9456-DR01

INSULATION RESISTANCE TESTER
OPERATION MANUAL

https://m.insize.com/page-62-1807.html

EN -- Please scan the QR code or visit the website for operation manual.

IT --- Scansiona il codice QR oppure visita il sito web per il manuale d'uso.

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PT -- Para aceder ao manual de instruções, por favor, faça a leitura do código QR ou visite o nosso site.

Contents

illustration

	High voltage hazard sign indicating that significant personal injury may occur.
	Prohibited: May cause personal injury or irreversible damage to the equipment.
	Warnings and Cautions: Personal injury or irreversible damage to equipment may occur.
	Important information .
	Please refer to details.

Safety Notice

When you find the following abnormal situations occur, please stop the operation immediately and disconnect the power cord. Immediately contact INSIZE for maintenance. Failure to do so will result in a fire or a potential electric shock hazard to the operator.

- The instrument is operating abnormally.
- The instrument produces unusual noises, odors, smoke or flashes during operation.
- During operation, the instrument generates high temperature or electric shock.
- Damaged power cord, power switch, or power outlet.
- Impurities or liquids flow into the instrument .

Disclaimer

Before starting to use the instrument, please read the following safety information carefully. INSIZE will not be responsible for any personal safety and property damage caused by the user's failure to comply with the following terms.

To prevent the danger of electric shock, please connect the power ground wire.

Do not use the instrument in a flammable and explosive gas, vapor or dusty environment. Using any electronic device in such an environment is a risk to personal safety.

Non-professional maintenance personnel should not open the instrument case in an attempt to repair the instrument. The instrument may still have undischarged charges for a period of time after it is turned off, which may cause an electric shock hazard to persons.

If the instrument has been damaged, the danger will be unpredictable. Please disconnect the power cord, do not use it again, and do not attempt to repair it yourself.

If the instrument is not working properly and its danger is unpredictable, disconnect the power cord, do not use it, and do not attempt to repair it yourself.

If the instrument is used in a manner other than that specified in this manual , the protection provided by the instrument will be invalid.

After the instrument starts the test, there is a high voltage at the test end, which will cause personal injury. Do not touch the bare metal part of the test lead with your body.

1. Installation and Setup Wizard

Thank you for purchasing our company's products! Please read this chapter carefully before use.
In this chapter you will learn about the following:

- Main Feature Packing List
- Power Requirements
- Operating environment
- cleaning

1.1 Packing List

Before using the instrument, please:
1. Check the appearance of the product for damage, scratches and other undesirable phenomena;
2. Check for missing instrument accessories against the instrument packing list .
If it is damaged or the accessories are insufficient, please contact the sales department or distributor of INSZIE immediately.

1.2 Power Requirements

The 9456-DR01 can only be used under the following power conditions:
Voltage: 100 ~ 240VAC (1±10%)
Frequency: 50Hz /60Hz (1±10%)

warn:
Danger of electric shock, please connect the power ground wire
If the user replaces the power cord, please make sure that the ground of the power cord is securely connected.

1.3 Operating environment

9456-DR01 must be used under the following environmental conditions:
Temperature: 0°C ~ 55°C,
Humidity: less than 70 %RH at 23°C

1.4 Cleaning

To prevent electric shock hazard, unplug the power cord before cleaning.
Please use a clean cloth dipped in a little water to clean the case and panel.
Do not clean the inside of the instrument.

warn:
Clean the instrument with a solvent (alcohol or gasoline, etc.).

1.5 Instrument handle

The handle of the instrument can be adjusted, hold both sides of the handle at the same time with both hands, gently pull to the sides, and then rotate the handle. The handle can be adjusted to four positions, as shown below:

Figure 1- 1schematic diagram, panel graphics do not match the actual)

Position 1 [Hold both sides of the handle with both hands at the same time, gently pull to both sides until it can rotate freely, and then switch to visual position 2]

Position 2 [Hold both sides of the handle with both hands at the same time, gently pull to both sides until it can rotate freely, and then switch to the hand-held position]

Portable position

Remove handle position. [Pull to the sides ① and upward ② to remove the handle.]

Notice! When rotating the handle, it must be pulled to both sides until it can be rotated. Do **not** forcefully rotate the handle when **the buckle is stuck .**
Otherwise, the handle buckle will be damaged.

2. Overview

In this chapter you will learn about:

- Introduction
- The main function

2.1 Introduction

Thank you for purchasing the 9456-DR01 Insulation Resistance Tester .

9456-DR01 Insulation Resistance Tester is a miniature desktop instrument controlled by high-performance ARM microprocessor with automatic real-time detection . The instrument adopts a full-color LCD display screen, a full-digital keyboard which makes the display clearer and the operation more convenient.

The instrument has a built-in 1 V~1000V voltage source with 1 V resolution , which can be freely programmed to output;

The instrument has 2% insulation resistance accuracy, and the measurement range can be up to 10GΩ . With 9 999 readings, the measurement speed can reach 30 times /second.

The instrument can store 10 sets of settings internally, and the external USB disk can also store 10 sets of settings, which is convenient for recalling different specifications.

The instrument has a built-in comparator, and the result of the comparator can be output through the Handler interface.

The instrument has a unique list scanning function, which can program 5 different voltages, perform insulation resistance scanning measurement, and output the 5 comparison results through HANDLER .

The instrument comes standard with USB -232 interface and RS-232 interface, uses SCPI (Standard Command for Programmable Instrument Standard Command Set) and Modbus RTU protocol to communicate with computer, PLC or WINCE equipment , and efficiently completes remote control and data acquisition Function.

The instrument comes standard with RS-485 interface, supports Modbus RTU protocol , and communicates with PLC very conveniently .

Reference: For technical specifications see chapter Specifications.

2.2 The main function

2.2.1 Range

Using the 4 range test,
Range auto , manual and nominal .
Range nominal : The instrument will automatically select the best range according to the nominal value.

2.2.2 Test speed

The instrument has three speeds: slow , medium and fast .
■ Auto- ranging method: (close for poor contact)
Slow : 2 times/sec
Medium speed : 13 times/sec
Fast : 18 times/sec
■ Manual range mode: (close with poor contact)
Slow: 2.2 times/sec
Medium speed: 18 times /sec
Fast: 29 times/sec
■ Auto range method: (open for poor contact)
Slow : 1.9 times/sec
Medium speed : 11 times /sec

Fast : 15 times /sec
■ Manual range method: (open with poor contact)
Slow: 2 times/sec
Medium speed: 15 times /sec
Fast: 22 times/sec

2.2.3 Trigger method

Internal trigger: Internal automatic cycle trigger test
Manual trigger: use the TRIG button to trigger a measurement
Remote Trigger: Trigger a measurement using a remote command
External trigger: Hanlder trigger.
Internal semi-automatic triggering: when using four- terminal measurement, the negative terminal is in normal contact, and a measurement is started

2.2.4 Basic accuracy

Voltage source accuracy: 1 %* set value ±2 V
Monitoring voltage accuracy: 2 %±1V (@output current< 1.8mA)
Slow: 2 %
Medium speed: 2 %
Fast: 5 %

Reference: Please refer to the Technical Specifications chapter for detailed accuracy.

2.2.5 Calibration function

Full-scale open circuit clear to "0": to eliminate the influence of stray impedance.

2.2.6 Comparator function (sort function)

9456-DR01 has a sorting function.
The measurement results include NG -HI , NG-LO and OK , and these results can be output to external equipment through the HANDLER interface.
In addition, 5 groups of list scan results can also be independently output to external devices through HANDLER .

2.2.7 System settings

1. Keyboard lock function
2. Administrator and user accounts, passwords can be set for administrators
3. The buzzer has two volume options, high and low.

2.2.8 Interface

RS-232 interface:
Support maximum baud rate of 115200bps, compatible with SCPI protocol and Modbus RTU protocol .
USB -232 interface :
A serial port is virtualized on the computer, which is compatible with SCPI protocol and Modbus RTU protocol .
RS-485 interface:
Supports a maximum baud rate of 115200 bps , using the Modbus RTU communication protocol.
Handler interface
Independent isolated power supply, users do not need to provide external power supply.
Full optocoupler isolation, built-in pull-up resistor input and output ports.
Input: trigger signal, output: OK / NG-HI / NG-LO , list scan output (NG1~NG5); measurement completion signal (EOM).

3. Start

In this chapter you will learn about:

- Get to know the front panel - including an introduction to the buttons and test terminals.
- Rear Panel - Introduces power and interface information.
- Power-on start - including power-on self-test process, instrument default value and instrument warm-up time.

3.1 Getting to know the front panel

3.1.1 Front Panel Description

Figure 3- 1Front Panel

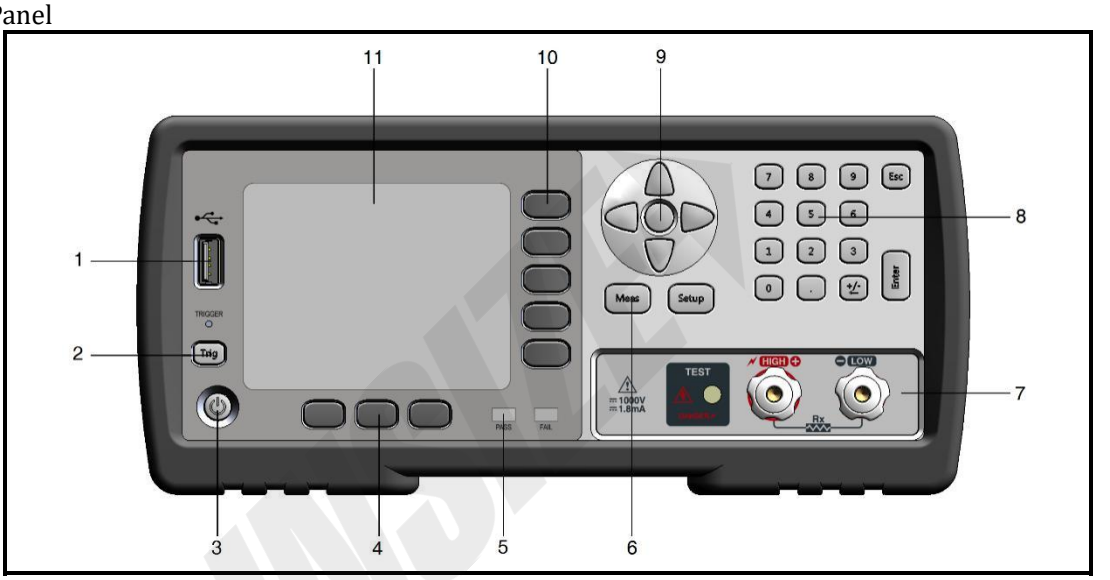
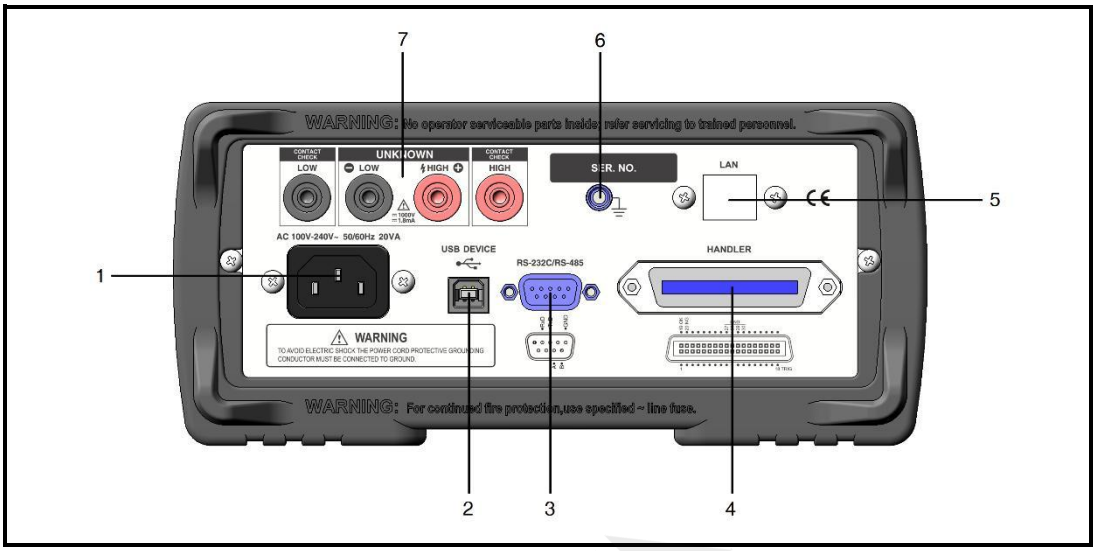


Table 3- 1Front panel function description

serial number	Function
1	USB disk interface
2	Manual trigger key and trigger indicator
3	Power switch : the orange indicator light represents the off state, and the green indicator light represents the power on
4	Bottom function keys
5	PASS/FAIL indicator
6	Main function keys: measure and set
7	test end
8	Numeric keypad
9	Cursor keys
1 0	side function keys
1 1	LCD display window

3.2 Know the rear panel

Figure 3- 2Rear Panel



1. Voltage socket AC 100V - 240V~, 50/60Hz , 20VA MAX.
2. USB -232 communication interface .
3. RS-232/RS-485 interface .
4. HANDLER interface .
5. LAN interface (option)
6. Ground Post (GND).
7. Rear test terminal and contact check terminal.

3.3 Power on

3.3.1 Boot

" ⏻ " at the bottom left of the panel is the power switch.
Orange light: off state
Green light : power-on status

3.3.2 Warm up

Warm-up time: To achieve the specified accuracy, the instrument needs to warm up for at least 15 minutes.

4. < Meas > Measurement Display Page

4.1 <Measurement display> page

Press [Meas] key to enter [Measurement Display] page.

The <Measurement Display> page can be set to mainly highlight the measurement results, and at the same time display the current sorting results in small characters.
Six common functions can be set on this page, they include:

Voltage – output voltage preset
speed – test speed settings
Trigger – trigger method settings
Range – test range setting

Figure 4- 1 <Measurement display> page

■ discharge state

■ test status

4.1.1 【Voltage】 setting

SCPI communication command: VOLTage <float>
The instrument has a built-in voltage source ranging from 1 V to 1000 V.
Voltage source accuracy: 1 %* set value ±2 V (@ 10V~1000V)
Voltmeter accuracy: 2 %* set value ±1 V (@output current < 1.8mA)

i	Note: The output voltage of the voltage source below 10V is for reference only; the measurement accuracy of the voltmeter below 10V is not measured .

■ Steps to set the voltage:

1 In the discharge state, press the [Meas] key to enter the measurement main page, or press the [Setup] key to enter the setting main page;

2 Use the cursor keys to select the [Voltage] field;

3 Use the function keys to directly select the preset voltage or directly input the desired voltage value with the numeric keyboard.

function keys	Function
10V	
25V	
50V	
100V	
200V	
400V	
500V	
1000V	

4.1.2 Test 【speed】

SCPI communication command: FUNCtion : RATE {SLOW,MED,FAST}

The instrument offers 3 test speeds (slow, medium and fast). The slower the speed, the more accurate and stable the test results are.

The instrument has three speeds: slow , medium and fast .

■ Auto- ranging method: (close for poor contact)

Slow : 2 times/sec

Medium speed : 13 times/sec

Fast : 18 times/sec

■ Manual range mode: (close with poor contact)

Slow: 2.2 times/sec

Medium speed: 18 times /sec

Fast: 29 times/sec

■ Auto range method: (open for poor contact)

Slow : 1.9 times/sec

Medium speed : 11 times/sec

Fast : 15 times/sec

■ Manual range method: (open with poor contact)

Slow: 2 times/sec

Medium speed: 15 times /sec

Fast: 22 times/sec

■ To set the test speed:

1 Press [Meas] key to enter the measurement page or [Setup] to enter the setup page;

2 Use the cursor keys to select the [Speed] field;

3 Use the function keys to select

function keys	Function
slow	
medium speed	
fast	

4.1.3 【Trigger】 Method

SCPI communication command: TRIGger:SOURce {INT, MAN,BUS, EXT,SEM}

The instrument has 4 trigger modes:

Trigger method	describe
internal	Continuous test, the trigger signal is continuously tested by the instrument according to the inherent cycle
manual	Each time the [Trig] key on the front panel is pressed, the instrument will perform a measurement cycle, and the instrument will be in a waiting state at other times.
Remotely	Use the command of the host computer to perform the trigger test. After receiving the trigger command, the remote trigger instrument executes one measurement cycle, and waits for other times.
external	I O trigger: When a rising edge pulse is received from the Handler interface on the rear panel, the instrument executes a measurement cycle. At other times the instrument is in a waiting state. Please refer to the Handler interface.
Internal semi-automatic	The same as the internal trigger function , the trigger signal is continuously tested by the instrument according to the inherent cycle. The difference is that in addition to using the start button to start the measurement, the negative terminal of the rear panel can also be started with poor contact .

Notice:
Internal semi-automatic triggering must use four-terminal Kelvin test lead.
Internal semi-automatic measurement steps:
1. Set the measurement time on the setting page , such as 2s ;
2. measurement is stopped ;
3. Keep the negative end of the Kelvin test lead (black test clip) open;
4. positive electrode contacts the DUT first ;
5. negative test clip contacts the DUT at the same time ;
6. The instrument starts the measurement and waits for the measurement timer to expire;
7. Discharge automatically and the measurement ends .

■ **Steps to set the trigger method:**

1. In the discharge state, press the [Meas] key to enter the measurement main page, or press the [Setup] key to enter the setting main page;
2. Use the cursor keys to select the [Trigger] field;
3. Use the function keys to select the trigger method.

function keys	Function
Internal	Internal trigger
Manual	Manual trigger
Remotely	Remote trigger
external	External trigger
Internal semi-automatic	Internal semi-automatic trigger

4.1.4 Test 【range】

S CPI communication command:
FUNCtion : RANGe {<range number>,min,max}
FUNCtion : RANGe:MODE {AUTO,HOLD,NOMinal}
9456-DR01 has set multiple ranges according to different voltages, and the variation range of each range is as follows:

Table 4- 1Range of Variation

Voltage range: < 100V

Range number	range	Measuring range	rise range	drop range
1	2MΩ	0.000MΩ~4.000MΩ	↓ 2MΩ ↓ 20MΩ ↓	↑ 1.8MΩ ↑ 18MΩ ↑
2	20MΩ	1.90MΩ~40.00MΩ		
3	200MΩ	19.0MΩ~400.0MΩ		

Voltage range: ⩾ 100V

Range number	range	Measuring range	rise range	drop range
1	2MΩ	0.000MΩ~4.000MΩ	↓ 2MΩ ↓ 20MΩ ↓ 200MΩ ↓	↑ 1.8MΩ ↑ 18MΩ ↑ 180MΩ ↑
2	20MΩ	1.90MΩ~40.00MΩ		
3	200MΩ	19.0MΩ~400.0MΩ		
4	2000MΩ	190MΩ~9999MΩ		

There are 3 range modes:

Table 4- 2 Test range description

Range method	describe	advantage	shortcoming

automatic	The instrument automatically selects the best test range according to the impedance value, and the range number in the range field will be automatically set.	Users do not need any involvement	Auto-ranging requires a predictive range, and the test speed will be lower than the manual-ranging method.
manual	The instrument will always use the user-specified range for testing	The test speed is the fastest.	The user needs to participate in the selection of the range
Nominal	Nominal range mode : the instrument will select the best range according to the lower limit of the comparator	The best way to sort test. The fastest speed.	Only suitable for sorting tests.

■ **Steps to set the range**:

1. Press [Meas] key to enter the measurement page or [Setup] key to enter the setup page;
2. Use the cursor keys to select the [Range] field;
3. Use the function keys to select range auto, manual or select range

function keys	Function
automatic	The instrument will automatically select the range
manual	The instrument is locked on the current range
Nominal	The instrument will select the best range based on the nominal value
increase+	Increment the range number while the range is changed to lock
reduce-	Decrease the range number while the range is changed to lock

i

Notice:
When the range is automatic, the instrument will predict the range in each measurement cycle, so the test speed will be slightly slower than the locked range, especially at medium and fast speeds. Moreover, during automatic measurement, frequent changing of the range will cause the response to slow down.
Usually, when the instrument is used for sorting measurement, the auto-ranging method is not suitable.
For sorting users, please select the nominal range method.

4.2 Measurement result display

4.2.1 Measurement result area description

Figure 4- 2 Measurement result display

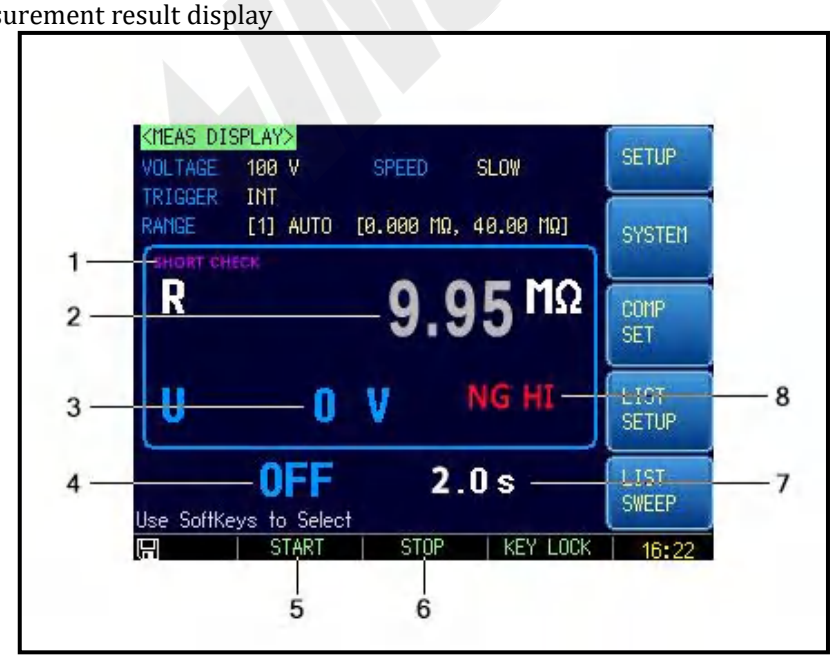


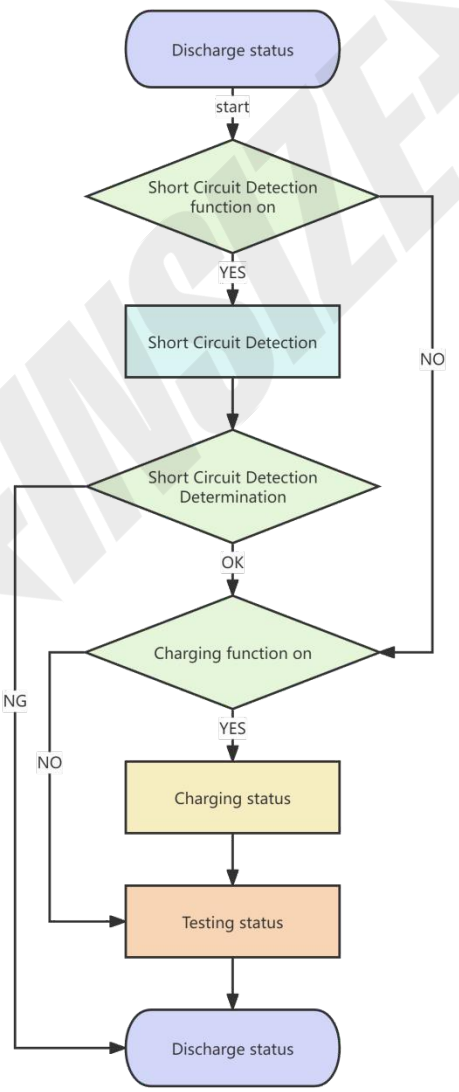
Table 4- 3 What is the measurement result area?

serial number	illustrate
1	Short circuit check display. It is only valid and displayed when the short-circuit check is turned on in the [Settings] page.
2	Insulation resistance display. During the measurement process, it is displayed in white font

	color, and in the discharge state, it is displayed in gray.
3	Voltmeter display. Always monitor the voltage across the measured terminal.
4	Status Display. The instrument is divided into 3 measurement states: discharge state (OFF) - State of Charge (CHAR) - Measurement Status (CHAR).
5	Start the test button. After pressing the [Start] key, the measured terminal HIGH ⊕terminal will output voltage, and the instrument will enter the charging or measuring state at the same time.
6	Stop testing keystrokes. After pressing the [Stop] key, the measured terminal HIGH ⊕terminal
7	charge or test timer is displayed.
8	Comparator status display. OK: qualified NG HI : Failed to exceed the upper limit NG LO: Failed to exceed lower limit CNG: poor contact CNG H: Poor contact HIGH⊕ end CNG L: Poor contact LOW⊖ end

4.2.2 Working status

Figure 4- 3state switching



- Discharge status: the status display is OFF, and the test indicator light is not lit.
  In this state, the discharge circuit of the terminal under test is always on , so the charge stored by the device connected to both ends of the terminal under test will be discharged to the voltage of 0 V in the machine .

- Charging status : The status display is CHAR, the test indicator light is on, and the measured terminal HIGH ⊕will have voltage output.
  On the <setting page> , set the [Charging Timing] to set the timing time, and press the start button , it will enter the charging state.
  charging state , the DUT will be rapidly charged with a constant current of 1.8 mA until the voltage reaches the preset value, and then the test will be changed to constant voltage.
  charging time is over , the instrument will automatically switch to the measurement state.

> **i** For larger battery packs, appropriately increasing the charging time will help fast measurement , especially when measuring with automated equipment , it will help fast sorting.

- Test status : The status is displayed as TEST, the test indicator light is on, and the tested terminal HIGH ⊕will have voltage output.
- Set [Measurement Timing] to OFF in < Settings Page > , the instrument will always be in the testing state until the stop key is pressed or the HANDLER discharge signal is applied externally.
  Preset the measurement time in [Measuring Timing] in the < Settings Page > , the instrument will return from the test state to the discharge state after measuring for a period of time .

5. < Setup > Setup page

All measurement-related settings are operated on the <Settings> page.
You only need to press the [Setup] key, and the instrument will enter the main setup page.

5.1 Measurement settings

In the <Settings> page, the instrument does not measure.

Figure 5- 1 <Settings> page

voltage , speed, trigger and range settings , please refer to the relevant chapters on the measurement display page : 4.1 <Measurement display> page

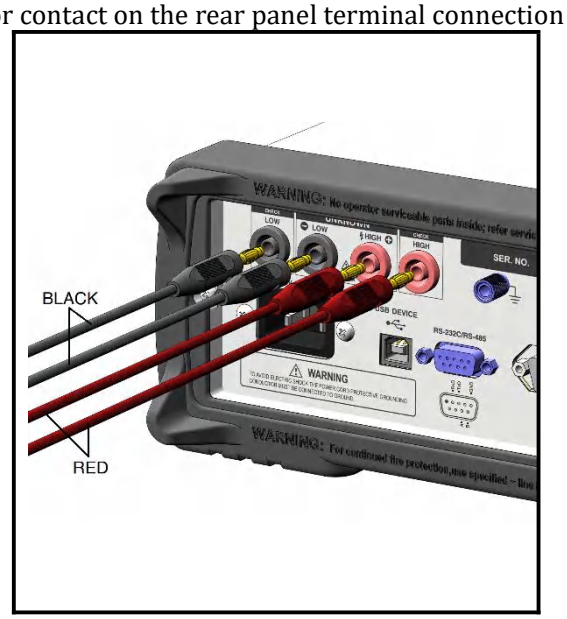
5.1.1 【Contact Check】 Switch

Since the measured insulation resistance value will exceed the measurement range of the instrument , the measured value will be displayed as overflow, so it will be impossible to distinguish whether it is the overflow caused by the high insulation resistance value of the DUT itself , or the measured value caused by the lack of good contact of the DUT . overflow , resulting in misjudgment .
To solve this problem, the instrument can use two additional terminals to detect poor contact at the HIGH and LOW ends respectively .

In both charging and measurement , a contact check test is performed first. A contact check is performed at the beginning and end of each measurement cycle , and once a bad contact occurs in one of them , the current measurement is terminated and returned to discharge.

contact check adds additional time to the measurement :
■ Auto range method: (open for poor contact)
Slow : 1.9 times/sec
Medium speed : 11 times/sec
Fast : 15 times/sec
■ Manual range method: (open with poor contact)
Slow: 2 times/sec
Medium speed: 15 times /sec
Fast: 22 times/sec

picture 5- 2Poor contact on the rear panel terminal connection



The instrument will first perform a bad contact check for each measurement , and if a bad contact is detected , the CNG flag will be displayed on the comparator status bar .
Once a bad contact is detected , the instrument will output a low level of CNG signal at the HANDLER interface , and at the same time the NG signal will also output a low level .

i	contact check switch is turned on, the measurement time is extended . Please refer to the Test Speed section .

