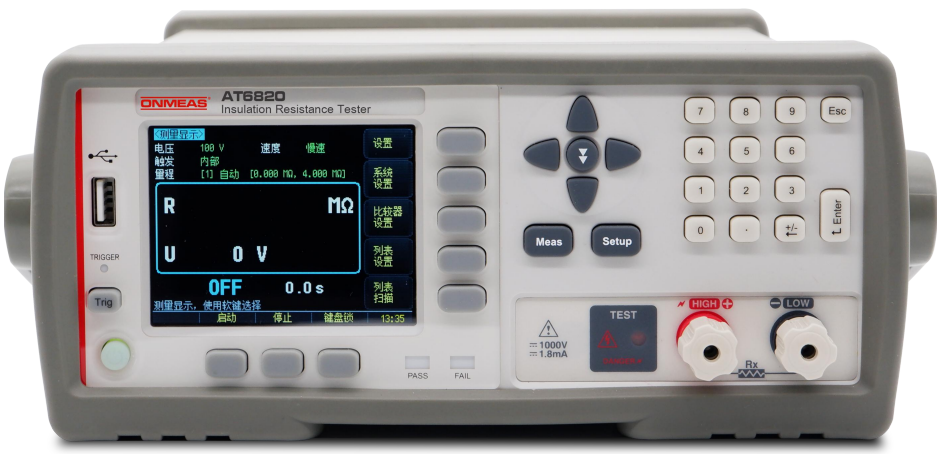
ONMEAS®

Rev.B1.0

AT6820

Insulation Resistance Meter



User's Guide

Scan QR code for operation video

Legend

	High-voltage danger symbol: may cause major personal injury.
	Prohibition: may cause personal injury or unrecoverable equipment damage.
	Warning and caution: may cause personal injury or unrecoverable equipment damage.
	Important information.
	Refer to the details.

Safety Notice

If any of the following abnormal conditions occurs, stop operation immediately and disconnect the power cord. Contact the Onmeas sales department immediately for repair. Otherwise, fire or a potential electric shock hazard to the operator may result.

- The instrument operates abnormally.
- The instrument produces abnormal noise, odor, smoke, or flashes during operation.
- The instrument generates high temperature or electric shock during operation.
- The power cord, power switch, or power socket is damaged.
- Foreign matter or liquid has entered the instrument.

i

Disclaimer

Please read the following safety information carefully before using the instrument. Onmeas assumes no liability for any personal injury or property damage caused by the user's failure to comply with the following provisions.

!

To prevent electric shock hazard, connect the power ground wire properly.

Do not use the instrument in an environment containing flammable or explosive gases, vapors, or excessive dust. Using any electronic equipment in such an environment poses a risk to personal safety.

Non-professional maintenance personnel must not open the instrument enclosure in an attempt to repair the instrument. Charge that has not been fully discharged may remain inside the instrument for some time after it is switched off, which may cause an electric shock hazard to persons.

If the instrument has been damaged, the hazards are unpredictable. Disconnect the power cord, do not use the instrument again, and do not attempt to repair it yourself.

If the instrument is not operating normally, the hazards are unpredictable. Disconnect the power cord, do not use the instrument again, and do not attempt to repair it yourself.

Using the instrument beyond the methods specified in this manual will disable its protective measures.

After the instrument starts testing, the test terminals carry high voltage which can cause personal injury. Never touch the exposed metal parts of the test leads with your body.

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1.Installation and Setup Guide

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

- Main Functions Packing List
- Power Requirements
- Operating Environment
- Cleaning

1.1 Packing List

Before formally using the instrument, please first:

1. Check the product appearance for damage, scratches or other defects;
2. Check the instrument accessories against the packing list for any missing items.

If there is damage or missing accessories, contact the Onmeas instrument sales department or your dealer immediately.

1.2 Power Requirements

The AT6820 can only be used under the following power conditions:

Voltage: 100~240VAC (1±10%)

Frequency: 50Hz/60Hz (1±10%)



Warning:

Risk of electric shock; connect the power ground properly

If the user replaces the power cord, make sure that the ground of the power cord is reliably connected.

1.3 Operating Environment

The AT6820 must be used under the following environmental conditions:

Temperature: 0°C~55°C,

Humidity: below 70%RH at 23°C

1.4 Cleaning

To prevent electric shock hazard, disconnect the power cord before cleaning.

Use a clean cloth dampened with a little clean water to clean the enclosure and panel.

Do not clean the inside of the instrument.

Warning:
Do not use solvents (alcohol or gasoline, etc.) to clean the instrument.

1.5 Instrument Handle

The instrument handle is adjustable. Hold both sides of the handle with both hands, pull it gently outward, and then rotate the handle. The handle can be adjusted to four positions, as shown in the figure below:

Figure 1- 1Instrument Handle (Schematic; the panel drawing differs from the actual unit)



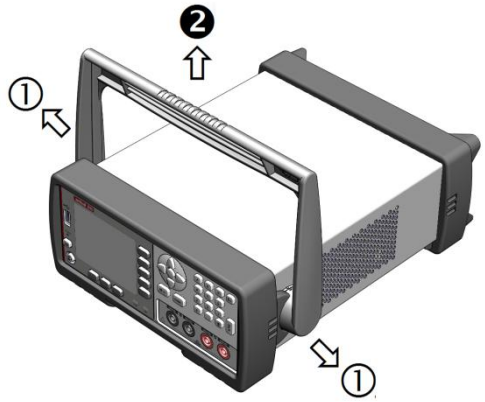
Position 1 [Hold both sides of the handle with both hands and pull gently outward until it rotates freely, then switch to viewing position 2]



Position 2 [Hold both sides of the handle with both hands and pull gently outward until it rotates freely, then switch to the carrying position]



Carrying position



Handle removal position.[Pull ① to both sides and remove the handle upward ②.]

Note! When rotating the handle, pull it apart to both sides until it can rotate,**Do Notdo not force-rotate the handle while**the snap is caught.

Otherwise the handle snap may be damaged.

2. Overview

In this chapter you will learn the following:

- Introduction
- Main Features

2.1 Introduction

Thank you for purchasing the AT6820 insulation resistance tester.

The AT6820 insulation resistance tester is a micro bench-top instrument for fully automatic real-time testing, controlled by a high-performance ARM microprocessor. With a full-color LCD display, a full numeric keypad and the Onmeas instrument operating system, the display is clearer and operation more convenient.

The instrument has a built-in 1V~1000V voltage source with 1V resolution, freely programmable output;

The instrument provides 2% insulation resistance accuracy with a measurement range of up to 1TΩ, 9,999 readings and a measurement speed of up to 30 readings/second.

The instrument can store 10 groups of settings internally, and the external USB disk can store another 10 groups, convenient for calling different specifications.

The instrument has a built-in comparator, and the bin comparison results can be output through the Handler interface.

The instrument features a list sweep function that can be programmed with 5 different voltages for insulation resistance sweep measurement, and outputs the 5 comparison results through HANDLER.

The instrument comes standard with a USB-232 interface and an RS-232 interface, and communicates with computers, PLCs or WINCE devices using SCPI (Standard Commands for Programmable Instruments) and the Modbus RTU protocol, efficiently accomplishing remote control and data acquisition.

The instrument comes standard with an RS-485 interface supporting the Modbus RTU protocol, making communication with PLCs very convenient.



Reference: for the technical specifications see the Specifications chapter.

2.2 Main Features

2.2.1 Range

Tested in 4 ranges,
Auto, manual and nominal ranging.
Nominal range (a new term defined by Onmeas): the instrument automatically selects the optimal range according to the nominal value.

2.2.2 Test Speed

The instrument provides three speed settings: slow, medium and fast.
■ Auto ranging mode: (contact check off)
Slow: 2 readings/second
Medium: 13 readings/second
Fast: 18 readings/second
■ Manual ranging mode: (contact check off)
Slow: 2.2 readings/second
Medium: 18 readings/second
Fast: 29 readings/second
■ Auto ranging mode: (contact check on)
Slow: 1.9 readings/second
Medium: 11 readings/second
Fast: 15 readings/second
■ Manual ranging mode: (contact check on)
Slow: 2 readings/second
Medium: 15 readings/second
Fast: 22 readings/second

2.2.3 Trigger Mode

Internal trigger: internally automatically triggers tests in cycles
Manual trigger: use the TRIG key to trigger one measurement
Remote trigger: use a remote command to trigger one measurement
External trigger: Handler trigger.
Internal semi-auto trigger: when 4-terminal measurement is used and the low terminal contact is good, starts one measurement

2.2.4 Basic Accuracy

Voltage source accuracy: 1% of setting ±2V
Monitor voltage accuracy: 2%±1V (@output current <1.8mA)
Slow: 2%
Medium: 2%
Fast: 5%



Reference: for the detailed accuracy see the Technical Specifications chapter.

2.2.5 Calibration Function

Full-range open zeroing: eliminates the influence of stray impedance.

2.2.6 Comparator Function (Sorting Function)

The AT6820 has a sorting function.
Measurement results include NG-HI, NG-LO and OK, and these results can be output to external devices through the HANDLER interface.
In addition, the 5 list sweep results can also be output independently to external devices through HANDLER.

2.2.7 System Settings

1. Keyboard lock function
2. Administrator and user accounts, and a password can be set for the administrator
3. The beeper has two volume options, high and low.

2.2.8 Interfaces

RS-232 interface:
Supports a baud rate of up to 115200bps, compatible with the SCPI protocol and the Modbus RTU protocol.
USB-232 interface:
Virtualizes a serial port on the computer, compatible with the SCPI protocol and the Modbus RTU protocol.
RS-485 interface:
Supports a baud rate of up to 115200bps, using the Modbus RTU communication protocol.
Handler interface
Independently isolated power supply; the user does not need to provide an external power source.
Input/output ports with full optocoupler isolation and built-in pull-up resistors.
Inputs: trigger signal; outputs: OK/NG-HI/NG-LO, list sweep outputs (NG1~NG5); measurement complete signal (EOM).

3. Getting Started

In this chapter you will learn the following:

- Getting to know the front panel — includes an introduction to the keys and test terminals.
- Rear panel — introduces the power supply and interface information.
- Power-on startup — includes the power-on self-test process, instrument defaults, and instrument warm-up time.

3.1 Getting to Know the Front Panel

3.1.1 Front Panel Description

Figure 3- 1Front Panel

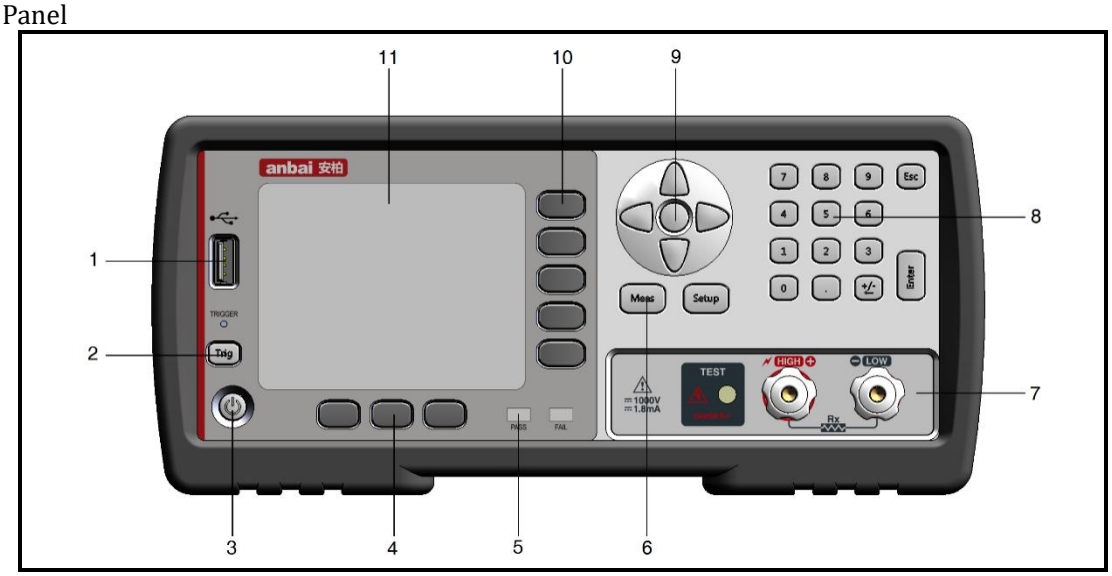
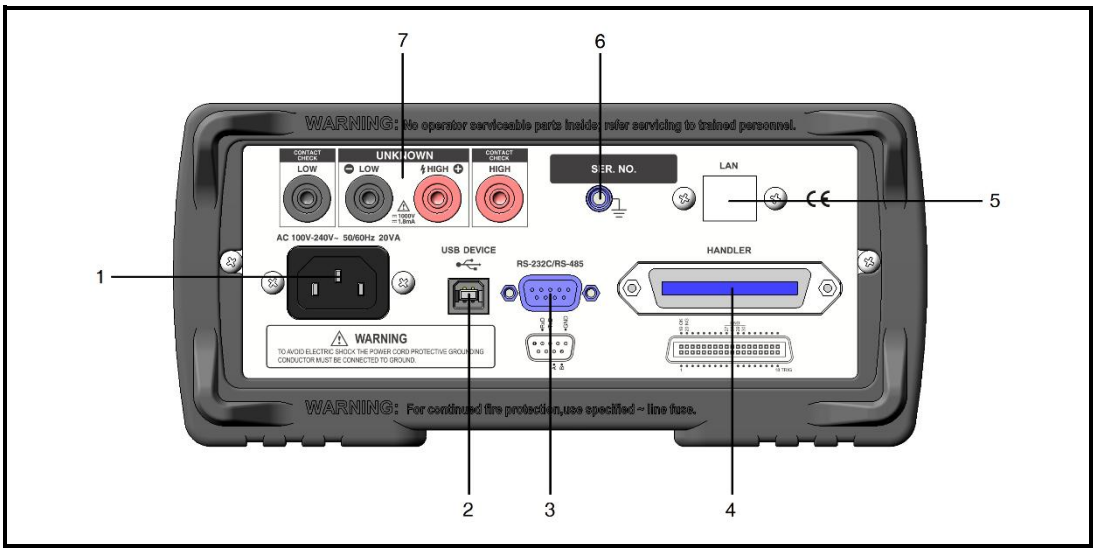


Table 3- 1Front Panel Function Description

No.	Function
1	USB disk interface
2	Manual trigger key and trigger indicator
3	Power switch: orange indicator means powered off, green indicator means powered on
4	Bottom soft keys
5	PASS/FAIL indicators
6	Main function keys: Meas and Setup
7	Test terminals
8	Numeric keypad
9	Cursor keys
10	Side soft keys
11	LCD display window

3.2 Getting to 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 (optional)
6. Grounding post (GND).
7. Rear test terminals and contact check terminals.

3.3 Power-On Startup

3.3.1 Powering On

The key marked “+” at the lower left of the panel is the power switch.
Orange indicator: powered off
Green indicator: powered on

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> Page

4.1 <Measure Display> Page

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

<Measure Display>page mainly highlights the measurement results, and shows the current sorting result in small characters.

On this page, 6 commonly used functions can be set. They include:

Voltage – output voltage preset

Speed – test speed setting

Trigger – trigger mode setting

Range – test range setting

Figure 4- 1 <Measure Display> Page

- Discharge state



- Test status



4.1.1 [Voltage] Setting

SCPI command: VOLTage <float>

The instrument has a built-in 1V~1000V voltage source.

Voltage source accuracy: 1% of setting ±2V (@10V~1000V)

Voltmeter accuracy: 2% of setting ±1V (@output current <1.8mA)

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

■ Steps for setting 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 settings main page;
2. Use the cursor keys to select the [Voltage] field;
3. Use the soft keys to directly select a preset voltage, or enter the desired voltage with the numeric keypad.

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

4.1.2 Test [Speed]

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

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

The instrument provides three speed settings: slow, medium and fast.

■ Auto ranging mode: (contact check off)

Slow: 2 readings/second

Medium: 13 readings/second

Fast: 18 readings/second

■ Manual ranging mode: (contact check off)

Slow: 2.2 readings/second

Medium: 18 readings/second

Fast: 29 readings/second

■ Auto ranging mode: (contact check on)

Slow: 1.9 readings/second

Medium: 11 readings/second

Fast: 15 readings/second

■ Manual ranging mode: (contact check on)

Slow: 2 readings/second

Medium: 15 readings/second

Fast: 22 readings/second

■ Steps for setting the test speed:

1. Press the [Meas] key to enter the measurement page or [Setup] to enter the settings page;
2. Use the cursor keys to select the [Speed] field;
3. Use the soft keys to select

Soft keys	Function
Slow	
Medium	
Fast	

4.1.3 [Trigger] Mode

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

The instrument has 4 trigger modes:

Trigger Mode	Description
Internal	Continuous testing: the trigger signal is generated internally by the instrument, which tests continuously at a fixed period
Manual	Each press of the front-panel [Trig] key executes one measurement cycle; at other times the instrument is in a waiting state.
Remote	Trigger testing with host commands. In remote triggering, the instrument executes one measurement cycle after receiving the trigger command; at other times it is in a waiting state.
External	IO triggering: upon receiving a rising-edge pulse from the Handler interface on the rear panel, the instrument executes one measurement cycle. At other times it is in a waiting state. Refer to the Handler interface.
Internal semi-auto	Same as internal triggering: the trigger signal is generated internally by the instrument, which tests continuously at a fixed period The difference: besides starting the measurement with the Start key, it can also be started by connecting the rear-panel poor-contact low terminal.

i

Note:

Internal semi-auto triggering requires a 4-terminal Kelvin test line; recommended model: ATL527 4-terminal Kelvin cable.

Internal semi-auto measurement steps:

1. Set the test time on the settings page, e.g. 2s;
2. The measurement is in the stopped state;
3. Keep the low end of the Kelvin test line (black clip) open;
4. Contact the positive terminal to the device under test first;
5. Then contact the negative clip to the device under test at the same time;
6. The instrument starts measuring and waits for the test timer to finish;
7. Automatic discharge; the measurement ends.

■ Steps for setting the trigger mode:

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

3 Use the soft keys to select the trigger mode.

Soft keys	Function
Internal	Internal trigger
Manual	Manual trigger
Remote	Remote trigger
External	External trigger
Internal semi-auto	Internal semi-auto trigger

4.1.4 Test [Range]

SCPI command:

FUNCtion:RANGe {<Range No.>,min,max}

FUNCtion:RANGe:MODE {AUTO,HOLD,NOMinal}

The AT6820 has multiple ranges according to different voltages; the variation range of each range is as follows:

Table 4- 1Range Variation

Voltage range: <100V

Range No.	Range	Measuring range	Up range	Down range
1	2MΩ	0.000MΩ~4.000MΩ	↓ 2MΩ ↓ 20MΩΩ ↓	↑ 1.8MΩ ↑ 18MΩΩ ↑
2	20MΩΩ	1.90MΩ~40.00MΩ		
3	200MΩ	19.0MΩ~400.0GΩ		

Voltage range: <500V

Range No.	Range	Measuring range	Up range	Down range
1	2MΩ	0.000MΩ~4.000MΩ	↓ 2MΩ ↓ 20MΩΩ ↓ 200MΩ ↓	↑ 1.8MΩ ↑ 18MΩΩ ↑ 180MΩ ↑
2	20MΩΩ	1.90MΩ~40.00MΩ		
3	200MΩ	19.0MΩ~400.0MΩ		
4	2000MΩ	190MΩ~400GΩ		

Voltage range: ≥500V

Range No.	Range	Measuring range	Up range	Down range
1	2MΩ	0.000MΩ~4.000MΩ	↓ 2MΩ ↓ 20MΩΩ ↓ 200MΩ ↓	↑ 1.8MΩ ↑ 18MΩΩ ↑ 180MΩ ↑
2	20MΩΩ	1.90MΩ~40.00MΩ		
3	200MΩ	19.0MΩ~400.0MΩ		

4	2000MΩ	190MΩ~1TΩ		

There are 3 ranging modes:

Table 4- 2 Test Range Description

Range mode	Description	Advantage	Disadvantage
Auto	The instrument automatically selects the optimum test range according to the impedance value, and the range number in the range field is set automatically.	No user intervention is required	Auto ranging needs to predict the range, so the test speed is lower than in manual ranging mode.
Manual	The instrument always uses the range specified by the user for testing	The test speed is the fastest.	The user needs to participate in range selection
Nominal	Nominal ranging mode: the instrument selects the best range according to the comparator lower limit	The best mode for sorting tests. The speed is the fastest.	Only suitable for sorting tests.

