding sub-station, then the system may automatically subtract the auxiliary The value of grounding point RB, only shows the ground resistance of the ground network A. The system will automatically save the last set auxiliary ground resistance value. Please pay attention to the setting.

Auxiliary grounding resistance settings apply to 2-point ground loop (2 point method), if the monitored point for the ground A, then the ground B is auxiliary ground. If the ground A and ground B add up to the grounding resistance is less than the engineering standards required value, then the ground A, ground B are qualified, you can ignore the auxiliary ground resistance setting.

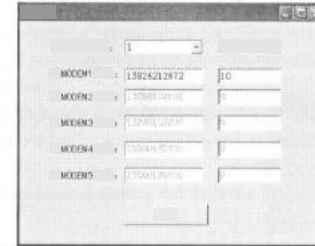
5. Wireless Network MODEM Initialization:

Power on the wireless receiver module first. If the initialization fails, the remote data cannot be read. The MODEM initialization status is indicated at the bottom left of the software interface. Click the menu "Edit \ MODEM initialization" to reinitialize MODEM.

6. Wireless network parameter setting:

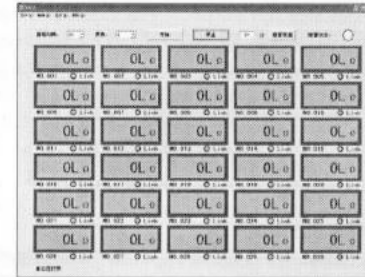
Click the menu "Edit \ Wireless Settings" to enter, according to the actual network settings. From the number of MODEM: refers to the communicator built-in GSM / GPRS module number, up to 5. From MODEM number: refers to the transmitter SIM card number (phone number). With the number of substations: refers to the number of detectors, each from MODEM up to 20 substations. Therefore, the system can only take up to 100 substations. Need to be

expanded to order separately. Set point "OK" to complete.



7. Wired network to read data

Confirm that the device is connected correctly, after the power is turned on, run the software, click on the "Start" control in the software, the communication is successful, the sub-station LINK indicator lights up green, and real-time monitoring display data. If communication with the communicator fails, LINK indicates a red light.

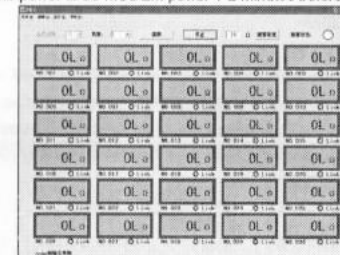


8. Wireless network to read data

MODEM initialization is successful, the wireless parameter setting is completed, the remote substation in the test launch state, click on the software "read" control, the main MODEM by SMS mode to read from the MODEM read signal from the MODEM response, the main MODEM recovered from MODEM Of the response signal, it indicates that the communication is successful, LINK indicator light green, and then display the read data. If communication with MODEM fails, the LINK indicator lights gray, and if the detector fails to communicate with the MODEM (Communicator), it lights red.

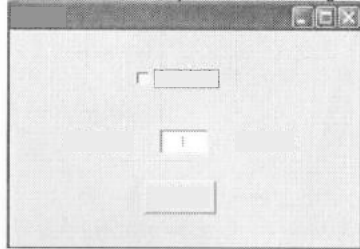
The time required to read the data once is the time required for sending and receiving a text message in the current communication network. Because of the busy communication network or the unstable signal, it sometimes needs to repeat the second click and read.

Note: Since the MODEM power-on initialization takes some time, only master-slave MODEM initialization software is effective after the completion of the power to be MODEM power 1-2 minutes before operating the software.



9. Automatically save the record

Click the menu "File \ Auto Save Settings" to enter, automatically store the recording interval of 1 ~ 200 hours, do not choose "Auto Save" is not recorded.



Automatically save the default directory is c: \ etc\ directory, the current date and serial number named, if the settings are automatically saved, before the software is shut down or stopped, if you want to access the record data, copy to other directory, open, not in Software to close or stop before the open, delete, move and other operations, otherwise it will affect the software's normal record.

Wireless network system, if set to automatically save, the time interval for sending the request is the time set by the user, when sending the request does not return after five minutes that the MODEM no return, the site under the MODEM automatically becomes offline, The displayed value is the last measured value.

Click the menu "File \ Save" to enter, you can save the currently read data, save the picture or document format.

10. Alarm setting

When the detected value is greater than the alarm threshold set by the system, the alarm status will be red and the corresponding substation data that exceeds the alarm value will turn red. 2800C type can also be set by the detector panel alarm value.

**XI. Basic Configuration**

Detector	1Set
Connector Wire	1PCS
User's Manual, Warranty Manual	1 Set