■ Turn on contact checking :

1. Press [Setup] key in discharge state to enter the setup page;
2. Use the cursor keys to select the [Contact Check] field;
3. Use the function keys to select

function keys	Function
closure	
Open	

contact check is turned on, the poor contact of the test line will be detected first during measurement. Once any end is disconnected , it will display an open circuit and enter the discharge state at the same time .

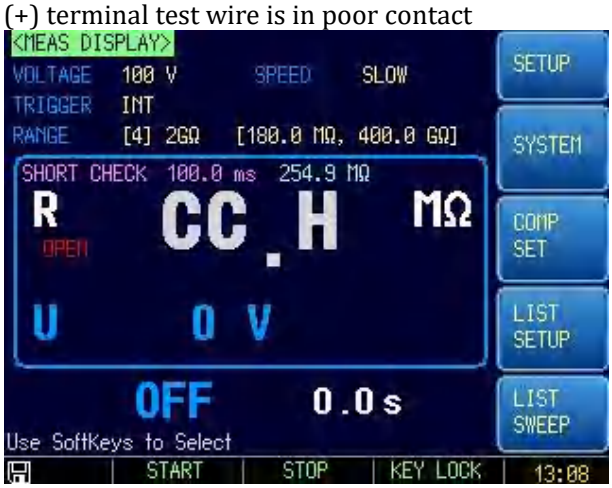
1. HIGH/LOW are open , it will be displayed as CC.HL

Figure 5- 3test lines are all in poor contact

The HIGH(+) and LOW(-) test leads need to be checked at this point.

2. HIGH(+) terminal is open, it will be displayed as CC .H

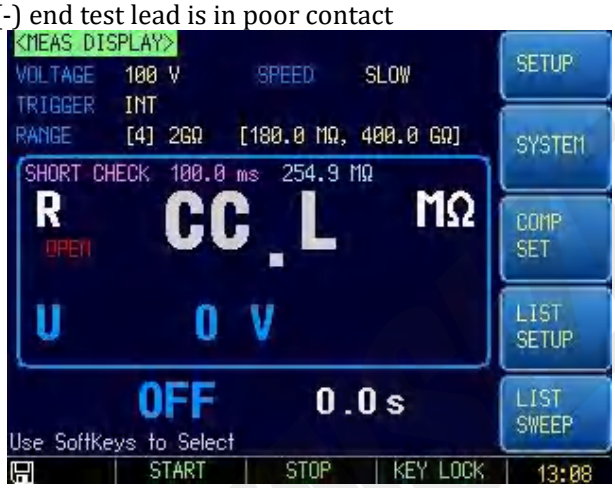
picture 5- 4HIGH (+) terminal test wire is in poor contact



At this point you need to check HIGH(+) terminal test lead.

3. LOW (-) terminal is open, it is displayed as CC . L

Figure 5- 5LOW (-) end test lead is in poor contact



At this point , you need to check the LOW (-) terminal test lead.

5.1.2 【Charging Timing】

The instrument has a charging function , which allows the DUT to be charged with a constant current of 1.8 mA before the preset voltage is reached, which is helpful for fast charging of capacitive loads and improves the response speed . If there are many false positives (exceeding the lower limit) during the measurement by automated equipment , the charging timing can be appropriately increased to improve .

> Charge Timer Min: 0.1 s , Max 999 s

■ set the charge timer :

1. Press [Setup] key in discharge state to enter the setup page;
2. Use the cursor keys to select the [Charging Timing] field;
3. (maximum 999 s) can be entered directly on the numeric keyboard , and the unit is ms and s .
   Or use the function keys to select:

function keys	Function
closure	Charging function off
200 ms	
500 ms	
1 s	
2 s	

5.1.3 【Measurement Timing】

If the measurement timer is set, the instrument will turn off the measurement and return to the discharge state after the measurement timer counts down to 0 s .

If the measurement timer is set to be off , the instrument will always be in the measurement state, until the stop

button is pressed , or the HANDLER STOP signal level is received, or the communication command is received , the measurement will be turned off and the instrument will return to the discharge state. When the measurement timer is turned off , the timer under the <measurement display> page will be displayed in positive count , and will not be updated after counting to 999.9s .

> Measurement timer min: 0.05 s , max 999 s

■ set the measurement timer :

1. Press [Setup] key in discharge state to enter the setup page;
2. Use the cursor keys to select the [Measurement Timing] field;
3. measurement time (maximum 999.9s) can be input directly with the numeric keyboard , and the unit is ms and s .

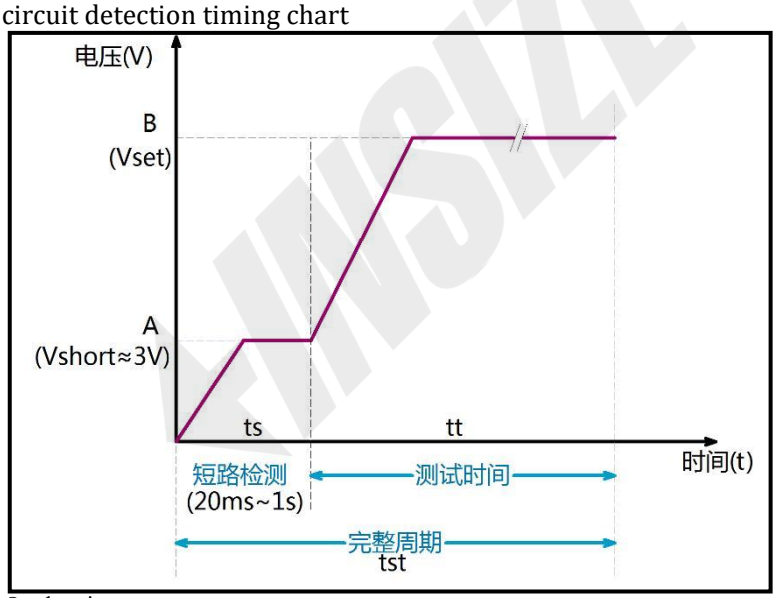
Or use the function keys to select:

function keys	Function
closure	Charging function off
200 ms	
500 ms	
1 s	
2 s	

5.1.4 【Short circuit detection】

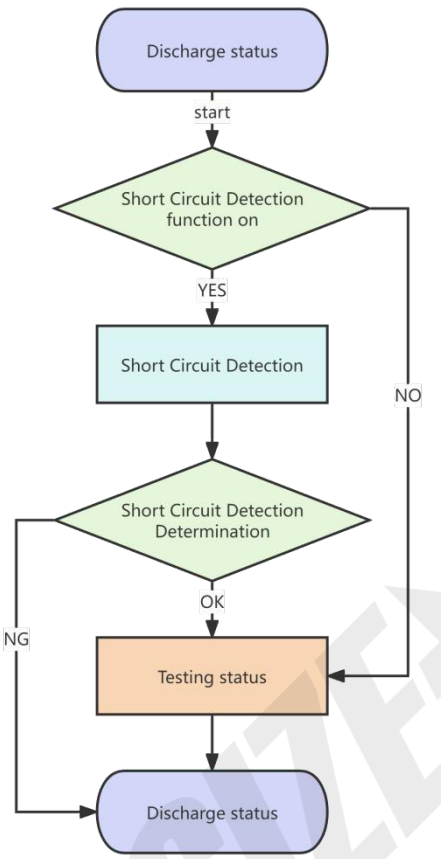
Due to the limitation of the manufacturing process of the DUT, there may be filamentous impurities behind the DUT. Some of these impurities may be fused by the output high voltage as impurities and remain in the product, but the product will be judged as qualified insulation . In order to avoid such misjudgment, before outputting high voltage, you can use the short-circuit check function , that is, use a lower test voltage (about 3V) for prediction, make sure that there is no short-circuit, and then perform normal output high-voltage measurement.

Figure 5- 6 Short circuit detection timing chart



On the picture :
Point A : short circuit detection output voltage, the voltage range fluctuates around 3V (2V~4V) .
Point B : Set the voltage .
ts : short -circuit detection time
tt : measurement time (including short-circuit detection time + test time)
tst : full cycle (=ts +tt)

Figure 5- 7 Short circuit detection flow chart



- Short-circuit detection time is set to [Auto]
  When the short- circuit detection time can not be determined , we need to set the detection timing to [Auto]. The automatic detection time varies according to the test speed:
  Slow : 0.5 s
  Medium speed : 0.25 s
  Fast : 0.1 s
  For example: at slow speed, the instrument will judge whether the DUT is short- circuited with a short-circuit detection time of up to 0.5 s . If the DUT is not short-circuited, it will display the short-circuit detection time and immediately switch to the test state . However , if a short circuit is detected continuously within 0.5 s , the instrument will end the current measurement and return to the discharge state.

> **i** If the test is performed in an automated device , it is not recommended to set the short-circuit detection time to [Auto] , because even at a fast time , it will take an additional 0.1s to complete a complete measurement cycle .

- Manual input of short-circuit detection time
  For the DUT of the same batch, the short circuit check time is similar, which lead us to set the check time manually to reach the shortest check time.

> **i** Short circuit timer min: 10ms , max 1s

Generally we can not know exactly the short circuit check time in advance,so we can easily accquire it by methods below:

1. The short circuit detection timer is set to [Auto] ;
2. Trigger selection [Internal];
3. Under discharge status,connect to DUT;
4. start test

Figure 5- 8 Short circuit detection flow chart.

5. Time is displayed after the short- circuit detection is completed , such as 6.1 ms shown in the above figure . Use multiple product detections to obtain a maximum time , and appropriately add a margin input to the short-circuit detection timer.

■ set the short circuit detection timer :

1 Press [Setup] key in discharge state to enter the setup page;

2 Use the cursor keys to select the [Short Circuit Detection] field;

3 measurement time (maximum 999.9 s) can be entered directly with the numeric keyboard , in ms and s .
or use the function keys to select

function keys	Function
closure	Short circuit detection function is off
automatic	Detection will take a maximum time of 500 ms .
100 ms	
200 ms	
500 ms	

5.1.5 Trigger 【Delay】

In the external trigger mode , in order to synchronize with the external device, it is sometimes necessary to set the trigger delay to ensure reliable measurement .
Trigger delay refers to the time between when the instrument receives the trigger signal and starts measuring.

i Trigger delay min: 1 ms , max 10 s

■ Enter the trigger steps:

1 Press [Setup] to enter the setting page;

2 Use the cursor keys to select the [Delay] field;

3 Use the numeric keypad to enter the time in ms and s . For example: enter 100 ms
Alternatively , the function keys make selections :

function keys	Function
closure	The trigger delay function is invalid .
50 ms	
100 ms	
200 ms	
500 ms	

5.1.6 【Source Internal Resistance】 Select

The instrument has two built-in current limiting resistors, normal and current limiting. When set to normal , the voltage source will provide enough current for charging and measurement, which can effectively improve the measurement efficiency.
For some DUTs that are sensitive to charging current, such as the insulation resistance measurement of crystal oscillators, clock oscillators, etc., in order to prevent high voltage damage to the DUT, it is necessary to set the source internal resistance to current limiting. For the measurement of power batteries, it is usually also necessary to set the current limiting mode .
source resistance in current-limit mode is 50 kΩ.

■ choose a current limiting resistor :

1 Press [Setup] to enter the setting page;

2 Use the cursor keys to select the [source internal resistance] field;

3 function keys to select :

function keys	Function
normal	
Limiting	Current sensitive devices, need to turn on current limit mode

6. Comparator settings

In discharge state, press the [Meas] key or the [Setup] key, and then press the [Comparator Setup] function key on the right to enter the <Comparator Setup> page.

In order to make full use of the comparator, 9456-DR01 also has a built-in Handler interface, which is used to output the comparison results of these files to PLC or industrial computer.
On the <Comparator> page, you can set the following:

- Comparator switch – Turn on/off the comparator
- Beeper settings – OK/NG/ Close the beeper function
- Beeper volume setting – Volume strength setting
- Upper and lower limit settings

Figure 6- 1 <Comparator Settings> page

6.1 Comparator settings

6.1.1 【Comparator】 Switch

Communication command: COMParator[: STATe] {OFF ,ON }

- To turn the comparator on or off:

1. Press [Meas] or [Setup] key to enter the corresponding page;
2. Press [Comparator Setting] key to enter the <Comparator Setting> page;
3. Use the cursor keys to select the [Comparator] field;
4. Use the function keys to select

function keys	Function
closure	Turn off the comparator
Open	Turn on the comparator (only AT 517L display)

6.1.2 【Beep】 Setting

Communication command: COMParator:BEEP {OFF, OK , NG }

The instrument can set a qualified beep or a non-qualified beep .

- Beeper settings:

1. Enter the <Comparator Settings> page
2. Use the cursor keys to select the [Beep] field;
3. Use the function keys to select

function keys	Function
closure	Beeper off
qualified	Qualified beeper
Failed	Ineligible options

■ Beacon Workflow

[Test Time] in the <Settings> page is off, in the test state , the buzzer will keep beeping until the OK/NG state is switched or the discharge button is pressed .

When the time is set in [Test Time] in the <Settings> page, it will only beep once when the test is completed , and will not beep in the test state.

A long beep of 0.2 s means qualified .

2 short beeps , it means unqualified.

> During continuous measurement, the buzzer will not beep when the measured value shows an overshoot or an open circuit .

6.1.3 【Beep volume】 Setting

SCPI command: COMParator: TONE { LOUD, WEAK }

Beeper volume can be set to strong and weak .

■ Beeper volume settings:

1. Enter the <Comparator Settings> page
2. Use the cursor keys to select the [Beep Volume] field;
3. Use the function keys to select

function keys	Function
powerful	
weak	

6.1.4 【Lower Limit】 Setting

SCPI command: COMParator: LOWer <float>

■ Enter the lower limit value

1. Go to the <Comparator> page
2. Use the cursor keys to select the [Lower Limit] field;
3. Enter data , select the unit with the sidebar function keys, for example : 10MΩ

6.1.5 【Upper Limit】 Setting

SCPI command: COMParator: UPper <float>

upper limit of the comparator is allowed to be set to infinity (∞) , at this time the upper limit will not participate in the operation and comparison.

■ Setting and entering upper limit values

1. Go to the <Comparator> page
2. Use the cursor keys to select the [Upper Limit] field;

3a. Enter data , select the unit with the sidebar function keys, for example : 1GΩ

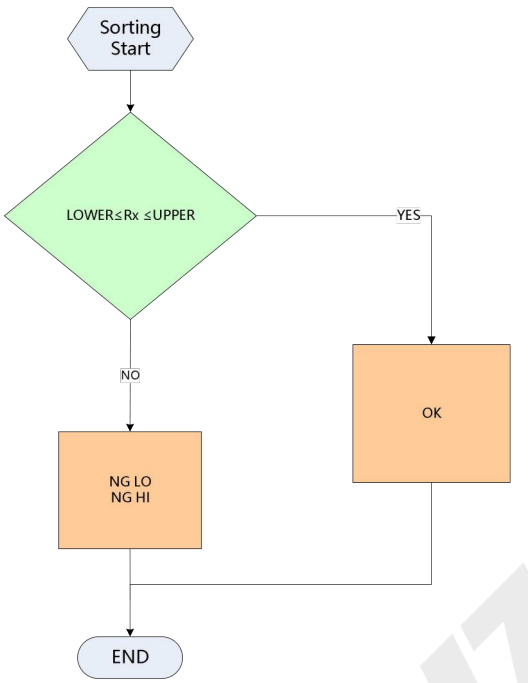
3b. Or select ∞ (infinity) for the sidebar function to close the upper limit.

> Once the upper limit of the comparator is set to ∞ (infinity) , the instrument comparator will only judge the lower limit, exceeding the lower limit will display OK (OK) , below the lower limit will display (NG LO) .

6.2 How Comparator Works

6.2.1 Sorting process

Figure 6- 2 Sorting process



7. List scan

9456-DR01 has a list scan function, which can scan and measure 5 groups of lists.
Before scanning the list, you need to set the list first.
On the <Measurement Display > page , press the function key

7.1 <List Settings> page

<List Setting > page can set 5 groups of list lines , including: voltage, charging time , test time , and comparator upper and lower limits .
The discharge time of each line is set uniformly .

Figure 7- 1 <List Settings > page

7.1.1 【Trigger】 Setting

List scan trigger settings include 3 trigger modes :

Trigger method	describe
manual	The instrument performs a scan each time the [Trig] key on the front panel is pressed.
Remotely	Use the command of the host computer to perform the trigger test. The remote trigger instrument performs a sweep after receiving the trigger command.
external	I O trigger: When a rising edge pulse is received from the Handler interface on the rear panel, the instrument performs a scan.

List scans do not support internal triggering.

Triggering is also related to the scanning method :
When the scan [Method] is set to [Sequence] , a trigger will scan the entire list once ;
[Mode] of the scan is set to [Single Step] , only the current line will be measured when triggered once .

■ **Steps to set the trigger method:**

1. On the <Measurement Display> page or the <Settings> page , press the function key [List Settings] to enter the <List Settings> page;
2. Use the cursor keys to select the [Trigger] field;
3. Use the function keys to select the trigger method.

function keys	Function
manual	Manual trigger
Remotely	Remote trigger
external	External trigger

7.1.2 Scan 【Method】

Triggering is also related to the scanning method :
When the scan [Method] is set to [Sequence] , a trigger will scan the entire list once ;
When [Mode] of the scan is set to [Single Step] , only the current line will be measured when triggered once .

■ To set the scan method:

1. On the <Measurement Display> page or the <Settings> page , press the function key [List Settings] to enter the <List Settings> page;
2. Use the cursor keys to select the [Method] field;
3. Use the function keys to select the trigger method.

function keys	Function
Sequence	Sequential list scan, one trigger to complete the measurement of all rows.
single step	Single-step scan, one trigger only completes the measurement of the current line.

7.1.3 【Discharge time】 setting

After each line measurement is completed, a discharge must be performed . Therefore, the discharge time cannot be turned off , the minimum discharge time is 10 ms and the maximum is 10 s.
discharge time is a unified setting, which is valid for each group of lists .

■ **Step too set the discharge time** :

1. On the <Measurement Display> page or the <Settings> page , press the function key [List Settings] to enter the <List Settings> page;
2. Use the cursor keys to select the [Discharge Time] field;
3. Use the function keys to select the discharge time , or directly input the time on the numeric keyboard.

function keys	Function
10 ms	
100 ms	
200 ms	
1 s	
2 s	

7.1.4 open list row

There are 5 groups in the list , and each group can be turned on or off independently.

■ **Step to set open / close row** :

1. On the <Measurement Display> page or the <Settings> page , press the function key [List Settings] to enter the <List Settings> page;
2. Use the cursor keys to select the fields 【01】~【05】;
3. Use the function keys to close

function keys	Function
Open	
closure	

7.1.5 List settings

■ [Voltage] setting:

1. On the <Measurement Display> page or the <Settings> page , press the function key [List Settings] to enter the <List Settings> page;
2. Use the cursor keys to enter the row to be set , and select the item [Voltage];
3. Use the function keys to set or directly enter the test voltage

function keys	function keys
10V	200V
25V	300V
50V	500V
100V	1000V

■ Comparator settings:

1. On the <Measurement Display> page or the <Settings> page , press the function key [List Settings] to enter the <List Settings> page;
2. Use the cursor keys to enter the line to be set , and select the item [Compare];
3. Enter the lower and upper bounds separately , where the upper bound can be set to infinity (∞) .

function keys	Function
∞	gigantic

■ Charging time setting:

1 On the <Measurement Display> page or the <Settings> page , press the function key [List Settings] to enter the <List Settings> page;

2 Use the cursor keys to enter the line that needs to be set , and select the [Charge] item ;

3 Select or enter the time directly . Charging time up to 99 s

function keys	Function
0 s	charge time off
0.2 s	
0.5 s	
1 s	
2 s	

■ Test time settings:

1 On the <Measurement Display> page or the <Settings> page , press the function key [List Settings] to enter the <List Settings> page;

2 Use the cursor keys to enter the line to be set , and select the [Test] item ;

3 Select or enter a time , the test time cannot be turned off, the minimum value is 0.1 s, and the maximum value is 99 s.

function keys	Function
0.1 s	
0.2 s	
0.5 s	
1 s	
2 s	

7.2 <List Scan > page

On the <Measurement Display> page or the <List Setting> page , press the function key [List Scan] to enter the <List Scan> page;
There are no options that can be set in the <List Scan > page , so the settings must be set in the <List Settings > page in advance.

Figure 7- 2 <List Scan> page

7.2.1 start scan

List scan does not support triggering , so the <List scan> page does not have the [Start] button.
triggering manually , press the [Trig] key to start the measurement.
triggered remotely , send The LIST :TRG instruction starts the measurement.
externally triggered, the measurement is started by receiving the Trig signal from the Handler interface .

7.2.2 Start scan measurement

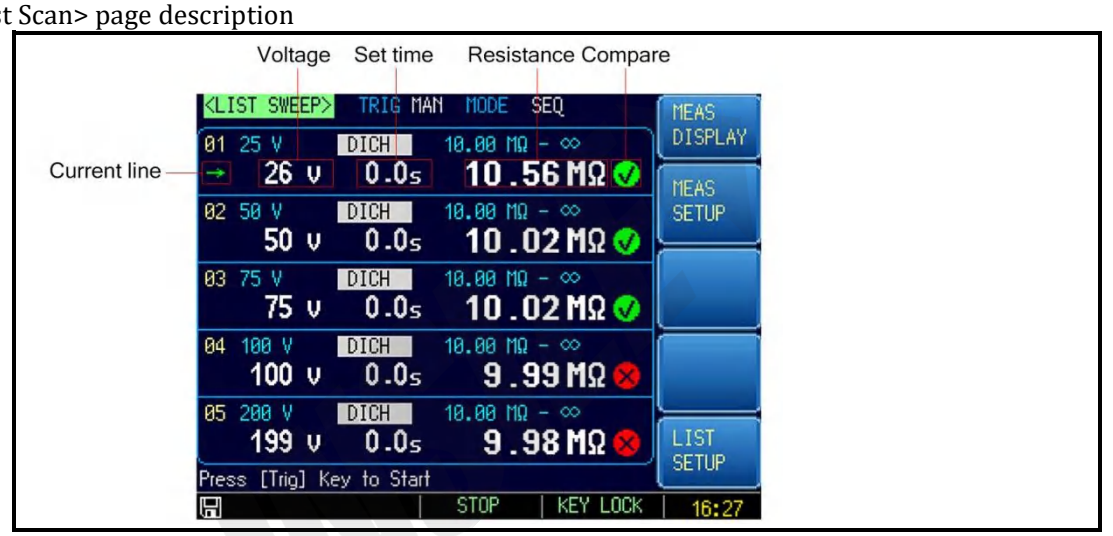
The following example shows how to perform sweep measurement.
The 5 groups are set as follows:

1 Scan settings

Figure 7- 3 <List setting> example

2 Go to the <List Scan > page

Figure 7- 4 <List Scan> page description



3 Trigger scan

this example , manual triggering is used , and the scan is started using the [Trig] key on the front panel .

4 charging

Figure 7- 5 Charging status , charging timer countdown starts

5 test status

Figure 7- 6 Measurement status , measurement timer countdown starts

6 discharge state

Figure 7- 7 Discharge state , the discharge timer countdown starts

7 End of current line scan

8. System Configuration

In this chapter you will learn about the system configuration of the instrument :

- System Configuration Page
- system information page

At any time, you only need to press the [Meas] or [Setup] key, and the [System] key will appear at the bottom of the main page.

8.1 System Configuration Page

[Setup] key to enter the < Setup > page , press [System] to enter the <System Configuration> page.
The System Configuration page includes the following settings:

- theme style – System color selection
- LANGUAGE – Chinese and English options
- [Key tone] Settings - Turn on/off the key tone
- [Date/Time] setting
- [Account] Settings - Administrator /User Account Password Settings
- [Remote Control] Setting - The instrument supports RS232 / RS485/USB interface
- [Baud rate] setting
- [Communication protocol] Select – SCPI/MODBUS protocol selection
- [Station No.] Select – Multi-machine communication station number setting
- Communication [command handshake] switch – SCPI turns on command handshake
- [Result sending] method – send measurement results automatically/manually
- SCPI [Terminator] Settings – SCPI Terminator Settings
- Line Frequency – 50Hz / 60Hz Filter Selection
- restore to factory settings – Reset instrument settings and system configuration parameters to factory values

All settings on the system configuration page will be automatically saved in the system and will be automatically loaded the next time the system is powered on.

Figure 8- 1 <System Configuration> page

8.1.1 Theme style

Instruments are available in 2 styles: classic and modern.
Classic style : dominated by a blue background .
Modern style : dominated by a black background .

- To choose a theme style

1. Go to the <System Configuration> page
2. Use the cursor keys to select [Theme Style] .
3. Use the function keys to select:

function keys	Function
classic	
modern	

8.1.2 Change the system language 【LANGUAGE】

Communication command: SYSTem:LANGuage {ENGLISH,CHINESE,EN,CN}

The instrument supports both Chinese and English languages.

- **Steps to change the language**

1. Go to the <System Configuration> page
2. Use the cursor keys to select [LANGUAGE].
3. Use the function keys to select the language:

function keys	Function
Chinese [CHS]	Simplified Chinese
ENGLISH	English

8.1.3 【Key tone】 setting

The key tone of the instrument can be turned off.

- Set key tone

step 1 Go to the <System Configuration> page
Step 2 Use the cursor keys to select the [Key Tone] field;
Step 3 Use the function keys to select

function keys	Function
closure	
Open	

8.1.4 Modified date and time

Communication command: SYSTem: dt <YYYYMMDDHHmmss>

The instrument uses a 24-hour clock.

- Change date:

1. Go to the <System Configuration> page
2. Use the cursor keys to select the [Date] field.
3. To set the date using the function keys:

function keys	Function
month+	+1 month
moon-	- January
day+	+1 day
day-	-1 day
Year+	+1 year
year-	-1 year

- Change the clock:

1. Go to the <System Configuration> page
2. Use the cursor keys to select the [Clock] field.
3. To set the clock using the function keys:

function keys	Function
time+	+1 hour
Time-	-1 hour
points+	+1 minute
Minute-	-1 minute
seconds+	+1s
Second-	-1 second

8.1.5 Account setting

The instrument has two user modes to choose from:

- Administrator – Except the [System Services] page, other functions are open to the administrator, and the parameters set by the administrator are saved in the system memory after a delay of 5 seconds, which is convenient for loading after the next boot.
- User - Except the [System Services] and [File] pages, users can operate other functions. The data modified by the user will be restored to the value set by the administrator after the next boot.

- Change account:

1. Go to the <System Configuration> page

2 Use the cursor keys to select the [Account] field.

3 Use the function keys to change:

function keys	Function
administrator	All functions except the [System Services] page are open If you forget your password, please call our sales department.
user	Except for the functions of the [System Services] page and the [File] page, which can be operated, the set data is not allowed to be saved.

■ Administrator password settings:

1 Go to the <System Configuration> page

2 Use the cursor keys to select the [Account] field.

3 Use the function keys to select:

function keys	Function
change the password	Enter a numeric password of up to 9 digits, including only numbers and symbols.
remove password	Admin will not be password protected

8.1.6 【Remote Control】 Settings

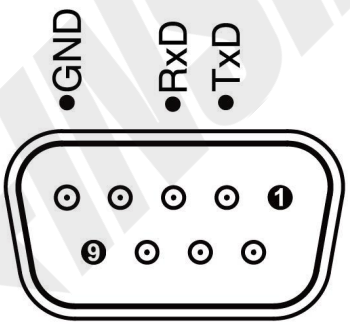
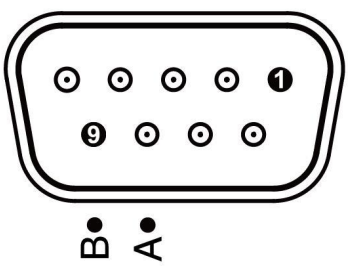
The instrument supports 3 remote control interfaces : RS23 2 , USB and RS485 interfaces.
three interfaces can run SCPI and Modbus (RTU) protocols.