■ Steps for setting the range:

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

Soft keys	Function
Auto	The instrument will select the range automatically
Manual	The instrument is locked on the current range
Nominal	The instrument will select the optimum range according to the nominal value
Increase +	Increases the range number, and the range is changed to lock
Decrease -	Decreases the range number, and the range is changed to lock

Note:

In auto ranging, the instrument performs range prediction in every measurement cycle, so the test speed is slightly slower than with a locked range, especially at medium and fast speeds. Moreover, frequent range changes during automatic measurement slow down the response.

Usually, auto ranging is not suitable when the instrument is used for sorting measurement. Users performing sorting should select the nominal range mode.

4.2 Measurement Result Display

4.2.1 Measurement Result Area Description

Figure 4- 2 Measurement Result Display

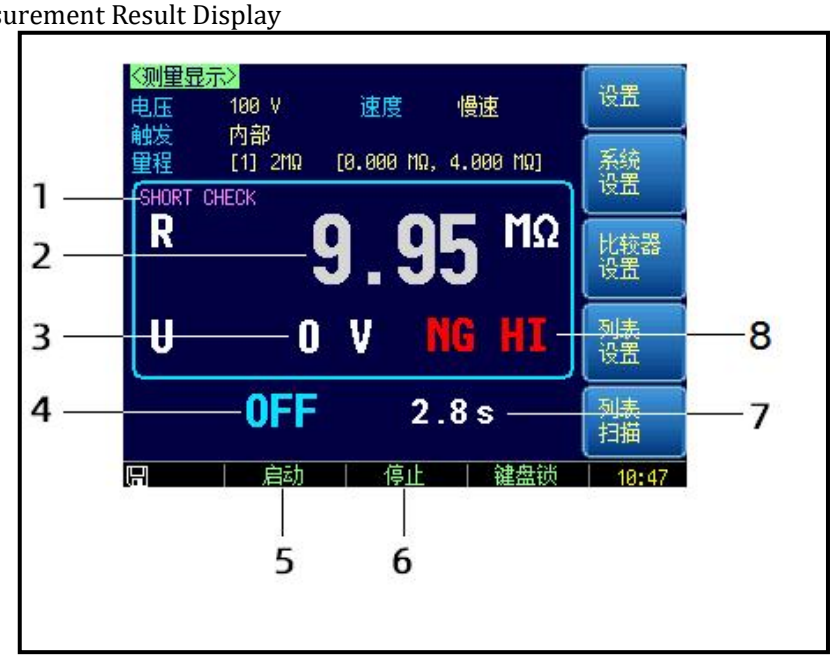
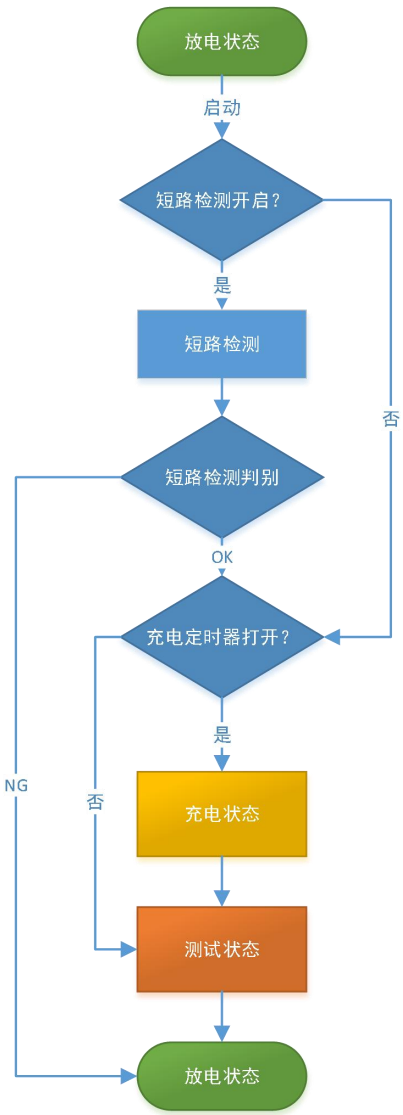


Table 4- 3 Measurement Result Area Description

No.	Description
1	Short-circuit check display. Valid and shown only when the short-circuit check is enabled on the [Settings] page.
2	Insulation resistance display. Shown in white during measurement and in gray in the discharge state.
3	Voltmeter display. Monitors the voltage across the terminals under test at all times.
4	Status display. The instrument has 3 measurement states: discharge state (OFF) - charge state (CHAR) - test state (CHAR).
5	Start test key. After pressing the [Start] key, the HIGH⊕ terminal of the device under test outputs voltage, and the instrument enters the charging or testing state.
6	Stop test key. After pressing the [Stop] key, the HIGH⊕ terminal of the device under test
7	Charge or test timer display.
8	Comparator status display. OK: pass NG HI: fail, over upper limit NG LO: fail, under lower limit CNG: poor contact CNG H: poor contact at the HIGH⊕ terminal CNG L: poor contact at the LOW⊖ terminal

4.2.2 Working States

Figure 4- 3 State Transitions



- Discharge state: the status shows OFF and the test indicator is off.
  In this state the discharge circuit of the terminals under test is always connected, so the charge stored in a device connected across the terminals is discharged internally to 0V.
- Charge state: the status shows CHAR, the test indicator is on, and the HIGH⊕ terminal under test outputs voltage.
  Set the [Charge Timer] time on the <Settings page>, press the Start key and the instrument enters the charging state.
  In the charging state, the device under test is first fast-charged with a constant current of 1.8mA until the voltage reaches the preset value, then switched to constant-voltage testing. After the charge timer finishes, the instrument automatically switches to the testing state.

> *i* For larger battery packs, appropriately increasing the charge time helps fast measurement, especially for fast sorting in automated equipment.

- Test state: the status shows TEST, the test indicator is on, and the HIGH⊕ terminal under test outputs voltage.

- If [Test Timer] is set to off on the <Settings page>, the instrument stays in the testing state until the Stop key is pressed or an external HANDLER discharge signal is applied.
  If [Test Timer] is preset with a test time on the <Settings page>, the instrument measures for that time and returns from the testing state to the discharge state.

5. <Setup> Settings Page

All settings related to measurement are performed on the <Setup> page.
Just press the [Setup] key and the instrument enters the settings main page.

5.1 Measurement Settings

On the <Settings> page, the instrument does not perform testing.

Figure 5- 1 <Settings> Page



For voltage, speed, trigger and range settings refer to the related sections of the measurement display page: 4.1 <Measurement Display> Page

5.1.1 [Contact Check] Switch

Since the insulation resistance under test can exceed the measurement range of the instrument, the measured value shows an overrange overflow; then it is impossible to distinguish whether the overflow comes from the high insulation resistance of the device itself or from poor contact of the device, causing misjudgment.
To solve this, the instrument can use two extra terminals to separately check whether the HIGH and LOW ends are in poor contact.

During charging and testing, a contact check is performed first. The contact check runs once at the start and once at the end of each measurement cycle; if poor contact occurs in either, the current measurement terminates and returns to the discharge state.

The contact check adds extra measurement time:
■ Auto ranging mode: (contact check on)
Slow: 1.9 readings/second
Medium: 11 readings/second
Fast: 15 readings/second

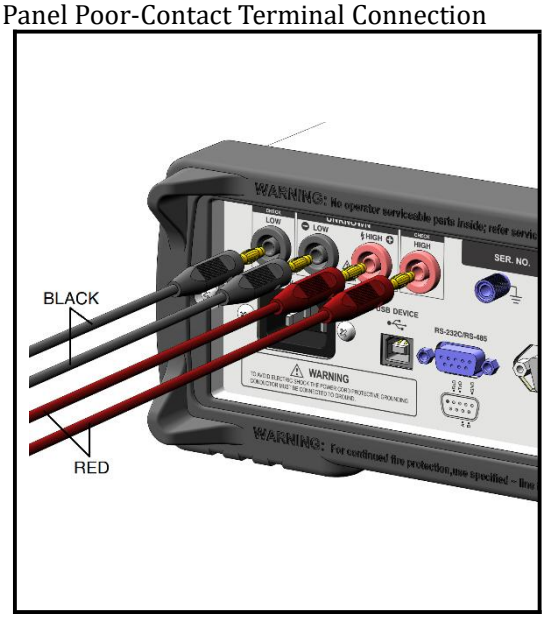
■ Manual ranging mode: (contact check on)

Slow: 2 readings/second

Medium: 15 readings/second

Fast: 22 readings/second

Figure 5- 2 Rear Panel Poor-Contact Terminal Connection





Every measurement first performs a poor-contact check; if poor contact is detected, a CNG flag is shown in the comparator status bar.

Once poor contact is detected, the instrument outputs a low level on the CNG signal of the HANDLER interface, and the NG signal also outputs low.

i With the contact check on, the measurement time becomes longer. Refer to the Test Speed section.

■ Turning on the contact check:

1. In the discharge state, press the [Setup] key to enter the settings page;
2. Use the cursor keys to select the [Contact Check] field;
3. Use the soft keys to select

Soft keys	Function
Off	
On	

With the contact check on, a test-lead poor-contact check runs first during measurement; if any end is disconnected, an open circuit is displayed and the instrument enters the discharge state.

1. When both HIGH/LOW are open, CC.HL is displayed

Figure 5- 3 All Test Leads in Poor Contact



Check the test leads of HIGH (+) and LOW (-).

2. When the HIGH (+) terminal is open, CC.H is displayed

Figure 5- 4 Poor Contact of the HIGH (+) Test Lead



Check the test lead of the HIGH (+) terminal.

3. When the LOW (-) terminal is open, CC.L is displayed

Figure 5- 5 Poor Contact of the LOW (-) Test Lead



Check the test lead of the LOW (-) terminal.

5.1.2 [Charge Timer]

The instrument has a charging function that allows charging the device under test with a constant current of 1.8mA before it reaches the preset voltage, helping capacitive loads charge quickly and improving response speed. If automated equipment shows a high misjudgment

rate (under lower limit) during measurement, appropriately increasing the charge timer can improve it.

Charge timer minimum: 0.1s, maximum: 999s

■ Setting the charge timer:

1. In the discharge state, press the [Setup] key to enter the settings page;
2. Use the cursor keys to select the [Charge Timer] field;
3. Enter the desired charge time directly with the numeric keypad (max. 999s), in ms and s.
   Or use the soft keys to select:

Soft keys	Function
Off	Charging function off
200 ms	
500 ms	
1s	
2s	

5.1.3 [Test Timer]

If the test timer is set, the instrument stops measuring and returns to the discharge state when the timer counts down to 0s.

If the test timer is set to off, the instrument stays in the measuring state until the Stop key is pressed, a HANDLER STOP signal level is received, or a communication command is received; then it stops measuring and returns to the discharge state. With the test timer off, the timer on the <Measurement Display> page counts up and stops updating after reaching 999.9s.

Test timer minimum: 0.05s, maximum: 999s

■ Setting the test timer:

1. In the discharge state, press the [Setup] key to enter the settings page;
2. Use the cursor keys to select the [Test Timer] field;
3. Enter the desired test time directly with the numeric keypad (max. 999.9s), in ms and s.
   Or use the soft keys to select:

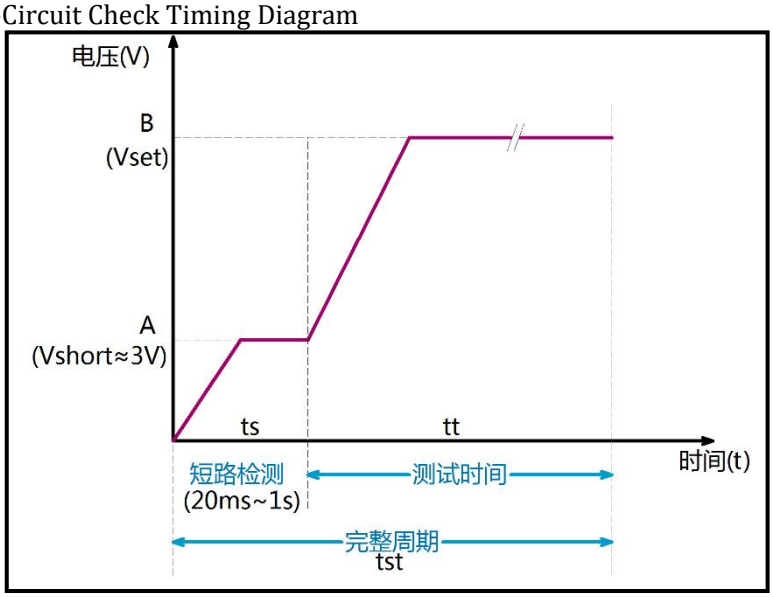
Soft keys	Function
Off	Charging function off
200 ms	
500 ms	
1s	
2s	

5.1.4 [Short-Circuit Check]

Due to manufacturing process limitations, the device under test may contain filamentary impurities; some of these may be fused by the output high voltage and remain in the product, yet the product would be judged insulation-pass. To avoid such misjudgment, before

outputting high voltage the short-circuit check can be used: a lower test voltage (about 3V) performs a pre-test, and normal high-voltage measurement proceeds only after confirming no short.

Figure 5- 6 Short-Circuit Check Timing Diagram



In the figure:

Point A: short-circuit check output voltage, fluctuating around 3V (2V~4V).

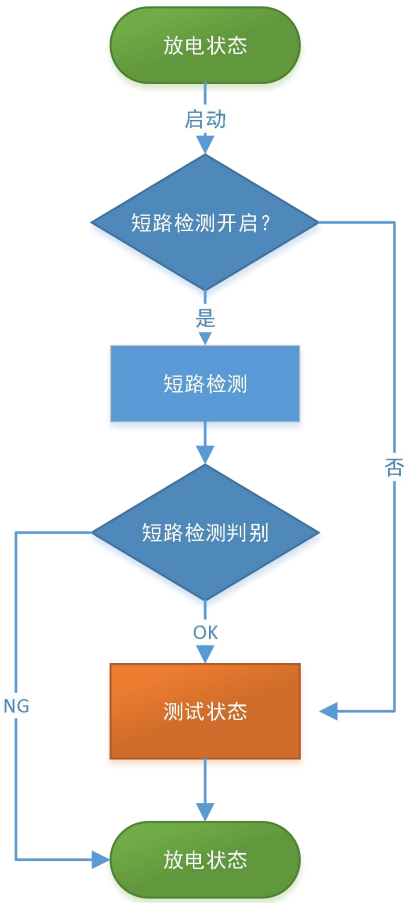
Point B: set voltage.

ts: short-circuit check time

tt: measurement time (short-circuit check time + test time)

tst: complete cycle (=ts+tt)

Figure 5- 7 Short-Circuit Check Flowchart



- Short-circuit check time set to [Auto]

  When the short-circuit check time is uncertain, set the check timer to [Auto]. The automatic check time differs with the test speed:

  Slow: 0.5s

  Medium: 0.25s

  Fast: 0.1s

  For example, at slow speed the instrument uses a short-circuit check time of up to 0.5s to judge whether the device is shorted; if not shorted, the short-circuit check time is displayed and it immediately enters the testing state. If a short persists throughout 0.5s, the instrument ends the current measurement and returns to the discharge state.

> For automated equipment testing, setting the short-circuit check time to [Auto] is not recommended, because even at fast speed a complete measurement cycle would take an extra 0.1s.

- Manually Entering the Short-Circuit Check Time

  For devices of the same batch, the short-circuit check time is usually similar; we can set the check time manually to achieve the shortest check time.

> Short-circuit timer minimum: 10ms, maximum: 1s

Usually the short-circuit check time cannot be known exactly in advance; it can be obtained

easily as follows:

1. Set the short-circuit check timer to [Auto];
2. Select [Internal] for the trigger;
3. Connect the device under test in the discharge state;
4. Starting a Test

Figure 5- 8 Short-Circuit Check Flowchart



5. After the short-circuit check completes, the check time is displayed, e.g. 6.1ms in the figure above. Test multiple products to obtain a maximum time,add an appropriate margin and enter it into the short-circuit check timer.

■ Setting the short-circuit check timer:

1. In the discharge state, press the [Setup] key to enter the settings page;
2. Use the cursor keys to select the [Short-Circuit Check] field;
3. Enter the desired test time directly with the numeric keypad (max. 999.9s), in ms and s.
   or use the soft keys to select

Soft keys	Function
Off	Short-circuit check off
Auto	Checks with a maximum time of 500ms.
100 ms	
200 ms	
500 ms	

5.1.5 Trigger [Delay]

In external trigger mode, a trigger delay is sometimes needed to synchronize with external equipment and ensure reliable measurement.

The trigger delay is the time from when the instrument receives the trigger signal to when measurement starts.

i Trigger delay minimum: 1ms, maximum: 10s

■ Steps for entering the trigger delay:

1. Press [Setup] to enter the Setup page;
2. Use the cursor keys to select the [Delay] field;
3. Enter the time with the numeric keypad, in ms and s. For example: enter100 ms
   Or select with the soft keys:

Soft keys	Function

Off	The trigger delay function is disabled.
50 ms	
100 ms	
200 ms	
500 ms	

5.1.6 [Source Resistance] Selection

The instrument has 2 built-in current-limiting resistors: normal and current-limited. When set to normal, the voltage source can provide sufficient current for charging and measurement, effectively improving measurement efficiency.

For devices sensitive to charging current, such as crystal oscillators and clock oscillators, the source resistance must be set to current-limited to prevent high voltage from damaging the device. For power battery measurement, current-limited mode is also usually required.

The source resistance in current-limited mode is 50kΩ.

- Steps for selecting the current-limiting resistor:

1. Press [Setup] to enter the Setup page;
2. Use the cursor keys to select the [Source Resistance] field;
3. Select with the soft keys:

Soft keys	Function
Normal	
Current-limited	For current-sensitive devices, enable current-limited mode

6. Comparator Settings

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

To make full use of the comparator, the AT6820 also has a built-in Handler interface to output these bin comparison results to PLCs or industrial computers.

On the <Comparator> page, you can set the following:

- Comparator switch – turn the comparator on/off
- Beeper settings – OK/NG/off beeper function
- Beeper volume setting – volume level setting
- Upper/Lower Limit Settings

Figure 6- 1 <Comparator Settings> Page



6.1 Comparator Settings

6.1.1 [Comparator] Switch

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

- Steps for turning the comparator on or off:

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

Soft keys	Function
Off	Turns off the comparator
On	Enabling the Comparator

6.1.2 [Beeper] Settings

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

The instrument can be set to a PASS beep or a FAIL beep.

■ Setting the beeper:

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

Soft keys	Function
Off	Beeper off
PASS	PASS beep
FAIL	FAIL option

■ Beeper workflow

When [Test Time] on the <Settings> page is off, in the testing state the beeper sounds continuously until the OK/NG state switches or the discharge key is pressed.

When [Test Time] on the <Settings> page is set to a time, the beeper sounds only once when the test completes, and does not sound during testing. Specifically,

a long 0.2s beep means pass.

two short beeps mean fail.

> *i* In continuous measurement, the beeper does not sound when the measured value shows overrange or open circuit.

6.1.3 [Beeper Volume] Setting

SCPI command: COMParator:TONE {LOUD,WEAK}

The beeper volume can be set to loud or weak.

■ Volume Setting:

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

Soft keys	Function
Loud	
Weak	

6.1.4 [Lower Limit] Setting

SCPI command: COMParator:LOWer <float>

■ Entering the lower limit

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

6.1.5 [Upper Limit] Setting

SCPI command: COMParator:UPper <float>

The comparator upper limit can be set to infinity (∞), in which case the upper limit does not participate in calculation and comparison.

■ Setting and Entering the Upper Limit

1 Enter the <Comparator> page

2 Use the cursor keys to select the [Upper Limit] field;

3a Enter the data and select the unit with the side soft keys, for example:1 GΩ

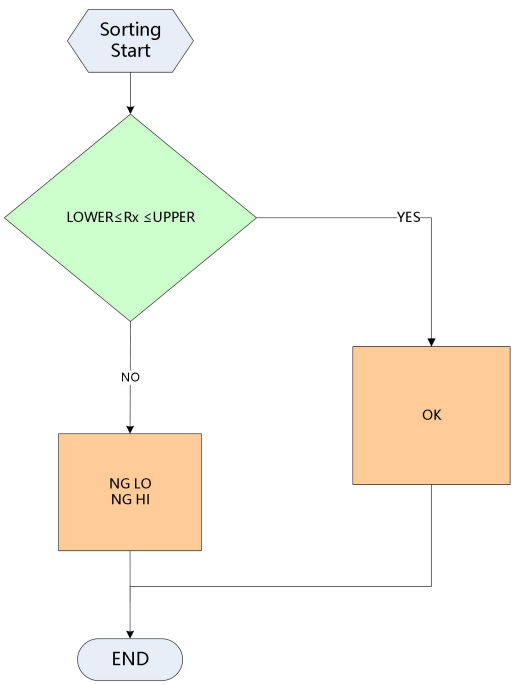
3b Or select ∞ (infinity) with the side soft keys to turn the upper limit off.

> Once the comparator upper limit is set to ∞ (infinity), the comparator judges only the lower limit: above it shows pass (OK), below it shows (NG LO).

6.2 How the Comparator Works

6.2.1 Sorting Process

Figure 6- 2 Sorting Process



7. List Sweep

The AT6820 has a list sweep function that can sweep-measure 5 list groups.
Before list sweep, list settings must be made first.
On the <Measurement Display> page, press the soft key

7.1 <List Settings> Page

The <List Settings> page sets the 5 list rows separately, including voltage, charge time, test time and comparator upper/lower limits.
The discharge time of each row is set uniformly.

Figure 7- 1 <List Settings> Page



7.1.1 [Trigger] Settings

List sweep trigger settings include 3 trigger modes:

Trigger Mode	Description
Manual	Each press of the front-panel [Trig] key executes one sweep.
Remote	Trigger testing with host commands. In remote triggering, the instrument executes one sweep after receiving the trigger command.
External	IO triggering: upon receiving a rising-edge pulse from the Handler interface on the rear panel, the instrument executes one sweep.

List sweep does not support internal triggering.

Triggering also depends on the sweep mode:
When sweep [Mode] is set to [Sequential], one trigger sweeps the complete list once;

When sweep [Mode] is set to [Single-step], one trigger measures only the current row.

- Steps for setting the trigger mode:

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

Soft keys	Function
Manual	Manual trigger
Remote	Remote trigger
External	External trigger

7.1.2 Sweep [Mode]

Triggering also depends on the sweep mode:

When sweep [Mode] is set to [Sequential], one trigger sweeps the complete list once;

When sweep [Mode] is set to [Single-step], one trigger measures only the current row.

- Steps for setting the sweep mode:

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

Soft keys	Function
Sequential	Sequential list sweep: one trigger completes the measurement of all rows.
Single-step	Single-step sweep: one trigger completes the measurement of the current row only.

7.1.3 [Discharge Time] Setting

After each row measurement completes, a discharge must be performed. Therefore the discharge time cannot be turned off; the minimum is 10ms and the maximum 10s.

The discharge time is set uniformly and applies to every list group.

- Steps for setting the discharge time:

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

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

7.1.4 Enabling List Rows

There are 5 list groups in total; each can be turned on or off independently.

■ Steps for turning rows on/off:

1. On the <Measurement Display> page or <Settings> page, press the [List Settings] soft key to enter the <List Settings> page;
2. Use the cursor keys to select the [01]~[05] fields;
3. Turn off with the soft keys

Soft keys	Function
On	
Off	

7.1.5 List Settings

■ [Voltage] setting:

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

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

■ Comparator settings:

1. On the <Measurement Display> page or <Settings> page, press the [List Settings] soft key to enter the <List Settings> page;
2. Use the cursor keys to enter the row to be set and select the [Compare] item;
3. Enter the lower and upper limits respectively; the upper limit can be set to infinity (∞).

Soft keys	Function
∞	Infinity

■ Charge time setting:

1. On the <Measurement Display> page or <Settings> page, press the [List Settings] soft key to enter the <List Settings> page;
2. Use the cursor keys to enter the row to be set and select the [Charge] item;
3. Select or enter the time directly. The charge time is at most 99s

Soft keys	Function
0 s	Charge time off
0.2 s	
0.5 s	
1 s	
2 s	

■ Test time setting:

1. On the <Measurement Display> page or <Settings> page, press the [List Settings] soft key to enter the <List Settings> page;
2. Use the cursor keys to enter the row to be set and select the [Test] item;
3. Select or enter the time; the test time cannot be turned off, minimum 0.1s, maximum 99s.

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

7.2 <List Sweep> Page

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

There are no settable options on the <List Sweep> page; all settings must be made in advance on the <List Settings> page.

Figure 7- 2 <List Sweep> Page



7.2.1 Starting a Sweep

List sweep does not support triggering, so the <List Sweep> page has no [Start] key.

In manual triggering, press the [Trig] key to start the measurement.

In remote triggering, send the LIST:TRG command to start the measurement.

In external triggering, the measurement starts when the Trig signal of the Handler interface is received.

7.2.2 Starting a Sweep Measurement

The following example illustrates how to perform a sweep measurement.

The 5 group settings are as follows:

1. Sweep settings

Figure 7- 3 <List Settings> Example



2 Enter the <List Sweep> page

Figure 7- 4 <List Sweep> Page Description



3 Triggering the sweep

In this example manual triggering is used; start the sweep with the [Trig] key on the front panel.

4 Charging state

Figure 7- 5 Charging state, charge timer countdown started



5 Test status

Figure 7- 6 Testing state, test timer countdown started



6 Discharge state

Figure 7- 7 Discharge state, discharge timer countdown started



7 Current row sweep finished

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, as long as you press the [Meas] or [Setup] key, the [System] key appears at the very bottom of the main page.

8.1 System Configuration Page

Press the [Setup] key to enter the <Settings> page, then press [System] to enter the <System Configuration> page.

The System Configuration page includes the following settings:

- Theme style – system color scheme selection
- LANGUAGE – Chinese/English selection
- [Key Tone] setting – turn the key tone on/off
- [Date/Time] setting
- [Account] setting – administrator/user account password setting
- [Remote Control] setting – the instrument supports RS232/RS485/USB interfaces
- [Baud Rate] Setting
- [Communication Protocol] selection – SCPI/MODBUS protocol selection
- [Station No.] selection – station number setting for multi-instrument communication
- Communication [Command Handshake] switch – SCPI command handshake on
- [Result Send] mode – send measurement results automatically/manually
- SCPI [Terminator] setting – SCPI terminator setting
- Power-line frequency – 50Hz/60Hz filter selection
- Factory reset – reset the instrument settings and system configuration parameters to factory values

All settings on the <System Configuration> page are automatically saved in the system and automatically loaded at the next power-on.

Figure 8- 1 <System Configuration> Page



8.1.1 Theme Style

The instrument offers 2 styles: Classic and Modern.

Classic style: mainly blue background.

Modern style: mainly black background.

- Steps for selecting the theme style

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

Soft keys	Function
Classic	
Modern	

8.1.2 Changing the System Language [LANGUAGE]

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

The instrument supports two languages: Chinese and English.

- Steps for changing the language

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

Soft keys	Function
Chinese [CHS]	Simplified Chinese
ENGLISH	English

8.1.3 [Key Tone] Settings

The key tone of the instrument can be turned off.

- Setting the key tone

Step 1 Enter the <System Configuration> page

Step 2 Use the cursor keys to select the [Key Beep] field;

Step 3 Use the soft keys to select

Soft keys	Function
Off	

On	

8.1.4 Setting the Date and Time

Communication command: SYSTem:dt <YYYYMMDDHHmmss>

The instrument uses a 24-hour clock.

- To change the date:

1. Enter the <System Configuration> page
2. Use the cursor keys to select the [Date] field.
3. Use the soft keys to set the date:

Soft keys	Function
Month+	+1 month
Month-	-1 month
Day+	+1 day
Day-	-1 day
Year+	+1 year
Year-	-1 year

- To change the clock:

1. Enter the <System Configuration> page
2. Use the cursor keys to select the [Clock] field.
3. Use the soft keys to set the clock:

Soft keys	Function
Hour+	+1 hour
Hour-	-1 hour
Minute+	+1 minute
Minute-	-1 minute
Second+	+1 second
Second-	-1 second

8.1.5 Account Settings

The instrument provides two user modes for selection:

- Administrator – all functions are open to the administrator except the [System Service] page, and the parameters set by the administrator are saved to the system memory after a 5-second delay for loading at the next power-on.
- User – except for the [System Service] and [File] pages, users can operate the other functions; the data modified by the user is restored to the values set by the administrator at the next power-on.

- To change the account:

1. Enter the <System Configuration> page
2. Use the cursor keys to select the [Account] field.
3. Use the soft keys to change:

Soft keys	Function
Administrator	All functions are open except the [System Service] page

	If the password is forgotten, please call the sales department of our company.
User	Functions other than those on the [System Service] page and [File] page can be operated, and the set data is not allowed to be saved.

■ Administrator password setting:

1. Enter the <System Configuration> page
2. Use the cursor keys to select the [Account] field.
3. Use the soft keys to select:

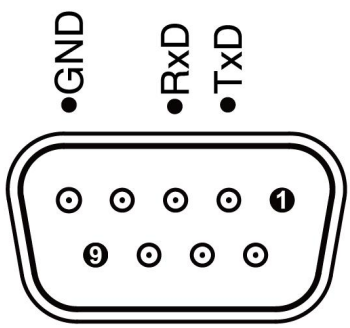
Soft keys	Function
Change Password	Enter a numeric password of up to 9 digits; the password contains only digits and symbols.
Delete Password	The administrator will not be password-protected

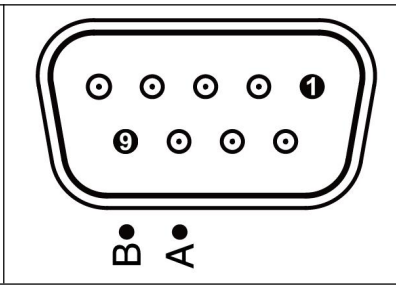
8.1.6 [Remote Control] Setting

The instrument supports 3 remote control interfaces: RS232, USB and RS485.
All three interfaces can run the SCPI and Modbus (RTU) protocols.

■ Selecting the remote control interface:

1. Enter the <System Configuration> page
2. Use the cursor keys to select the [Remote Control] field;
3. Use the soft keys to select

Soft keys	Function
RS232	RS232 communicates via the DB9 interface on the rear panel, using 3 of its pins: P2: TxD P3: RxD P5: GND 
USB	USB-232 interface; communicates via the USB interface on the rear panel
RS485	RS485 communicates via the DB9 interface on the rear panel, using 2 of its pins: P8: A(+) P9: B(-)



8.1.7 [Communication Protocol] Selection

The instrument supports 2 communication protocols: SCPI and Modbus (RTU). SCPI is usually more convenient for communication with computers, while the Modbus protocol is easier to use for communication with industrial control equipment such as PLCs, and supports multi-instrument communication.

■ Selecting the communication protocol:

1. Enter the <System Configuration> page
2. Use the cursor keys to select the [Communication Protocol] field;
3. Use the soft keys to select

Soft keys	Function
SCPI	
Modbus	

8.1.8 [Station No.] Selection

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

> *i* Multi-instrument communication is also possible using the SCPI protocol extended by Onmeas. Add “addr #;:” at the beginning of each command line to select a slave.
> For example: addr 02;:fetch?∆ fetches data from the slave with station number 2.

■ Selecting the RS485 station number:

1. Enter the <System Configuration> page
2. Use the cursor keys to select the [Station No.] field;
3. Use the soft keys to select

Soft keys	Function
00 Broadcast	The 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	

Under the Modbus protocol, to facilitate operating multiple identical instruments simultaneously, the instrument allows station number 00 for broadcast communication. When communicating via station number 00, the instrument only receives commands and does not return a response code.

8.1.9 [Baud Rate] Setting

The instrument has a built-in RS-232 interface. Once a valid command is received on the RS-232 interface, the instrument immediately communicates with the host at the set baud rate and the keyboard is locked.

To ensure correct communication, confirm that the baud rate is set correctly; the host computer and the instrument cannot communicate correctly if their baud rates are different.

The RS-232/RS-485/USB configuration of the instrument is as follows:

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

Set the baud rate:

1. Enter the <System Configuration> page
2. Use the cursor keys to select the [Baud Rate] field;
3. Use the soft keys to select

Soft keys	Function
9600	
19200	For communication with a host via Modbus, this baud rate is recommended
38400	
57600	
115200	For communication with a computer host via SCPI, this high baud rate is recommended.

8.1.10 SCPI [Command Handshake] Switch

This function is valid for the SCPI protocol only.

The instrument supports the SCPI command handshake.

SCPI Command: `SYSTem:SHAKhand {ON,OFF,0,1}`

SCPI Query Command: `SYSTem:SHAKhand?`

When the Command Handshake is turned on, all commands sent by the host computer to the

instrument are returned to the host computer unchanged, and data is returned only afterwards. When the Command Handshake is turned off, commands sent by the host computer to the instrument are processed immediately.

■ Steps for setting the Command Handshake:

1. Enter the <System Configuration> page
2. Use the cursor keys to select the [Command Handshake] field;
3. Use the soft keys to select

Soft keys	Function
Off	Do not use the command handshake. Unless specially required, set the command handshake to off.
On	

8.1.11 SCPI Measurement [Result Send] Mode

This function is valid for the SCPI protocol only.

The instrument supports automatically sending data to the host. After each test is completed, the data is sent to the host automatically, without the host having to send the FETCH? command. After each test, the instrument sends the test result and the comparator result to the host in the following format:

+1. 000E+09, 100, 0K

Here,

+1.000e+20 means overrange overflow (over upper limit)

-1.000e+20 means underrange overflow (under lower limit)

OK means pass

NG LO means fail, under lower limit

NG HI means fail, over upper limit



If Result Send is set to AUTO, the measurement data is returned depending on whether [Test Timer] is on:

When the test timer is set toOff, the instrument returns data once per measurement;

when the test timer is set to a time, data is returned only once at the end of the measurement.

■ Steps for setting [Result Sending]:

1. Enter the <System Configuration> page
2. Use the cursor keys to select the [Result Sending] field;
3. Use the soft keys to select

Soft keys	Function
FETCH	Only the FETCH? command can acquire all measurement data
Auto	Automatically sent to the host computer after each test is completed

8.1.12 SCPI [Terminator] Switch

This function is valid for the SCPI protocol only.

The instrument supports the SCPI command terminator setting.

The host may send commands with or without a terminator; the instrument can receive and parse both.

When sending response results to the host, the instrument always appends the set terminator at the end.

Terminator: Commands between the instrument and the host must contain a terminator so each side can recognize the end of a command.

The instrument supports 3 terminators:

Terminators	ASCII name	ASCII hexadecimal	Number of bytes	Description
LF(0x0A)	Line feed	0x0A	1 byte	Instrument default
CR(0x0D)	Carriage return	0x0D	1 byte	
CR+LF	Carriage return + line feed	First byte 0x0D Second byte 0x0A	2 bytes	
NUL(0x00)	Null character	0x00	1 byte	

Steps for setting the terminator:

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

Soft keys	Function
LF(0x0A)	LF: line feed, ASCII 0x0A
CR(0x0D)	CR: carriage return, ASCII 0x0D
CR+LF	
NUL(0x00)	NUL: null character, ASCII 0x00

8.1.13 SCPI [Error Code] Display

This function is valid for the SCPI protocol only.

SCPI Command: `SYSTem:CODE {ON,OFF,0,1}`

SCPI Query Command: `SYSTem:CODE?`

With error codes on, the instrument returns an error code after receiving a command.

For query commands, an error code is returned only when the command is in error.

With error codes off, the host can send the ERR? command to query the error code of the last command execution.

- **Steps for setting error codes:**

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

Soft keys	**Function**
Off	Error codes are not returned automatically.
On	Error codes are returned after each single-line command executes.

8.1.14 [Power-Line Frequency] Setting

The measurement stability of the instrument depends heavily on the power-line frequency; select it according to the local country’s power-line frequency: 50Hz in mainland China, 60Hz in Taiwan.

■ **Selecting the power-line filter:**

1. Enter the <System Configuration> page
2. Use the cursor keys to select the [Power-Line Frequency] field;
3. Use the soft keys to select

Soft keys	Function
50Hz	Sets the 50Hz power-line frequency; the power-line frequency in China is 50Hz
60Hz	Sets the 60Hz power-line frequency; the power-line frequency in Taiwan is 60Hz

8.2 System Information Page

Press the [Setup] key to enter the <Settings> page, press the [System] key on the taskbar at the very bottom to enter the <System Configuration> page, and press the soft keys to select [System Information].

The System Information page has no user-configurable options.

Figure 8- 2 <System Information> Page



9. File Management

Press the [File] soft key at the bottom to enter the <File Management> page.
File Management allows the user to save settings into 10 files, convenient for loading at power-on or when changing the device under test.

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

- [Power-On File] – specifies the file loaded at power-on
- [Auto Save] – modified parameters are saved to the current file in real time
- [File] – save, load or delete files.

Figure 9- 1 <File Management> Page



9.1 [Power-On File]

The Power-On File option specifies the file loaded at power-on.

- Steps for setting the power-on file:

1. Enter the <File Management> page
2. Use the cursor keys to select the [Power-on Recall] field;
3. Use the soft keys to select

Soft keys	Function
File 0	Loads the settings of File 0 at power-on
Current File	Loads the settings of the current file number at power-on

9.2 [Auto Save]

When Auto Save is allowed, the parameters set by the user are saved to the current file automatically.

- Steps for setting Auto Save:

1. Enter the <File Management> page

2 Use the cursor keys to select the [Auto Save] field;

3 Use the soft keys to select

Soft keys	Function
Allow	The parameters set by the user are saved to the current file automatically
Forbid	The parameters set by the user can only be saved to the file manually; otherwise they will be lost at the next power-on.

9.3 [File 0]~[File 9]

The user can specify 10 files (0~9) for saving, loading and deleting.

- Steps for setting the files:

Step 1 Enter the <File Management> page

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

Step 3 Use the soft keys to select

Soft keys	Function
Save	Saves all settings to the current file
Read	Reads the file parameters into the system
Delete	The file data will be deleted

10. USB Disk Storage

The measurement data of the <Measurement page> can be stored automatically to a USB disk. Press the [Setup] key, then press the [USB Disk Storage] soft key to enter the <USB Disk Storage> page.

Instrument

- [Timed Save] – when the test timer is off, data is saved to the file at intervals
- [Auto Enable] – when a USB disk is inserted, the file opens automatically and storage starts
- [File] – create a new file

Figure 10- 1 <USB Disk Storage> Page



10.1.1 [Timed Save]

The timed save function can be enabled only when all of the following are met:

1. The [Test Timer] on the <Settings> page is set to off;
2. The trigger mode is internal trigger;
3. The [Timed Save] time is set and not off.

Outside of the above, the timed save function is ineffective even if a time is set.

■ Steps for setting [Timed Save]:

1. Enter the <USB Disk Storage> page
2. Use the cursor keys to select the [Timed Save] field
3. Select [Off] with the soft keys, or enter the interval directly; the minimum timed-save interval is 1s.

Soft keys	Function
Off	

10.1.2 [Auto Enable]

When [Auto Enable] is on, each time a USB disk is inserted the instrument checks whether the most recently used file exists on the disk; if so, the file opens automatically and is used for logging.

■ Steps for enabling [Auto Enable]:

1. Enter the <USB Disk Storage> page
2. Use the cursor keys to select the [Auto Enable] field
3. Use the soft keys to select

Soft keys	Function
On	
Off	

10.1.3 Creating a [New File]

The [New File] field creates a new file on the USB disk; the file name is defined by the user. The file format is fixed as CSV.

■ Steps for creating a [New File]:

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

Soft keys	Function
Create file	A character keyboard will pop up; enter a custom file name. After entering, press the [OK] soft key to create a new file; the file name will appear in the list.

10.1.4 [File] Selection

1. Enter the <USB Disk Storage> page
2. Use the [Next Page] or [Previous Page] soft keys to select the [File 0]~[File 9] page or the [File 10]~[File 19] page
3. Use the cursor keys to select the [File 0]~[File 19] field;
4. Use the soft keys to select

Soft keys	Function
On	Opens this file for data storage
Off	Closes this file
Delete	Deletes this file; the stored data is cleared as well and cannot be recovered after deletion.

10.1.5 USB Disk Data Storage Mechanism

The file stores data differently under internal and external triggering.

- Internal trigger recording process
  1. When the [Test Timer] is set to [Off], measurement data is stored at the [Timed Save] interval
  2. When the [Test Timer] is set to a time, measurement data is stored once at the end of the test.
- External trigger recording
  1. When the [Test Timer] is set to [Off], data is saved once per triggered measurement;
  2. When the [Test Timer] is set to a time, measurement data is stored once at the end of the test.

11. Preparing for Measurement

For a quick start, this chapter briefly demonstrates how to perform a measurement and verify the output voltage.
Before starting a measurement, first become familiar with the preceding settings chapters.

11.1 Connecting the Test Terminals

When connecting with test leads,
insert the red banana plug into the HIGH ⊕ terminal;
insert the black banana plug into the LOW ⊖ terminal.