■ Select the remote control interface :

1 Go to the <System Configuration> page

2 Use the cursor keys to select the [Remote Control] field;

3 Use the function keys to select

function keys	Function
RS232	RS232 uses the DB9 interface on the rear panel for communication, using 3 of the pins : P2 : TxD P3: RxD P5: GND 
USB	USB-232 interface, use the rear panel USB interface for communication
RS485	RS 485 uses the DB9 interface on the rear panel for communication , using 2 of the pins: P8: A(+) P9: B(-) 

8.1.7 【Communication Protocol】 Select

The instrument supports two communication protocols: SCPI and Modbus (RTU) protocol. Usually, it is more convenient to use SCPI to communicate with computers, and to communicate with industrial control equipment such as PLC. The Modbus protocol is easier to use and supports multi-computer communication.

■ Select communication protocol:

1 Go to the <System Configuration> page

2 Use the cursor keys to select the [Communication Protocol] field;

3 Use the function keys to select

function keys	Function
SCPI _	
Modbus _	

8.1.8 【Station No.】 Select

multi-machine communication.
If the Modbus (RTU) protocol is used, be sure to set the station number address of the machine .
This station number can also be used for SCPI communication protocol for multi-machine communication.

i Multi-machine communication can also be performed using the SCPI communication protocol. At the beginning of each line of instructions, add addr #; : The subsystem can select the slave .
For example : addr 02 ; :fetch? ΔRepresents fetching data from the slave of station number 2.

■ Select RS 485 station number:

1 Go to the <System Configuration> page

2 Use the cursor keys to select the [Station No.] field;

3 Use the function keys to select

function keys	Function
0 0 Broadcast	instrument will only receive commands and will not return any data.
01	
02	
03	
04	
05	
06	
07	
08	
09	
10	
11	
12	
13	
14	
15	

i Under the Modbus protocol , in order to facilitate the simultaneous operation of multiple identical instruments , the instrument is allowed to use station number 00 for broadcast communication, and station number 00 for communication, the instrument only receives commands and does not return response codes.

8.1.9 【Baud rate】 Setting

The instrument has a built-in RS-232 interface. After the instrument receives the correct command in the RS-232 interface , it immediately communicates with the host at the set baud rate, and the keyboard is locked at the same time.
In order to communicate correctly, please confirm that the baud rate is set correctly. If the baud rate of the host computer and the instrument is different, the correct communication will not be possible.
The instrument RS-232/RS - 485 /USB configuration is as follows:

- Data bits: 8 bits
- Stop bit: 1 bit
- Parity: none
- Baud rate: configurable

Set the baud rate:

1 Go to the <System Configuration> page

2 Use the cursor keys to select the [Baud Rate] field;

3 Use the function keys to select

function keys	Function
9600	
19200	Modbus communicates with the host, it is recommended to use this baud rate

38400	
57600	
115200	SCPI communicates with the computer host, it is recommended that you use this high-speed baud rate.

8.1.10 SCPI 【command handshake】 switch

This function is only valid for SCPI protocol .
The instrument supports SCPI command handshake.
SCPI Command: `SYSTem: SHAKhand { ON,OFF,0,1}`
SCPI Query Command: `SYSTem: SHAKhand?`

After the command handshake is turned on, all commands sent by the host to the instrument will be returned to the host as they are, and then the data will be returned.
Commands sent by the host to the instrument will be processed immediately after the command handshake is turned off.

■ **Steps to set up the command handshake**:

1. Go to the <System Configuration> page
2. Use the cursor keys to select the [Command handshake] field;
3. Use the function keys to select

function keys	Function
close	No instruction handshake is used. Set Command Handshake to Off unless specifically required.
open	

8.1.11 SCPI Measurement 【Result Sending】 Method

This function is only valid for SCPI protocol .

The instrument supports the function of automatically sending data to the host. Data will be automatically sent to the host after each test, without the need for the host to send a FETCH? instruction.
The instrument will send the test results and comparator results to the host after each test, the format is as follows:

+1. 000E+09, 100, OK

+1. 0 00e+20 means overrun
-1.000e+20 means under overflow
OK Representative qualified
N G LO means unqualified lower limit
NG HI means not qualified to go to the Super League

If the result sending is set to AUTO, the measurement data needs to be returned according to whether [Measuring Timing] is turned on or not :
When the measurement timing is set to off , the data will be returned once every time the instrument measures ;
When the measurement timer sets the time , it returns only once at the end of the measurement .

■ set [Result Send]:

1. Go to the <System Configuration> page
2. Use the cursor keys to select the [Result Send]field;
3. Use the function keys to select

function keys	Function
FETCH	Can only use the instruction FETCH? Get all measurement data
automatic	Automatically sent to the host after each test is completed

8.1.12 SCPI 【terminator】 switch

This function is only valid for SCPI protocol .
The instrument supports SCPI command terminator setting.
It can be used when the host computer sends the command, or it can be used without the terminator, and the instrument can receive and parse it.
When the instrument sends the response result to the upper computer , the set terminator will always be sent at the end .
Terminator: There must be a terminator in the communication command between the instrument and the host , so as to facilitate mutual identification of the end of the command .

Instrument supports 3 types of terminators :

terminator _	ASCII name	ASCII hex	number of bytes	illustrate
LF(0x0A)	newline	0x0A	1 byte	Instrument default
CR (0x0D)	carriage return	0x0D	1 byte	
CR +LF	carriage return + line feed	1st byte 0x0D 2nd byte 0x0A	2 bytes	
NUL (0x00)	null character	0x00	1 byte	

Steps to set the terminator:

1. Go to the <System Configuration> page
2. Use the cursor keys to select the [Terminator] field;
3. Use the function keys to select

function keys	Function
LF(0x0A)	L F: Line feed , ASCII code : 0x 0A
CR (0x0D)	CR: carriage return , ASCII code : 0x 0D
CR+ LF	
NUL (0x00)	N UL: Null character , ASCII code : 0x 00

8.1.13 SCPI 【Error code】 display

This function is only valid for SCPI protocol .
SCPI Command: `SYSTem: CODE {ON,OFF,0,1}`
SCPI Query Command: `SYSTem: CODE?`

Error code is turned on, the instrument will return an error code after receiving the command .
If it is a query command, an error code will be returned only if the command is wrong .
Error code is closed, the host can send the command by ERR? Query the error code generated by the last command execution .

■ **Error code setting :**

1. Go to the <System Configuration> page
2. Use the cursor keys to select the [Error Code] field;
3. Use the function keys to select

function keys	**Function**
close	Error codes are not automatically returned.
open	error code returns the execution error code after executing the single-line instruction .

8.1.14 【Power frequency】 setting

The measurement stability of the instrument depends heavily on the power frequency. Please select it according to the power frequency of the current country.

■ **Select line frequency filter:**

1. Go to the <System Configuration> page
2. Use the cursor keys to select the [Power Frequency] field;
3. Use the function keys to select

function keys	**Function**
50Hz	Set to 50Hz power frequency
60Hz	Set to 60 Hz power frequency

8.2 System information page

Press the [Setup] key to enter the <Setup> page, press the [System] key in the bottom task bar to enter the <System Configuration> page, and press the function key to select [System Information].
The system information page has no user-configurable options.

Figure 8- 2 <System Information> page

9. File management

Press the bottom function key [File] to enter the <File Management> page.
File management allows users to save settings into 10 files for easy access at startup or when changing specifications.

On the <File Management> page, you can set the following:

- [Start-up call] - Specifies the file to be called at startup
- [Auto save] - Parameters that are allowed to be modified are saved in the current file in real time
- [document] - Specifies to save, read, or delete files.

Figure 9- 1 <File Management> page

9.1 【Start-up call】

The boot call option can specify the file to be called at boot time.

- Steps to set up power-on invocation:

1. Enter the <File Management> page
2. Use the cursor keys to select the [Power-On Call] field;
3. Use the function keys to select

function keys	Function
file 0	Load the settings of file 0 at boot
current file	Load the setting value of the current file number at startup

9.2 【Auto save】

When the auto-save option is enabled, the parameters set by the user will be automatically saved to the current file.

- **Steps to set up auto save**:

1. Enter the <File Management> page
2. Use the cursor keys to select the [Auto Save] field;
3. Use the function keys to select

function keys	Function
allow	The parameters set by the user will be automatically saved to the current file
prohibit	The parameters set by the user can only be saved in the file manually by the user, otherwise the parameters will be lost after the next power-on.

9.3 【File 0】~【File 9】

Users can specify 10 files from 0 to 9 to save, load and delete.

■ **Steps to set up the file:**

step 1 Enter the <File Management> page

Step 2 Use the cursor keys to select the [File 0]~[File 9] fields;

Step 3 Use the function keys to select

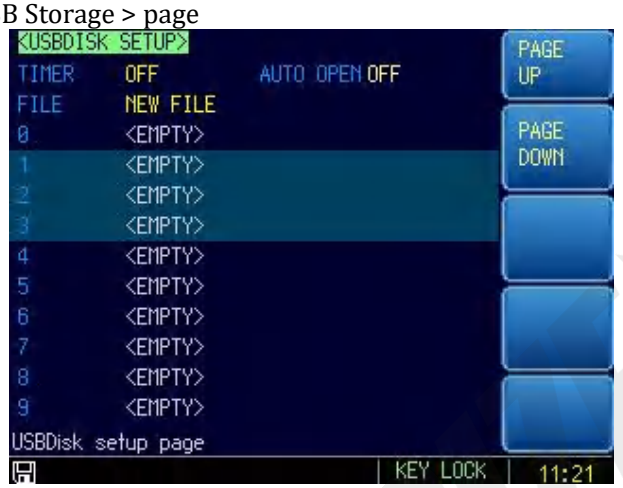
function keys	Function
save	Save all settings to the current file
read	Read the parameters of the file into the system
delete	file data will be deleted

10. U disk storage

The measurement data of < measurement page> can be automatically stored in the U disk.
Press [Setup] key, then press [U Disk Storage] function key to enter the < U Disk Storage > page.
Instrument

- [Timed save] - When the measurement timer is set to off, the data will be saved in the file periodically
- [Auto-enable] - When inserting the U disk , the file is automatically opened and stored
- [File] - Create a new file

Figure 10- 1 < USB Storage > page



10.1.1 【Timed save】

Only be enabled if the following conditions are met:

1. [Measurement Timing] under the <Settings> page is set to off ;
2. trigger mode is internal trigger;
3. [Timer Save] Set the time and cannot be closed .

In addition to the above, even if the timer save time is set , the timer save function is invalid .

- **Steps to set [Timed Save]**:

1 Enter the < U Disk Storage > page

2 Use the cursor keys to select the [Timer Save] field

3 Use the function keys to select [Close], or directly input the timing time . The minimum timing interval for timing saving is 1 s.

function keys	Function
closure	

10.1.2 【Automatically enable】

[Auto-Enable] field is turned on , every time the U disk is inserted, it will detect whether there is a recently used file in the U disk file, if there is, it will automatically open the file and use it for recording.

- **Steps for file [Auto-enable]**:

1 Enter the < U Disk Storage > page

2 Use the cursor keys to select the [Auto Enable] field

3 Use the function keys to select

function keys	Function
Open	
closure	

10.1.3 Create 【new file】

Create [New File] field , used to create a new file in the U disk, the file name is user-defined.
The file format is fixed to CSV format.

- Steps to create a [new file]:

1. Enter the < U Disk Storage > page
2. Use the cursor keys to select the [File] field
3. Use the function keys to select

function keys	Function
Create a file	A character keyboard will pop up , enter a custom file name . After the input is completed , pressing the function key [OK] will create a new file and the file name will be displayed in the list.

10.1.4 【File】Select

1. Enter the < U Disk Storage > page
2. Use [Next Page] or [Previous Page] Use the function keys to select the pages of [File 0]~[File 9] Or [File 10]~[File 19] page
3. Use the cursor keys to select the [File 0]~[File 19] fields;
4. Use the function keys to select

function keys	Function
Open	Open this file for data storage
closure	close this file
delete	Delete this file, the stored data will be cleared, and the file will not be recovered after deletion.

10.1.5 U disk data storage mechanism

Internal triggering and external triggering differ in how files store data.

- Internal trigger recording process
  1. When the [measurement timer] is set to [off] , the measurement data will be stored at the interval of [timed save]
  2. When the time is set by the [measurement timer] , the measurement data will be stored once when the test is finished .
- External trigger recording
  1. When the [Measurement Timer] is set to [Off] , each time a measurement is triggered , the data will be saved once ;
  2. When the time is set by the [measurement timer] , the measurement data will be stored once when the test is finished .

11. Prepare for measure

For a quick start, this chapter will briefly demonstrate how to make a measurement while verifying that the voltage output is normal.
To start a measurement, please familiarize yourself with the previous setup chapters .

11.1 Test side connection

When using test leads to connect,
Insert the red banana plug into HIGH ⊕ end;
Insert the black banana plug into the L OW ⊖ end.

Danger:
In the charging and testing state (the test terminal TEST high voltage indicator on the front panel will be on), the measured terminal HIGH ⊕will output high voltage. If the user connects the HIGH terminal to the ground, there will be a negative voltage at the L OW terminal at this time. ⊖, so do not touch any test terminals and exposed metal parts of the test leads to prevent the risk of electric shock.

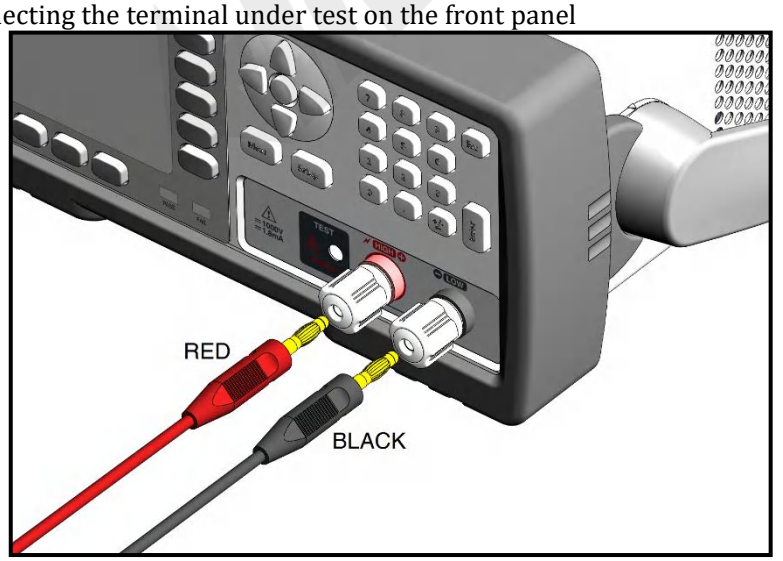
Notice:
Please use our company's test wire for measurement. The standard test wire has a higher insulation level and will not affect personal safety and measurement results.

Do not measure the insulation resistance of active devices, which may damage the instrument. The capacitive load must be fully discharged before measuring.

Notice:
The front and rear two sets of test terminals are connected in parallel inside the instrument, please be sure to use only one of them for testing.

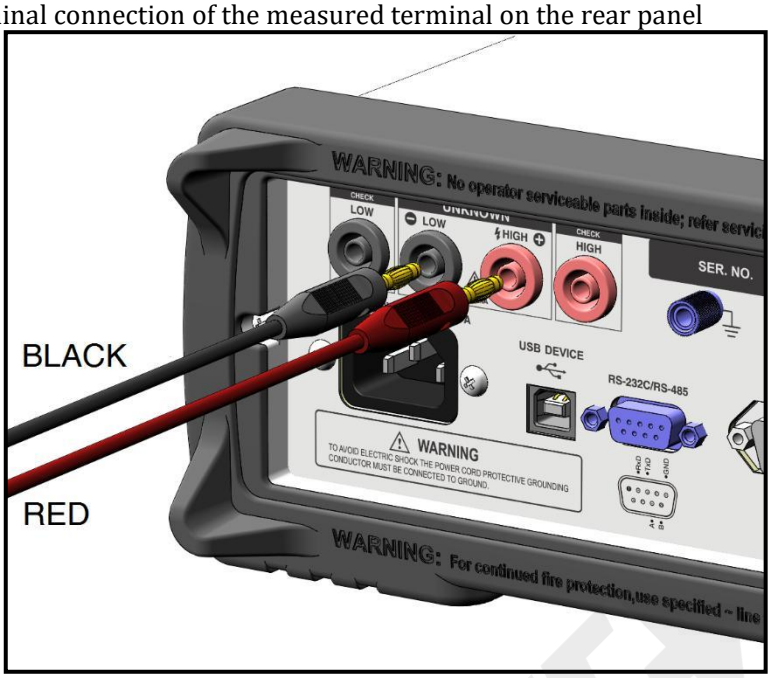
11.1.1 The connection method of the front panel test terminal

Figure 11- 1Connecting the terminal under test on the front panel



11.1.2 The connection method of the rear panel test terminal

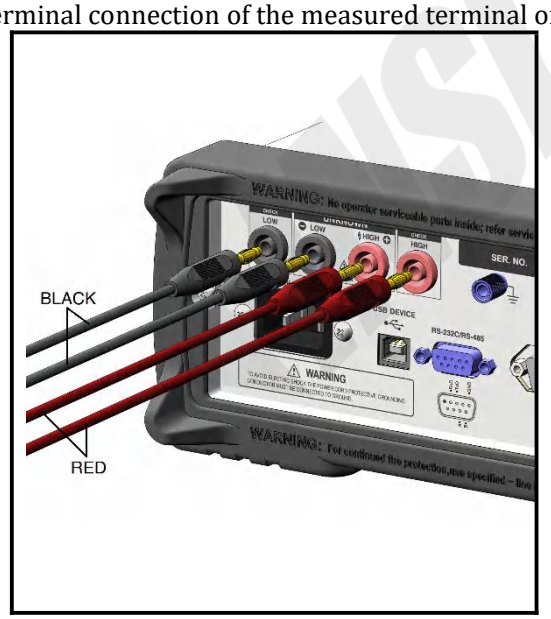
Figure 11- 2-terminal connection of the measured terminal on the rear panel

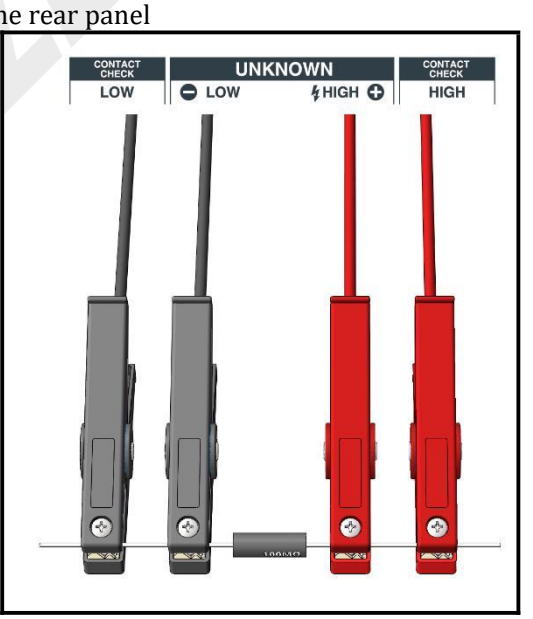


11.1.3 Connection method for rear panel contact check

If you use the contact check function, you need to connect 2 additional test leads to the CONTACT CHECK terminal on the rear panel, and use 4 terminals for measurement.

picture 11- 3-terminal connection of the measured terminal on the rear panel





Please refer to the Contact Inspection section on the <Settings> page.

11.2 Start measuring

warn:

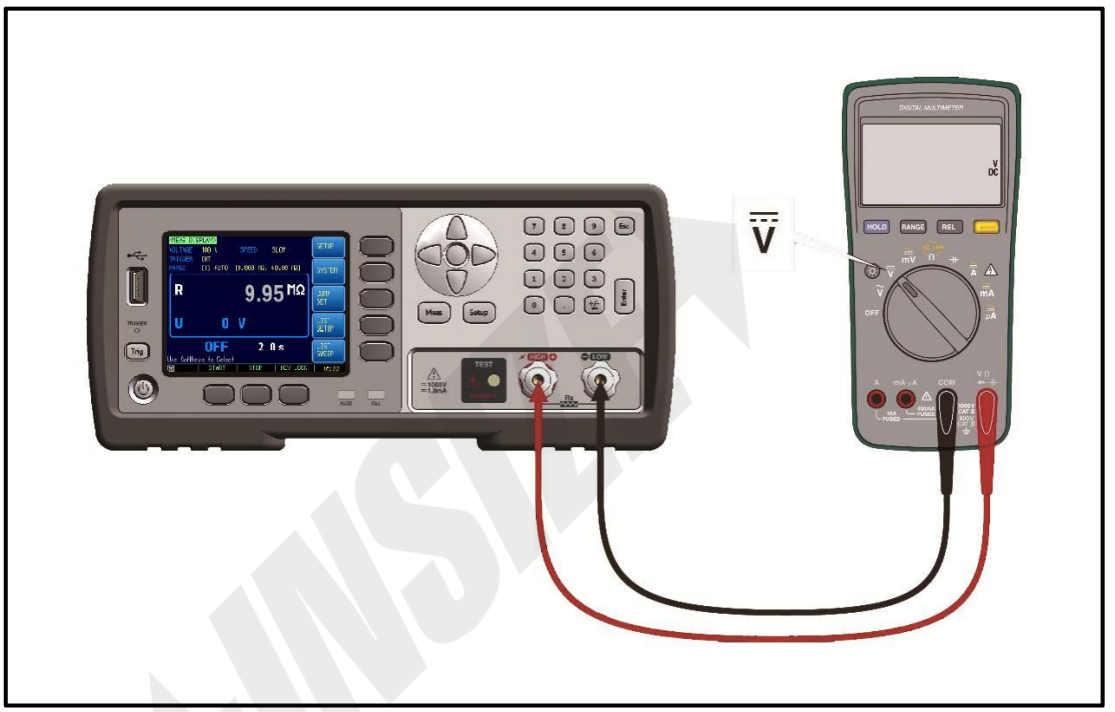
- When the TEST indicator of the test terminal is on, do not touch the test terminal on the front and rear panels and the exposed metal parts of the test clip to avoid the danger of electric shock.
- When test is completed, please enter the discharge state and discharge the DUT .

i	Note : In order to simply explain the measurement process of this instrument , we use the internal resistance measurement of a multimeter as the DUT to demonstrate the working process, and the multimeter also verifies whether the output voltage of the instrument is normal. If you have a handheld or bench-top multimeter handy, follow the steps below to connect it.

11.2.1 Digital Multimeter Settings

1. Set the multimeter to DC voltage
2. Put the red rod of the multimeter into the HIGH ⊕end (red) of the 9456-DR01
   Put the black rod of the multimeter into the LOW ⊖end (black) of the 9456-DR01
   (You can also use the red and black test clips that come standard with the 9456-DR01 to be clamped on the multimeter rod, but please be careful not to touch the metal parts to avoid the danger of electric shock.)

11.2.2 Connect the DUT



11.2.3 Set instrument parameters

9456-DR01 is set up as follows

1. Confirm that in the discharge state , the status display is OFF, and the TEST indicator is off.
2. Press [Setup] key to enter the < Setup > page
3. Please follow the parameters set by the instrument to be consistent with the following figure

4. Press [Meas] key to enter <Measurement Display> page
5. Setup is over .

11.2.4 【Start】Measurement

In the discharge state, press the [Start] key , the instrument will start to measure.

picture 11- 4【Start】key to start measurement

The measurement screen is displayed on the screen:

Figure 11- 5Measurement results

on the picture,

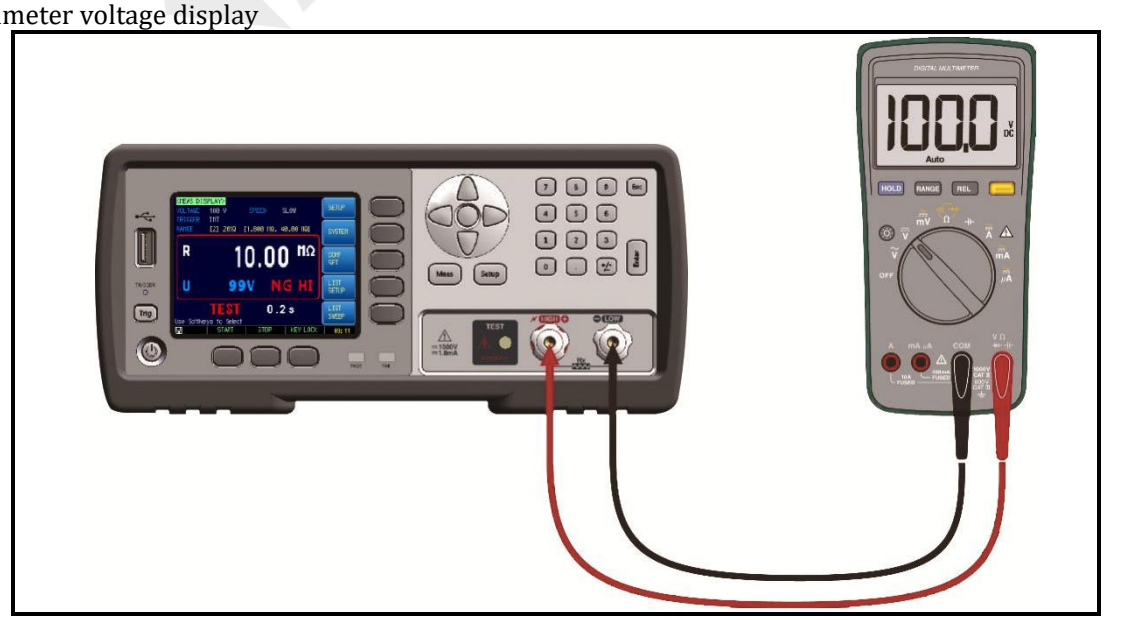
R 10.00MΩ : Indicates that the internal resistance of the multimeter is 10 MΩ

U 99 V: Indicates that the output voltage is 99 V

11.2.5 Verify voltage

9456-DR01 measures the internal resistance of the multimeter's DC voltage range, the multimeter also verifies the output voltage value of the instrument.

Figure 11- 6multimeter voltage display



11.2.6 【Stop】 Measurement

When in test state, pressing the [Stop] key will end the measurement and return to the discharge state .

picture 11- 7【Stop】 key to end the measurement

12. Handler Interface

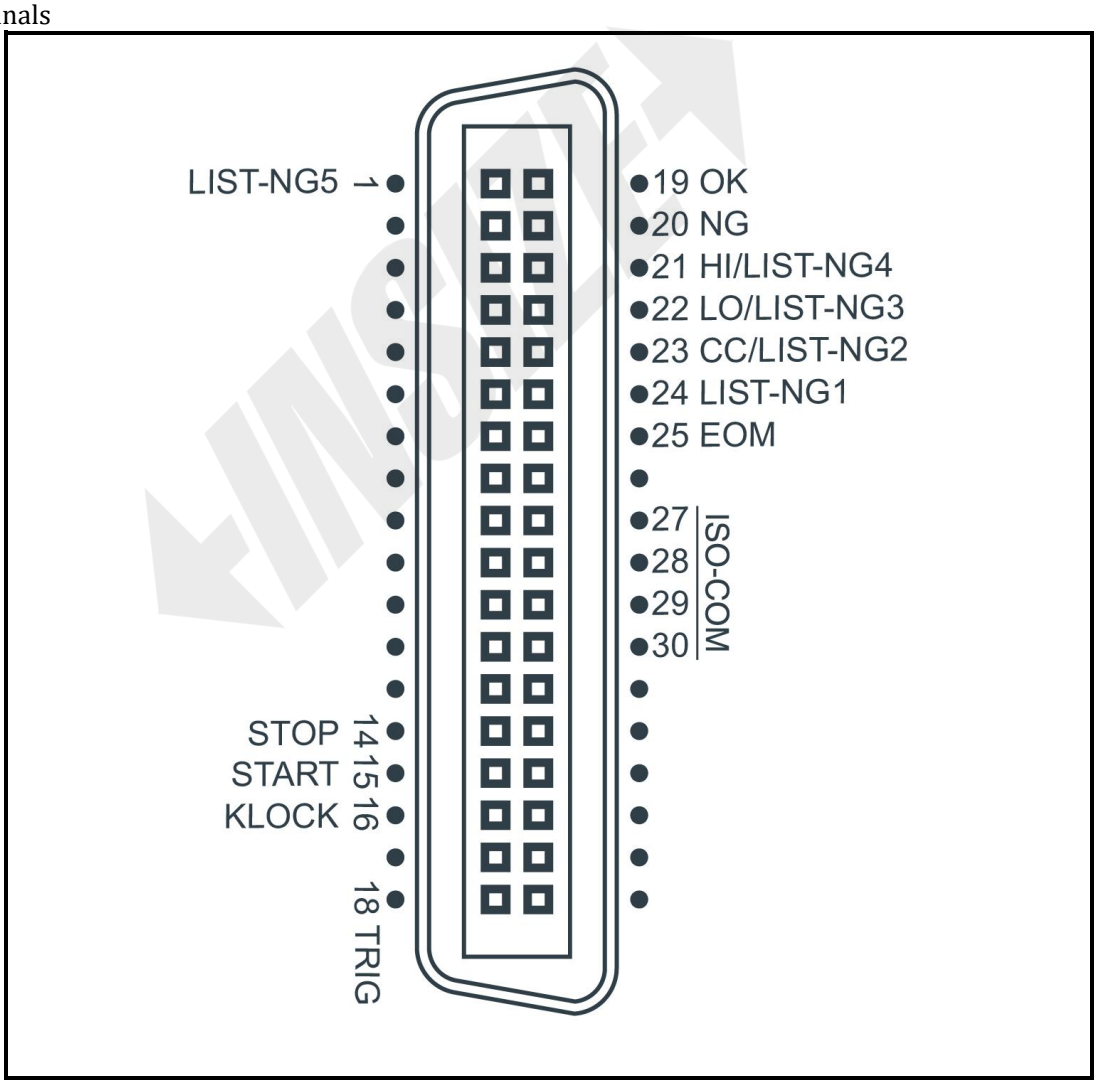
You will learn the following:

- Terminals
- How to connect and interface the schematic

The instrument provides users with a fully functional processor interface, which includes OK/NG sorting output, HI/LO, LIST-NG1~5 output , EOM test completion signal output and TRIG (external trigger start) input and other signals . Through this interface, the instrument can easily complete the automatic control function with the user's system control components.