Danger:
In the charging and testing states (the TEST high-voltage indicator on the front panel test terminals lights up), the H terminal under testIGH⊕outputs high voltage. If the user connects the HIGH terminal to earth, the LOW⊖ terminal will carry a negative voltage; therefore do not touch any test terminals or the exposed metal parts of test leads to avoid electric shock.

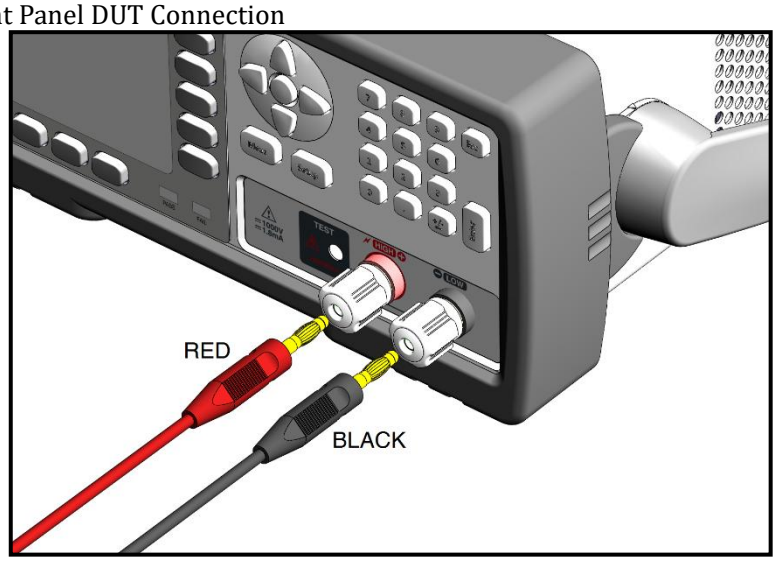
Note:
Use our test leads for measurement; the supplied test leads have a high insulation grade and will not affect personal safety or measurement results.

Do not measure the insulation resistance of active devices; this may damage the instrument. Capacitive loads must be fully discharged before measurement.

Note:
The front and rear test terminal groups are connected in parallel inside the instrument; be sure to use only one group for testing.

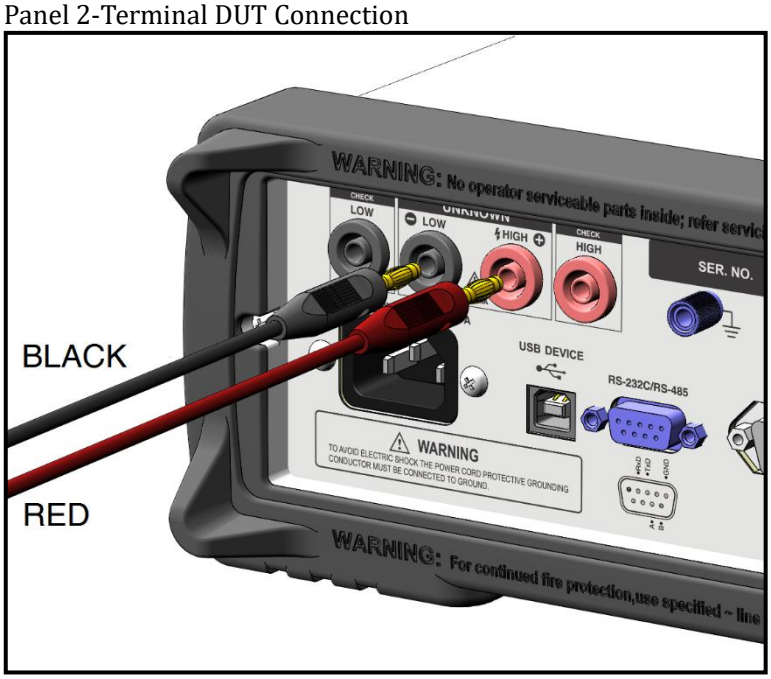
11.1.1 Front Panel Test Terminal Connection

Figure 11- 1 Front Panel DUT Connection



11.1.2 Rear Panel Test Terminal Connection

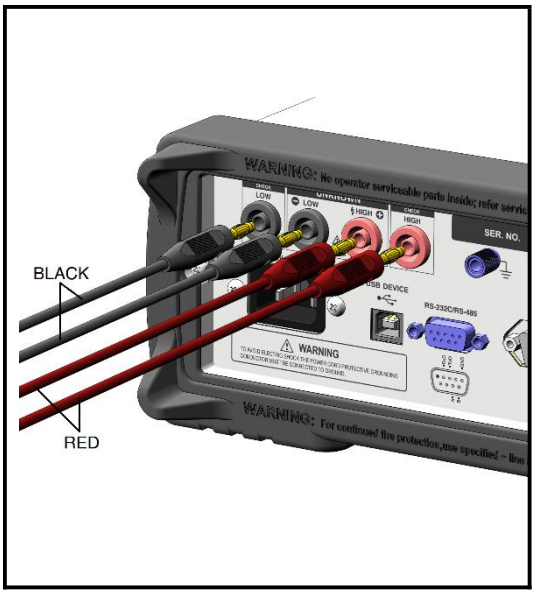
Figure 11- 2 Rear Panel 2-Terminal DUT Connection



11.1.3 Rear Panel Contact Check Connection

If the contact check function is used, 2 extra test leads are needed to connect to the CONTACT CHECK terminals on the rear panel, using 4-terminal measurement.

Figure 11- 3 Rear Panel 4-Terminal DUT Connection





Refer to the contact check section of the <Settings> page.

11.2Starting a Measurement

Warning:

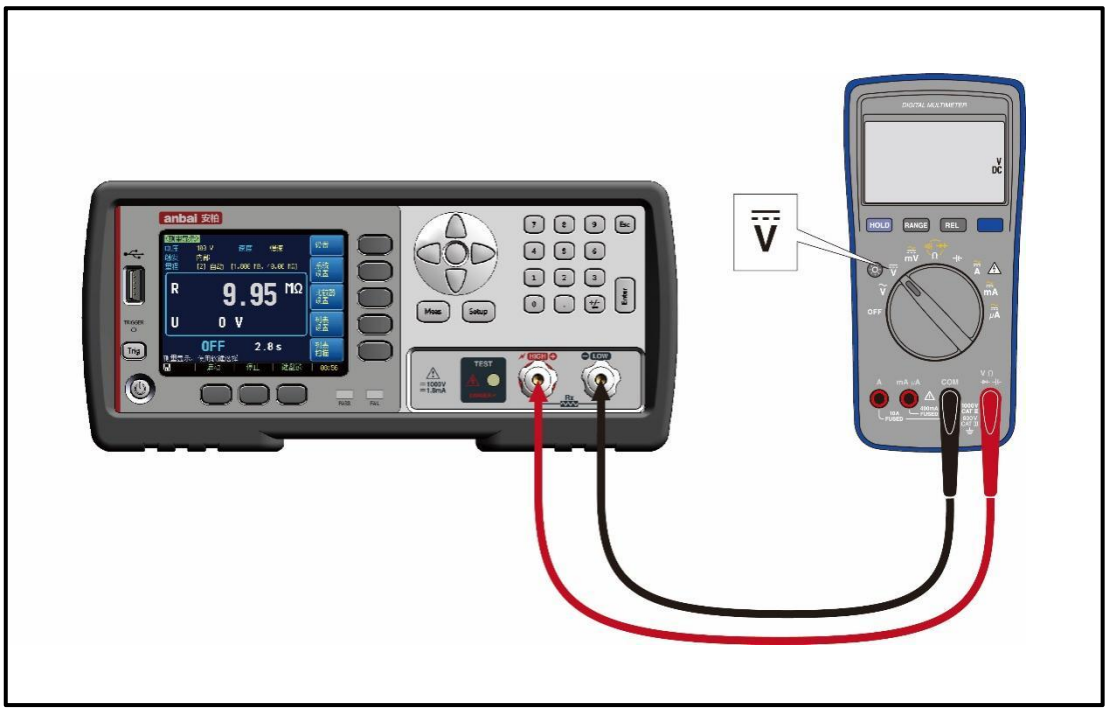
- While the TEST indicator of the test terminals is lit, do not touch the test terminals on the front/rear panels or the exposed metal parts of the test clips, to guard against electric shock.
- After testing, enter the discharge state to discharge the device under test.

Note: to briefly illustrate the measurement process of this instrument, we use the internal resistance measurement of a multimeter as the device under test to demonstrate the working process; the multimeter also verifies whether the instrument output voltage is normal.
If you have a handheld or bench multimeter at hand, connect it following the steps below.

11.2.1 Digital Multimeter Setup

1. Set the multimeter to the DC voltage range
2. Insert the red probe of the multimeter into the HIGH⊕ terminal (red) of the AT6820
   Insert the black probe of the multimeter into the LOW⊖ terminal (black) of the AT6820
   (You may also clamp the supplied red/black test clips of the AT6820 onto the multimeter probes, but be careful not to touch the metal parts, to guard against electric shock.)

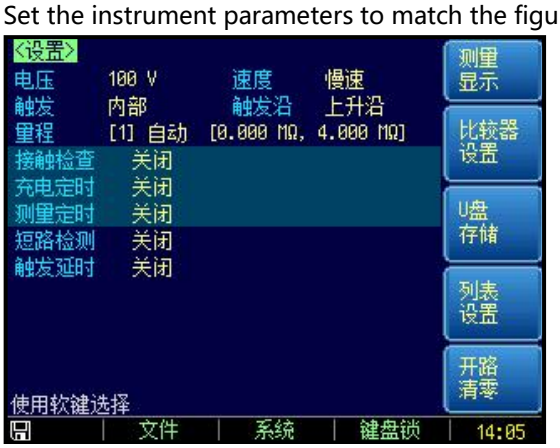
11.2.2 Connecting the Device Under Test



11.2.3 Setting the Instrument Parameters

Set the AT6820 as follows

1. Confirm the discharge state: the status shows OFF and the TEST indicator is off.
2. Press the [Setup] key to enter the <Settings> page
3. Set the instrument parameters to match the figure below



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

11.2.4 [Start] Measurement

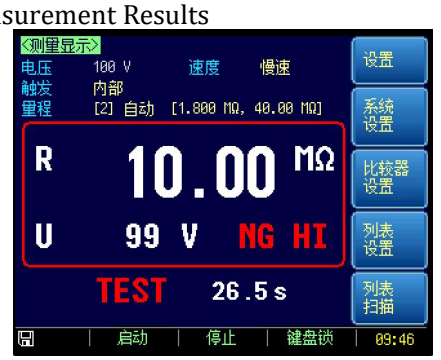
In the discharge state, press the [Start] key and the instrument begins measuring.

Figure 11- 4 Press [Start] to Begin Measurement



The measurement screen will be shown on the display:

Figure 11- 5 Measurement Results



In the figure,

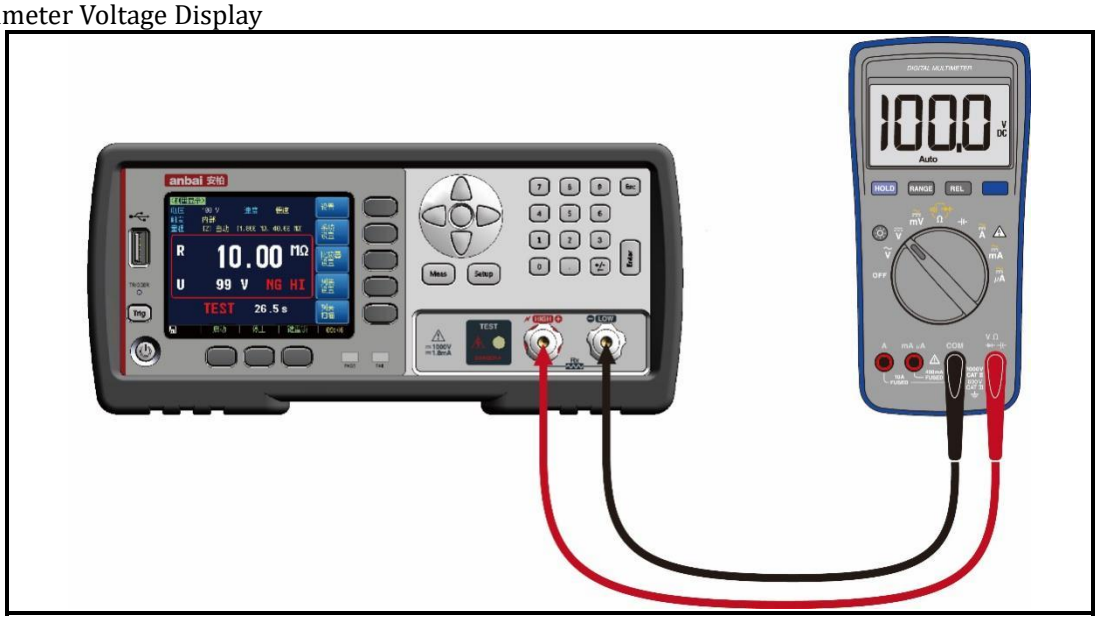
R 10.00MΩ: means the internal resistance of the multimeter is 10MΩ

U 99 V: means the output voltage is 99V

11.2.5 Verifying the Voltage

While the AT6820 measures the internal resistance of the multimeter’ s DC voltage range, the multimeter simultaneously verifies the output voltage of the instrument.

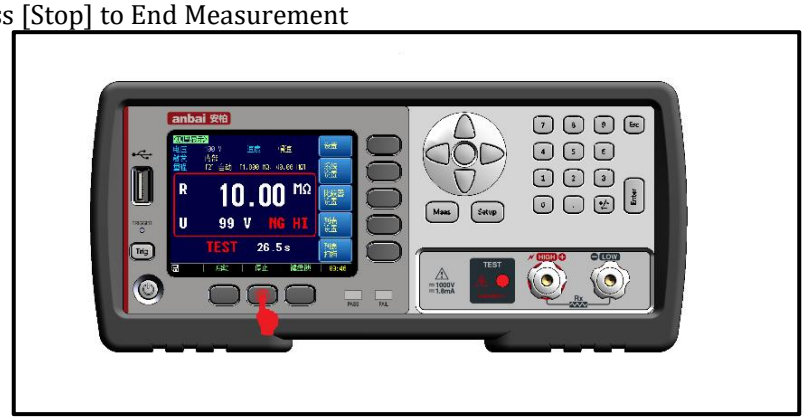
Figure 11- 6 Multimeter Voltage Display



11.2.6 [Stop] Measurement

In the testing state, pressing the [Stop] key ends the measurement and returns to the discharge state.

Figure 11- 7 Press [Stop] to End Measurement



12. Handler Interface

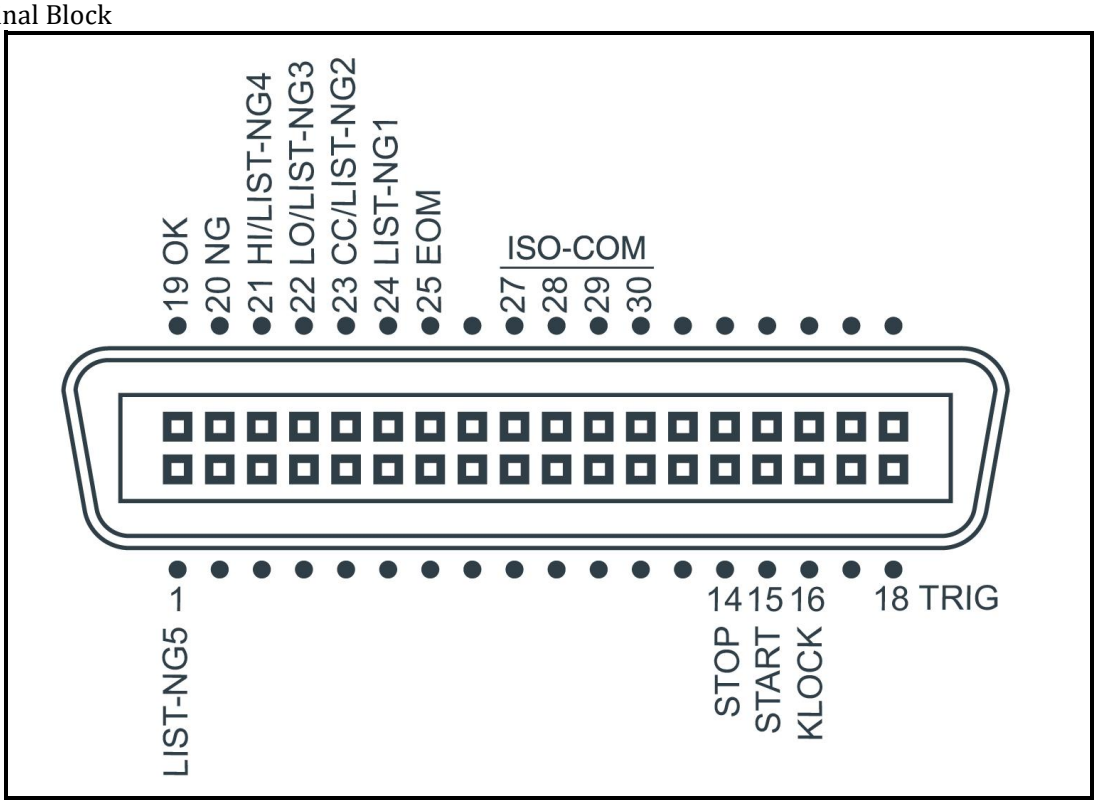
You will learn about the following:

- Terminals
- How to Connect and Interface Schematics

The instrument provides a full-featured Handler interface, including OK/NG sorting outputs, HI/LO, LIST-NG1~5 outputs, the EOM end-of-test signal output, and the TRIG (external trigger start) input. Through this interface, the instrument can easily implement automatic control together with the user’s system control components.

12.1 Terminal Blocks and Signals

Figure 12- 1 Terminal Block



- Output terminals (all signals are active low)

Table 12- 1 Output Pin Definitions

Pin	Name	Description
1	LIST-NG5	Active low. List sweep bin 5 fail output.
19	OK	Measurement page or list sweep page: overall pass. 0: OK
20	NG	Measurement page or list sweep page: overall fail. 0: NG
21	HI LIST-NG4	This pin is a multiplexed signal. Measurement page: over-upper-limit fail. Active low.

		List sweep page: list 4 fail. Active low.
22	LO LIST-NG3	This pin is a multiplexed signal. Measurement page: under-lower-limit fail. Active low. List sweep page: list 3 fail. Active low.
23	CC LIST-NG2	This pin is a multiplexed signal. Measurement page: poor contact (open). 0: NG List sweep page: list 2 fail. Active low.
24	SHORT LIST-NG1	This pin is a multiplexed signal. Measurement page: short circuit. 0: SHORT List sweep page: list 1 fail. Active low.
25	EOM	0: ready 1: waiting

Note:

1. P21/P22/P23/P24 are multiplexed signals; they differ between the measurement page and the list sweep page.
2. P25 EOM signal:
3. On the measurement page and list sweep page: high while measuring, low after measurement completes.
4. On other pages: always high.

- Input terminals

Table 12- 2Input Pin Definitions

Pin	Name	Description
14	STOP	Stop measurement (discharge). Pulse signal, low level held for 20~100ms (typical 50ms).
15	START	Start measurement (charge). Pulse signal, low level held for 20~100ms (typical 50ms).
16	KLOCK	Key lock. Pulse signal, low level held for 20~100ms (typical 50ms). This signal only locks; it does not unlock. Unlocking must be done on the instrument.
18	TRIGGER	Trigger input terminal. Rising-edge active, low level held for 10ms~100ms.

- Power terminals

Table 12- 3Power Pin Definitions

Pin	Name	Description
27	ISO-COM	Common ground terminal; must not be left floating. Be sure to connect it reliably to the COM terminal of the external controller (e.g. PLC) power supply.
28		
29		
30		
35	Internal ISO-VCC **Output**	Internal VCC positive terminal output; internal isolated power supply: 5V, 0.2A, 1W max **Do not connect unless necessary.**
36		

Warning:

1. Pins P35/36 are the ISO-VCC outputs of the internal isolated power supply.
2. In normal PLC connection, leave P35/P36 floating.
3. The internal power supply is limited (5V, 0.2A, 1W max) and cannot drive power relays or high-power LEDs.
4. P35/P36 have a built-in self-recovering fuse; above 0.5A the ISO-VCC connection is cut, and prolonged short circuit will burn the fuse.

12.2Connection Methods

■ Power

Built-in fully isolated power supply; no external power needed, but ISO-COM must be common-grounded:

ISO-COM: P27~P30

■ Electrical Parameters

Output signal: optocoupler-isolated Darlington collector output. Active low.

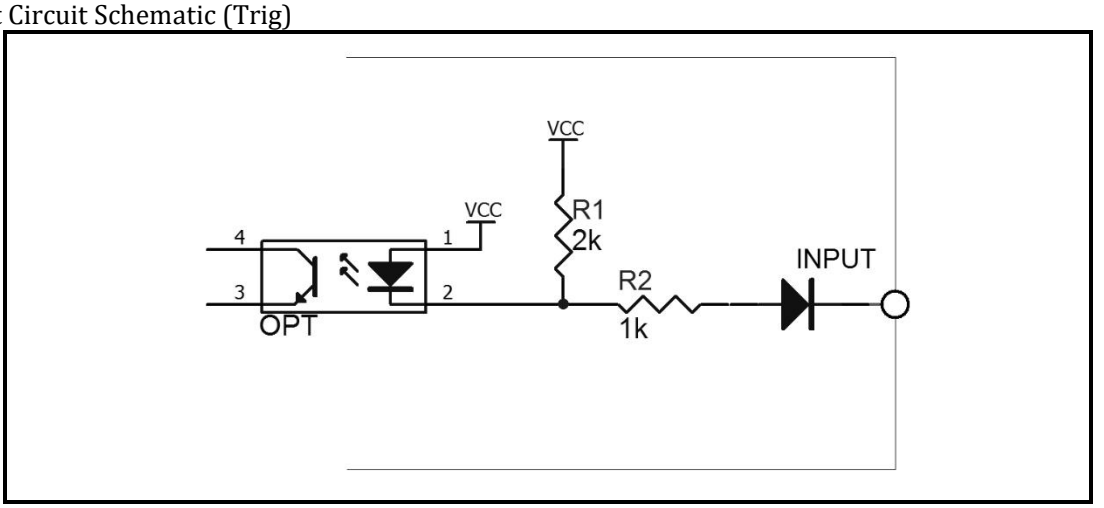
Max. voltage: 3V~30V, 24V recommended.

Input signal: Optocoupler isolated. Active low.

Max. current: 50mA

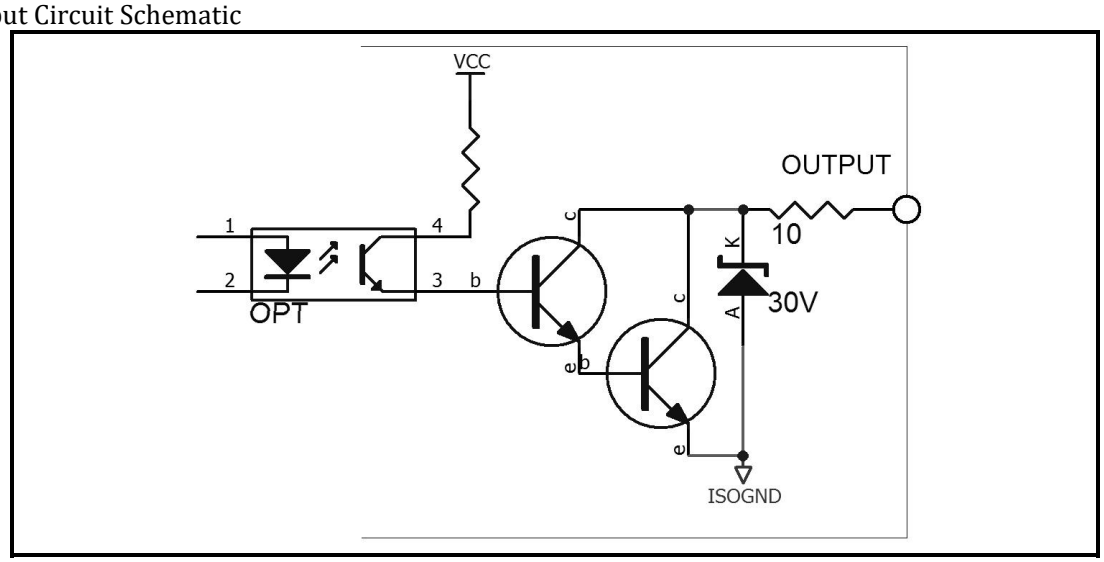
12.2.1 Input Circuit Schematic

Figure 12- 2 Input Circuit Schematic (Trig)



12.2.2 Output Circuit Schematic

Figure 12- 3 Output Circuit Schematic



12.2.3 Input Circuit Connection Methods

Figure 12- 4 Connection to a Switch

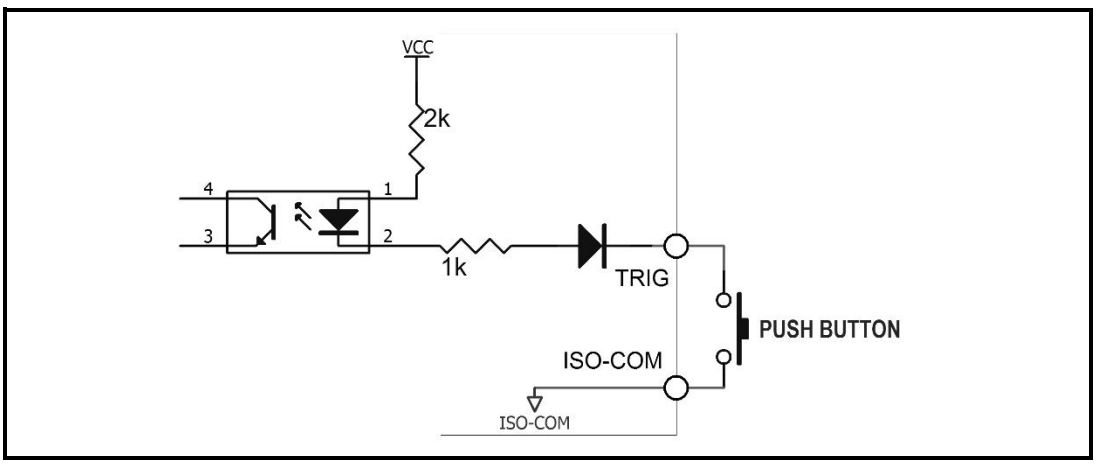


Figure 12- 5 Control Using a Relay

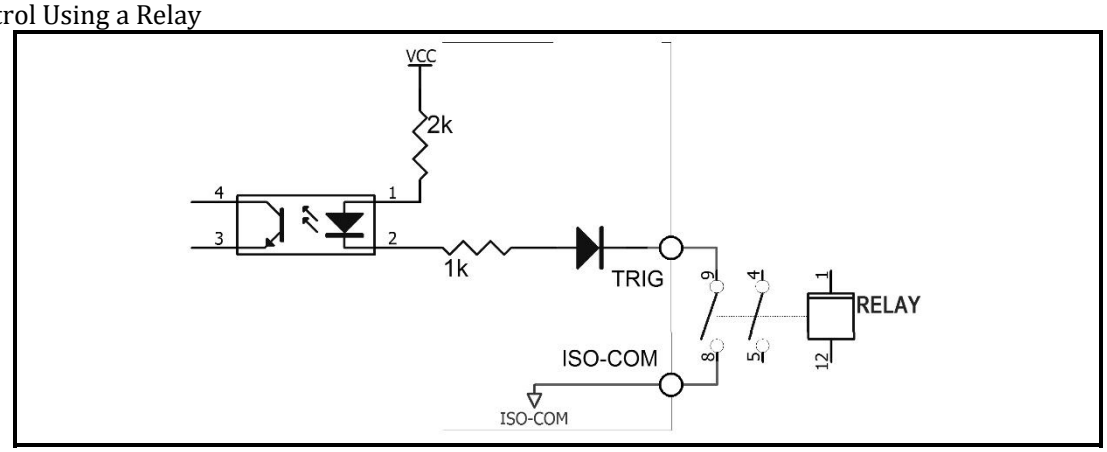


Figure 12- 6 Control Using a PLC Negative Common Terminal

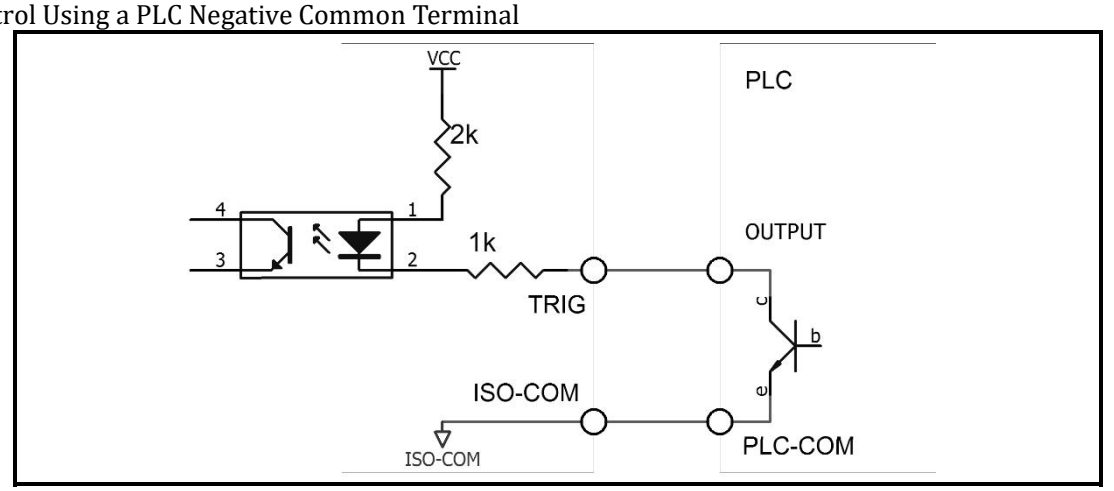
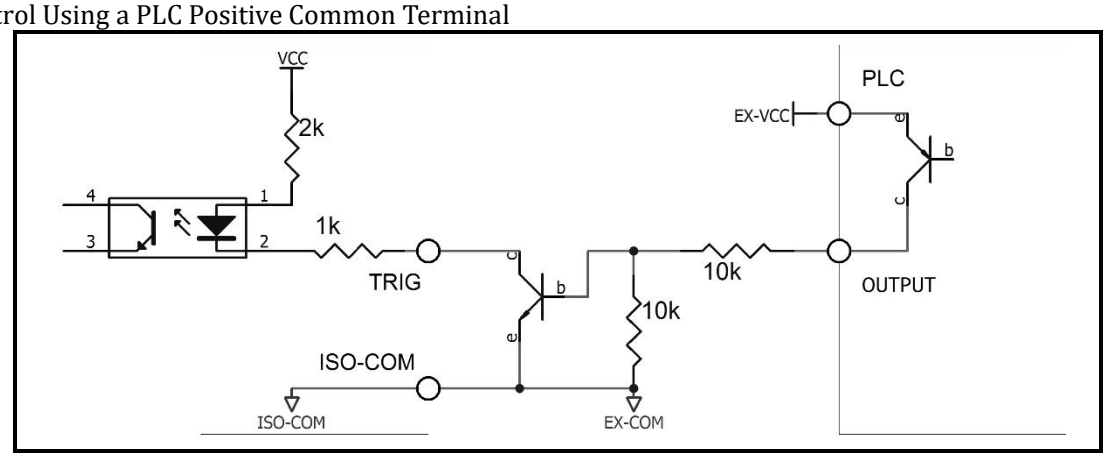


Figure 12- 7 Control Using a PLC Positive Common Terminal



12.2.4 Output Circuit Connection Methods

Figure 12- 8 Controlling a Relay

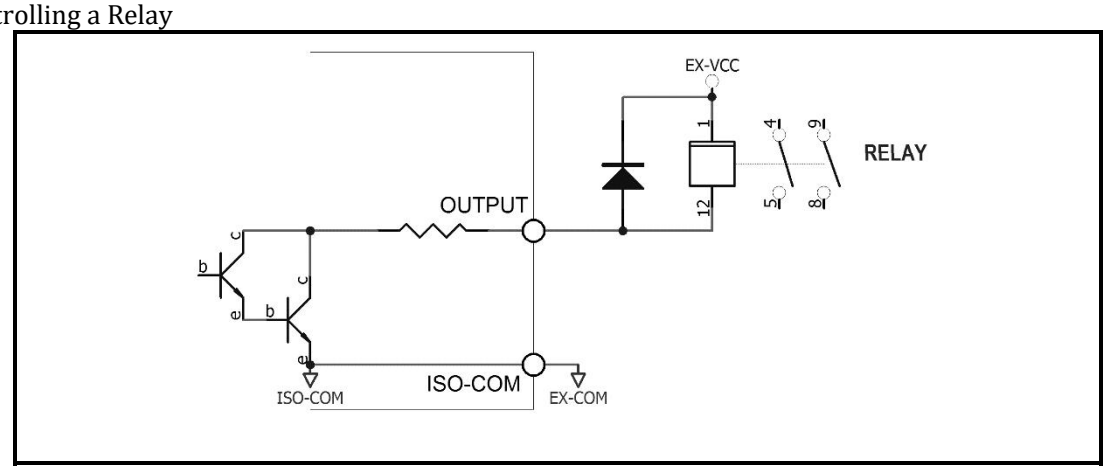


Figure 12- 9 Controlling an LED or Optocoupler

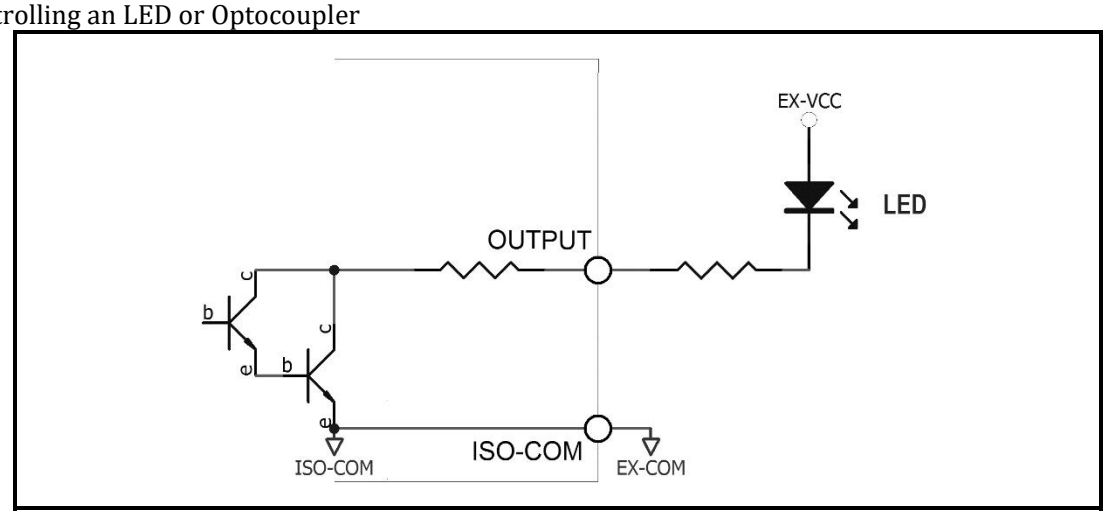


Figure 12- 10 Negative-Logic Output

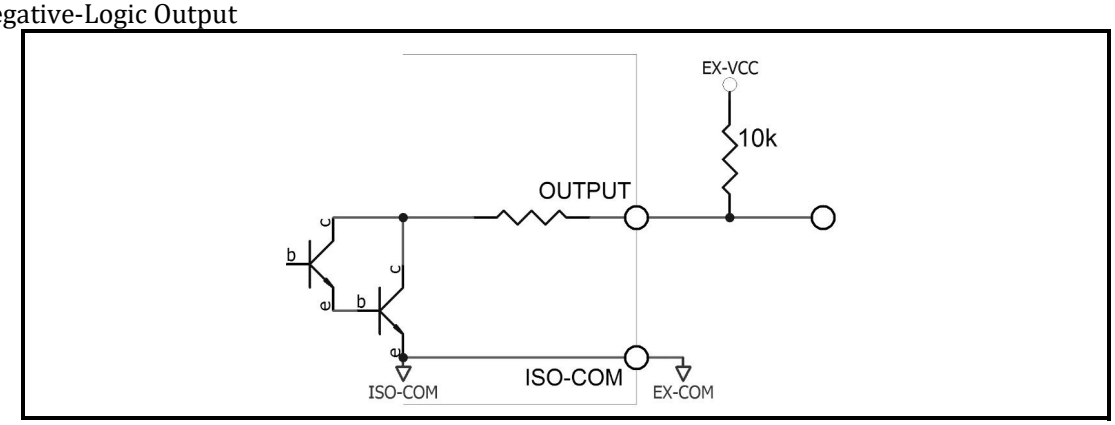


Figure 12- 11 Two Ports Forming a Logic-OR Circuit

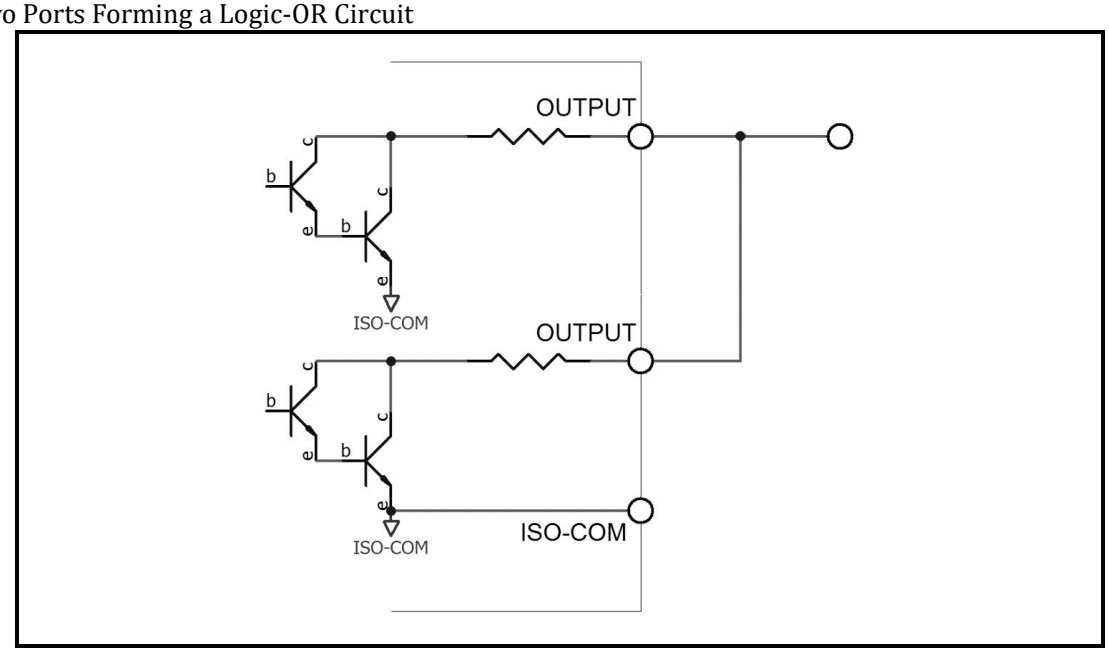


Figure 12- 12 Output to a PLC Negative Common Terminal

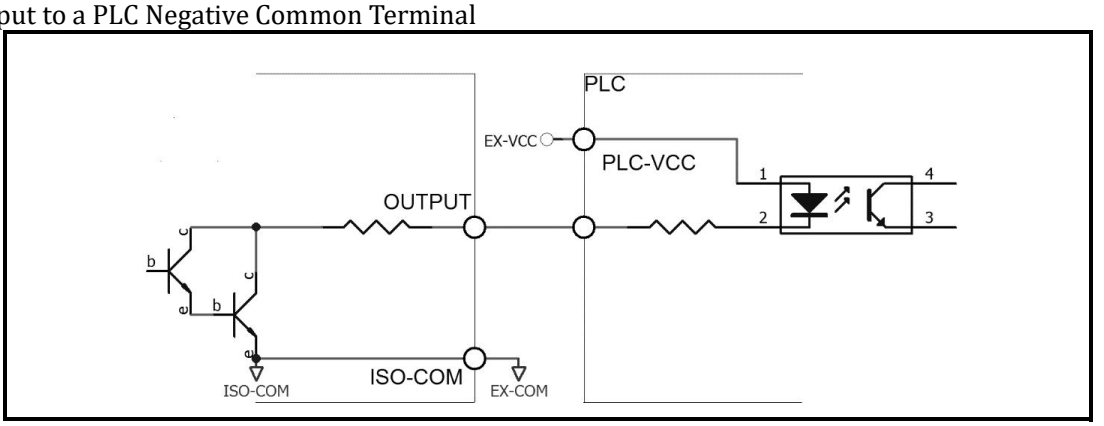
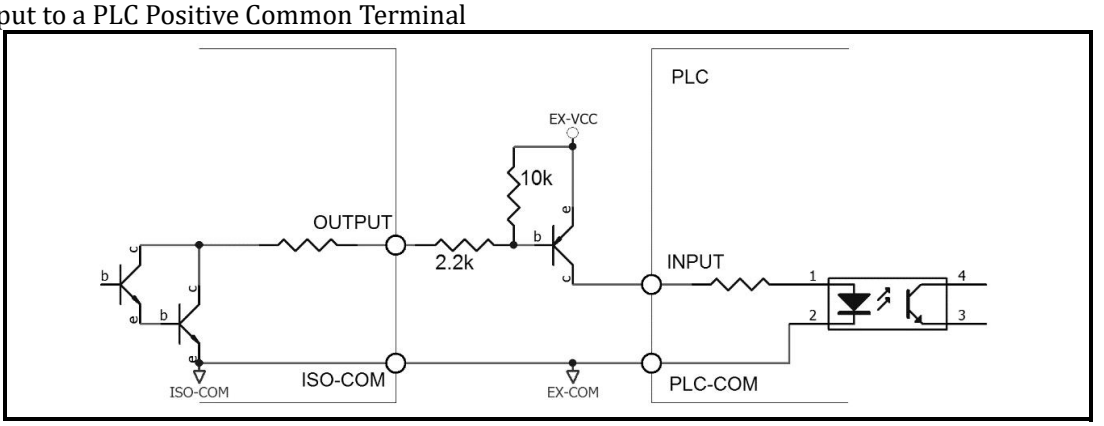