12.1 Terminals and Signals

Figure 12- 1Terminals



- Output (all signals are active low)

Table 12- 1output pin definition

pin	name	illustrate
1	LIST-NG5	Active low . List scan file 5 failed output.
19	OK	Measured pages or list scanned pages: total pass. 0: OK

20	NG	Measuring Pages or List Scanning Pages: Total Fail. 0: NG
21	HI LIST-NG4	This pin is a multiplexed signal . Measurement page: Super unqualified . Active low. List scan page : List 4 failed . Active low.
22	LO LIST-NG3	This pin is a multiplexed signal . Measurement page: The lower super is unqualified . Active low List scan page: List 3 failed . Active low.
23	CC LIST-NG2	This pin is a multiplexed signal . Measurement page: Poor contact (open circuit) . 0: NG List scan page: List 2 failed . Active low.
24	SHORT LIST-NG1	This pin is a multiplexed signal . Measurement page: Short circuit. 0: SHORT List scan page: List 1 failed . Active low.
25	EOM	0: ready 1: wait

Note :
1. P21/P22/P23/P24 are multiplexed signals , and the signals of measurement page and list scan page are different .
2. P25 EOM signal:
   In the measurement page and list scan page : active high level during measurement , low level after measurement .
   Other pages : always high .

■ input

Table 12- 2-input pin definition

pin	name	illustrate
14	STOP	Stop measurement (discharge). Pulse signal, the low level is maintained for 20 ~ 100ms (typical value is 50ms) .
15	START	Start measurement (charging). Pulse signal, the low level is maintained for 20 ~ 100ms (typical value is 50ms) .
16	KLOCK	key lock. Pulse signal , the low level is maintained for 20 ~ 100ms (typical value is 50ms) . This signal is only for locking, not for unlocking , and unlocking must be done on the instrument.
18	TRIGGER	trigger input. The rising edge is valid , and the low level is maintained for 10ms ~ 100ms .

■ power supply

Table 12- 3power supply pin definition

pin	name	illustrate
27	ISO-COM	Common ground , floating is not allowed . Be sure to connect it reliably with the COM terminal of the power supply of the external controller (such as PLC) .
28		
29		
30		
35	internal ISO-VCC **output**	Positive output of internal VCC power supply, internal isolated power supply power: 5V, 0.2 A , 1 WMAX **Do not connect unless necessary .**
36		

Warning:
1. Pins P 35/36 are internally isolated power ISO- VCC outputs .
2. Connecting with PLC normally , please float P35/P36 .
3. Internal power supply is limited (5V, 0.2A, 1W MAX) and cannot drive power relays or high power LEDs.
4. P35/P36 have built-in self-recovery fuse, more than 0.5 A will cut off the ISO- VCC connection, long-term short circuit will cause the fuse to burn.

12.2 Connection method

■ power supply

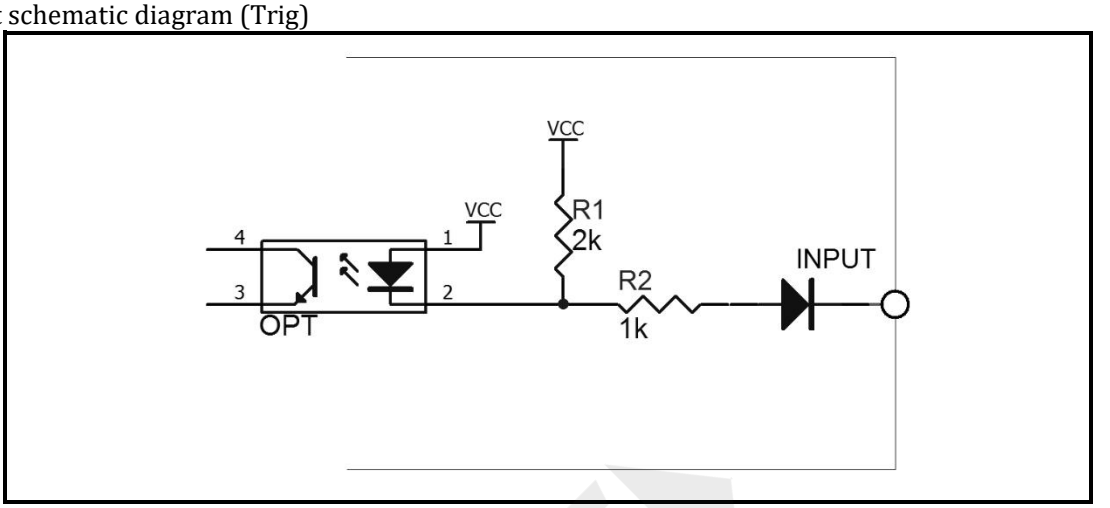
Built-in fully isolated power supply, no need for external power supply, but must share the ground ISO-COM :
ISO-COM : P27~P30

■ Electrical parameters

Output Signal:	Optocoupler isolated Darlington collector output. Active low.
Maximum voltage:	3V ~30V , 24V is recommended .
Input signal:	optocoupler isolation. Active low.
Maximum current:	50mA

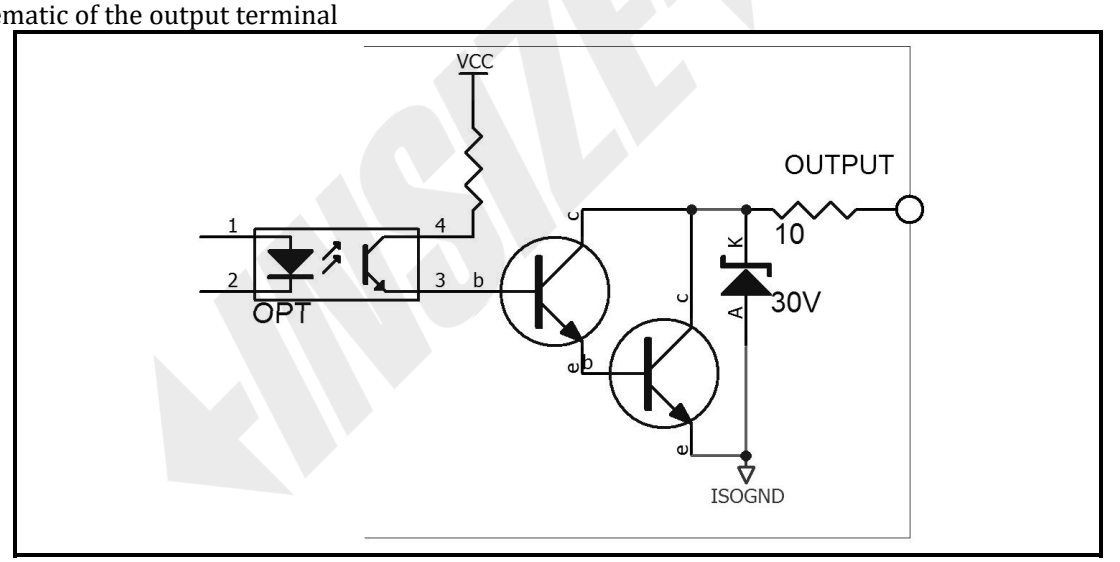
12.2.1 Input Schematic

Figure 12- 2 Input schematic diagram (Trig)



12.2.2 Schematic of the output terminal

Figure 12- 3 Schematic of the output terminal



12.2.3 Input circuit connection method

Figure 12- 4 connection to switch

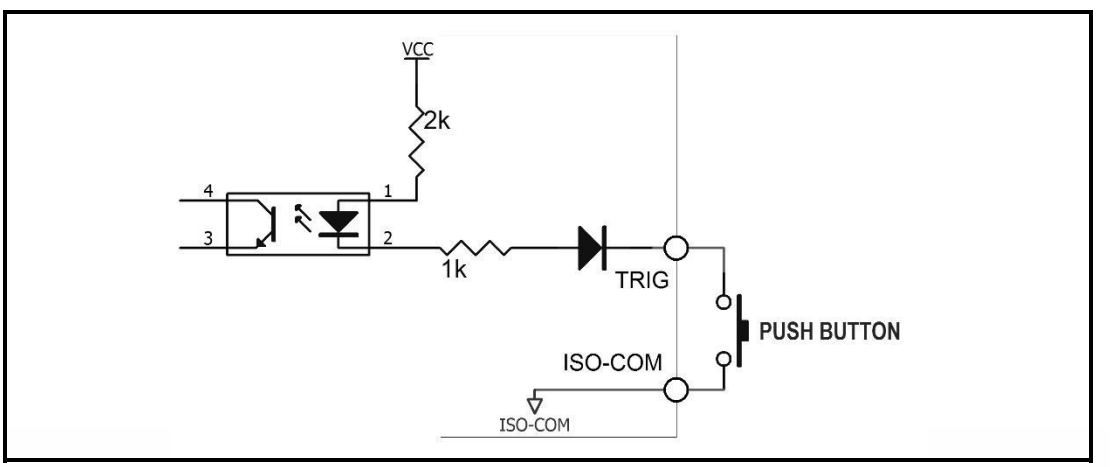
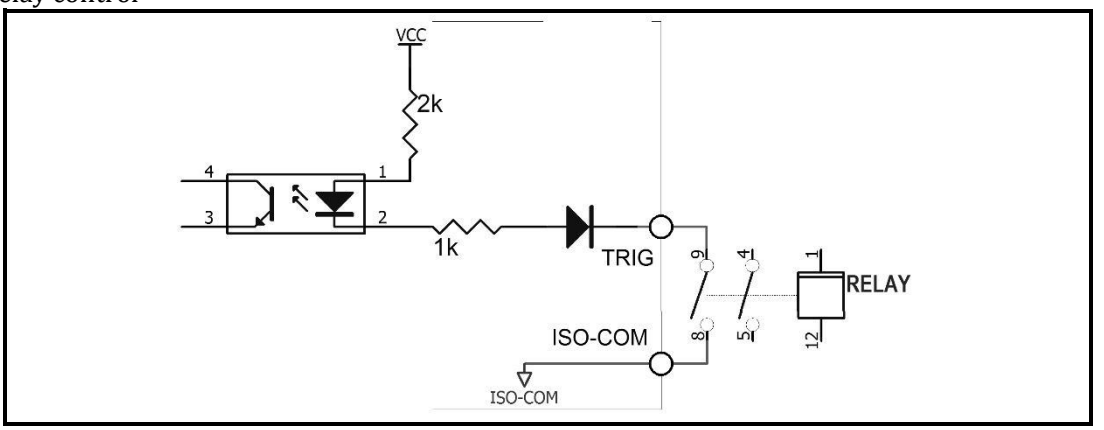


Figure 12- 5 Use relay control



picture 12- 6 Use PLC negative common terminal to control

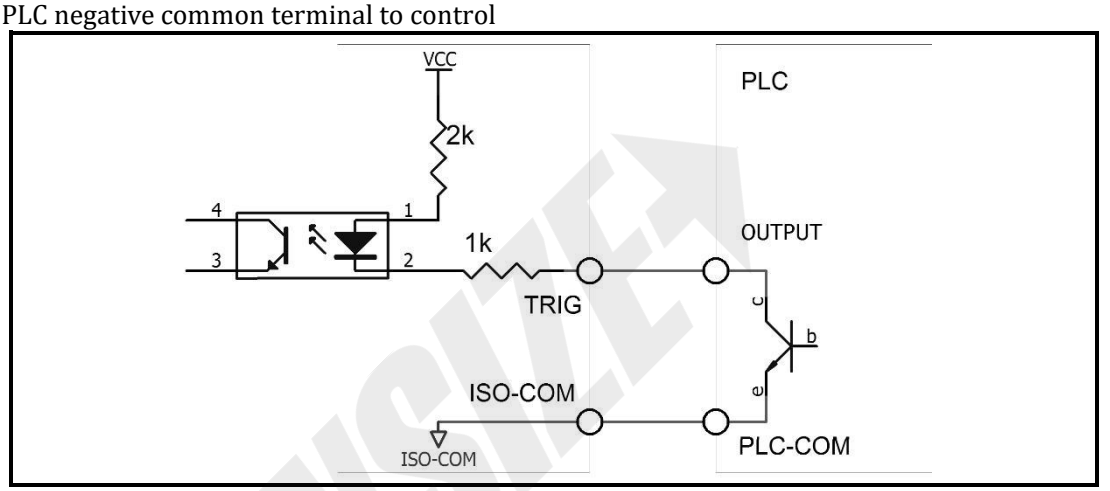
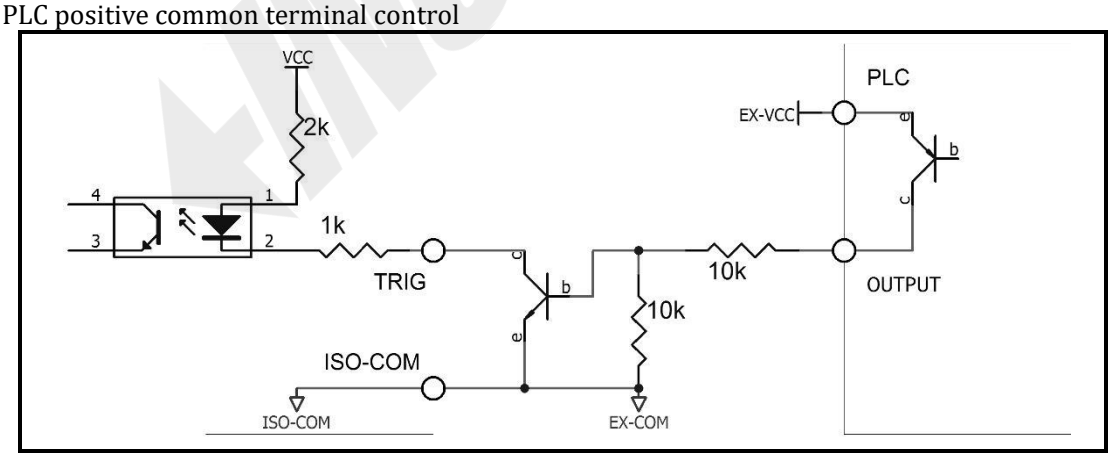
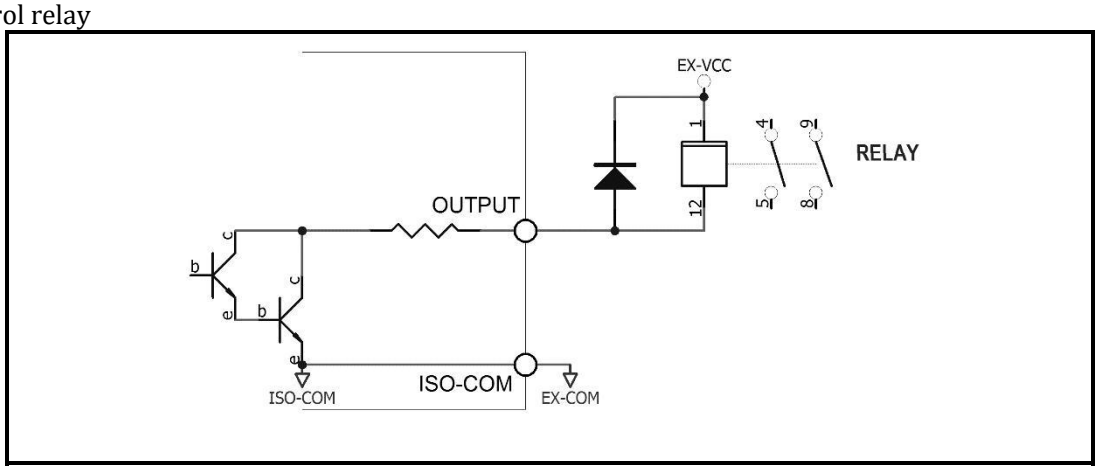


Figure 12- 7 Use PLC positive common terminal control



12.2.4 Output circuit connection

Figure 12- 8 control relay



picture 12- 9 Control LEDs or optocouplers

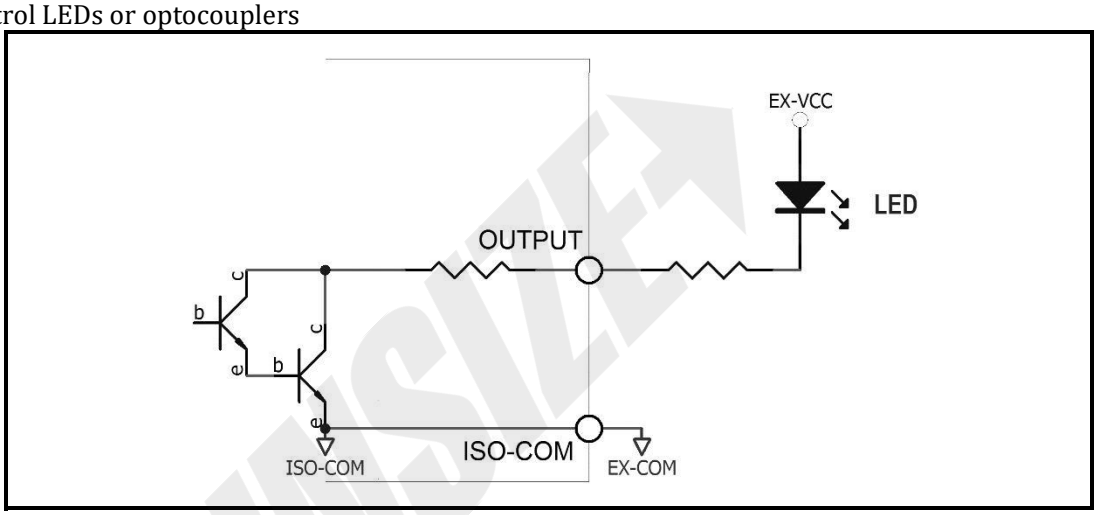


Figure 12- 10 Negative logic output

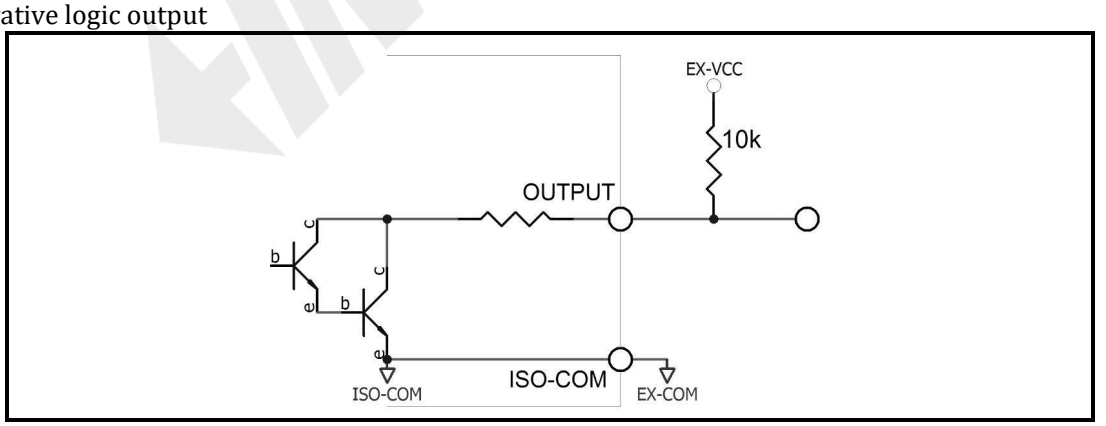
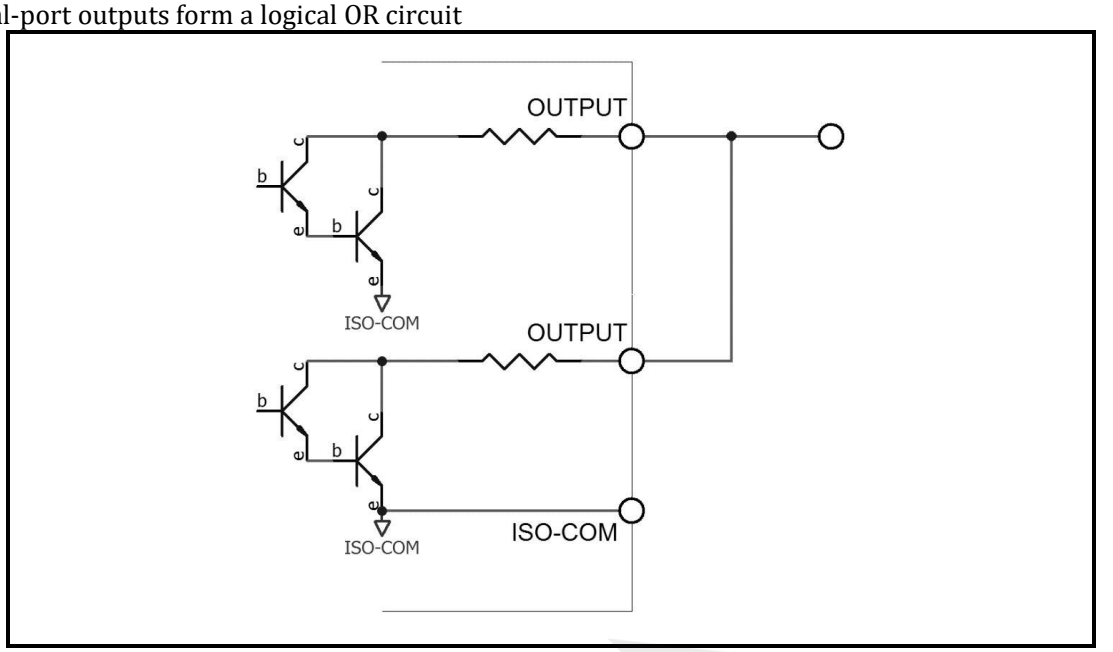


Figure 12- 11 Dual-port outputs form a logical OR circuit



picture 12- 12 Output to PLC negative common terminal

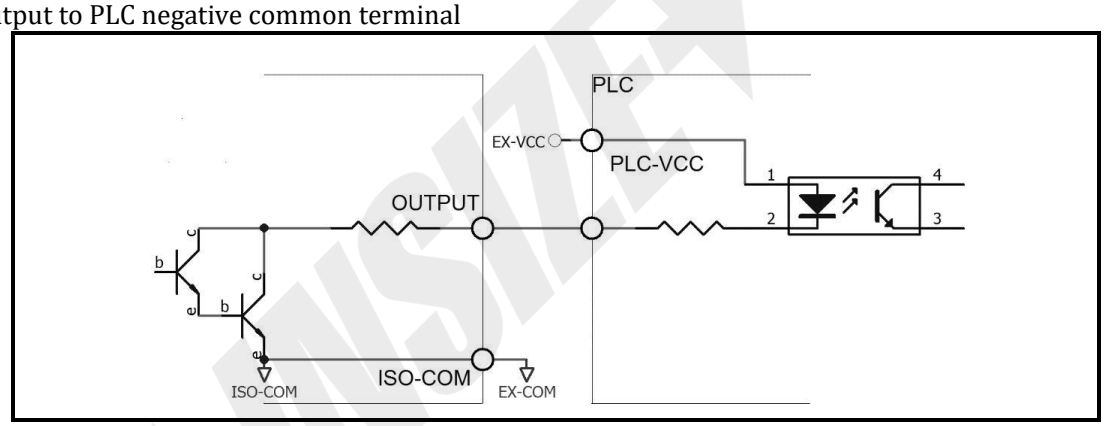
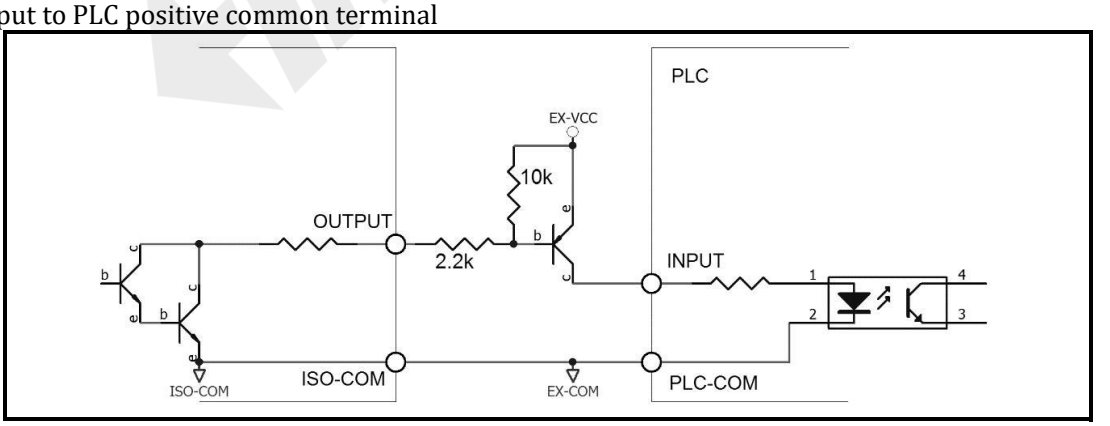


Figure 12- 13 Output to PLC positive common terminal



12.3 Periodic Table

Figure 12- 14 Periodic Table

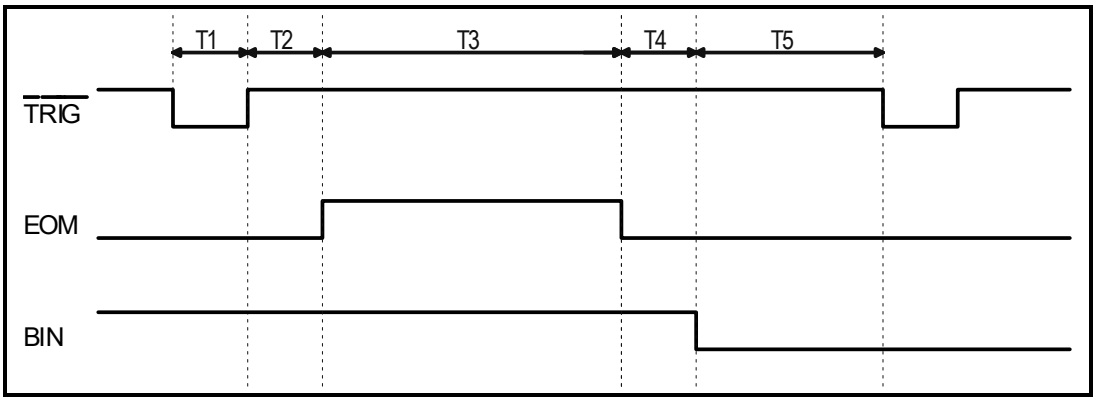


Table 12- 4 schedule

describe			minimum
T1	Trigger pulse width		1ms
T2	Measurement period	Trigger delay	<10μs
T3		measure time	related to settings
T4		BIN output delay	200μs
T5	wait time after trigger		0 s

13. Remote communication

You will learn the following:

- Introducing the RS-232 Interface
- RS-232 connection.
- Select the baud rate .
- Software Agreement.