Figure 12- 13 Output to a PLC Positive Common Terminal



12.3 Timing Table

Figure 12- 14 Timing Table

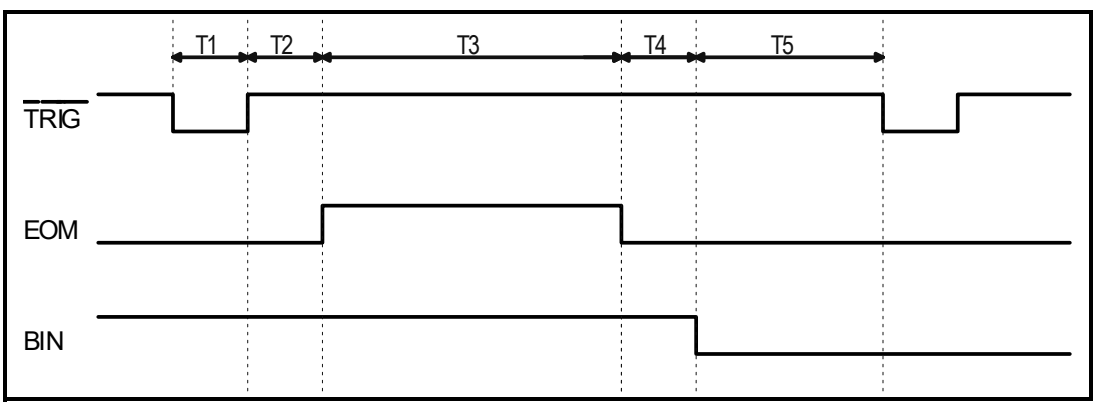


Table 12- 4 Time Table

Description			Minimum
T1	Trigger pulse width		1ms
T2	Measurement cycle	Trigger delay	<10μs
T3		Measurement time	Depends on settings
T4		BIN output delay	200μs
T5	Waiting time after trigger		0s

13. Remote Communication

You will learn about the following:

- About the RS-232 Interface
- RS-232 connection.
- Selecting the baud rate.
- Software protocol.

The instrument uses the RS-232 interface (standard configuration) to communicate with a computer and perform all instrument functions. With standard SCPI commands, users can also conveniently develop various data acquisition systems of their own.

13.1 RS-232C

RS-232 is a serial communication standard widely used today, also called the asynchronous serial communication standard, used for data communication between computers and between computers and peripherals. RS is the English abbreviation of “Recommended Standard” (recommended standard), and 232 is the standard number. This standard was officially published in 1969 by the Electronic Industries Association (EIA) of the United States; it specifies that data is transmitted one bit at a time over a single data line.

Most serial port configurations are usually not strictly based on the RS-232 standard: a 25-pin connector is used on each port (today's computers mostly use a 9-pin connector). The most commonly used RS-232 signals are shown in the following table:

Table 13- 1 Common 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 Set Ready	DSR	6	6
Data Carrier Detect	DCD	8	1
Data Terminal Ready	DTR	20	4
Transmitted data	TXD	2	3
Received data	RXD	3	2
Ground	GND	7	5
Request to Send	RTS	4	7

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

Table 13- 2 Minimum Subset of the RS-232 Standard

Signal	Symbol	9-pin connector pin number
Transmitted data	TXD	2
Received data	RXD	3

Ground	GND	5

13.1.1 RS232C Connection

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

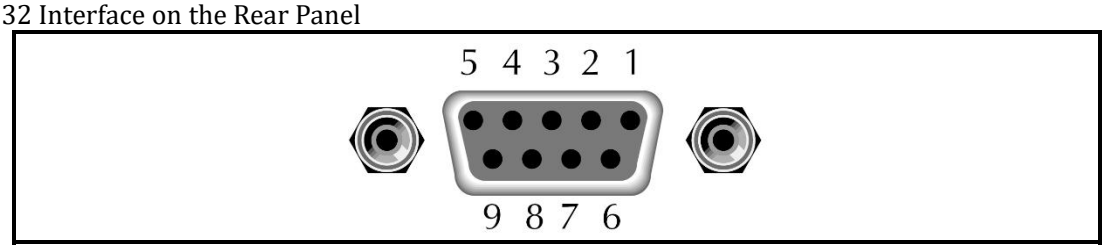
Note: The instrument cannot use a null modem cable.

You can make it yourself, or purchase a 9-core**straight-through** cable yourself, or purchase one from Onmeas.

Note the following for a user-made 3-wire cable:

·When using the DB9 port built into the PC, pins 4-6 and 7-8 of the DB-9 connector (male) on the computer side may need to be shorted

Figure 13- 1 RS-232 Interface on the Rear Panel



To avoid electrical shock, turn off the instrument power when plugging/unplugging connectors.

- Default communication settings of the instrument:

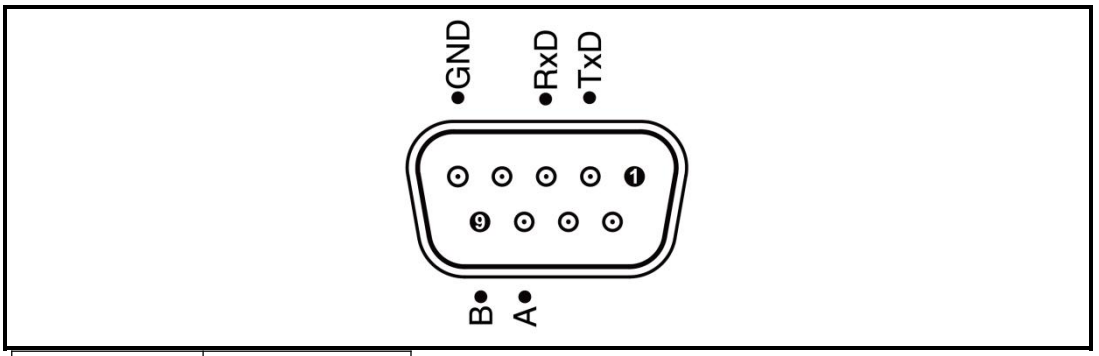
Transmission mode: Full-duplex asynchronous communication with start and stop bits
Data bits: 8 bits
Stop bits: 1 bit
Parity: None

13.2RS485 Connection

The instrument comes standard with an RS485 interface and also supports the Modbus RTU protocol.

RS485 is a communication interface supporting multi-instrument communication: one host can be connected in parallel with multiple slaves.
The detailed RS485 specification is not the focus of this user manual; refer to
https://en.wikipedia.org/wiki/RS-485

The RS485 interface of the instrument shares the same DB9 connector with the RS232 interface:



Pin	Function
8	A
9	B

13.3 Handshaking Protocol

Since the instrument uses the minimum subset of the RS-232 standard and does not use hardware handshake signals, the instrument can enable software handshake to reduce possible data loss or data errors during communication. High-level language software engineers should develop the computer communication software strictly according to the following handshake protocol:

- The instrument command parser only accepts ASCII format, and command responses also return ASCII codes.
- The command string sent by the host must end with NL (‘\n’); the instrument command parser starts executing the command string only after receiving the terminator.
- The instrument can enable the Command Handshake: after receiving each character, the instrument immediately sends that character back to the host computer, and the host computer can send the next character only after receiving this returned character.

!

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

1. The software handshake is turned off; refer to the <System Settings> page of the instrument to turn it on.
2. Serial port connection fault; check the cable connections.
3. The communication format of the high-level language program on the computer side is incorrect. Try checking whether the serial port number and the communication format are correct, and whether the baud rate is the same as that set on the instrument.
4. If the instrument is still parsing the previous command, the host cannot receive the instrument’s response either; please wait and try again.

<If the problem still cannot be solved, immediately consult the Onmeas technical engineers>

13.4SCPI Language

SCPI (Standard Commands for Programmable Instruments) is a universal command set for test instruments adopted by Onmeas. SCPI, also known as TMSL (Test and Measurement System Language), was developed by Agilent Technologies as an extension of IEEE488.2 and has been widely adopted by test equipment manufacturers to date.



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

14. SCPI Command Reference

This chapter includes the following topics:

- Command Parser — understand some rules of the command parser.
- Command Syntax — rules for writing command lines
- Query Syntax — rules for writing query commands
- Query Response — format of the query response
- Command Summary

This chapter provides all the SCPI commands used by the instrument. Through these SCPI commands, 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; the instrument command parser starts parsing after capturing the terminator or after 20ms without input.

Example: Valid command string:

AAA:BBB CCC;DDD EEE;:FFF

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

14.1.1 Command Parsing Rules

1. The command parser only parses and responds to ASCII code data.
2. Command parsing starts after the terminator is received. (The terminator can be set on the <System Configuration> page.)
3. If no terminator is received, the parser starts parsing the command after waiting 20ms without receiving a character.
4. If the command handshake is on, each time the parser receives a character it immediately echoes the character back to the host; the host may continue sending the next character only after receiving this echo character.
5. After parsing an error, the command parser immediately terminates parsing and the current command becomes invalid.
6. After parsing a query command, the command parser terminates parsing of the current command string, and the subsequent string is ignored.
7. The command parser is not case-sensitive when parsing command strings.
8. The command parser supports abbreviated command forms; for the abbreviation specifications, refer to the following chapters.

14.1.2 Symbol Conventions and Definitions

This chapter uses some symbols that are not part of the command tree; they are only intended to facilitate a better understanding of command strings.

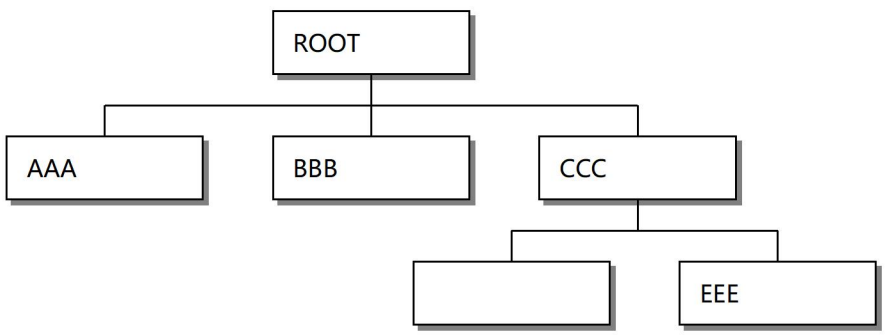
Indicator	Description

<.....>	The text in angle brackets represents a parameter of the command, for example: <float> represents a floating-point parameter <integer> represents an integer parameter
[.....]	The text in square brackets represents an optional command, for example: COMP[:STAT] ON = COMP ON
{.....}	Parameters in braces represent single-choice items, for example: FUNC:RATE {SLOW,MED,FAST}: the parameter is one of the items
Capital letters	The abbreviated form of the command
□	Space character, representing one space, for reading only.

14.1.3 Command Tree Structure

SCPI commands adopt a tree structure and can extend down three levels (Note: the command parser of this instrument can parse down any number of levels). The highest level here is called the subsystem command. Only after a subsystem command is selected are the commands below it valid. SCPI uses the colon (:) to separate higher-level commands from lower-level commands.

Figure 14- 1Command Tree Structure



Example

ROOT:CCC:DDD ppp

ROOT Subsystem command

CCC Second level

DDD Third level

ppp Parameter

14.2Commands and Parameters

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

Example

AAA:BBB□1.234

Command [Parameters]

14.2.1 Commands

Command words can be in long form or abbreviated form. The long form makes it easier for

engineers to understand the meaning of the command string; the abbreviated form is convenient for writing.

14.2.2 Parameters

1. A command with a single command word and no parameters.
   Example: AAA:BBB
2. The parameter can be in the form of a string, and its abbreviation rules still follow the “command abbreviation rules” in the previous section.

E.g.: AAA:BBB□1.23

3. The parameter can be in numeric form

<integer>	Integer 123, +123, -123
<float>	Floating point in any form: Fixed-point floating point: 1.23, -1.23 Floating point in scientific notation: 1.23E+4, -1.23e-4 Floating point with multiplier: 1.23k, 1.23MA, 1.23G, 1.23u
<SciFloat>	Floating point in scientific notation: 1.2345E+04 means 1.2345×10^4

Table 14- 1Multiplier Abbreviations

Value	Multiplier
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, multiplier units are spelled differently from the standard names, for example:
“1M” means 1 milli, not 1 mega
“1MA” means 1 mega

14.2.3 Separators

The instrument command parser only accepts the allowed separators; for any other separator the parser generates the “Invalid separator” error. These separators include:

; Semicolon, used to separate two commands.

Example: AAA:BBB 100.0;CCC:DDD

: Colon, used to separate command trees or to restart the command tree.

Example: AAA:BBB:CCC 123.4;:DDD:EEE 567.8

? Question mark, used for queries.

Example: AAA?

□ Space, used to separate parameters.

Example: AAA:BBB□1.234

14.2.4 Error Codes

The corresponding error codes are as follows:

Error Codes	Description	
*E00	No error	No error
*E01	Bad command	Command error
*E02	Parameter error	Parameter error
*E03	Missing parameter	Missing parameter
*E04	buffer overrun	Buffer overflow
*E05	Syntax error	Syntax error
*E06	Invalid separator	Invalid separator
*E07	Invalid multiplier	Invalid multiplier unit
*E08	Numeric data error	Numeric value error
*E09	Value too long	Number too long
*E10	Invalid command	Invalid command
*E11	Unknow error	Unknown error

14.3 Command Summary

All commands are interpreted in the order of subsystem commands; all subsystems are listed below

- DISPlay Display subsystem
- FUNCtion Function subsystem
- CORRection Correction subsystem
- COMParator Comparator subsystem
- SYSTem System subsystem
- TRIGger Trigger subsystem
- FETCh? Result acquisition subsystem
- ERRor Error information subsystem

Common commands:

- IDN? Instrument information query subsystem
- TRG Trigger and acquire data

14.4 DISPlay Subsystem

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

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 switches to the specified page.

Command syntax	DISPlay:PAGE <page name>
Parameters	<page name> includes: MEASurement Measurement display page SETUP(MSET) Settings page COMParator Comparator page SYSTem System configuration page SYSTEMINFO(SINF) System information page CATalog File management page SWEEP(LIST) List sweep page SWEEPTABEL(LSET) List settings page USBDisk USB disk storage page
Example	Send> disp:page setup //Switch to the settings 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 sweep page lset List settings page usb USB disk storage page
Example	Send> disp:page? Return> test

14.4.2 DISP:LINE

DISP:LINE displays a string of text on the prompt bar at the bottom of the page. The text can display up to 30 characters.

DISP:LINE? acquires the text currently shown on the prompt bar.

Command syntax	DISPlay:LINE <*string*>
Parameters	<string> up to 30 characters
Example	Send> DISP:LINE “This is a Comment.”
Query syntax	DISPlay:LINE?
Example	Send> DISP:LINE? Return> NULL //NULL means a blank line

14.5 FUNCtion Subsystem

> Note:
> Parameters set with the FUNCtion subsystem are not stored to the file automatically; after setting, call the FILE subsystem to save, or use the common command SAV to store to the internal file.

Figure 14- 3 FUNCtion Subsystem Tree

FUNCtion	:RANGe	{Range No., 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 setting

Parameters set via the FUNCtion subsystem are not saved in the instrument; they must be set again at the next power-on.

14.5.1 FUNCtion:RANGe Range

FUNC:RANG sets the ranging mode and range number

Command syntax	FUNCtion:RANGe {<integer(1~4)>,min,max}
Parameters	where <Range No.> 1~4 **min** minimum range (=1) **max** maximum range (differs with voltage; refer to **Error! Reference source not found.Error! Reference source not found.**)
For example	Send> FUNC:RANG 4//Switch to range 4
Query syntax	FUNC:RANG?
Query response	Range No. 1~4
Example	Send> FUNC:RANGE? Return> 4

14.5.2 FUNCtion:RANGe:MODE Ranging Mode

FUNC:RANG:MODE switches the ranging mode

Command syntax	FUNCtion:RANGe:MODE {AUTO,HOLD(MANual),NOMinal}
For example	Send> FUNC:RANG:MODE NOM<NL> //Switch to nominal ranging mode
Query syntax	FUNC:RANG:MODE?
Query response	{AUTO,HOLD,NOM}

14.5.3 FUNCtion:RATE Test Speed

FUNC:RATE or FUNC:SPEED sets the test speed.

Command	FUNCtion:RATE {SLOW,MED,FAST}

syntax	FUNCtion:SPEED {SLOW,MED,FAST}
For example	Send> FUNC:RATE MED //Set to medium-speed testing
Query syntax	FUNCtion:RATE? FUNCtion:SPEED?
Query response	{SLOW,MED,FAST}

14.5.4 FUNCtion:CONTCHECK (CC) Contact Check

FUNC:CONTCHECK or FUNC:CC sets the contact check switch.

Command syntax	FUNCtion:CONTCHECK {OFF,ON,0,1} FUNCtion:CC {OFF,ON,0,1}
For example	Send> FUNC:CC ON
Query syntax	FUNCtion:CONTCHECK? FUNCtion:CC?
Query response	{on,off} //returns lowercase on/off

14.5.5 FUNCtion:SRES Source Resistance

FUNC:SRES sets the voltage source resistance. For current-sensitive precision devices or power batteries, current-limited mode may be required.

Command syntax	FUNCtion:SRES {NORMAL,LIMIT}
For example	Send> FUNC:SRES LIMIT //Set to current-limited mode
Query syntax	FUNCtion:SRES?
Query response	{NORMAL,LIMIT} //returns capital letters

14.6VOLTage Subsystem

The VOLTage subsystem sets the test voltage.

Figure 14- 4 VOLTage Subsystem Tree

VOLTage	<integer (10~1000)>

Command syntax	VOLTage <10~1000>
For example	Send> VOLT 100 //Set to 100V
Query syntax	VOLT?
Query response	<4-digit positive integer (□□10~1000)>
For example	Send> VOLT? Return> □100 //Returns a 4-digit positive integer; if fewer than 4 digits, prefixed with spaces.

Note:

1. Since the voltage setting affects the maximum range, confirm the maximum range change after setting the voltage. For example, at 100V and above the maximum range is range 4; below 100V the maximum range switches to range 3.
2. The returned voltage value is a 4-digit positive integer; if fewer than 4 digits, prefixed with spaces to fill 4 digits.
3. Parameters set with the VOLTage subsystem are not stored to the file automatically; after setting, call the FILE subsystem to save, or use the common command SAV to store to the internal file.
4. The voltage value can be set only in the discharge state.

14.7 TIMEr Subsystem

The TIMEr subsystem sets the charge timer, test timer, short-circuit check timer and trigger delay.

Figure 14- 5 TIMEr Subsystem Tree

TIMEr	:CHARge	<float>	Charge timer setting; 0 means off
	:SAMPle	<float>	Test timer setting; 0 means off
	:SHORt	<float>	Short-circuit timer setting; 0 means off, 9 means auto
	:TRIGdelay	<float>	Trigger delay setting; 0 means off

14.7.1 TIMEr:CHARge Charge Timer

TIMEr:CHARge sets the charge timer.

Charge timer minimum: 0.1s, maximum: 999s; 0 means the timer is off.
If the timer time is out of range, error code *E02 (Parameter error) is returned.

Command syntax	TIMEr:CHARge <float>
For example	Send> TIME:CHAR 0.5 //Set the charge timer to 0.5s Send> TIME:CHAR 0 //Charge timer off
Query syntax	TIMEr:CHARge?
Query response	<FixFloat> 4 digits total, 1 decimal place; if fewer digits, prefixed with spaces
Example	Send> TIME:CHAR? Return> □□0.0 //Charge timer off

14.7.2 TIMEr:TEST Test Timer

TIMEr:TEST sets the test timer.

Test timer minimum: 0.05s, maximum: 999s; 0 means the timer is off.
If the timer time is out of range, error code *E02 (Parameter error) is returned.

Command	TIMEr:TEST <float>

syntax	
For example	Send> TIME:TEST 0.2 //Set the test timer to 0.2s Send> TIME:TEST 0 //Test timer off
Query syntax	TIMEr:TEST?
Query response	<FixFloat> 4 digits total, 1 decimal place; if fewer digits, prefixed with spaces
Example	Send> TIME:TEST? Return> □□0.2 //Test timer set to 0.2s

14.7.3 TIMEr:SHORt Short-Circuit Check Timer

TIMEr:SHORt sets the short-circuit check timer.

> Short-circuit timer minimum: 0.01s, maximum: 1s; 0 means the timer is off, 9 means auto.
> If the timer time is out of range, error code *E02 (Parameter error) is returned.

Command syntax	TIMEr:SHORt <float>
For example	Send> TIME:SHOR 0.1 //Set the short-circuit timer to 0.1s Send> TIME:SHOR 0 //Short-circuit timer off Send> TIME:SHOR 9 //Set the short-circuit timer to auto
Query syntax	TIMEr:SHORt?
Query response	<FixFloat> 3 digits total, 2 decimal places
Example	Send> TIME:SHOR? Return> 0.10 Send> TIME:SHOR? Return> 9.00 //Short-circuit timer auto

14.7.4 TIMEr:TRIGdelay Trigger Delay Timer

TIMEr:TRIGdelay sets the trigger delay timer.

> Trigger delay timer minimum: 1ms, maximum: 9.999; 0 means the timer is off.
> If the timer time is out of range, error code *E02 (Parameter error) is returned.

Command syntax	TIMEr:TRIGdelay <float>
For example	Send> TIME:TRIG 10m //Set the trigger delay timer to 10ms Send> TIME:TRIG 0 //Trigger delay timer off
Query syntax	TIMEr:TRIGdelay?
Query response	<FixFloat> 4 digits total, 3 decimal places
Example	Send> TIME:TRIG? Return> 0.000 //Timer off Send> TIME:TRIG?

	Return> 0.010

14.8 COMParator Subsystem

The COMP subsystem sets the comparator parameters.

> Note:
> Parameters set with the COMParator subsystem are not stored to the file automatically; after setting, call the FILE subsystem to save, or use the common command SAV to store to 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] turns off the comparator or sets the number of bins.

Command syntax	COMParator[:STATe] {OFF,ON,0,1}
For example	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 Beeper

COMP:BEEP enables the beeper.

Command syntax	COMParator:BEEP {OFF,OK,NG}
For example	Send> COMP:BEEP OK //PASS beep
Query syntax	COMP:BEEP?
Query response	{OFF,OK,NG}

14.8.3 COMParator:TONE Comparator Volume

COMP:TONE sets the beeper volume, with loud (LOUD) and weak (WEAK) options.

Command syntax	COMParator:TONE {LOUD,WEAK}
For example	Send> COMP:MODE SEQ //Switch to sequential comparison mode

Query syntax	COMP:TONE?
Query response	{LOUD,WEAK}

14.8.4 COMParator:LOWer Comparator Lower Limit

COMP:LOWer sets the comparator lower limit; the data can be a floating point in any form.

Command syntax	COMParator:LOWer <float>
For example	Send> COMP:LOW 1MA //Set the lower limit to 1MΩ Send> COMP:LOW 1G //Set the lower limit to 1GΩ Send> COMP:LOW 10E6 //Set the lower limit to 10MΩ
Query syntax	COMP:LOW?
Query response	<SciFloat scientific notation>
Example	Send> COMP:LOW? Return> 1.000E+06 //=1MΩ

14.8.5 COMParator:UPper Comparator Upper Limit

COMP:UPper sets the comparator upper limit; the data can be a floating point in any form.

i Comparator limit maximum: 10G; out of range returns error code 90
Setting the upper limit to 1E20 means infinity; the upper limit does not participate in comparison.

Command syntax	COMParator:UPper {<float upper limit>, OFF}
For example	Send> COMP:UP 10G //Set the upper limit to 10GΩ Send> COMP:UP 10E9 //Set the upper limit to 10GΩ Send> COMP:UP 10E6 //Set the limit to 10MΩ Send> COMP:UP 1E20 //Upper limit off Send> COMP:UP OFF //Upper limit off
Query syntax	COMP:UP?
Query response	<SciFloat scientific notation>
Example	Send> COMP:UP? Return> 1.000E+10 //=10GΩ Return> 1.000E+20 //1E20 means the upper limit is off

14.8.6 COMParator:LIMIT (LMT) Comparator Upper/Lower Limits

COMP:LIMIT sets the comparator upper/lower limits.

Command syntax	COMParator:LIMIT <float lower limit>,<float upper limit>
For example	Send> COMP:LMT 10MA,100MA //Lower limit=10MΩ, upper limit=100MΩ Send> COMP:LMT 1G,1E20 //Lower limit=1GΩ, upper limit off
Query syntax	COMP:LMT?
Query	<scifloat>,<scifloat>

response	
Example	Send> COMP:LMT? Return> 1.000E+09,+1.000E+20 //Lower limit=1GΩ, upper limit off

14.9SYSTem Subsystem

The SYSTem subsystem sets system-related parameters. Most of these commands relate to the <System Configuration> page of the instrument.

> Note:
> Parameters set with the SYSTem subsystem are stored to system memory automatically; no extra SAV command is needed.

Figure 14- 7 SYSTem Subsystem Tree

SYSTem	:LANGuage	{ENGLISH,CHINESE,EN,CN}	System language setting
	:STYLe	{CLASSIC,MORDEN}	Theme style setting
	:TIME	<YEAR>,<MONTH>,<DAY>,<HOUR>,<MINUTE>,<SECOND>	Internal clock setting
	:KEYLock(KLOC)	{ON(1),OFF(0)}	Key lock setting
	:KEYBeep	{ON(1),OFF(0)}	Key beep settings
	:SHAKEHAND(SHAK)	{ON(1),OFF(0)}	SCPI handshake setting
	:CODE	{ON(1),OFF(0)}	SCPI error code
	:TERM?	{LF,CR,CR+LF,NUL}	Terminator query
	:RESult	{FETCh,AUTO}	Result send setting
	:FILTer	{50Hz,60Hz,AUTO}	Power-line filter setting

14.9.1 SYSTem:LANGuage System Language

Sets the instrument language.

Command syntax	SYSTem:LANGuage {ENGLISH,CHINESE,EN,CN}
For example	Send> SYST:LANG EN //Set to English display

Query syntax	SYST:LANG?
Query response	{ENGLISH,CHINESE}

14.9.2 SYSTem:SYTLe Theme Style Setting

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

Command syntax	SYSTem:STYLe { CLASSIC,MORDEN}
For example	Send> SYST:STYLe MORDEN//The instrument theme style changes to Modern
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>
For example	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>
For example	Send> SYST:TIME? Receive> 2016-12-30 11:18:31

14.9.4 SYSTem:KEYLock or SYSTem:KLOCk Keyboard Lock Setting

Command syntax	SYSTem:KEYLock {ON,OFF,0,1} SYSTem:KLOCk {ON,OFF,0,1}
For example	Send> SYST:KEYL OFF //Unlock the keyboard
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}
Parameters	{OFF,ON,0,1}
For example	Send> SYST:BEEP OFF
Query syntax	SYSTem:BEEPer?
Query response	{on,off}

14.9.6 SYSTem:SHAKhand Communication Handshake Command (Header Echo)

With the communication handshake on, the instrument echoes the received command back to the host as-is before returning the data.

Command syntax	SYSTem:SHAKhand {ON,OFF,0,1}
For example	Send> SYST:SHAK ON
Query syntax	SYSTem:SHAKhand?
Query response	{on,off}

14.9.7 SYSTem:CODE Error Code Return Setting

With SYSTem:CODE on, an error code may be returned after each received command.
The corresponding error codes are as follows:

Error Codes	Description
*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	Unknow error

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

Command syntax	SYSTem:CODE {ON,OFF,0,1}
For example	Send> SYST:CODE ON
Query syntax	SYSTem:CODE?
Query response	{on,off}

14.9.8 SYSTem:TERM? Querying the Terminator (Query Only)

SYSTem:TERM? queries the terminator used by the instrument.

Query syntax	SYSTem:TERM?
For example	Send> SYST:TERM? Return> CR+LF

14.9.9 SYSTem:RESult Test Result Send

SYSTem:RESult sets the data sending mode: automatic, or via the FETCH command.

- ☐ If Result Send is set to AUTO, the measurement data is returned depending on whether [Test Timer] is on:
- ☐ When [Test Timer] is set toOff, the instrument returns data once per measurement;
- ☐ when the test timer is set to a time, data is returned only once at the end of the measurement.

Command syntax	SYSTem:RESult {FETCH,AUTO}
Parameters	{FETCH,AUTO} FETCH: the data is returned to the host only via the fetch? command; the instrument sends passively. AUTO: after each test, the test result is sent to the host automatically; the instrument sends actively, without host participation.
For example	Send> SYST:RES AUTO //Set to automatic sending
Query syntax	SYST:RES?
Query response	{FETCH,AUTO}

14.9.10SYSTem:FILTer Setting the Power-Line Frequency

SYSTem:FILTer sets the local AC power frequency. The power-line frequency affects measurement stability; be sure to select correctly.

The power-line frequency is 50Hz in mainland China and 60Hz in Taiwan.

Command syntax	SYSTem:FILTer {50Hz,60Hz}
For example	Send> SYST:FILT 50Hz
Query syntax	SYSTem:FILTer?
Query response	{50Hz, 60Hz}

14.10 TRIGger Subsystem

Figure 14- 8 TRIGger Subsystem Tree

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

TRIGger sets the trigger source and generates a trigger.

14.10.1TRIGger[:IMMediate]

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

- ☐ When [Result Send] on the <System Configuration> page is set to auto, one trigger returns measurement data.
- ☐ When [Result Send] on the <System Configuration> page is set to FETCH, no measurement data is returned.
- ☐ If data must be returned, use the TRG command.
- ☐ If the current state is discharge, it automatically enters the charge/test state and measures once

Command syntax	TRIGger[IMMediate]
For example	Send> **TRIG** //The instrument tests once and stops

14.10.2TRIGger:SOURce

TRIG:SOUR sets the trigger source.

Command syntax	TRIGger:SOURce {INT,MAN,BUS,EXT}
For example	Send> TRIG:SOUR BUS //Set to bus trigger mode.
Query syntax	TRIG:SOUR?
Query response	{INT,MAN,BUS,EXT>

14.10.3TRG

TRG generates one trigger when the trigger source is set to BUS, and returns the triggered test data.

- ☐ Each TRG command trigger returns measurement data, regardless of the [Result Send] option.
- ☐ If the current state is discharge, it automatically enters the charge/test state, measures once and returns the measurement result.
- ☐ To keep the length of each returned value equal, trailing spaces are appended.
- ☐ If the charge time or test time is set too long, adjust the host communication to avoid timeout errors.
- ☐ Valid only on the <Measurement Display> page.
- ☐ Remote triggering must be set to [Remote].

Returned 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	Comparator

Command syntax	TRG
For example	Send> **TRG** //The instrument tests once and returns the test data Return> +1.007e+09,□100,OFF□□

14.11 FETCh (READing) Subsystem

The FETCh (READing) subsystem acquires test data.

Figure 14- 9 FETCh? Subsystem Tree

FETCh READing	FETCh?	Acquires measurement data compatible with AT682/683 (compatibility command; do not use in new applications)
	READing?	Acquires complete measurement data (use this command in new applications)
	:MAIN?	Acquires resistance data only

14.11.1READing? Acquiring Measurement Data

On the <Measurement Display> page, sending READing? returns the current measurement data.

- ☐ To use this command, the [Result Send] field on the <System Configuration> page must be set to [FETCH]
- ☐ To keep the length of each returned value equal, trailing spaces are appended
- ☐ This command is valid only on the <Measurement Display> page
- ☐ In the discharge state, the last measured value is always returned
- ☐ For compatibility with AT682/AT683 commands, the data acquisition command of the AT6820 is changed to READing

Query syntax	READing?
Query response	<SciFloat>,<FixFloat>,{OFF□□,OK□□□,NG□HI,NG□LO}
For example	Send> READing? Return> +1.008e+09,□100,OFF□□

14.11.2FETCh? Acquiring Measurement Data, Compatible with AT683/682*

This command is for compatibility with AT682/AT683; do not use it in brand-new applications.

On the <Measurement Display> page, sending FETCh? returns the current measurement data, in the same format as our AT683/AT682.

The returned data format is as follows:

0.00000e+00,0.00000e+00,GD A measured value of 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	Comparator

Query syntax	FETCh?
Query response	<SciFloat>,<**0.00000e+00**>,{GD,NG} Here, <SciFloat> insulation resistance value; 0.00000e+00 means the data is not ready <0.00000e+00> fixed value; this value is unused in the AT6820. GD means pass, NG means fail
For example	Send> FETC? Return> 1.00204e+07,0.00000e+00,NG

14.11.3READing:MAIN? Acquiring Insulation Resistance Data Only

READing:MAIN? returns only the insulation resistance value.

Query syntax	READing:MAIN?
Query response	<SciFloat>
For example	Send> READing? Return> +1.008e+09

14.12 LIST Subsystem

LIST				
	STATe		<integer>,{on(1),off(0)}	List row status setting
	VOLTage		<integer>,<integer>	Row number, voltage value
	TIMEr	DISCH	<float>	Discharge Time
		CHAR	<integer>,<float>	Row number, charge time
		TEST	<integer>,<float>	Row number, test time
	TRIGger	[:IMMediate]		Trigger one sweep
		:SOURce	{MAN,BUS,EXT}	List sweep trigger source
		:MODE	{SEQ,STEP}	List sweep sweep mode
	TRG			Trigger one sweep and return the measurement result

Note: all parameter setting commands take effect only after the list sweep stops.

14.12.1LIST:STATe

LIST:STATe turns a specified row on/off.

Command syntax	LIST:STATe <spot: 1~5>,{on,off,1,0} where spot: positive integer, row number: 1~5
For example	Send> LIST:STATe 1,off //Turn off row 1
Query syntax 1	LIST:STATe?□<spot: 1~5> Returns the status of the specified row
Query response	{on,off}
For example	Send> LIST:STAT?□4 Return> off //Returns lowercase on/off
Query syntax 2	LIST:STATe?
Query response	{on,off}
For example	Send> LIST:STAT? Return> off,on,on,on,off //Shows the status of each row in order

14.12.2LIST:VOLTage

LIST:VOLTage sets the voltage value of a specified row.

Command syntax	LIST:VOLTage <spot: 1~5>,<voltage:10~1000> Here, spot positive integer, row number: 1~5 voltage positive integer, voltage value 10~1000
For example	Send> LIST:VOLT 1,100 //Set the voltage of row 1 to 100V
Query syntax 1	LIST:VOLTage?□<spot: 1~5> Returns the voltage value of the specified row
Query response	<4-digit positive integer (□□10~1000)>
For example	Send> LIST:VOLT?□3 Return> □100 //Returns a 4-digit positive integer; if fewer than 4 digits, prefixed with spaces.
Query syntax 2	LIST:VOLTage? Returns the voltage values of all rows
Query response	<spot 1: integer>,< spot 2: integer>,< spot 3: integer>,< spot 4: integer>,< spot 5: integer>
For example	Send> LIST:VOLT? Return> □□25,□□50,□100,□200 //Returns the voltage of each row in order.

14.12.3LIST:TIMEr:DISCH

LIST:TIMEr:DISCH sets the uniform discharge time for all rows.

Command syntax	LIST:TIMEr:DISCH <float>
For	Send> LIST:TIME:DISCH 100m //Set the discharge time to 100ms

example	Send> LIST:TIME:DISCH 1 //Set the discharge time to 1s
Query syntax	LIST:TIMEr:DISCH?
Query response	<FixFloat> unit: s
For example	Send> LIST:TIME:DISCH? Return> 0.010 //The discharge time is 0.01s

14.12.4LIST:TIMEr:CHAR

LIST:TIMEr:CHAR sets the charge time of a specified row.

Command syntax	LIST:TIMEr:CHAR <spot 1~5>,<float>
For example	Send> LIST:TIME:CHAR 2,500m //Set the charge time of row 2 to 500ms Send> LIST:TIME:CHAR 1,0 //Set the charge time of row 1 to 0s (off)
Query syntax 1	LIST:TIMEr:CHAR?□<spot 1~5> Returns the charge time of the specified row
Query response	<FixFloat> unit: s
For example	Send> LIST:TIME:CHAR?□2 Return> □0.5 //The charge time is 0.5s
Query syntax 2	LIST:TIMEr:CHAR? Returns the charge times of all rows
Query response	<spot 1: FixFloat>,<spot 2: FixFloat>,<spot 3:FixFloat>,<spot 4:FixFloat>,<spot 5:FixFloat>
For example	Send> LIST:TIME:CHAR? Return> □0.5,□0.5,□1.0,□1.0,□1.0 //Shows the charge time of each row in order

14.12.5LIST:TIMEr:TEST

LIST:TIMEr:TEST sets the test time of a specified row.

i	Note: the test time cannot be set to 0s (off).

Command syntax	LIST:TIMEr:TEST <spot 1~5>,<float>
For example	Send> LIST:TIME:TEST 1,200m //Set the test time of row 1 to 200ms Send> LIST:TIME:TEST 2,0.5 //Set the test time of row 2 to 0.5s
Query syntax 1	LIST:TIMEr:TEST?□<spot 1~5> Returns the test time of the specified row
Query response	<FixFloat> unit: s
For example	Send> LIST:TIME:TEST?□5 Return> □1.0 //The test time is 1s
Query syntax 2	LIST:TIMEr:TEST? Returns the test times of all rows

Query response	<spot 1: FixFloat>,<spot 2: FixFloat>,<spot 3:FixFloat>,<spot 4:FixFloat>,<spot 5:FixFloat>
For example	Send> LIST:TIME:TEST? Return> □0.2,□0.2,□0.5,□0.1,□0.5 //Shows the test time of each row in order

14.12.6LIST:LiMiT

LIST:LiMiT sets the comparator upper/lower limits of a specified row.

Command syntax	LIST:LiMiT <spot 1~5>,<lower limit float>,<upper limit float>
For example	Send> LIST:LMT 1,1MA,10MA //Set the comparator of row 1 to 1MΩ~10MΩ Send> LIST:LMT 2,2MA,1G //Set the comparator of row 2 to 2MΩ~1GΩ Send> LIST:LMT 3,2MA,1e20 //Set the comparator of row 3 to 2MΩ~∞
Query syntax 1	LIST:LiMiT?□<spot 1~5> Returns the comparator limits of the specified row
Query response	<lower limit SciFloat>, <upper limit SciFloat>
For example	Send> LIST:LMT?□2 Return> 2.000e+06,1.000e+09
Query syntax 2	LIST:LiMiT? Returns the comparator limits of all rows
Query response	<spot 1: lower FixFloat>,<spot 1: upper FixFloat>, <spot 2: lower FixFloat>,<spot 2: upper FixFloat>, <spot 3: lower FixFloat>,<spot 3: upper FixFloat>, <spot 4: lower FixFloat>,<spot 4: upper FixFloat>, <spot 5: lower FixFloat>,<spot 5: upper FixFloat>
For example	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

14.12.7LIST:TRIGger:SOURce

LIST:TRIGger:SOURce sets the list sweep trigger source.

The list sweep trigger source does not include the internal trigger option.

Command syntax	LIST:TRIGger:SOURce {MAN,BUS,EXT}
For example	Send> LIST:TRIG:SOUR BUS //Set to bus trigger mode.
Query syntax	LIST:TRIG:SOUR?
Query response	{MAN,BUS,EXT>

14.12.8LIST:TRIGger:MODE

LIST:TRIGger:MODE sets the list sweep mode.

Command syntax	LIST:TRIGger:MODE {SEQ,STEP}
For example	Send> LIST:TRIG:MODE SEQ //Set the sweep mode to Sequential.
Query syntax	LIST:TRIG:MODE?
Query response	{SEQ,STEP}

14.12.9LIST:TRIGger[:IMMediate]

LIST:TRIG[:IMM] triggers one sweep only when the list sweep trigger source is set to remote (BUS); equivalent to the [Trig] key and the Handler Trig signal.