The instrument uses the RS-232 interface (standard configuration) to communicate with the computer to complete all instrument functions. Through standard SCPI commands, users can also easily program various collection systems suitable for themselves.

13.1 RS-232C

RS-232 is a serial communication standard widely used at present, also known as an asynchronous serial communication standard, which is used to realize data communication between computers and between computers and peripherals. RS is the English abbreviation of "Recommended Standard", and 232 is the standard number. This standard is a standard officially announced by the Electronic Industries Association (EIA) in 1969. It stipulates that one bit at a time is transmitted through a data line.

Most serial port configurations are usually not strictly based on the RS-232 standard: 25-pin connectors are used on each port (most modern computers use 9-pin connectors). The most commonly used RS-232 signals are shown in the table:

Table 13- 1 Commonly used RS-232 signals

Signal	symbol	25 pin connector pin number	9-pin connector pin number
request to send	RTS	4	7
clear to send	CTS	5	8
data setup preparation	DSR	6	6
data carrier sounding	DCD	8	1
data terminal preparation	DTR	20	4
send data	TXD	2	3
Receive data	RXD	3	2
ground	GND	7	5
request to send	RTS	4	7

In addition, RS232 also has a minimum subset, which is also the connection method used by the instrument.

Table 13- 2 Smallest subset of RS-232 standard

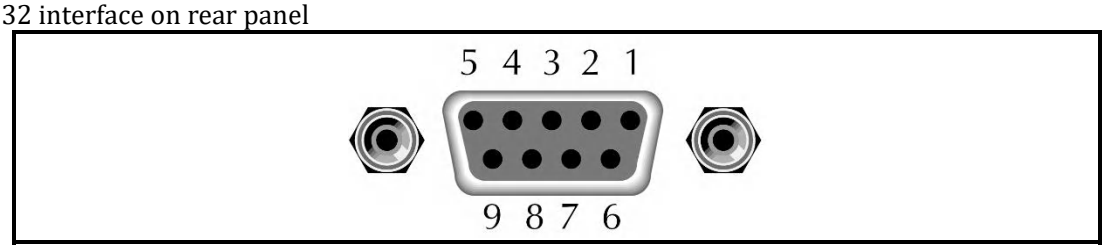
Signal	symbol	9-pin connector pin number
send data	TXD	2
Receive data	RXD	3
ground	GND	5

13.1.1 RS 232Cconnection

The RS-232 serial interface can be interconnected with the serial interface of a controller (eg, a personal computer or industrial computer) via a straight-through DB-9 cable.

NOTE: The instrument cannot use a null modem cable.
You can make or purchase a 9-conductor straight- **through** cable from INSIZE.
User-made 3-wire cables should pay attention to:
• Use the DB9 port that comes with the PC, it may be necessary to short-circuit the 4-6, 7-8 of the DB-9 connector (pin) on the computer side

Figure 13- 1 RS-232 interface on rear panel



! To avoid electrical shock, turn off the power to the instrument when plugging or unplugging the connector .

- Instrument default communication settings:

Transmission mode: full-duplex asynchronous communication with start bit and stop bit
Data bits: 8 bits
Stop bit: 1 bit
Check Digit: None

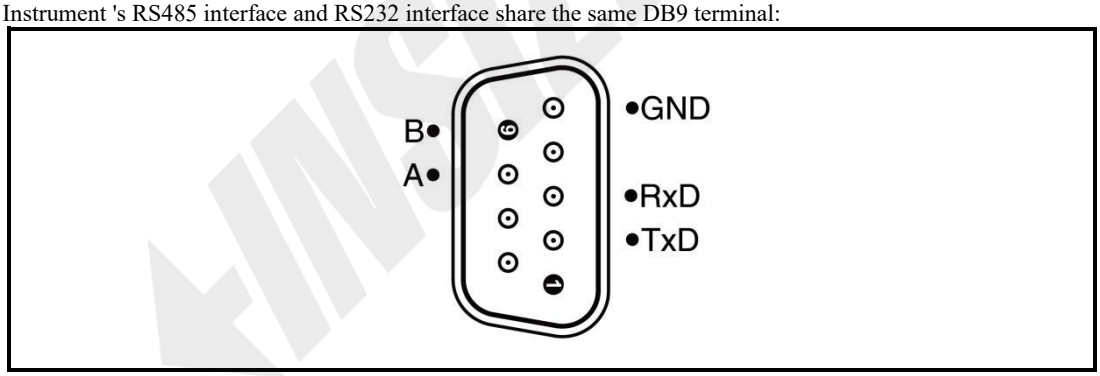
13.2 RS 485 connection

The instrument comes standard with RS485 interface and supports ModbusRTU protocol at the same time .

RS 485 is a communication interface that supports multi-machine communication, which can be connected in parallel with multiple slave machines through one host .

Detailed RS485 specification is not the focus of this user manual, please refer to
https://en.wikipedia.org/wiki/RS-485

Instrument 's RS485 interface and RS232 interface share the same DB9 terminal:



pin	Function
8	A
9	B

13.3 Handshake protocol

Since the instrument uses the smallest subset of the RS-232 standard and does not use hardware handshake signals, in order to reduce possible data loss or data errors in communication, the instrument can enable software handshakes. Advanced language software engineers should strictly follow the following handshakes Protocol, for the preparation of computer communication software:

- The instrument command parser only accepts ASCII format, and the command response also returns ASCII code.
- The command string sent by the host must end with NL (' \n '), and the instrument command parser will start executing the command string after receiving the terminator.
- The instrument can set the command handshake: after receiving a character, the instrument immediately sends the character back to the host, and the host can only send the next character after receiving the echo character.

If the host cannot receive the data returned by the instrument, you can try to solve it by using the following methods:

1. Software handshake is disabled, please refer to the instrument <System Settings> page to enable it.
2. Serial port connection failure, please check cable connection.
3. The communication format of the high-level language program on the computer side is incorrect. Please try to check if the serial port number, the communication format is correct and if the baud rate is the same as the instrument setting.
4. If the instrument is parsing the last command and the host cannot receive a response from the instrument, please try again later.

<The problem still cannot be solved, please consult the technical engineer of INSIZE>

13.4 SCPI language

SCPI- Standard Commands for Programmable Instruments (Programmable Instrument Standard Commands) is a general command set used for testing instruments. SCPI, also known as TMSL-Test and Measurement System Language (Test System Language), was developed by Agilent Technologies based on IEEE488.2 extensions and has been widely adopted by test equipment manufacturers.

The built-in command parser of the instrument is responsible for parsing various command formats of the user. Since the command parser is based on the SCPI protocol, but is not fully SCPI-compliant, please read the "SCPI Command Reference" chapter carefully before starting work.

14. SCPI Command Reference

This chapter covers the following areas :

- Command Parser - Learn some rules of command parser .
- Command syntax - rules for writing command lines
- Query syntax - writing rules for query commands
- query response - the format of the query response
- Command Reference

This chapter provides all SCPI commands used by the instrument, through which all functions of the instrument can be fully controlled.

14.1 Command string parsing

The host can send a string of commands to the instrument, and the instrument command parser starts parsing after catching the terminator or no input for 20ms.

E.g: Valid command strings:

AAA:BBB CCC;DDD EEE;:FFF

The instrument command parser is responsible for all command parsing and execution, and you must first understand its parsing rules before writing a program.

14.1.1 Command Parsing Rules

1. command parser only parses and responds to ASCII data.
2. Command parsing starts after the terminator is received . (Terminator can be set in <System Configuration > page)
3. If no terminator is received, the command parser will wait for 20ms to start parsing the command after no character is received.
4. If the command handshake is turned on, the command parser will send the character back to the host immediately after receiving the character, and the host can only continue to send the next character after receiving the echo character.
5. After the command parser finds an error, it immediately terminates the parsing, and the current command is invalid.
6. After the command parser parses the query command, it terminates the parsing of the command string, and then the string is ignored.
7. The parsing of command strings by the command parser is not case-sensitive.
8. The command parser supports command abbreviations, and the abbreviation specifications are described in the following chapters.

14.1.2 Notational Conventions and Definitions

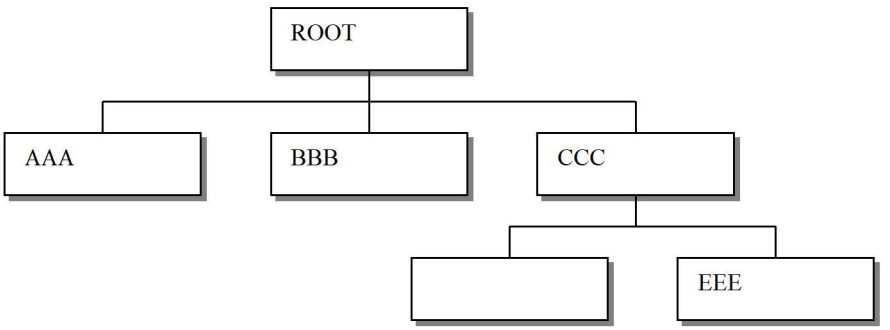
This chapter uses some symbols that are not part of the command tree, but are used for better understanding of command strings.

logo	illustrate
< ….. >	The text in angle brackets represents the arguments to the command, for example : <float> represents a floating point parameter <integer> represents an integer parameter
[…]	I square brackets indicate optional commands, for example: COMP[:STAT] ON = COMP ON
{ …}	In curly braces indicate single options, for example: FUNC:RATE { SLOW,MED,FAST } parameter is one of
capital letters	abbreviated form of command
☐	The space character, representing a space , is only used for reading purposes .

14.1.3 Command tree structure

Tree structure is used for SCPI commands , which can go down to three levels (note: the command parser of this instrument can parse down to any level) , and the highest level is called subsystem command here. This subordinate command is valid only when a subsystem command is selected . SCPI uses a colon (:) to separate high-level and low -level commands.

Figure 14- 1Command tree structure



for example ROOT:CCC:DDD ppp

ROOT subsystem command

CCC Level 2

DDD Level 3

ppp parameter

14.2 Commands and Parameters

A command tree consists of **commands and [parameters]** , separated by a space (ASCII: 20H).

for example AAA:BBB □1.234

command [parameters]

14.2.1 Order

The command word can be in the long command format or the abbreviated form. Using the long format is convenient for engineers to better understand the meaning of the command string; the abbreviated form is suitable for writing.

14.2.2 parameter

1. Single command word command, no parameters.
   For example: AAA:BBB
2. Arguments can be strings, and their abbreviation rules still follow the "Command Abbreviation Rules" in the previous section.
   Such as: AAA:BBB□1.23
3. Arguments can be in numeric form

< integer >	Integer 123, +123, -123
< floa t>	Arbitrary floating point numbers : Fixed- point floating-point numbers: 1.23, -1 .23 numbers in scientific notation : 1.23E+4, -1.23e-4 magnification : 1.23k, 1.23MA, 1.23G, 1.23u
< SciFloat>	numbers in scientific notation : 1.234 5E+04 means 1.2345×10^{4}

Table 14- 1magnification

Numerical value	magnification
1E15 (PETA)	PE
1E12 (TERA)	T
1E9 (GIGA)	G
1E6 (MEGA)	MA
1E3 (KILO)	K
1E-3 (MILLI)	M
1E-6 (MICRO)	U
1E-9 (NANO)	N
1E-12 (PICO)	P
1E-15 (PEMTO)	F
1E-18 (ATTO)	A

Since SCPI is not case sensitive, the magnification unit is not written differently than the standard name, for example :
" 1M " Expressed as 1 milli, not 1 mega
" 1MA " means 1 Mega

14.2.3 Delimiter

Instrument command parsers only accept allowed separators, and command parsers for other separators will generate an "Invalid separator " error. These delimiters include:

; semicolon, used to separate two commands.

For example: AAA:BBB 100.0 ; CCC:DDD

: colon, used to separate command trees, or command tree restarts.

For example: AAA : BBB : CCC 123.4; : DDD : EEE 567.8

? Question mark, used for query.

For example: AAA ?

□ Space, used to separate parameters.

For example: AAA:BBB□1.234

14.2.4 Error code

The corresponding error codes are as follows:

error code	illustrate	
*E00	No error	no errors
*E01	Bad command	command error
*E02	Parameter error	Parameter error
*E03	Missing parameter	Missing parameters
*E04	buffer overrun	buffer overflow
*E05	Syntax error	Grammatical errors
*E06	Invalid separator	illegal delimiter
*E07	Invalid multiplier	Illegal Multiplier Unit
*E08	Numeric data error	Numerical error
*E09	Value too long	number is too long
*E10	Invalid command	invalid instruction
*E11	Unknown error	unknown mistake

14.3 Command Reference

All commands are explained in subsystem command order, all subsystems are listed below

- DISPlay display subsystem
- FUNCtion functional subsystem
- CORR ection correction subsystem
- COMP arator comparator subsystem
- SYSTem system subsystem
- TRIG ger trigger subsystem
- FETC h? Get Results Subsystem
- ERRor error message subsystem

public command:

- IDN? Instrument Information Query Subsystem
- TRG trigger and get data

14.4 DISPlay display subsystem

The DISPlay subsystem can be used to switch between different display pages or to display a string of text on the page tooltip.

Figure 14- 2 DISPlay subsystem tree

DISPlay	:PAGE	{TEST,SETUP(MSET),COMParator,CORRECTION(CSET),FILE,SYSTem,SYSTEMINFO(SINF)}
	:LINE	<string>

14.4.1 DISPlay:PAGE

DISP:PAGE is used to switch to the specified page.

command syntax	DISPlay : PAGE <page name>
parameter	< page name > includes:

	MEASurement measurement display page SETUP (MSET) setup page COMParator comparator page SYSTem system configuration page SYSTEMINFO (SINF) system information page CATalog file management page SWEEP (LIST) list scan page SWEEPTABEL(LSET) list setting page USBdisk U disk storage page _
E.g	Send > disp:page setup // Switch to the setup page
query syntax	DISP:PAGE?
query response	<page name> abbreviation meas measurement display page mset settings page comp comparator page syst system configuration page sinf system information page cat file management page list list scan page lset list settings page usb flash drive storage page
E.g	send > disp:page? return > test

14.4.2 DISP:LINE

DISP:LINE is used to display a string of text in the tooltip at the bottom of the page. Text can display up to 30 characters.
DISP:LINE? Used to get the displayed text of the current tooltip.

command syntax	DISPlay : LINE < *string* >
parameter	<string> up to 30 characters
E.g	Send > DISP:LINE " This is a Comment. "
query syntax	DISPlay : LINE?
E.g	Send >DISP:LINE? Return >NULL //NULL, representing a blank row

14.5 FUNCtion subsystem

> Note :
> FUNCtion subsystem will not be automatically stored in the file. After setting the parameters, you need to call the FILE subsystem to save or the public command SAV to store them in the internal file.

Figure 14- 3 FUNCtion subsystem tree

FUNCtion	:RANGe	{range number, max, min}		Range number setting
		:MODE	{AUTO,HOLD,NOMinal}	Range mode
	:SPEED(RATE)	{SLOW,MED,FAST }		speed setting
	:CONTCHECK(CC)	{ON,OFF,0,1}		Contact Check Settings

Using the parameters set by the FUNCtion subsystem, the instrument will not be saved in the system, and needs to be reset the next time it is powered on.

14.5.1 FUNCtion:RANGe range

FUNC:RANG is used to set the range mode and range number

command syntax	FUNCtion : RANGe {< integer (1~4)>,min,max}
parameter	Where, < range number > 1 ~ 4 **min** minimum range (=1) **max** maximum range (The maximum range is different depending on the voltage)
E.g	Send > FUNC:RANG 4 // Switch to 4 range
query syntax	FUNC: RANG?
query response	Range No. 1 ~ 4
E.g	Send > FUNC:RANGE? Return> 4

14.5.2 FUNCtion:RANGe:MODE Range method

FUNC:RANG:MODE is used to switch the range mode

command syntax	FUNCtion : RANGe:MODE {AUTO,HOLD(MANual) ,NOMinal}
E.g	Send> FUNC:RANG:MODE NOM <NL> // Switch to the nominal range mode
query syntax	FUNC:RANG:MODE?
query response	{AUTO,HOLD,NOM}

14.5.3 FUNCtion:RATE Test speed

FUNC:RATE or FUNC:SPEED is used to set the test speed.

command syntax	FUNCtion : RATE {SLOW,MED,FAST} FUNCtion :SPEED {SLOW,MED,FAST}
E.g	Send > FUNC:RATE MED // Set to medium speed test
query syntax	FUNCtion : RATE ? FUNCtion :SPEED?
query response	{SLOW,MED,FAST}

14.5.4 FUNCtion: CONTCHECK(CC) Contact Check

FUNC: CONTCHECK or FUNC:CC is used to set the contact check switch .

command syntax	FUNCtion :CONTCHECK { OFF,ON,0,1 } FUNCtion :CC { OFF,ON,0,1 }
E.g	Send > FUNC:CC ON
query syntax	FUNCtion : CONTCHECK ? FUNCtion : CC ?
query response	{ on,off } // return to lowercase on /off

14.5.5 FUNCtion: SRES source internal resistance

FUNC: SRES is used to set the internal resistance of the voltage source . For current - sensitive precision devices or power batteries, the current-limiting mode may need to be selected.

command syntax	FUNCtion :SRES { NORMAL,LIMIT }
E.g	Send > FUNC: SRES LIMIT // Set to current limit mode
query syntax	FUNCtion : SRES ?
query response	{ NORMAL,LIMIT } // return as uppercase letters

14.6 VOLTage subsystem

The voltage subsystem is used to set the test voltage.

Figure 14- 4 VOLTage Subsystem Tree

VOLTage	< integer (10 ~ 1000)>

command syntax	VOLTage <10~1000>
E.g	Send > VOLT 100 // set to 100V
query syntax	VOLT?
query response	< 4 -digit positive integer (□□10 ~1000) >
E.g	Send > VOLT ? Return>□ 100 //Return 4-digit positive integer, if less than 4 digits, fill up the prefix spaces .

Note :

1. Since the voltage value setting will affect the maximum range, please confirm the change of the maximum range after setting the voltage. For example , when the voltage is 100 V and above , the maximum range is 4 range , and after switching to below 100 V, the maximum range will be switched to 3 range .
2. returned voltage value is a 4-digit positive integer, which is not enough to fill the 4-digit prefix blank.
3. VOLTage subsystem will not be automatically stored in the file. After setting the parameters, you need to call the FILE subsystem to save or the public command SAV to store them in the internal file.
4. can only be set in the discharge state.

14.7 TIMEr subsystem

The TIMEr subsystem is used to set the charge timer , measurement timer, short-circuit timer and trigger delay time .

Figure 14- 5TIMEr subsystem tree

TIMEr	:CHARge	<float>	Charge timer setting , 0 means off
	:SAMPle	<float>	Measurement timer setting , 0 means off
	:SHORt	<float>	Short circuit timer setting , 0 means off, 9 means automatic
	: TRIGdelay	<float>	Trigger delay setting, 0 means off

14.7.1 TIMEr : CHARge charge timer

TIME r:CHARge is used to set the charge timer .

i Charge timer : 0.1 s , maximum 999 s , set to 0 means the timer is off .
timing time exceeds the range , the error code * E02 (Parameter error) will be returned .

command syntax	TIMEr :CHARge <float>
E.g	send > TIME:CHAR 0.5 // charge timer set to 0.5 s Send > TIME :CHAR 0 // charge timer off
query syntax	TIMEr :CHARge?
query response	< FixFloat> 4 digits in total , 1 decimal point , and fill up with spaces before the prefix of insufficient digits
E.g	Send >TIME:CHAR? Return > ☐☐0.0 // charge timer is off

14.7.2 TIMEr : TEST measurement timer

TIME r : TEST is used to set the measurement timer .

i Measurement timer minimum value: 0.05s , maximum value 999s , set to 0 means the timer is off .
timing time exceeds the range , the error code * E02 (Parameter error) will be returned .

command syntax	TIMEr : TEST <float>
E.g	send > TIME:TEST 0.2 // measure timer set to 0.2s send > TIME : TEST 0 // measurement timer off
query syntax	TIMEr: TEST?
query response	< FixFloat> 4 digits in total , 1 decimal point , and fill up with spaces before the prefix of insufficient digits
E.g	Send >TIME: TEST ? Return>☐☐0.2 // charge timer off

14.7.3 TIMEr : SHORt short circuit detection timer

TIME r: SHORt is used to set the short circuit detection timer .

i Short circuit detection timer minimum value: 0.01s , maximum value 1s , set to 0 means the timer is off , set to 9 means automatic.
timing time exceeds the range , the error code * E02 (Parameter error) will be returned .

command syntax	TIMEr : SHORt <float>
E.g	send > TIME : SHOR 0.1 // Short circuit detection timer is set to 0.1s Send > TIME : SHOR 0 // Short circuit detection timer is off Send > TIME : SHOR 9 // Short circuit detection timer is set to automatic
query syntax	TIMEr:SHORt?
query response	< FixFloat> 3 total digits , 2 decimal places
E.g	Send >TIME: SHOR ? return > 0.10 Send >TIME: SHOR ? Return > 9.00 // Short circuit detection timer automatic

14.7.4 TIMEr : TRIGdelay trigger delay timer

TIME r: TRIGdelay is used to set the trigger delay timer .

i Trigger delay timer minimum value: 1ms , maximum value 9.999 , set to 0 means the timer is closed.
timing time exceeds the range , the error code * E02 (Parameter error) will be returned .

command syntax	TIMEr : TRIGdelay <float>
E.g	Send > TIME : TRIG 10m // Short circuit detection timer set to 10ms Send > TIME : TRIG 0 // Short circuit detection timer is off
query syntax	TIMEr:TRIGdelay?
query response	< FixFloat> 4 total digits , 3 decimal places
E.g	Send >TIME: TRIG ? Return > 0. 000 // Timer off state

	Send >TIME: TRIG ? returns > 0.010

14.8 COMParator subsystem

The COMP subsystem is used to set the comparator parameters.

> Note :
> COMParator subsystem will not be automatically stored in the file. After setting the parameters, you need to call the FILE subsystem to save or the public command SAV to store them in the internal file.

Figure 14- 6 COMParator Subsystem Tree

COMParator	[:STATe]	{OFF,ON}	Comparator Status
	:BEEP	{OFF,OK,FAIL}	Beeper settings
	:TONE	{LOUD,WEAK}	Beeper volume
	:LOWer	<float>	lower limit
	:UPper	<float>	upper limit
	:LIMIT(LMT)	<float>,<float>	lower limit , upper limit

14.8.1 COMParator[:STATe] Comparator Status

COMP[:STATe] is used to close the comparator or set the number of scales.

command syntax	COMParator[: STATe] {OFF, ON,0,1}
E.g	send >COMP:STAT ON // turn on the comparator send >COMP OFF // turn off the comparator
query syntax	COMP[:STAT]?
query response	{ off , on }

14.8.2 COMParator:BEEP Comparator beep

COMP:BEEP is used to enable the beeper.

command syntax	COMParator:BEEP {OFF, OK ,NG}
E.g	Send > COMP:BEEP OK // Qualified Beeper
query syntax	COMP:BEEP?
query response	{OFF, OK ,NG}

14.8.3 COMParator: TONE comparator volume

COMP:TONE is used to set the sound volume, the volume includes two options : strong (LOUD) and weak (WEAK) .

command syntax	COMParator: TONE { LOUD, WEAK }
E.g	Send > COMP:MODE SEQ // switch to sequence comparison mode
query syntax	COMP: TONE ?
query response	{ LOUD,WEAK }

14.8.4 COMParator: LOWer comparator lower limit

COMP: LOWer sets the lower limit of the comparator , the data can be any form of floating point number .

command syntax	COMParator: LOWer <float>
E.g	Send > COMP: LOW 1MA // lower limit set to 1 MΩ Send > COMP: LOW 1G // lower limit set to 1 GΩ Send > COMP: LOW 10E6 // lower limit set to 10 MΩ
query syntax	COMP: LOW ?
query response	< S cifloat Scientific Notation >
E.g	Send > COMP:LOW? Return > 1.0 0 0E+0 6 // = 1M Ω

14.8.5 COMParator: UPper comparator upper limit

COMP: UPper sets the upper limit of the comparator, the data can be any form of floating point number .

> Comparator limit max: 10 G , out of range , will return error code 90
> The upper limit value is set to 1E20 , which represents infinity, and the upper limit will not participate in the comparison operation.

command syntax	COMParator: UPper { <float cap >, OFF}
E.g	Send > COMP: UP 10G // The upper limit is set to 10GΩ Send > COMP: UP 10E9 // cap set to 10 GΩ Send > COMP: UP 10E6 // lower limit set to 10 MΩ

	send > COMP: UP 1E20 // lower limit off Send > COMP: UP OFF // lower limit off
query syntax	COMP: UP ?
query response	< S cifloat Scientific Notation >
E.g	Send > COMP: UP ? return > 1.0 0 0E+10 // = 10 GΩ Return > 1.0 0 0E+ 2 0 // 1E20 means lower limit is off

14.8.6 COMParator: LIMIT (LMT) comparator upper and lower limits

COMP: LIMIT is used to set the upper and lower limits of the comparator .

command syntax	COMParator: LIMIT <float lower limit>,<float upper limit>
E.g	Send > COMP: LMT 1 0MA , 10 0 MA // lower limit=10 MΩ, upper limit =100 MΩ Send > COMP: LMT 1 G , 1E20 // lower limit = 1 GΩ, upper limit is set to off
query syntax	COMP: LMT?
query response	<scifloat>,<scifloat>
E.g	Send > COMP:LMT? Return > 1.000E+ 09 ,+1.000E+ 20 //Lower limit =1GΩ, upper limit is closed

14.9 SYSTem subsystem

The SYSTem subsystem is used to set system-related parameters. Most of these commands are related to the instrument <System Configuration > page .

> Note :
> Parameters set by the SYSTem subsystem will be automatically stored in system memory without the need for additional SAV instructions .

Figure 14- 7 SYSTem subsystem tree

SYStem	: LANGuage	{ENGLISH,CHINESE,EN,CN}	System language setting
	: STYLe	{ CLASSIC,MORDEN}	Theme style settings
	: TIME	<YEAR>,<MONTH>,<DAY>,<HOUR>,<MINUTE> ,<SECOND>	In-flight time setting
	: KEYLock (KLOC)	{ON(1),OFF(0)}	Key lock settings
	: KEYBeep	{ON(1),OFF(0)}	Key tone setting
	: SHAKEHAND (SHAK)	{ON(1),OFF(0)}	SCPI handshake settings
	:CODE	{ON(1),OFF(0)}	SCPI error code
	: TERM?	{ LF,CR,CR+LF,NUL }	terminator query
	: RESult	{FETCh,AUTO}	Result sending settings
	: FILT ler	{50Hz,60Hz,AUTO}	Power frequency filter settings

14.9.1 SYSTem: LANGuage system language

Instrument language setting.

command syntax	SYSTem:LANGuage {ENGLISH,CHINESE,EN,CN}
E.g	send > SYST:LANG EN // set to English display
query syntax	SYST:LANG?
query response	{ENGLISH,CHINESE}

14.9.2 SYSTem: SYTLe theme style settings

The instrument has 2 built-in theme styles, CLASSIC and MORDEN.

command syntax	SYSTem: STYLe { CLASSIC, MORDEN }
E.g	Send > SYST: STYLe MORDEN // Instrument theme style will be changed to modern style
query syntax	SYST: STYL ?
query response	{ CLASSIC, MORDEN }

14.9.3 SYSTem: TIME system time setting

command syntax	SYSTem:TIME <YEAR>,<MONTH>,<DAY>,<HOUR>,<MINUTE> ,<SECOND>
E.g	Send > SYST: TIME 2020,2,1,11,18,31 //2020-2-1 11:18:31
query syntax	SYSTem:TIME?
query response	<YEAR> - <MONTH> - <DAY> <HOUR> : <MINUTE> :<SECOND>
E.g	send > SYST: TIME? Receive > 2016-12-30 11:18:31

14.9.4 SYSTem: KEYLock or SYSTem : KLOCk Keypad lock settings

command syntax	SYSTem: KEYLock { ON,OFF,0,1}

	SYSTem: KLOCk { ON,OFF,0,1}
E.g	send > SYST: KEYL OFF // Keyboard unlock
query syntax	SYSTem: KEYLock? SYSTem: KLOCk?
query response	{ on, off }

14.9.5 SYSTem: KEYBeep key tone setting

Key tone on/ off setting

command syntax	SYSTem: KEYBeep { OFF,ON,0 ,1}
parameter	{OFF,ON,0,1}
E.g	Send > SYST: BEEP OFF
query syntax	SYST em : BEEPer ?
query response	{ on, off }

14.9.6 SYSTem: SHAKhand communication handshake command (data header return)

communication handshake is turned on , the instrument will return the received command to the host as it is, and then return the data.

command syntax	SYSTem: SHAKhand { ON,OFF,0,1}
E.g	Send > SYST: SHAK ON
query syntax	SYSTem: SHAKhand?
query response	{ on, off }

14.9.7 SYSTem: CODE error code return setting

SYST em :CODE is turned on , it is allowed to return an error code after each command is received .
The corresponding error codes are as follows:

error code	illustrate
*E00	No error
*E01	Bad command
*E02	Parameter error
*E03	Missing parameter
*E04	buffer overrun
*E05	Syntax error
*E06	Invalid separator
*E07	Invalid multiplier
*E08	Numeric data error
*E09	Value too long
*E10	Invalid command
*E11	Unknown error

If the error code function is disabled, the host can obtain the error code by sending the ERR? command.

command syntax	SYSTem: CODE { ON,OFF,0,1}
E.g	Send > SYST: CODE ON
query syntax	SYSTem: CODE?
query response	{ on, off }

14.9.8 SYSTem: TERM? Terminator used by the query (query only)

SYST em :TERM? is used to query the terminator used by the instrument.

query syntax	SYSTem: TERM?
E.g	send > SYST: TERM? Return > CR+LF

14.9.9 SYSTem: RESult test result sending

SYST em : RESult can set the data transmission method: automatic transmission or through FETCH instruction.

- ☐ If the result sending is set to AUTO, the measurement data needs to be returned according to whether [Measuring Timing] is turned on or not :
- ☐ When [Measurement Timing] is set to off , the instrument will return data once every time it measures ;
- ☐ When the time is set in [Measurement Timing] , it will only return once at the end of the measurement .

command syntax	SYSTem: RESult {FETCH,AUTO}
parameter	{FETC H,AUTO} FETCH: The data needs to be returned to the host through the command fetch?, and the instrument sends it passively. AUTO: After each test is completed, the test results are automatically sent to the host, and the instrument actively sends data without the participation of the host computer.

E.g	Send > SYST: RES AUTO // set to send automatically
query syntax	SYST: RES ?
query response	{FETCH,AUTO}

14.9.10 SYSTem: FILTer sets the power frequency

SYST em : FILTer is used to set the local AC power frequency. The power frequency affects the stability of the measurement data , so be sure to select the correct one.

command syntax	SYSTem: FILTer { 50Hz , 60Hz }
E.g	send > SYST: FILT 50Hz
query syntax	SYSTem: FILTer ?
query response	{ 50Hz , 60Hz }

14.10 TRIGger Subsystem

Figure 14- 8 TRIGger Subsystem Tree

TRIGger	[:IMMediate]		trigger once
	:SOURce	{INT,MAN,BUS,EXT}	Trigger source selection
TRG			Trigger once and return data after measurement is complete

TRIGger is used to set the trigger source and generate a trigger.

14.10.1 TRIGger[:IMMediate]

TRIG[:IMM] generates a trigger when the trigger source is set to BUS.

- ☐ the [Result Send] in the <System Configuration > page is set to Auto, the measurement data will be returned after triggering once .
- ☐ [Result Send] in the <System Configuration > page is set to FETCH , the measurement data will not be returned.
- ☐ If data must be returned , use the TRG instruction.
- ☐ If the current state is discharge state , it will automatically enter the charge/test state and measure once

command syntax	TRIGger[IMMediate]
E.g	send > **TRIG** // instrument stops after one test

14.10.2 TRIGger:SOURce

TRIG:SOUR is used to set the trigger source.

command syntax	TRIGger:SOURce {INT, MAN, BUS, EXT}
E.g	Send > TRIG:SOUR BUS // Set to bus trigger mode.
query syntax	TRIG: SOUR?
query response	{ INT, MAN, BUS, EXT>

14.10.3 TRG

When the trigger source is set to BUS, TRG generates a trigger and returns the data of the trigger test.

- ☐ The measurement data will be returned if the TRG command is not triggered once , regardless of the [Result Send] option .
- ☐ If the current state is the discharge state , it will automatically enter the charge/test state and measure once and return the measurement result .
- ☐ In order to ensure that the data length of each return value is equal, space completion will be added at the end .
- ☐ If the charging time or measurement time is set too long, it is necessary to adjust the communication of the upper computer to avoid the timeout error .
- ☐ only on the <Measurement Display > page .
- ☐ Remote trigger must be set to [Remote] .

Return data format:

```
+1.008e+09,□100,OFF□□
+1.008e+09,□100,NG HI
+1.008e+09,□100,NG HI
+1.006e+09, □100,OK□□□
```

```
+1.006e+09,□100,OK□□□
```

+1.006e+09	□100	OK□□□
Insulation resistance value	Voltage value	Comparators

command syntax	TRG
E.g	send > **TRG** // instrument test once and return test data Return> +1.007e+09,□100,OFF□□

14.11 FETCh (READing) subsystem

The FETCh (READing) subsystem is used to obtain test data.

Figure 14- 9 FETCh? Subsystem Tree

FETCh READING	FETCh?	Obtain measurement data compatible with AT682 /683 (compatible commands, do not use for new applications)
	READING?	Get full measurement data (new applications use this command)
	:MAIN?	Get resistance data only

14.11.1 READ ing? Get measurement data

On the <Measurement Display > page , send READing? The current measurement data will be returned .

- ☐ To use this command, the [Result Send] field under the <System Configuration> page must be set to [FETCH]
- ☐ In order to ensure that the data length of each return value is equal, space completion will be added at the end
- ☐ This command is only valid on the <Measurement Display> page
- ☐ In discharge state , will always return to the last measured value

query syntax	READING ?
query response	<SciFloat>,< FixFloat >, {OFF □□ ,OK□□□,NG ☐ HI,NG☐LO}
E.g	Send > READing ? Return> +1.008e+09,□100,OFF□□

14.11.2 FETCh ? Obtain measurement data

On the <Measurement Display > page , send FETCh? It will return the current measurement data.
returned data is as follows:
0.00000e+00, 0.00000e+00, the GD // measurement value is 0.00000e +00 means the data is invalid
1.00000e+07,0.00000e+00,GD
1.00204e+07,0.00000e+00,NG

1.00204e+07,0.00000e+00,NG		
1.00204e+07	0.00000e+00	NG
Insulation resistance value	invalid value	Comparators

query syntax	FETCh?
query response	<SciFloat>,< **0.00000e+00** >, {GD,NG} Among them , <SciFloat> Insulation resistance value, 0.00000 e +00 means data not ready < 0.00000e+00 > Fixed value, this value is invalid in 9456-DR01 . GD means qualified , NG means unqualified
E.g	Send > FETC? returns > 1.00204e+07,0.00000e+00,NG

14.11.3 READing : MAIN ? Get insulation resistance data only

READing:MAIN? Returns the insulation resistance value only.

query syntax	READing :MAIN?
query response	<SciFloat>
E.g	Send > READing ? Return > +1.008e+09

14.12 LIST subsystem

LIST	STATe		< integer>,{on(1),off(0)}	List row state settings
	VOLT age		<integer>,< integer >	line number , voltage value
	TIME r	DICH	< float>	discharge time
		CHAR	< integer >,<float>	line number, charging time
		TEST	< integer >,< float>	line number , test time
	TRIGger _	[:IMMediate]		trigger a scan
		:SOURce	{MAN,BUS,EXT}	List Sweep Trigger Source
		:MODE	{SEQ,STEP }	list scan scan method
	TRG			Trigger a sweep and return measurement results

Note that all parameter setting commands must be valid after the list scan is stopped .

14.12.1 LIST: STATe

LIST: STATe turns on/off the specified line.

command syntax	LIST:STATe <spot: 1~5 >, {on,off,1,0} Among them , spot: positive integer type , line number: 1 ~ 5
E.g	send > LIST:STATe 1,off // turn off line 1
query syntax 1	LIST:STATe ?☐<spot: 1~5> Returns the specified row status
query response	{on,off}
E.g	Send > LIST:STAT ?☐4 return >off // return lowercase on / off
query syntax 2	LIST:STATe ?
query response	{on,off}
E.g	send > LIST:STAT ? Return>off,on,on,on,off // Display the status of each line in turn

14.12.2 LIST:VOLT age

LIST:VOLT age sets the voltage value of the specified row.

command syntax	LIST:VOLTage <spot: 1~5 >, <voltage:10~1000> Among them , spot Positive integer type , line number: 1 ~ 5 voltage positive integer type , the voltage value is 10 ~ 1000
E.g	send > LIST:VOLT 1,100 // set the voltage of row 1 to 100V
query syntax 1	LIST: VOLT age ?☐<spot: 1~5> Returns the specified row voltage value
query response	< 4 -digit positive integer (☐☐10 ~1000) >
E.g	Send > LIST:VOLT ?☐ 3 Return>☐ 100 //Return 4-digit positive integer, if less than 4 digits, fill up the prefix spaces .
query syntax 2	LIST: VOLT age ? Returns the voltage value of all rows
query response	< spot 1: integer > , < spot 2: integer > , < spot 3: integer > , < spot 4: integer > , < spot 5: integer >
E.g	Send > LIST:VOLT ? Return>☐☐25,☐☐50,☐ 100 ,☐200 //Return the voltage value of each row in turn .

14.12.3 LIST :T IMEr : DICH

LIST:TIMEr:DICH is used to set the uniform discharge time of each line .

command syntax	LIST:TIMEr : DICH <float>
E.g	Send > LIST :T IME:DICH 100m // Set the discharge time to 100 ms Send > LIST :T IME:DICH 1 // Set the discharge time to 1s
query syntax	LIST: T IMEr:DICH?

query response	<FixFloat> Units _
E.g	Send > LIST :T IME:DICH ? return > 0.010 // discharge time is 0.01 s

14.12.4 LIST : T IMEr : CHAR

LIST:TIMEr:CHAR is used to set the charging time of the specified row .

command syntax	LIST:TIMEr :CHAR <spot 1~5>, <float>
E.g	Send > LIST :T IME:CHAR 2,500m // Row 2 charging time is set to 500 ms send > LIST :T IME:CHAR 1,0 // line 1 charge time set to 0 s (off)
query syntax 1	LIST: T IMEr:CHAR ?☐<spot 1~5> Returns the charging time for the specified row
query response	<FixFloat> Units _
E.g	Send> LIST :T IME:CHAR ?☐ 2 Return > ☐ 0.5 // charging time is 0. 5s
query syntax 2	LIST: T IMEr:CHAR ? Returns all row charging times
query response	< spot 1: FixFloat> ,<spot 2: FixFloat>,<spot 3:FixFloat>,<spot 4:FixFloat>,<spot 5:FixFloat>
E.g	Send > LIST :T IME:CHAR ? Return> ☐ 0.5, ☐ 0.5, ☐ 1.0, ☐1 .0, ☐ 1.0 // Display the charging time of each line in turn

14.12.5 LIST :T IMEr : TEST

LIST:TIMEr:TEST is used to set the measurement time of the specified row .

i Note that the measurement time cannot be set to 0s (off) .

command syntax	LIST:TIMEr : TEST <spot 1~5>, <float>
E.g	Send > LIST :T IME:TEST 1,200m // Row 1 measurement time set to 200 ms send > LIST :T IME:TEST 2,0.5 // line 2 measurement time is set to 0.5 s
query syntax 1	LIST: T IMEr:TEST ?☐<spot 1~5> Returns the measurement time of the specified row
query response	<FixFloat> Units _
E.g	Send> LIST :T IME:TEST ?☐5 return > 1.0 // measurement time is 1 s
query syntax 2	LIST: T IMEr: TEST ? Returns all row measurement times
query response	< spot 1: FixFloat> ,<spot 2: FixFloat>,<spot 3:FixFloat>,<spot 4:FixFloat>,<spot 5:FixFloat>
E.g	Send > LIST :T IME:TEST ? Return> ☐ 0.2, ☐ 0.2, ☐0 .5, ☐0 .1, ☐0 .5 // Display the measurement time of each line in sequence

14.12.6 LIST : Li MiT

LIST:LiMiT is used to set the upper and lower limits of the comparator for the specified line .

command syntax	LIST:Li MiT <spot 1~5>, < lower limit float>, < upper limit float>
E.g	Send > LIST : LMT 1,1MA,10MA // 1st row comparator set to 1 MΩ~10MΩ Send > LIST : LMT 2,2MA,1G // 2nd row comparator set to 2 MΩ~1GΩ Send > LIST : LMT 3,2MA,1e20 // 3rd row comparator set to 2 MΩ~ ∞
query syntax 1	LIST:Li MiT?☐<spot 1~5> Returns the specified row comparator limit
query response	<lower limit SciFloat>, <upper limit SciFloat>
E.g	Send> LIST : LMT ? 2 Return > 2.000e+06, 1.000e+09
query syntax 2	LIST: LiMiT? Returns all row comparator limits
query response	< spot 1: lower limit FixFloat> , < spot 1: upper limit FixFloat>, < spot 2: lower limit FixFloat> , < spot 2: upper limit FixFloat>, < spot 3: lower limit FixFloat> , < spot 3: upper limit FixFloat>, < spot 4: lower limit FixFloat> , < spot 4: upper limit FixFloat>, < spot 5: lower limit FixFloat> , < spot 5: upper limit FixFloat>
E.g	Send > LIST : LMT ? Return> 1.000e+06, 2.000e+06, 2.000e+06,3.000e+06, 3.000e+06,4.000e+06, 4.000e+06,5.000e+06,

	5.000e+06,6.000e+06

14.12.7 LIST :TRIG ger :SOURce

LIST: TRIG ger :SOUR ce is used to set the trigger source of list sweep .
List scan trigger sources do not contain internal trigger options.

command syntax	LIST: TRIGger:SOURce { MAN,BUS, EXT}
E.g	Send > LIST :TRIG:SOUR BUS // Set to bus trigger mode.
query syntax	LIST: TRIG: SOUR?
query response	{MAN,BUS, EXT>

14.12.8 LIST : TRIG ger : MODE

LIST: TRIG ger :MODE is used to set the list scan mode.

command syntax	LIST: TRIGger: MODE { SEQ,STEP}
E.g	Send > LIST :TRIG: MODE SEQ // Set the scan mode to sequence .
query syntax	LIST: TRIG: MODE ?
query response	{SEQ,STEP}

14.12.9 LIST: TRIGger[:IMMediate]

LIST: TRIG[:IMM] When the list scan trigger source is set to remote (BUS), only one scan is triggered, and the function is equivalent to the button 【 Trig 】 and the Handler Trig signal .

i

- ☐ the [Result Send] in the <System Configuration > page is set to Auto, the measurement data will be returned after triggering once .
- ☐ [Result Send] in the <System Configuration > page is set to FETCH , the measurement data will not be returned , and it is necessary to send LIST:FETC h ? command to obtain measurement results .
- ☐ If data must be returned , use the LIST: TRG instruction.
- ☐ If the charging time or measurement time is set too long, it is necessary to adjust the communication of the upper computer to avoid the timeout error .
- ☐ LIST:TRIG command can only be received after the list scan has ended .

command syntax	LIST: TRIGger[IMMediate]
E.g	Send > **LIST: TRIG**

14.12.10 LIST:FETCh ?

LIST:FETC h ? Used to get all list measurement results, or measurement data for a specified row.

query syntax 1	LIST:FETCh ? Returns all row measurement data
query response	<01>,<R:SciFloat>,<V:Integer>, <COMP> , <02>,<R:SciFloat>,<V:Integer>,<COMP>, <03>,<R:SciFloat>,<V:Integer>,<COMP>, <04>,<R:SciFloat>,<V:Integer>,<COMP>, <05>,<R:SciFloat>,<V:Integer>,<COMP>
E.g	Send > LIST:FETCh? Return> 01, -1.000e+00, 0,OFF□□ , // represents the current line is off 02,+1.005e+07, 50, OK□□□, 03,+1.004e+07, 75, OK□□□, 04,+1.001e+07, 100, OK□□□, 05, +0.000e+00, 0,□□□□□ // represents that the current line measurement has not started or completed
query syntax 2	LIST:FETCh ?☐<spot: 1~5> Returns the measurement data for the specified row
E.g	Send > LIST:FETCh? 1 Return> 01,+1.009e+07, 25, OK□□□ Send > LIST:FETCh? 2 Return> 02, +0.000e+00 , 25, □□□□□ // Indicates that the current line measurement has not started or completed Send > LIST:FETCh? 3 Return> 03, -1.000e+00, 0, OFF□□ // Indicates that the current line is closed

i

- ☐ returned data is: -1.000e+00, 0, OFF□□ // Indicates that the current line is closed .
- ☐ returned data is : + 0.000e+00, 0,□□□□□ // Indicates that the current line

	has not been measured . ☐ LIST:FETCh ? Valid only on <List Scan > page . ☐ LIST:FETCh ? Not limited by scan trigger mode .

14.12.11 LIST:TRG

LIST: TRG is used to trigger a scan and return the measurement results after each line is measured .

query syntax 1	LIST:TRG
query response	<01>,<R:SciFloat>,<V:Integer>, <COMP> , <02>,<R:SciFloat>,<V:Integer>,<COMP>, <03>,<R:SciFloat>,<V:Integer>,<COMP>, <04>,<R:SciFloat>,<V:Integer>,<COMP>, <05>,<R:SciFloat>,<V:Integer>,<COMP>
E.g	Send > LIST:TRG? Return> 02,+1.005e+07, 50, OK□□□ 03,+1.004e+07, 75, OK□□□ 04,+1.001e+07, 100, OK□□□ 05,+1.000e+07, 200, OK□□□

14.13 FILE(MMEM) subsystem

The FILE(MMEM) subsystem is used to manage files and can be used to save user parameters to the internal flash memory , or to read flash files into the system.

Figure 14- 10FILE(MMEM) subsystem tree

FILE MMEM	: SAVE _	< no parameter > or <file number 0-9 >	Save current file or specified file
	: LOAD	< no parameter > or <file number 0-9 >	Load current file or specified file
	:DELete	<file number 0-9 >	delete file

14.13.1 FILE:SAVE save file

FILE:SAVE can save the current settings to the current file or the specified file.

Command Syntax 1	FILE:SAVE
E.g	Send > FILE:SAVE // save to current file
Command syntax 2	FILE:SAVE <File No. 0-9>
E.g	send > FILE:SAVE 1 // save to file 1

14.13.2 FILE:LOAD read file

FILE:LOAD can read file data into the system.

Command Syntax 1	FILE:LOAD
E.g	Send > FILE:LOAD // Read the current file data to the system
Command Syntax 1	FILE:LOAD <File No. 0-9>
E.g	Send > FILE:LOAD 1 // read the data of file 1 to the system

14.13.3 FILE:DELete deletes the specified file

FILE: DELete can delete the data of the specified file.

command syntax	FILE:DELete <File No. 0-9>
E.g	send > FILE:DEL 1 // delete file 1
Note	Deleting the current file will not affect the parameters of the system

14.13.4 SAV _

SAV can save the current settings to the current file.

command syntax	SAV = FILE : SAVE
E.g	send > **SAV** // save to the current file

14.13.5 RCL

RCL can read the current file data into the system.

command syntax	RCL = FILE:LOAD

E.g	Send > FILE:LOAD // Read the current file data to the system

14.14 IDN? Subsystem

Figure 14- 11 IDN? Subsystem Tree

ID N ?	Query system information

The IDN? subsystem is used to return the version number of the instrument.

query syntax	IDN?
query response	<MODEL>,<Revision>,<SN>,< Manufacturer > _
E.g	Send > IDN? Return> 9456-DR01,REV A2.39,7546159,INSIZE CO.,LTD

14.15 ERRor subsystem

The error subsystem is used to obtain information about the last error that occurred

Query syntax:	ERRor?
Query response:	Error string
E.g:	send > ERR? <NL> return > no error. <NL>

The corresponding error codes are as follows:

error code	illustrate
*E00	No error
*E01	Bad command
*E02	Parameter error
*E03	Missing parameter
*E04	buffer overrun
*E05	Syntax error
*E06	Invalid separator
*E07	Invalid multiplier
*E08	Numeric data error
*E09	Value too long
*E10	Invalid command
*E11	Unknown error

15. Modbus (RTU) communication protocol

This chapter covers the following areas :

- Data Format - Learn about the Modbus communication format .
- Function
- Variable area
- function code

15.1 Data Format

We follow the Modbus (RTU) communication protocol, the instrument will respond to the command of the upper computer and return a standard response frame.

15.1.1 command frame

Figure 15- 1 Modbus command frame

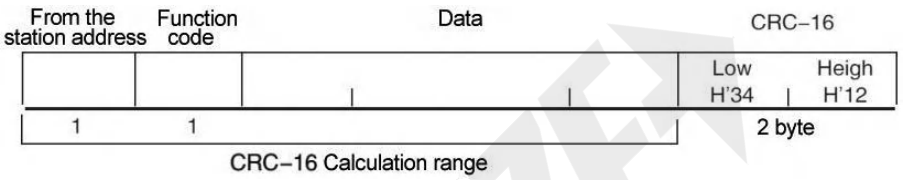


Table 15- 1 Instruction frame description

	A squelch interval of at least 3.5 character time is required
Slave address	1 byte Modbus Can support 00~ 0 x 63 slaves Specify 00 for unified broadcast In instruments without the RS 485 option, the default slave address is 0x01
function code	1 byte 0 x 03 : read multiple registers 0 x 04 := 03 H, not used 0 x 06 : write a single register, can be replaced with 10H 0x08 : _ _ Echo test (for debugging only) 0 x 10 : write to multiple registers
data	Specify register address, quantity and content
CRC- 16	2 bytes, LSB first Cyclic Redun dancy Check Calculate all data from the station address to the end of the data to get the CRC 16 check code
	A squelch interval of at least 3.5 character time is required

15.1.2 CRC-16 calculation method

1. Set the initial value of the CRC-16 register to 0x FFFF .
2. XOR the CRC-16 register and the first byte data of the message , and return the result to the CRC register.
3. Fill the MSB with 0 , while right-shifting the CRC register by 1 bit.
4. If the bit shifted from the LSB is " 0 ", repeat step (3) (processing the next shift) . If the bit shifted from the LSB is ' 1 ', XOR the CRC register with 0x A001 and return the result to the CRC register.
5. Repeat steps (3) and (4) until you move 8 bits.
6. If the information processing has not ended, XOR operation is performed on the CRC register and the next byte of the information, and the CRC register is returned, and the execution is repeated from step (3) .
7. the result of the calculation (the value of the CRC register) to the message from the lower byte.

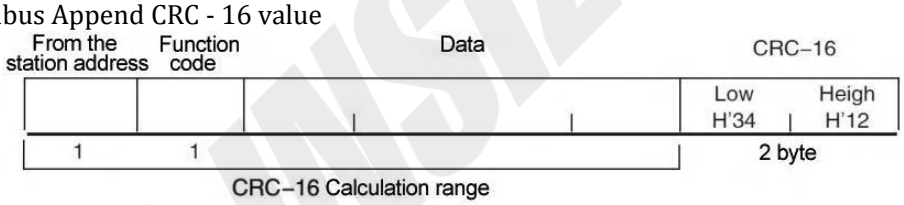
The following is a CRC calculation function in VB language:

```
FUNCTION CRC16(DATA() AS BYTE) AS BYTE()
IM CRC16LO AS BYTE, CRC16HI AS BYTE 'CRC REGISTER
IM CL AS BYTE, CH AS BYTE ' POLYNOMIAL CODE &HA001
IM SAVEHI AS BYTE, SAVELO AS BYTE
```

```
IM I AS INTEGER
IM FLAG AS INTEGER
RC16LO = &HFF
RC16HI = &HFF
L = &H1
H = &HA0
OR I = 0 TO UBOUND(DATA)
CRC16LO = CRC16LO XOR DATA(I) ' EACH DATA IS XORED WITH THE CRC REGISTER
FOR FLAG = 0 TO 7
SAVEHI = CRC16HI
SAVELO = CRC16LO
CRC16HI = CRC16HI \ 2 'THE HIGH BIT IS SHIFTED TO THE RIGHT BY ONE
CRC16LO = CRC16LO \ 2 'THE LOW BIT IS SHIFTED TO THE RIGHT BY ONE
IF ((SAVEHI AND &H1) = &H1) THEN ' IF THE LAST BIT OF THE HIGH-ORDER BYTE IS 1
CRC16LO = CRC16LO OR &H80 ' THE LOWER BYTE IS SHIFTED TO THE RIGHT AND THE FRONT IS FILLED WITH
1
END IF ' OTHERWISE ADD 0 AUTOMATICALLY
IF ((SAVELO AND &H1) = &H1) THEN ' IF LSB IS 1 , XOR WITH POLYNOMIAL CODE
CRC16HI = CRC16HI XOR CH
CRC16LO = CRC16LO XOR CL
END IF
NEXT FLAG
EXT I
IM RETURNDATA(1) AS BYTE
ETURNDATA(0) = CRC16HI 'CRC HIGH BIT
ETURNDATA(1) = CRC16LO 'CRC LOW BIT
RC16 = RETURNDATA
END FUNCTION
```

Calculated CRC - 16 data needs to be appended to the end of the command frame, for example: 1 234H :

picture 15- 2 Modbus Append CRC - 16 value



15.1.3 response frame

Unless it is a 0 0 H slave address broadcast command, other slave address devices will return response frames.

Figure 15- 3 normal response frame

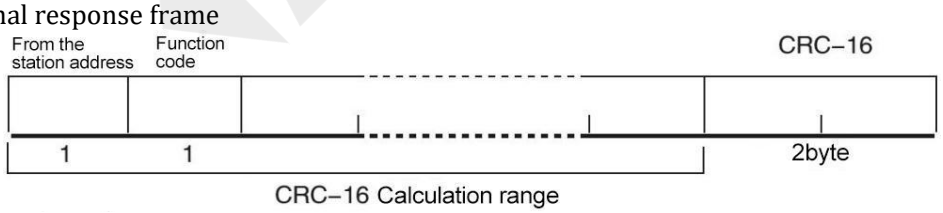


Figure 15- 4 exception response frame

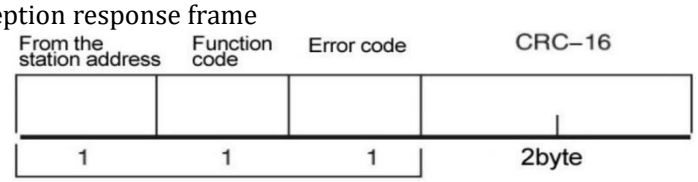


Table 15- 2 Exception response frame description

Slave address	1 byte The slave address is returned as it is
function code	1 byte The function code of the instruction frame is logically ORed (OR) on BIT 7 (0x8 0), for example: 0x 03 OR 0 x 80 = 0 x83
error code	Exception code: 0x 01 Function code error (function code not supported) 0 x 02 register error (register does not exist)

	0 x 03 Data error 0 x 04 Execution error
CRC- 16	2 bytes, LSB first Cyclic Redun dancy Check Calculate all data from the station address to the end of the data to get the CRC 16 check code

15.1.4 No response

In the following cases, the instrument will not perform any processing and will not respond, resulting in a communication timeout.

1. Slave address error
2. transmission error
3. CRC- 16 error
4. The number of digits is wrong, for example: the total digits of function code 0x03 must be 8, and the received digits are less than 8 or more than 8 bytes.
5. When the slave address is 0x 00 , it represents the broadcast address and the instrument does not respond.

15.1.5 error code

Table 15- 3 Error code description

error code	name	illustrate	priority
0x01	Function code error	Function code does not exist	1
0x02	register error	register does not exist	2
0x03	data error	wrong number of registers or number of bytes	3
0x04	execution error	The data is illegal, the written data is not within the allowed range	4

15.2 function code

The instrument only supports the following function codes, other function codes will respond to error frames.

Table 15- 4 function code

function code	name	illustrate
0x03	read multiple registers	Read multiple consecutive register data
0x04	same as 0x 03	replace with 0x 03
0x08	echo test	The received data is returned as it is
0x10	write to multiple registers	Write to multiple consecutive registers

15.3 Register

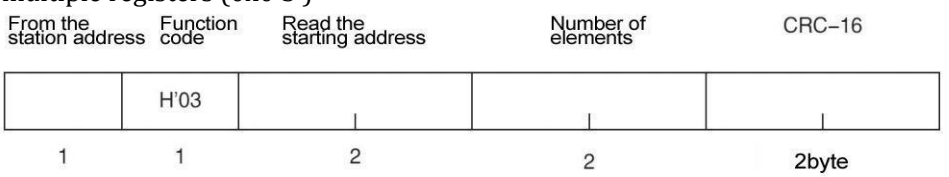
The number of registers of the instrument is in 2-byte mode, that is, 2 bytes must be written each time, for example: the speed register is 0x 3002 , the data is 2 bytes, and the value must be written 0x 0001

data:
The instrument supports the following values:

1. 1 register, double-byte (1 6 -bit) integer, for example: 0x6 4 → 00 64
2. 2 registers, four-byte (32 -bit) integers, eg: 0 x 12345678 → 12 34 56 78
3. 2 registers, four-byte (3 2 -bit) single-precision floating-point numbers, 3. 14 → 40 48 F5 C3

15.4 Read multiple registers

Figure 15- 5 Read multiple registers (0x0 3)



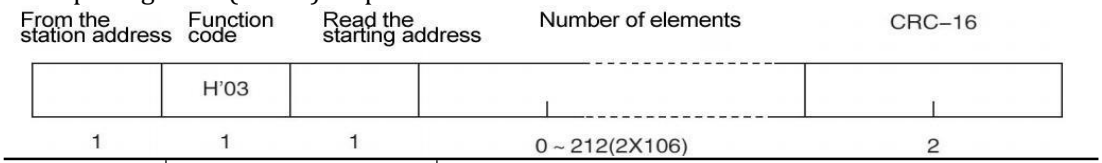
The function code for reading multiple registers is 0 x 03 .

surface 15- 5 read multiple registers

name	name	illustrate
	Slave address	no RS 485 address is specified, the default is 0 1

0x03	function code	
	initial address	Register start address, please refer to Modbus Instruction Set
	Number of read registers 000 1~ 006 A (1 06)	Number of registers to read consecutively. Please refer to Modbus instruction set to ensure that these register addresses are present, otherwise an error frame will be returned.
CRC-16	check code	

Figure 15- 6 Read multiple registers (0x0 3) response frame



name	name	illustrate
	Slave address	return as is
0x03 or 0x83	function code	No exception: 0x 03 Error code : 0x83
	number of bytes	= number of registers x 2 For example: 1 register returns 0 2
	data	read data
CRC-16	check code	

15.5 Write to multiple registers

Figure 15- 7 Write to multiple registers (0x 1 0)

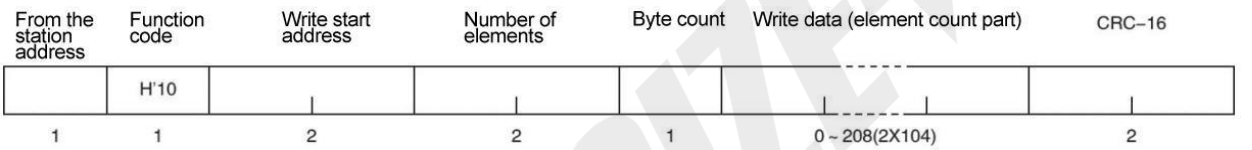
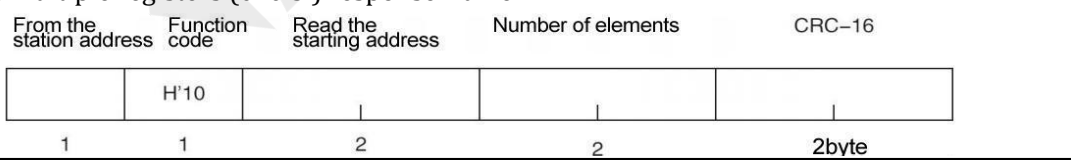


Table 15- 6 write to multiple registers

name	name	illustrate
	Slave address	no RS 485 address is specified, the default is 0 1
0x10	function code	
	initial address	Register start address, please refer to Modbus Instruction Set
	Number of write registers 000 1~ 0068 (1 04)	Number of registers to read consecutively. Please refer to Modbus instruction set to ensure that these register addresses are present, otherwise an error frame will be returned.
	number of bytes	= number of registers x 2
C RC-16	check code	

picture 15- 8 Write multiple registers (0x0 3) response frame

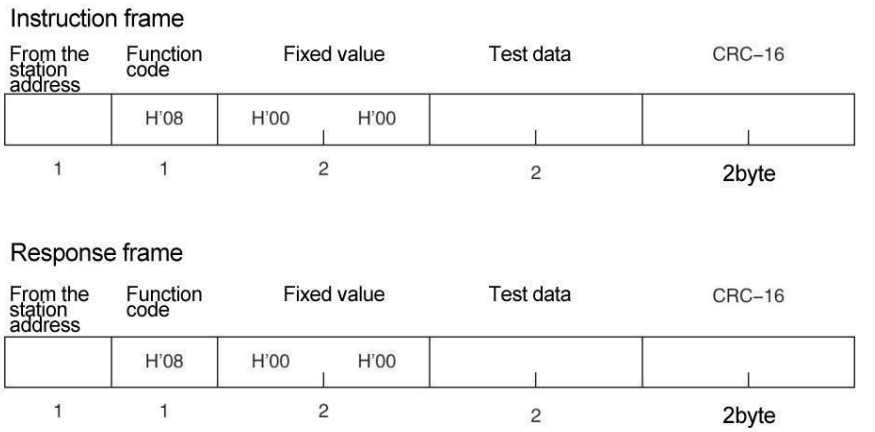


name	name	illustrate
	Slave address	return as is
0x10 or 0x 90	function code	No exception: 0x 10 Error code : 0x90
	initial address	
	Number of registers	
	C RC-16 check code	

15.6 Echo test

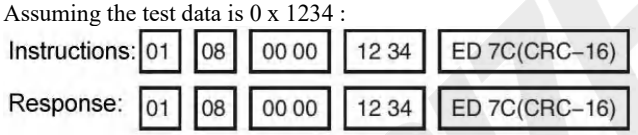
Echo test function code 0x 08 , used to debug Modbus.

Figure 15- 9 echo test (0x0 8)



name	name	illustrate
	Slave address	return as is
0x08 _ _	function code	
	Fixed value	0 0 00
	Test Data	Any number: e.g. 12 34
	C RC-16 check code	

E.g:
Assuming the test data is 0 x 1234 :



16. Modbus (RTU) instruction set

This chapter covers the following areas :

- register address

! Unless otherwise specified, the values of the command and response frames in the following description are all hexadecimal data.

16.1 Register overview

Below lists the register address adopted by the instrument. Any address not listed will return error code 0x02.

Table 0- 1 Register overview

register		number of bytes	name	Numerical value	illustrate
address	quantity				
2 000	2	4	Read measurement results	4-byte floating point number Byte Order A A B B C C D D	read only
2002	1	2	Read the measured voltage	2-byte integer	read only
2003	1	2	Read the comparator result of the channel	2 -byte integer	read only
2200	2	4	Read measurement results	4-byte floating point number byte order CCDDAABB	read only
2300	4	8	Trigger once and read the measurement Resistor (4 bytes) Voltage (2 bytes) Comparator (2 bytes)	Resistor : 4-byte float Character order : AABBCCDD Voltage : 2 byte integer Comparator : 2-byte integer	read only
2500	2	4	Read List Line 1 Resistance Measurements	4-byte floating point number	read only
2502	2	4	Read List Row 2 Resistance Measurements	4-byte floating point number	read only
2504	2	4	Read List Line 3 Resistance Measurements	4-byte floating point number	read only
2506	2	4	Read List Line 4 Resistance Measurements	4-byte floating point number	read only
2508	2	4	Read List Line 5 Resistance Measurements	4-byte floating point number	read only
2510	1	2	Read List Line 1 Voltage Measurements	2-byte integer	read only
2511	1	2	Read List Line 2 Voltage Measurements	2-byte integer	read only
2512	1	2	Read list row 3 voltage measurement results	2-byte integer	read only
2513	1	2	Read list row 4 voltage measurement results	2-byte integer	read only
2514	1	2	Read List Line 5 Voltage Measurements	2-byte integer	read only
2520	1	2	read list row 1 compare result	2-byte integer	read only
2521	1	2	read list row 2 compare result	2-byte integer	read only
2522	1	2	read list row 3 compare result	2-byte integer	read only
2523	1	2	read list row 4 compare result	2-byte integer	read only
2524	1	2	read list row 5 compare result	2-byte integer	read only
0000	1	2	Read instrument version number	4 byte integer	Read only, data occupies 2 registers
3000	1	2	Range number	0001 ~ 0004	Read and write registers, 2-byte integers

3001	1	2	Range method	0000 : Auto range 0001 : Manual range 0002 : Nominal range	Read and write registers, 2-byte integers
3002	1	2	Test speed	0000: slow 0001 : medium speed 0002 : fast	Read and write registers, 2-byte integers
3003	1	2	Voltage	000A ~03E8	Read and write registers, 2-byte integers
3004	1	2	Trigger method	0000: Internal trigger 0001: Manual trigger 0002: Remote trigger 0003: External trigger	Read and write registers, 2-byte integers
3005	1	2	Contact check	0000: close 0001: open	Read and write registers, 2-byte integers
3006	1	2	source resistance	0000: normal 0001: Current limit	Read and write registers, 2-byte integers
3010	2	4	charging time	4-byte floating point number	Read and write registers
3012	2	4	test time	4-byte floating point number	Read and write registers
3014	2	4	short circuit time	4-byte floating point number	Read and write registers
3016	2	4	Trigger delay	4-byte floating point number	Read and write registers
3010	1	2	Comparator Status	0000: close 0001 : open	Read and write registers, 2-byte integers
3101	1	2	Comparator beep	0000: close 0001: OK 0002 : NG	Read and write registers, 2-byte integers
3102	1	2	Beeper volume	0001: weak 0002: Strong	Read and write registers, 2-byte integers
3110	2	4	Comparator lower limit	4-byte floating point number	Read and write registers
3112	2	4	Comparator upper limit	4-byte floating point number	Read and write registers
3120	1	2	List trigger method	0001: Manual 0002: Remote 0003: External	Read and write registers
3121	1	2	List scan method	0000: Sequence 0001: single step	Read and write registers
3122	2	4	List scan discharge time	4-byte floating point number	Read and write registers
3200	1	2	List scan line 1 state	0000 : close 0001: open	Read and write registers
3201	1	2	List scan line 2 state	0000 : close 0001: open	Read and write registers
3202	1	2	List scan line 3 state	0000 : close 0001: open	Read and write registers
3203	1	2	List Scan Line 4 Status	0000 : close 0001: open	Read and write registers
3204	1	2	List scan line 5 state	0000 : close 0001: open	Read and write registers
3210	1	2	List Scan Line 1 Voltage	2-byte positive integer	Read and write registers
3211	1	2	List scan line 2 voltage	2-byte positive integer	Read and write registers
3212	1	2	List scan line 3 voltage	2-byte positive integer	Read and write registers
3213	1	2	List scan line 4 voltage	2-byte positive integer	Read and write registers
3214	1	2	List scan line 5 voltage	2-byte positive integer	Read and write registers
3220	2	4	List Scan Line 1 Charge Time	4 -byte floating point number	Read and write registers
3222	2	4	List Scan Line 2 Charge Time	4 -byte floating point number	Read and write registers
3224	2	4	List Scan Line 3 Charge Time	4 -byte floating point number	Read and write registers
3226	2	4	List Scan Line 4 Charge Time	4 -byte floating point number	Read and write registers
3228	2	4	List Scan Line 5 Charge Time	4 -byte floating point number	Read and write registers
3230	2	4	List scan line 1 test time	4 -byte floating point number	Read and write registers
3232	2	4	List scan line 2 test time	4 -byte floating point number	Read and write registers
3234	2	4	List scan line 3 test time	4 -byte floating point number	Read and write registers
3236	2	4	List scan line 4 test time	4 -byte floating point number	Read and write registers
3238	2	4	List scan line 5 test time	4 -byte floating point number	Read and write registers
3240	2	4	List scan line 1 lower limit	4 -byte floating point number	Read and write registers
3242	2	4	List scan line 2 lower limit	4 -byte floating point number	Read and write registers
3244	2	4	List scan line 3 lower limit	4 -byte floating point number	Read and write registers
3246	2	4	List scan line 4 lower limit	4 -byte floating point number	Read and write registers
3248	2	4	List scan line 5 lower limit	4 -byte floating point number	Read and write registers

3250	2	4	List scan line 1 cap	4 -byte floating point number	Read and write registers
3252	2	4	List scan line 2 cap	4 -byte floating point number	Read and write registers
3254	2	4	List scan line 3 cap	4 -byte floating point number	Read and write registers
3256	2	4	List scan line 4 cap	4 -byte floating point number	Read and write registers
3258	2	4	List scan line 5 cap	4 -byte floating point number	Read and write registers
4000	1	2	Save settings to current file	Fixed value: 0001	Write-only register, data 2 bytes
4001	1	2	Read current file data	Fixed value: 0001	Write-only register, data 2 bytes
4002	1	2	Save settings to specified file	000 0 ~ 0009	Write-only register, data 2 bytes
4003	1	2	Read the specified file data	0000~ 0009	Write-only register, data 2 bytes
4020	1	2	file boot call	0000: file 0 0001 : current file	Read and write registers, 2-byte integers
4021	1	2	auto save	0000: Forbidden 0001 : Allowed	Read and write registers, 2-byte integers
4022	1	2	system language	0000 : English 0001 : Simplified Chinese	Read and write registers, 2-byte integers
4023	1	2	Power frequency	0000 : 50Hz _ 0001 : 60Hz _	Read and write registers, 2-byte integers
5002	1	2	key lock	0000 : Unlock 0001 : Locked	write-only register , 2 bytes
5004	1	2	trigger once (=Handler Trig signal)	Fixed value : 0001	write-only register, 2 bytes
5006	1	2	Status settings	0000: stop 0001: start	write-only register, 2 bytes

16.2 Get measurement data

16.2.1 Obtain resistance measurement results 【2000】 【2001】

Registers 2000~ 2001 are used to obtain the resistance value of the instrument .
instruction:

1	2	3	4	5	6	7	8
01	03	2200		0002		CFCB	
Slaves	read	register		Number of registers		check code	

response

1	2	3	4	5	6	7	8	9
01	03	04	**4B**	**18**	**E5**	**26**	A6	9A
01	03	byte	single precision floating point number				CRC-16	

- Get measurement data:

Among them, B4~B6 are single-precision floating -point numbers , byte order AA BB CC DD
Measured data: 4B 18 E5 26 Converted to float: 0 x4B18E526 = 1.0020134E7 (decimal)

floating point numbers , please refer to the website http://www.binaryconvert.com/convert_float.html

16.2.2 Obtaining voltage measurement results 【2002】

Register 2002 is used to obtain the instrument resistance value .
instruction:

1	2	3	4	5	6	7	8
01	03	200 2		0001		2E0A	
Slaves	read	register		Number of registers		check code	

response

1	2	3	4	5	6	7
01	03	02	**00**	**64**	**B9**	**AF**
Slaves	read	byte	integer		CRC-16	

Where B4 ~ B5 are integers: 0 x 0064 = 100 (decimal)

16.2.3 Get the comparator result 【2003】

Register 2003 is used to obtain the comparator result . The returned 2-byte integer represents the comparator result:
00 0 0 : OK
00 0 1 : NG LO
00 0 2 : NG HI
0003 : OFF

00 0 4 : SHORT

■ read

1	2	3	4	5	6	7	8
01	03	20	03	00	01	7F	CA
Slaves	read	register		Number of registers		check code	

response:

1	2	3	4	5	6	7
01	03	02	**00**	**03**	**F8**	**45**
Slaves	read	byte	integer		CRC-16	

16.2.4 Get all results at the same time 【2000】~【2003】

■ read

1	2	3	4	5	6	7	8
01	03	20	00	00	04	4F	C9
Slaves	read	register		Number of registers		check code	

response:

1	2	3	4-5	6-7	8-9	10-11	12-13
01	03	08	4B 18	C297	0000	0003	6D6B
Slaves	read	byte	Resistor float		Voltage	Comparators	CRC16

Among them ,
B4-B7: 4B18C297 resistance value (float) = 1.0011287E7Ω
B8-B9: 0000 voltage value (integer) = 0V
B10-B11 :0003 Comparator = OFF

16.2.5 Get Measurement Results (CCDD AABB) 【2200】

Register 2 2 00~ 2201 is used to obtain the resistance value of the instrument .
instruction:

1	2	3	4	5	6	7	8
01	03	2200		0002		CFCB	
Slaves	read	register		Number of registers		check code	

response

1	2	3	4	5	6	7	8	9
01	03	04	**C2**	**97**	**4B**	**18**	40	9D
01	03	byte	single precision floating point number				CRC-16	

Among them, B4~B6 are measurement data: C2 97 4B 18 Represents a single-precision floating -point number , high -order word first , byte order CCDDAABB .
swapping word order , 4B18C297 is converted to decimal number as 1.0011287E7

16.2.6 Trigger once and return measurement result (AABBCCDD) 【2300】-【2303】

Register 2 3 00~ 2303 is used to obtain instrument measurement data, and the resistance floating point number format is AABBCCDD.

■ read

1	2	3	4	5	6	7	8
01	03	2300		0003		0E4F	
Slaves	read	register		Number of registers		check code	

response:

1	2	3	4-5	6-7	8-9	10-11	12-13
01	03	08	4B18	C1EA	0064	0003	2C87
		number of bytes	Resistance value (float)		Voltage	Comparators	CRC 16

Among them, B4~B 7 are resistance values : 4 B18C1EA stands for single-precision floating -point numbers . byte order AA BB CC DD converted to decimal is 1.0011114E7
B8-B9 voltage value : 0 x 0064 = 100 (decimal)
B10-B11 Comparator Value: 0 x0003 = OFF

■ This directive is valid under the following conditions :
- ☐ Turn on when charging
- ☐ <Measurement display > page
- ☐ Trigger is set to 【 Remote 】

■ After the command is issued, it needs to wait for a measurement to complete before returning the data, so

the response will be slightly delayed in the slow test .

16.2.7 Trigger once and return measurement result (CCDD AABB) 【2400】

Register 2400 ~ 2403 is used to obtain instrument measurement data, and the resistance floating point number format is CCDDAABB .

■ Read:

1	2	3	4	5	6	7	8
01	03	2400		000 3		4EF9	
Slaves	read	register		Number of registers		check code	

response:

1	2	3	4 -5	6-7	8-9	10-11	12-13
01	03	08	C160	4B18	0064	0003	162A
		number of bytes	Resistance value (float)		Voltage	Comparators	CRC 16

Among them, B4~ B7 are resistance values : C160 4B18 represent single-precision floating -point numbers . byte order CCDDAABB, adjusted byte order is 4B18C160, converted to decimal number is 1.0010976E7
B8-B9 voltage value : 0 x 0064 = 100 (decimal)
B10-B11 Comparator Value: 0 x0003 = OFF

i

This directive is valid under the following conditions :
■ Charging timer on
■ <Measurement display > page
■ Trigger is set to 【 Remote 】

16.3 Parameter settings

16.3.1 Test range 【3000】

■ write :

1	2	3	4	5	6	7	8	9	10	11
01	10	30	00	00	01	02	00	01	57	93
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Range No. 1 ~ 4
Write returns :

1	2	3	4	5	6	7	8
01	10	30	00	00	01	0E	C9
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3000		000 1		8B0A	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**04**	**B9**	**87**
Slaves	read	byte	integer		CRC-16	

B4-B5: 0004 Range 4 .

16.3.2 Range mode 【3001】

■ write :

1	2	3	4	5	6	7	8	9	10	11
01	10	30	01	00	01	02	00	00	97	82
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Range mode
0000: Automatic
0001: Manual
0002: Nominal

Write returns :

1	2	3	4	5	6	7	8
01	10	30	01	00	01	5F	09
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3001		000 1		DACA	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**02**	**39**	**85**
Slaves	read	byte	integer		CRC-16	

B4-B5: 0 002 = nominal

16.3.3 Speed 【3002】

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	30	02	00	01	02	00	01	56	71
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Speed
0000: slow
0001: medium speed
0002: fast

Write returns :

1	2	3	4	5	6	7	8
01	10	30	02	00	01	AF	09
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3002		0001		2ACA	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slaves	read	byte	integer		CRC-16	

B4-B5: 0001 medium speed

16.3.4 Test voltage 【3003】

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	3003		0001		02	0064		978B	
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Voltage value 0xA~ 0x3E8 (10~1000 in decimal)

Write returns :

1	2	3	4	5	6	7	8
01	10	30	03	00	01	FE	C9
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3003		0001		7B0A	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**64**	**B9**	**AF**
Slaves	read	byte	integer		CRC-16	

B4-B5: Voltage value 0064 = 100 (decimal)

16.3.5 Trigger method 【3004】

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	3004		0001		02	0001		5617	
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Trigger method
0000: Internal trigger
0001: Manual trigger
0002: Remote trigger
0003: External trigger
0004: Internal semi-automatic trigger
Write returns :

1	2	3	4	5	6	7	8
01	10	30	04	00	01	4F	08
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3004		000 1		CACB	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slaves	read	byte	integer		CRC-16	

B4-B5: 0001 = Manual trigger

16.3.6 Contact check switch 【3005】

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	3005		0001		02	0001		5617	
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Contact Check Switch
0000: close
0001: open
Write returns :

1	2	3	4	5	6	7	8
01	10	30	05	00	01	1E	C8
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3005		0001		9B0B	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**00**	**B8**	**44**
Slaves	read	byte	integer		CRC-16	

B4-B5: 0000 = off

16.3.7 Source internal resistance 【3006】

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	3006		0001		02	0001		57F5	
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Source Internal Resistance
0000: normal
0001: Current limit
Write returns :

1	2	3	4	5	6	7	8
01	10	30	06	00	01	EE	C8
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3006		000 1		6B0B	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**00**	**B8**	**44**
Slaves	read	byte	integer		CRC-16	

B4-B5: 0000 = off

16.3.8 Charging time 【3010】

> charge timer : 0.1 s , maximum 999 s , set to 0 means the timer is off .
> timing time is out of range , error code 90 will be returned .

■ write

1	2	3	4	5	6	7	8	9	10	11	12	13
01	10	3010		0002		04	3F 80 00 00				5617	
Station No	Write	register		Number of registers		byte	floating point number				CRC16	

B8-B11: Charging time, floating point format
3 F 80 00 00 = 1 (decimal)
Write returns :

1	2	3	4	5	6	7	8
01	10	30	10	00	02	4F	0D
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3010		0002		CACE	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7	8	9
01	03	04	**3F**	**80**	**00**	**00**	**F7**	**CF**
Slaves	read	byte	floating point number				CRC-16	

B4-B7:3 F 80 00 00 = 1 (decimal)

16.3.9 Measurement time 【3012】

> Measurement timer minimum value: 0.05s , maximum value 999s , set to 0 means the timer is off .
> timing is out of range , the error code 90 will be returned

■ write

1	2	3	4	5	6	7	8	9	10	11	12	13
01	10	3012		0002		04	3F 00 00 00				2B6F	
Station No	Write	register		Number of registers		byte	floating point number				CRC16	

B8-B11: Measurement time, floating point format
00 00 00 00: means close
3 F 00 00 00 = 0.5 (decimal)
Write returns :

1	2	3	4	5	6	7	8
01	10	30	12	00	02	EE	0D
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3012		0002		6B0E	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7	8	9
01	03	04	**3F**	**00**	**00**	**00**	**F6**	**27**
Slaves	read	byte	floating point number				CRC-16	

B4-B7:3 F 00 00 00 = 0.5 (decimal)

16.3.10 Short circuit detection 【3014】

> Trigger delay timer minimum value: 1ms , maximum value 9.999 , set to 0 means the timer is closed.
> timing time is out of range , error code 90 will be returned .

■ write

1	2	3	4	5	6	7	8	9	10	11	12	13
01	10	3014		0002		04	41 10 00 00				B2A8	
Station No	Write	register		Number of registers		byte	floating point number				CRC16	

B8-B11: Short circuit detection time, floating point format
0 0 00 00 00 : (0 decimal) means off
41 10 00 00 : (decimal 9) means automatic
Write returns :

1	2	3	4	5	6	7	8
01	10	30	14	00	02	0E	CC
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3014		0002		8B0F	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7	8	9
01	03	04	**41**	**10**	**00**	**00**	**EF**	**0A**
Slaves	read	byte	floating point number				CRC-16	

B4-B7: 41 10 00 00 (9 decimal) stands for automatic.

16.3.11 Trigger delay 【3016】

> Trigger delay timer minimum value: 1ms , maximum value 9.999 , set to 0 means the timer is closed.
> timing is out of range , the error code 90 will be returned

■ write

1	2	3	4	5	6	7	8	9	10	11	12	13
01	10	3016		0002		04	3D CC CC CD				7F8E	
Station No	Write	register		Number of registers		byte	floating point number				CRC16	

B8-B11: Trigger delay setting, floating point format
0 0 00 00 00 : (0 decimal) means off
3D CC CC CD = (decimal) 0.1
Write returns :

1	2	3	4	5	6	7	8
01	10	30	16	00	02	0E	CC
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3016		0002		2ACF	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7	8	9
01	03	04	**3D**	**CC**	**CC**	**CD**	**A3**	**35**
Slaves	read	byte	floating point number				CRC-16	

B4-B7: 3D CC CC CD = (decimal) 0.1 .

16.4 Comparator settings

The comparator parameter setting register address starts from 3100.

16.4.1 Comparator status 【3100】

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	31	10	00	01	02	00	01	47	53
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Comparator Status
0000: close
0001: open

■ Write returns :

1	2	3	4	5	6	7	8
01	10	31	10	00	01	0F	35
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3010		000 1		8AF6	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slaves	read	byte	integer		CRC-16	

B4-B5: 0001 open

16.4.2 Comparator beep 【3101】

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	3101		0001		02	0001		4682	
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Beeper status
0000: close
0001: Qualified beep
0002: Unqualified beep
Write returns :

1	2	3	4	5	6	7	8
01	10	3101		0001		5EF5	
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3101		000 1		DB36	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slaves	read	byte	integer		CRC-16	

B4-B5: 0001 Qualified Beeper

16.4.3 Sound volume 【3102】

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	31 0 2		0001		02	0002		06B0	
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Beeper volume
0000: invalid
0001: weak

0002: Strong
Write returns :

1	2	3	4	5	6	7	8
01	10	3102		0001		AEF5	
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3102		000 2		2B36	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**02**	**39**	**85**
Slaves	read	byte	integer		CRC-16	

B4-B5: 0002 Volume is strong

16.4.4 Comparator limit value 【3110-3113】

The comparator lower limit value uses 2 registers [3110] ~ [3111] , 4-byte floating point type.
limit value of the comparator uses 2 registers [311 2] ~ [311 3] , 4-byte floating point type.

> Comparator limit max: 10 G , out of range , will return error code 90
> The upper limit value is set to 60 AD 78 EC = 1E20 (decimal), which represents infinity, and the upper limit will not participate in the comparison operation.

The lower limit and upper limit can be set separately or at the same time.

a） Lower limit value setting

■ write

1	2	3	4	5	6	7	8	9	10	11	12	13
01	10	3110		0002		04	4B 18 96 80				52D1	
Station No	Write	register		Number of registers		byte	floating point number				CRC16	

B8-B11: Lower limit value , floating point format
4B 18 96 80 = 1E7 (10M decimal)
Write returns :

1	2	3	4	5	6	7	8
01	10	31	10	00	02	4E	F1
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3010		0002		CB32	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7	8	9
01	03	04	**4B**	**18**	**96**	**80**	**F7**	**CF**
Slaves	read	byte	floating point number				CRC-16	

B4-B7: 4B 18 96 80 = 1E7 (10M decimal)

b） Upper limit value setting

■ write

1	2	3	4	5	6	7	8	9	10	11	12	13
01	10	3112		0002		04	60 AD 78 EC				8687	
Station No	Write	register		Number of registers		byte	floating point number				CRC16	

B8-B11: Lower limit value , floating point format
60 AD 78 EC = 1E20 (decimal): Represents infinity.
Write returns :

1	2	3	4	5	6	7	8
01	10	31	12	00	02	EF	31
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3012		0002		CB32	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7	8	9
01	03	04	**60**	**AD**	**78**	**EC**	**56**	**5F**
Slaves	read	byte	floating point number				CRC-16	

B4-B7: 60 AD 78 EC = 1E20 (decimal): represents infinity.

c) Set the upper and lower limits at the same time:

■ Write (10 M~∞)

1	2	3	4	5	6	7	8 ~15	16	17
01	10	3110		0004		08	4B 18 96 80 60 AD 78 EC	8687	
Station No	Write	register		Number of registers		byte	lower and upper limit	CRC16	

B8-B11: 4 B 18 96 80 lower limit 10MΩ ,
B12-B15: 60 AD 78 EC upper limit value 1E20 : represents infinity.
Write returns :

1	2	3	4	5	6	7	8
01	10	31	10	00	04	CE	F3
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3010		0004		CB32	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4~7	8~11	12	13
01	03	04	**4B 18 96 80**	**60 AD 78 EC**	**F8**	**D1**
Slaves	read	byte	lower limit	Upper limit	CRC-16	

B4~B7: 4 B 18 96 80 lower limit value 10MΩ
B8~B11 : 60 AD 78 EC upper limit value 1E20 : represents infinity

16.5 File operations

As the isntrument setting is saved in file, if [Auto save]field in<File> page is not open, after all Modbus command is set,the data can not be saved in internal FlashRom in real time, which wil cause the data in the register stored during last instrument switch on be recoved as original file data.
User can use file operating register to save settings into current or designated file. Meanwhile,can transfer designated file data into setting register.

> **i** You can open the [Auto Save] field in the <File> page , and the parameters set each time will be automatically saved , and the file command can be ignored .

16.5.1 Save to current file 【4000】

Send the value 0001 to 4000 register, the instrument will perform the file write operation, and all settings will be saved to the current file.
This register cannot be read.

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	40	00	00	01	02	00	01	26	54
Slaves	Write	register		Number of registers		byte	data		CRC 16	

B8-B9 data values:
0001: Fixed value, other values will return error code 90
response:

1	2	3	4	5	6	7	8
01	10	40	00	00	01	14	09
Slaves	Write	register		Number of registers		CRC16	

16.5.2 Reload the current file 【4001】

Send the fixed value 0001 to 400 1 register, the instrument loads the current file data into the system.
This register cannot be read.

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	40	01	00	01	02	00	01	27	85

Slave _	Write	register	Number of registers	byte	data	CRC

B8-B9 data values:
0001: Fixed value, other values will return error code 90
response:

1	2	3	4	5	6	7	8
01	10	40	0 1	00	01	45	C9
Slaves	Write	register		Number of registers		CRC16	

16.5.3 Save to the specified file 【4002】

Send the file number to the 400 2 register, the instrument will execute the file write operation, all settings will be saved to the specified file, and the specified file will be used as the current file of the system.
This register cannot be read.

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	40	02	00	01	02	00	01	27	85
Slave _	Write	register		Number of registers		byte	data		CRC	

where the data values are:
B8~B9: file name 0000 ~0009
response:

1	2	3	4	5	6	7	8
01	10	40	0 2	00	01	45	C9
Slaves	Write	register		Number of registers		CRC16	

16.5.4 Load the specified file 【4003】

Send the file number to the 40 03 register, the instrument will load the settings of the specified file into the system, and the specified file will be used as the current file of the system.
This register cannot be read.

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	40	0 3	00	01	02	00	0 0	27	85
Slave _	Write	register		Number of registers		byte	data		CRC	

where the data values are:
B8~B9: file name 0000 ~0009
response:

1	2	3	4	5	6	7	8
01	10	40	0 3	00	01	E4	09
Slaves	Write	register		Number of registers		CRC16	

16.6 List scan

16.6.1 List scan trigger mode 【3120】

> The list scan trigger method does not have an automatic trigger option.

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	3120		0001		02	0002		0032	
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Trigger method
0001: Manual trigger
0002: Remote trigger
0003: External trigger
Write returns :

1	2	3	4	5	6	7	8
01	10	31	20	00	01	8B	3C
Slaves	Write	register		Number of		CRC16	

			registers	

■ Read :

1	2	3	4	5	6	7	8
01	03	3120		0001		8B3C	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slaves	read	byte	integer		CRC-16	

B4-B5: 0001 = Manual trigger

16.6.2 List scan method 【3121】

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	3121		0001		02	0001		41 E2	
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Trigger method
0000 : Sequential scan
0001 : Single step scan
Write returns :

1	2	3	4	5	6	7	8
01	10	31	twenty one	00	01	DA	FC
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3121		0001		DAFC	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slaves	read	byte	integer		CRC-16	

B4-B5: 0001 = single step scan

16.6.3 Discharge time setting 【3122-3223】

> The minimum value of the discharge timer : 0.01 s , the maximum value is 10 s , the timer cannot be turned off .
> timing time is out of range , error code 90 will be returned .

■ write

1	2	3	4	5	6	7	8	9	10	11	12	13
01	10	3122		0002		04	3D CC CC CD				70 F9	
Station No	Write	register		Number of registers		byte	floating point number				CRC16	

B8-B11: Discharge time 0.01~10 , floating point format .
3D CC CC CD = 0.1 (decimal)
Write returns :

1	2	3	4	5	6	7	8
01	10	31	twenty two	00	02	EF	3E
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3122		0002		6AFD	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7	8	9
01	03	04	**3D**	**CC**	**CC**	**CD**	**A3**	**35**
Slaves	read	byte	floating point number				CRC-16	

B4-B7: 3D CC CC CD = 0.1 (decimal)

16.6.4 Trigger scan 【3124】

Sending the fixed value 0001 to register 3124 will perform a scan.

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	3124		0001		02	0001		41 no	
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Trigger method
0001: Fixed value
Write returns :

1	2	3	4	5	6	7	8
01	10	31	24	00	01	4F	3E
Slaves	Write	register		Number of registers		CRC16	

16.6.5 List status setting 【3200】~【3204】

Each line of the list corresponds to one register:
3200: Line 1 Status
3201: Line 2 Status
3202: Line 3 Status
3203: Line 4 Status
3204: Line 5 Status

■ write row 1 status

1	2	3	4	5	6	7	8	9	10	11
01	10	32	00	00	01	02	00	01	47	53
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: List Status
0000: close
0001: open
Write returns :

1	2	3	4	5	6	7	8
01	10	32	00	00	01	0F	71
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3200		000 1		8AB2	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slaves	read	byte	integer		CRC-16	

B4-B5: 0001 open

16.6.6 List voltage setting 【3210】~【3214】

Each row of the list corresponds to a voltage register:
3210: row 1 voltage
3211: Line 2 Voltage
3212: row 3 voltage
3213: row 4 voltage
3214: row 5 voltage

■ Write Row 1 Voltage

1	2	3	4	5	6	7	8	9	10	11
01	10	32	10	00	01	02	00	0A	37	04
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: Voltage value , integer type 10 ~1000
000A = 10 (decimal)
Write returns :

1	2	3	4	5	6	7	8
01	10	32	10	00	01	0E	B4
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3210		000 1		8B77	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	**00**	**0A**	**38**	**43**
Slaves	read	byte	integer		CRC-16	

B4-B5: Voltage value , integer type 10 ~ 1000
000A = 10 (decimal)

16.6.7 List charging time setting 【3220-3221】~【3228-3229】

Each row of charging time corresponds to 2 voltage registers :
3220-3221 : Row 1 Charge Time
3222-3223 : Row 2 Charge Time
3224-3225 : Line 3 Charge Time
3226-3227 : Row 4 Charge Time
3228-3229 : Line 5 Charge Time

■ Write Line 1 Charge Time

1	2	3	4	5	6	7	8 9 10 11	12	13
01	10	32	20	00	02	04	3F 80 00 00	8B	77
Station No	Write	register		Number of registers		byte	data	CRC16	

B8-B 11 : charging time, floating point type, 0.1 ~99s
3F 80 00 00 = 1.0 (decimal)
Write returns :

1	2	3	4	5	6	7	8
01	10	32	20	00	02	4E	BA
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3220		000 1		CB79	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7	8	9
01	03	04	**3F**	**80**	**00**	**00**	**F7**	**CF**
Slaves	read	byte	floating point number				CRC-16	

B4-B7: Charging time, floating point type, 0.1 ~99s
3F 80 00 00 = 1.0 (decimal)

16.6.8 List measurement time setting 【3230-3231】~【3238-3239】

Each row of charging time corresponds to 2 voltage registers :
3230-3231 : Line 1 measurement time
3232-3233 : Line 2 measurement time
3234-3235 : Line 3 measurement time
3236-3237 : Line 4 measurement time
3238-3239 : Line 5 measurement time

■ Write line 1 measurement time

1	2	3	4	5	6	7	8 9 10 11	12	13
01	10	32	30	00	02	04	3F 00 00 00	B1	CE
Station No	Write	register		Number of registers		byte	data	CRC16	

B8-B 11 : Measurement time, floating point type, 0.1 ~99s
3F 00 00 00 = 0.5 (decimal)
Write returns :

1	2	3	4	5	6	7	8
01	10	32	30	00	02	0E	B4
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3230		000 2		CABC	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7	8	9
01	03	02	**3F**	**00**	**00**	**00**	**F6**	**27**
Slaves	read	byte	floating point number				CRC-16	

B4-B7: Measurement time, floating point type, 0.1 ~99s
3F 00 00 00 = 0.5 (decimal)

16.6.9 List comparator lower limit setting 【3240-3241】~【3248-3249】

Each row of charging time corresponds to 2 voltage registers :
3240-3241 : row 1 comparator lower limit
3242-3243 : Row 2 Comparator Low Limit
3244-3245 : Row 3 Comparator Lower Limit
3246-3247 : Row 4 Comparator Lower Limit
3248-3249 : Line 5 Comparator Lower Limit

■ Write Line 1 Comparator Lower Limit

1	2	3	4	5	6	7	8 9 10 11	12	13
01	10	32	40	00	02	04	49 74 24 00	F7	B8
Station No	Write	register		Number of registers		byte	data	CRC16	

B8-B 11 : Comparator lower limit , floating point type
49 74 24 00 = 1E6 (decimal)
Write returns :

1	2	3	4	5	6	7	8
01	10	32	40	00	02	4E	A4
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3240		000 2		CB67	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7	8	9
01	03	02	**49**	**74**	**twenty four**	**00**	**B7**	**75**
Slaves	read	byte	floating point number				CRC-16	

B4- B7 : Measurement time, floating point type, 0.1 ~99s
49 74 24 00 = 1E6 (decimal)

16.6.10 List comparator upper limit setting 【3250-3251】~【3258-3259】

Each row of charging time corresponds to 2 voltage registers :
3250-3251 : row 1 comparator upper limit
3252-3253 : Row 2 Comparator Upper Limit
3254-3255 : Line 3 Comparator Upper Limit
3256-3257 : Line 4 Comparator Upper Limit
3258-3259 : Line 5 Comparator Upper Limit

■ Write row 1 comparator cap

1	2	3	4	5	6	7	8 9 10 11	12	13
01	10	32	50	00	02	04	60 AD 78 EC	17	9E
Station No	Write	register		Number of registers		byte	data	CRC16	

B8-B 11 : Comparator upper limit , floating point type
60 AD 78 EC = 1E20 (decimal) : represents ∞
Write returns :

1	2	3	4	5	6	7	8
01	10	32	50	00	02	4F	61
Slaves	Write	register		Number of registers		CRC16	

■ Read :

1	2	3	4	5	6	7	8
01	03	3250		000 2		565F	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7	8	9
01	03	02	**60**	**AD**	**78**	**EC**	**B7**	**75**
Slaves	read	byte	floating point number				CRC-16	

B4- B7 : Measurement time, floating point type, 0.1 ~99s
60 AD 78 EC = 1E20 (decimal) : represents ∞

16.6.11 Read resistance measurement results 【2500】-【2509】

> resistance value is BF 80 00 00 (decimal -1), which means the current row is off.
> The resistance value is 00 00 00 00 (0 decimal), which means the data has not been updated.

a) Read the resistance measurement results of the specified row

2500 – 2501 Resistor value for row 1
2502 – 2503 Row 2 Resistor Values
2504 – 2505 Resistor values for row 3
2506 – 2507 Resistor values for row 4
2508 – 2509 Resistor values for row 5

Each line of measurement results uses 2 registers, formatted as floating point numbers.

■ Read :

1	2	3	4	5	6	7	8
01	03	2500		0002		565F	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7	8	9
01	03	02	**4B**	**25**	**61**	**DB**	**95**	**D7**
Slaves	read	byte	floating point number				CRC-16	

B4- B7 : Resistance measurement , floating point type
4 B 25 61 DB = 1.0838491E7 (decimal)

) Read all resistance measurements in the list

■ Read :

1	2	3	4	5	6	7	8
01	03	2500		000A		CEC1	
Slaves	read	register		Number of registers		check code	

Response :
Returned data:

1	2	3	0 4 0 5 0 6 0 7	0 8 0 9 10 11	12 13 14 15	16 17 18 19	20 21 22 23	24 35
01	03	14	4B 25 61 DB	4B 19 55 8B	4B 18 D6 A5	4B 18 52 1D	4B 18 33 AF	**73DA**
			②	②	③	④	⑤	
			5 sets of scan data					CRC

5 rows of data are
① 4B 25 61 DB = 1.0838491E7 (decimal)
② 4B 19 55 8B = 1.0048907E7 (decimal)
③ 4B 18 D6 A5 = 1.0016421E7 (decimal)
④ 4B 18 52 1D = 9.982493E6 (decimal)
⑤ 4 B 18 33 AF =9.974703E6 (decimal)

16.6.12 Read the voltage measurement result 【2510】-【2514】

a) Read the voltage measurement result of the specified row

2510 line 1 voltage value
251 1 row 2 voltage value
251 2 row 3 voltage value
251 3 row 4 voltage value
251 4 line 5 voltage value

Each line of measurement results uses 1 register, formatted as an integer .

■ Read :

1	2	3	4	5	6	7	8
01	03	2510		000 1		8EC3	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	00	0A	95	D7
Slaves	read		Voltage value		CRC16	

B4-B5 : voltage measurement , integer type

000A = 10 (decimal)

b) Read all voltage measurements in the list

■ Read :

1	2	3	4	5	6	7	8
01	03	2510		000 5		8F00	
Slaves	read	register		Number of registers		check code	

Response :

Returned data:

1	2	3	0 4 0 5	0 6 07	08 09	10 11	12 13	14 15
01	03	14	00 0A	00 19	00 32	00 63	00 C7	5A9F
			④	②	⑤	④	⑤	
			5 sets of scan data					CRC

5 rows of data are

① 00 0A = 10 (decimal)

② 00 19 = 25 (decimal)

③ 00 32 = 50 (decimal)

④ 00 63 = 99 (decimal)

⑤ 00 C7 = 199 (decimal)

16.6.13 Read the comparison result 【2520】-【2524】

b) Read the comparison result of the specified row

2520 Comparison result of row 1

2521 line 2 comparison results

2522 row 3 comparison results

2523 row 4 comparison results

2524 row 5 comparison results

Each line of measurement results uses 1 register, formatted as an integer .

■ Read :

1	2	3	4	5	6	7	8
01	03	2520		0001		8ECC	
Slaves	read	register		Number of registers		check code	

Response :

1	2	3	4	5	6	7
01	03	02	00	00	B8	44
Slaves	read		Voltage value		CRC16	

B4- B5 : comparison result, integer type

0000 = OK

0001 = NGLO

0002 = NGHI

0003 = OFF

b) Read all voltage measurements in the list

■ Read :

1	2	3	4	5	6	7	8
01	03	2520		0005		8F0F	
Slaves	read	register		Number of registers		check code	

Response :

Returned data:

1	2	3	0 4 0 5	0 6 07	08 09	10 11	12 13	14 15
01	03	14	00 00	00 00	00 00	00 01	00 01	B4B6
			⑥	②	⑦	④	⑤	
			5 sets of scan data					CRC

5 rows of data are

① 00 00 = OK
② 00 00 = OK
③ 00 00 = OK
④ 00 01 = NG LO
⑤ 00 01 = NG LO

16.7 System function

16.7.1 Key lock 【5002】

Write-only registers.

1	2	3	4	5	6	7	8	9	10	11
01	10	5002		0001		02	0000		F7B7	
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9:
0000 : Unlock
0001 : Locked
Write returns :

1	2	3	4	5	6	7	8
01	10	50	02	00	01	B1	09
Slaves	Write	register		Number of registers		CRC16	

16.7.2 Trigger 【5004】

Write-only registers. It is only valid under the <Measurement Display > page and the trigger mode is remote.

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	5004		0001		02	0001		3611	
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9: 0001 fixed value
Write returns :

1	2	3	4	5	6	7	8
01	10	50	04	00	01	51	08
Slaves	Write	register		Number of registers		CRC16	

16.7.3 Start/Stop Test 【5006】

■ write

1	2	3	4	5	6	7	8	9	10	11
01	10	5006		0001		02	0002		77F2	
Station No	Write	register		Number of registers		byte	data		CRC16	

B8-B9:
0000: stop
0002: start
Write returns :

1	2	3	4	5	6	7	8
01	10	50	06	00	01	F0	C8
Slaves	Write	register		Number of registers		CRC16	

17. Specification

You will learn the following:
technical indicators.
General Specifications .
Dimensions .

17.1 Technical indicators

The following data were measured under the following conditions:
Temperature condition: 23℃ ± 5℃
Humidity condition: ≤ 65% RH No condensation
Warm-up time: > 30 minutes
Calibration time: 12 months

17.1.1 Voltage accuracy

voltage source	10 V~1000V arbitrary setting
Voltage Source Accuracy	1 %±2V
Voltage measurement accuracy	2%±1V (CV, <1.8 mA)
Maximum charging current	≈1.8 mA
short circuit current	<2mA

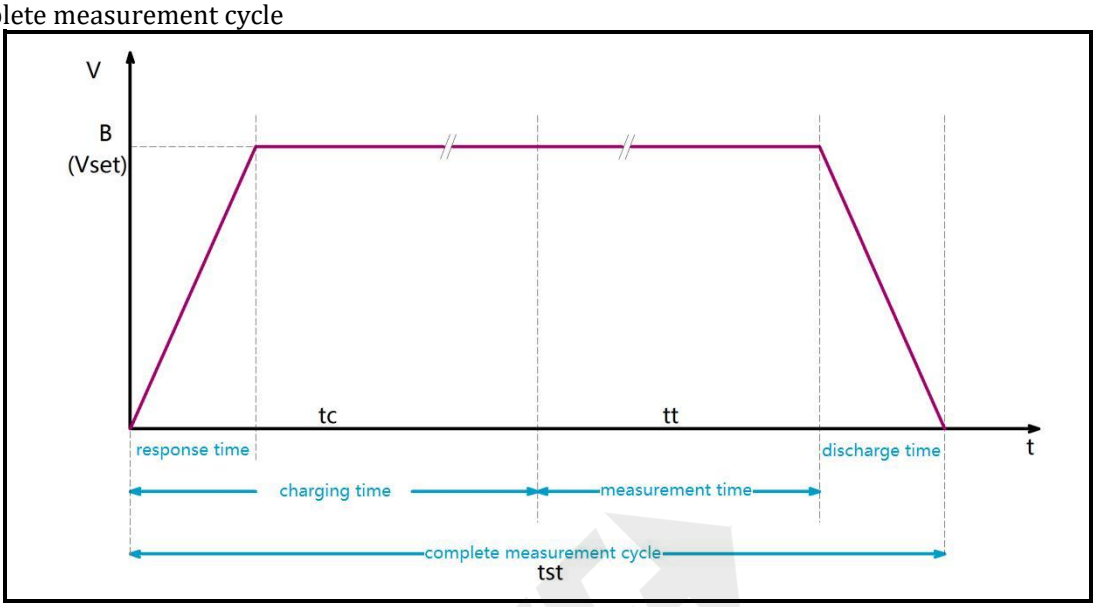
17.1.2 Resistance Measurement Accuracy

Rated voltage	quantity	Procedure	Display range	Resolution	Accuracy
10 V ≤ Vx < 100 V	1	2 MΩ	0.000MΩ ~ 4.000MΩ	0.001 MΩ	2%±5d
	2	20 MΩ	1.90MΩ ~ 40.00MΩ	0.01 MΩ	2%±5d
	3	200 MΩ	19.0MΩ ~ 400.0MΩ	0.1 MΩ	5%±5d
100 V ≤ Vx < 500 V	1	2 MΩ	0.000MΩ ~ 4.000MΩ	0.001 MΩ	2%±5d
	2	20 MΩ	1.90MΩ ~ 40.00MΩ	0.01 MΩ	2%±5d
	3	200 MΩ	19.0MΩ ~ 400.0MΩ	0.1 MΩ	5%±5d
	4	2 GΩ	190MΩ ~ 4.000GΩ	1 MΩ	5%±10d
500 V ≤ Vx < 1000 V	1	2 MΩ	0.000MΩ ~ 4.000MΩ	0.001 MΩ	2%±5d
	2	20 MΩ	1.90MΩ ~ 40.00MΩ	0.01 MΩ	2%±5d
	3	200 MΩ	19.0MΩ ~ 400.0MΩ	0.1 MΩ	2%±5d
	4	2 GΩ	190MΩ ~ 4.000GΩ	1 MΩ	5%±5d
			4.000GΩ ~ 9.99GΩ		25%±10d

17.2 Timer

17.2.1 Measurement period

Figure 17- 1 complete measurement cycle



When charging time is off:
Complete measurement cycle = response time + measurement time + discharge time
When charging time is on:
Complete measurement cycle = response time + charging time + measurement time + discharge time

17.2.2 charging time

Charging time range	0.1 s~999 .9 s (can be turned off)
show	Count down , enter the measurement state after the count reaches 0.0 s
Resolution	100 ms

17.2.3 Measurement time

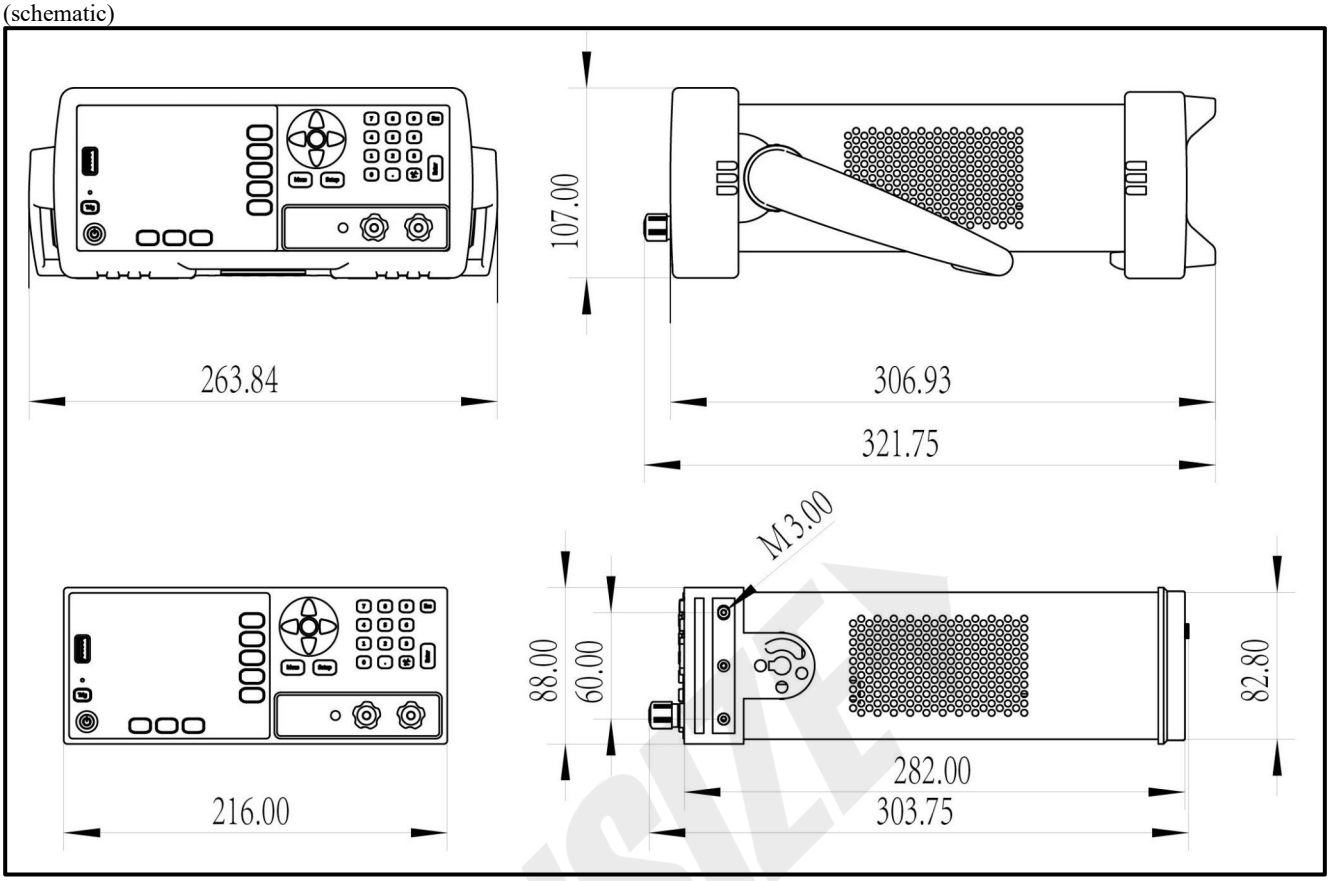
Measurement time range	0. 05s~999 . 9s (continuous measurement after shutdown)
show	Time off: count up, no longer count after reaching 999.9 s
	Time ON : When counting down, the measurement ends after 0.00 s, and the discharge state is entered
Resolution	10ms

17.3 General Specifications

Screen	3.5-inch TFT-LCD true color display.	
Measuring range	0.000M ~ 9.99GΩ	
Test speed	■ Auto- ranging method: (close for poor contact) Slow : 2 times/sec Medium speed : 13 times/sec Fast : 18 times/sec ■ Manual range mode: (close with poor contact) Slow: 2.2 times/sec Medium speed: 18 times /sec Fast: 29 times/sec ■ Auto range method: (open for poor contact) Slow : 1.9 times/sec Medium speed : 11 times/sec Fast : 15 times/sec ■ Manual range method: (open with poor contact) Slow: 2 times/sec Medium speed: 15 times /sec Fast: 22 times/sec	
Range method	Auto , Manual and Nominal Span	
list scan	quantity	5 groups
	discharge time	Unified setting : 10 ms~10s
	charging time	Independent setting: 100 ms~99s
	Measurement time	Independent setting: 100 ms~99s
	Comparators	Independent setting: 0 ~10GΩ
Short circuit detection	Way	Off/Auto/Preset time
	preset time	10ms ~ 1.00s
	Automatic detection	Fast : 100ms max Medium speed : max. 250 ms Slow : 500 ms max
	Short circuit output voltage	≈3 V
	action	set time: end measurement set time: enter the normal measurement cycle
Contact check	method	4 terminals
	show	CC.HL: Both HIGH and LOW have poor contact CC.H: Poor contact at HIGH end CC.L: Poor contact at LOW side
Comparators	set range	0 ~ 10GΩ
	Compare results	OK: qualified NG LO : Lower Super NG HI: Super League
	beep	OK/NG/OFF
	Beeper volume	weak/strong
Trigger method	Internal , manual, remote and external triggering	
file storage	Parameters are automatically or manually saved to memory, 10 files in internal memory and 10 files in USB files	
USB storage	Timed save or trigger save to USB disk , 20 files	
interface	Handler interface RS232 interface USB interface RS485 interface	
Protocol	SCPI/ ModBus (RTU)	
Environmental requirements	index	Temperature 18℃~28℃ Humidity <65% RH No condensation
	operate	Temperature 10℃~40℃ Humidity 10~85% RH
	store	Temperature 0℃~50℃ Humidity 10~90% RH
Power Requirements	Voltage	AC 100V ~ 240V, 50Hz/60Hz
	fuse	250 V /2A slow blow (installed inside the instrument)
	power	20 VA max
	weight	≈5kg

17.4 Dimensions

(schematic)



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