- ☐ When [Result Send] on the <System Configuration> page is set to auto, one trigger returns measurement data.
- ☐ When [Result Send] on the <System Configuration> page is set to FETCH, no measurement data is returned; after the sweep finishes, send the LIST:FETCh? command to acquire the results.
- ☐ If data must be returned, use the LIST:TRG command.
- ☐ If the charge time or test time is set too long, adjust the host communication to avoid timeout errors.
- ☐ The LIST:TRIG command is accepted only after the list sweep finishes.

Command syntax	LIST:TRIGger[IMMediate]
For example	Send> **LIST:TRIG**

14.12.10 LIST:FETCh?

LIST:FETCh? acquires all list measurement results, or the measurement data of a specified row.

Query syntax 1	LIST:FETCh? Returns the measurement data of all rows
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>
For example	Send> LIST:FETCh? Return> 01,**-1.000e+00, 0,OFF□□,** //means the current row 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,**□□□□□ //means the current row measurement has not started or is not complete
Query syntax 2	LIST:FETCh?□<spot: 1~5>

	Returns the measurement data of the specified row
For example	Send> LIST:FETCh? 1 Return> 01,+1.009e+07, 25,OK□□□ Send> LIST:FETCh? 2 Return> 02,**+0.000e+00**, 25,□□□□□ //means the current row measurement has not started or is not complete Send> LIST:FETCh? 3 Return> 03,**-1.000e+00, 0,OFF**□□ //means the current row is off

- ☐ The returned data is:-1.000e+00, 0,OFF□□ means the current row is off.
- ☐ The returned data is: +0.000e+00, 0,□□□□□ means the current row measurement is not complete.
- ☐ LIST:FETCh? is valid only on the <List Sweep> page.
- ☐ LIST:FETCh? is not restricted by the sweep trigger mode.

14.12.11 LIST:TRG

LIST:TRG triggers one sweep and returns the measurement result after each row measurement completes.

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>
For example	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 manages files: it can save user parameters to the internal flash, or read flash files into the system.

Figure 14- 10 FILE (MMEM) Subsystem Tree

FILE MMEM	:SAVE	<no parameter> or <file No. 0-9>	Save the current file or a specified file
	:LOAD	<no parameter> or <file No. 0-9>	Load the current file or a specified file
	:DELete	<file No. 0-9>	Delete a file

14.13.1FILE:SAVE Saving a File

FILE:SAVE saves the current settings to the current file or a specified file.

Command syntax 1	FILE:SAVE
For	Send> FILE:SAVE //Save to the current file

example	
Command syntax 2	FILE:SAVE <File No. 0-9>
Example	Send> FILE:SAVE 1 //Save to File 1

14.13.2FILE:LOAD Loading a File

FILE:LOAD reads file data into the system.

Command syntax 1	FILE:LOAD
For example	Send> FILE:LOAD //Read the current file data into the system
Command syntax 1	FILE:LOAD <File No. 0-9>
For example	Send> FILE:LOAD 1 //Read the data of File 1 into the system

14.13.3FILE:DELete Deleting a Specified File

FILE:DELete deletes the data of a specified file.

Command syntax	FILE:DELete <File No. 0-9>
For example	Send> FILE:DEL 1 //Delete File 1
Note	Deleting the current file does not affect the system parameters

14.13.4SAV

SAV saves the current settings to the current file.

Command syntax	SAV = FILE:SAVE
For example	Send**> SAV** //Save to the current file

14.13.5RCL

RCL reads the current file data into the system.

Command syntax	RCL = FILE:LOAD
For example	Send> FILE:LOAD //Read the current file data into the system

14.14 IDN? Subsystem

Figure 14- 11 IDN? Subsystem Tree

IDN?	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>
For example	Send> IDN? Return> AT6820,REV E0.90,0000000,Onmeas INSTRUMENTS LTD.

14.15 ERRor Subsystem

The error subsystem retrieves the information about the most recent error

Query syntax:	ERRor?
Query response:	Error string
Example:	Send> ERR?<NL> Return> no error.<NL>

The corresponding error codes are as follows:

Error Codes	Description
*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	Unknow error

15. Modbus (RTU) Communication Protocol

&

This chapter includes the following topics:

- Data Format — understand the Modbus communication format.
- Function
- Variable area
- Function Codes

15.1 Data Format

We comply with the Modbus (RTU) communication protocol; the instrument will respond to the commands of the host computer and return a standard response frame.

See:

You can contact the sales department of our company to obtain the Onmeas communication test tool, which contains Modbus communication debugging methods. It includes a CRC-16 calculator and conversion of floating-point numbers to the Modbus floating-point format.

15.1.1 Command Frame

Figure 15- 1 Modbus Command Frame



Table 15- 1 Command Frame Description

	At least 3.5 character times of silence required
Slave address	1 byte Modbus can support 00~0x63 slaves Specified as 00 for broadcast In instruments not fitted with the RS485 option, the default slave address is 0x01
Function Codes	1 byte 0x03: Read multiple registers 0x04: =03H, not used 0x06: Write single register, can be replaced by 10H 0x08: Echo Test (used only for debugging) 0x10: Write multiple registers
Data	Specifies the register address, quantity, and content
CRC-16	2 bytes, low byte first

	Cyclic Redundancy Check All data from the slave address to the end of the data is calculated to obtain the CRC16 check code
	At least 3.5 character times of silence required

15.1.2 CRC-16 Calculation Method

1. Set the initial value of the CRC-16 register to 0xFFFF.
2. Perform an XOR operation on the CRC-16 register and the first byte of the message, and return the calculation result to the CRC register.
3. Fill the MSB with 0 and shift the CRC register right by 1 bit.
4. If the bit shifted out from the LSB is "0", repeat step (3) (process the next shift). If the bit shifted out from the LSB is "1", perform an XOR operation on the CRC register and 0xA001, and return the result to the CRC register.
5. Repeat steps (3) and (4) until 8 bits have been shifted.
6. If the message has not been fully processed, perform an XOR operation on the CRC register and the next byte of the message, return the result to the CRC register, and repeat from step (3).
7. Append the calculated result (the value of the CRC register) to the message starting from the low-order byte.

The following is a CRC calculation function written in VB:

```
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) 'XOR each data with the CRC register
       For flag = 0 To 7
           SaveHi = CRC16Hi
           SaveLo = CRC16Lo
                     CRC16Hi = CRC16Hi \ 2      'Shift the high byte right one bit
                     CRC16Lo = CRC16Lo \ 2      'Shift the low byte right one bit
                     If ((SaveHi And &H1) = &H1) Then 'If the last bit of the high byte
is 1
                                CRC16Lo = CRC16Lo Or &H80   'then fill the front of the low
byte with 1 after shifting
                     End If            'otherwise fill 0 automatically
                     If ((SaveLo And &H1) = &H1) Then 'If the LSB is 1, XOR with the
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 byte
  eturnData(1) = CRC16Lo       'CRC low byte
 RC16 = ReturnData
End Function
```

Our company's “Onmeas communication test tool ”” contains Modbus communication debugging methods. It includes a CRC-16 calculator.

The calculated CRC-16 data must be appended to the end of the command frame, for example: 1234H:

Figure 15- 2 Modbus Appended CRC-16 Value



15.1.3 Response Frame

Unless it is a command broadcast with the slave address 00H, the instrument will return a response frame for any other slave address.

Figure 15- 3 Normal Response Frame

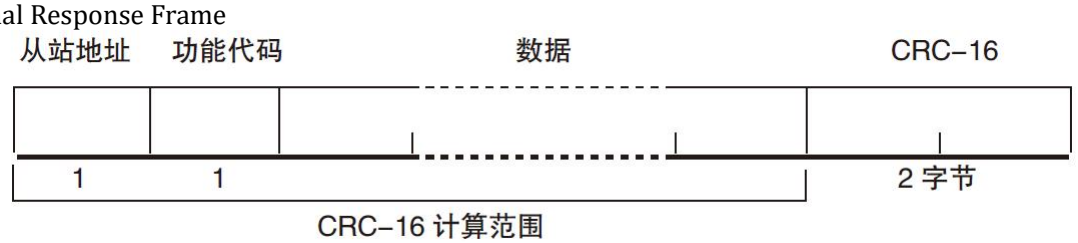


Figure 15- 4 Exception Response Frame



Table 15- 2 Exception Response Frame Description

Slave address	1 byte The slave address is returned as is
Function Codes	1 byte The function code of the command frame is logically ORed with BIT7 (0x80), for example: 0x03 OR 0x80 = 0x83
Error Codes	Exception codes: 0x01 Function code error (function code not supported) 0x02 Register error (register does not exist) 0x03 Data error 0x04 Execution error
CRC-16	2 bytes, low byte first Cyclic Redundancy Check All data from the slave address to the end of the data is calculated to obtain the CRC16 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. Digit count error, for example: the total digit count for function code 0x03 must be 8, while the received count is less than 8 or greater than 8 bytes.
5. When the slave address is 0x00, it represents the broadcast address and the instrument does not respond.

15.1.5 Error Codes

Table 15- 3 Error Code Description

Error Codes	Name	Description	Priority
0x01	Function code error	Function code does not exist	1
0x02	Register error	Register does not exist	2
0x03	Data error	Register quantity or byte count error	3
0x04	Execution error	Invalid data, the written data is not within the allowed range	4

15.2 Function Codes

The instrument supports only the following function codes; for other function codes, an error frame will be returned.

Table 15- 4 Function Codes

Function Codes	Name	Description
0x03	Read Multiple Registers	Read data from multiple consecutive registers
0x04	Same as 0x03	Please use 0x03 instead
0x08	Echo Test	The received data is returned as is
0x10	Write Multiple Registers	Write multiple consecutive registers

15.3 Registers

The register size of the instrument is in 2-byte mode; that is, 2 bytes must be written each time. For example: the speed register is 0x3002, the data is 2 bytes, and the value must be written as 0x0001

Data:

The instrument supports the following types of values:

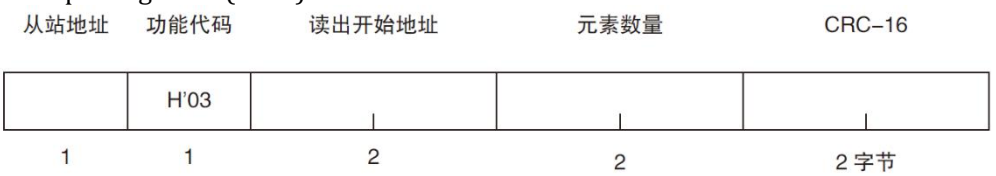
1. 1 register, double-byte (16-bit) integer, for example: 0x64 → 00 64

2. 2 registers, four-byte (32-bit) integer, for example: 0x12345678 → 12 34 56 78
3. 2 registers, four-byte (32-bit) single-precision floating-point number, 3.14 → 40 48 F5 C3

Our company's “Onmeas communication test tool ”” contains Modbus communication debugging methods. It includes a floating-point converter.

15.4Read Multiple Registers

Figure 15- 5 Read Multiple Registers (0x03)

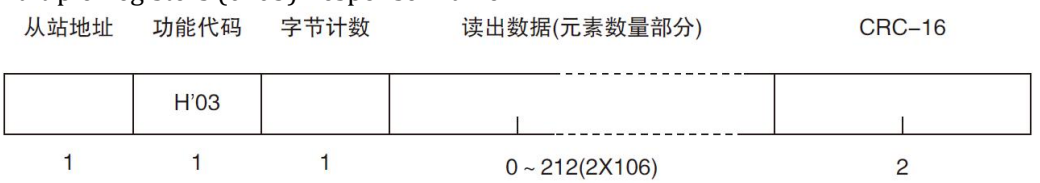


The function code for reading multiple registers is 0x03.

Table 15- 5 Read Multiple Registers

Name	Name	Description
	Slave address	When no RS485 address is specified, the default is 01
0x03	Function Codes	
	Starting address	Starting register address, refer to the Modbus command set
	Number of registers to read 0001~006A (106)	Number of registers to read consecutively. Refer to the Modbus command set to ensure that all these register addresses exist; otherwise, an error frame will be returned.
CRC-16	Check Code	

Figure 15- 6 Read Multiple Registers (0x03) Response Frame



Name	Name	Description
	Slave address	Returned as is
0x03 or 0x83	Function Codes	No exception: 0x03 Error code: 0x83
	Number of bytes	= number of registers x 2 For example: 1 register returns 02
	Data	Data read
CRC-16	Check Code	

15.5 Write Multiple Registers

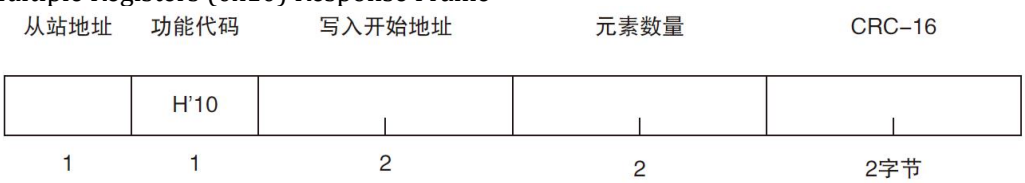
Figure 15- 7 Write Multiple Registers (0x10)



Table 15- 6 Write Multiple Registers

Name	Name	Description
	Slave address	When no RS485 address is specified, the default is 01
0x10	Function Codes	
	Starting address	Starting register address, refer to the Modbus command set
	Number of registers to write 0001~0068 (104)	Number of registers to read consecutively. Refer to the Modbus command set to ensure that all these register addresses exist; otherwise, an error frame will be returned.
	Number of bytes	= number of registers x 2
CRC-16	Check Code	

Figure 15- 8 Write Multiple Registers (0x10) Response Frame



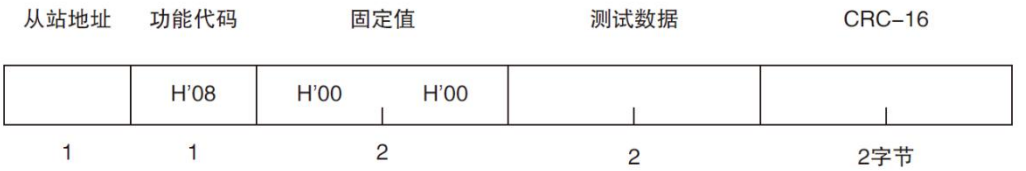
Name	Name	Description
	Slave address	Returned as is
0x10 or 0x90	Function Codes	No exception: 0x10 Error code: 0x90
	Starting address	
	No. of Registers	
	CRC-16 Check Code	

15.6 Echo Test

The function code of the Echo Test is 0x08, which is used for debugging Modbus.

Figure 15- 9 Echo Test (0x08)

指令帧



响应帧



Name	Name	Description
	Slave address	Returned as is
0x08	Function Codes	
	Fixed value	00 00
	Test data	Any value: for example 12 34
	CRC-16 Check Code	

Example:

Assume the test data is 0x1234:

指令：	01	08	00 00	12 34	ED 7C(CRC–16)
响应：	01	08	00 00	12 34	ED 7C(CRC–16)

16. Modbus (RTU) Command Set

This chapter includes the following topics:

- Register Address

Our company's “Onmeas communication test tool “” contains Modbus communication debugging methods. It includes a floating-point converter.

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

16.1 Register Overview

The following lists all register addresses used by the instrument. Any address not in the table will return error code 0x02.

Table 16- 1 Register Overview

Registers		Number of bytes	Name	Value	Description
Address	Quantity				
2000	2	4	Read measurement result	4-byte floating-point number Byte order AABBCCDD	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 result	4-byte floating-point number Byte order CCDDAABB	Read-only
2300	4	8	Trigger once and read the measurement result Resistance (4 bytes), voltage (2 bytes), comparator (2 bytes)	Resistance: 4-byte floating point Byte order: AABBCCDD Voltage: 2-byte integer Comparator: 2-byte integer	Read-only
2500	2	4	Read list row 1 resistance measurement result	4-byte floating-point number	Read-only
2502	2	4	Read list row 2 resistance measurement result	4-byte floating-point number	Read-only
2504	2	4	Read list row 3 resistance measurement result	4-byte floating-point number	Read-only

2506	2	4	Read list row 4 resistance measurement result	4-byte floating-point number	Read-only
2508	2	4	Read list row 5 resistance measurement result	4-byte floating-point number	Read-only
2510	1	2	Read list row 1 voltage measurement result	2-byte integer	Read-only
2511	1	2	Read list row 2 voltage measurement result	2-byte integer	Read-only
2512	1	2	Read list row 3 voltage measurement result	2-byte integer	Read-only
2513	1	2	Read list row 4 voltage measurement result	2-byte integer	Read-only
2514	1	2	Read list row 5 voltage measurement result	2-byte integer	Read-only
2520	1	2	Read list row 1 comparison result	2-byte integer	Read-only
2521	1	2	Read list row 2 comparison result	2-byte integer	Read-only
2522	1	2	Read list row 3 comparison result	2-byte integer	Read-only
2523	1	2	Read list row 4 comparison result	2-byte integer	Read-only
2524	1	2	Read list row 5 comparison result	2-byte integer	Read-only
0000	1	2	Read the instrument version number	4-byte integer	Read-only, data occupies 2 registers
3000	1	2	Range No.	0001~0004	Read/Write register, 2-byte integer
3001	1	2	Range mode	0000: Auto range 0001: manual range 0002: Nominal range	Read/Write register, 2-byte integer
3002	1	2	Test Speed	0000: Slow 0001: Medium 0002: Fast	Read/Write register, 2-byte integer
3003	1	2	Voltage	000A~03E8	Read/Write register, 2-byte integer
3004	1	2	Trigger Mode	0000: internal trigger 0001: manual trigger 0002: remote trigger 0003: external trigger	Read/Write register, 2-byte integer
3005	1	2	Contact check	0000: Off 0001: On	Read/Write register, 2-byte integer
3006	1	2	Source Resistance	0000: normal 0001: current-limited	Read/Write register, 2-byte integer

3010	2	4	Charge Time	4-byte floating-point number	Read/write register
3012	2	4	Test Time	4-byte floating-point number	Read/write register
3014	2	4	Short-circuit time	4-byte floating-point number	Read/write register
3016	2	4	Trigger delay	4-byte floating-point number	Read/write register
3100	1	2	Comparator status	0000: Off 0001: On	Read/Write register, 2-byte integer
3101	1	2	Comparator beeper	0000: Off 0001: OK 0002: NG	Read/Write register, 2-byte integer
3102	1	2	Beeper volume	0001: weak 0002: loud	Read/Write register, 2-byte integer
3110	2	4	Comparator lower limit	4-byte floating-point number	Read/write register
3112	2	4	Comparator upper limit	4-byte floating-point number	Read/write register
3120	1	2	List trigger mode	0001: Manual 0002: remote 0003: external	Read/write register
3121	1	2	List sweep mode	0000: sequential 0001: single-step	Read/write register
3122	2	4	List sweep discharge time	4-byte floating-point number	Read/write register
3200	1	2	List sweep row 1 status	0000: Off 0001: On	Read/write register
3201	1	2	List sweep row 2 status	0000: Off 0001: On	Read/write register
3202	1	2	List sweep row 3 status	0000: Off 0001: On	Read/write register
3203	1	2	List sweep row 4 status	0000: Off 0001: On	Read/write register
3204	1	2	List sweep row 5 status	0000: Off 0001: On	Read/write register
3210	1	2	List sweep row 1 voltage	List sweep row 2 voltage	Read/write register
3211	1	2	List sweep row 3 voltage	List sweep row 2 voltage	Read/write register
3212	1	2	List sweep row 4 voltage	List sweep row 2 voltage	Read/write register
3213	1	2	List sweep row 5 voltage	List sweep row 2	Read/write register

				voltage	
3214	1	2	List sweep row 6 voltage	List sweep row 2 voltage	Read/write register
3220	2	4	List sweep row 1 charge time	4-byte floating-point number	Read/write register
3222	2	4	List sweep row 2 charge time	4-byte floating-point number	Read/write register
3224	2	4	List sweep row 3 charge time	4-byte floating-point number	Read/write register
3226	2	4	List sweep row 4 charge time	4-byte floating-point number	Read/write register
3228	2	4	List sweep row 5 charge time	4-byte floating-point number	Read/write register
3230	2	4	List sweep row 1 test time	4-byte floating-point number	Read/write register
3232	2	4	List sweep row 2 test time	4-byte floating-point number	Read/write register
3234	2	4	List sweep row 3 test time	4-byte floating-point number	Read/write register
3236	2	4	List sweep row 4 test time	4-byte floating-point number	Read/write register
3238	2	4	List sweep row 5 test time	4-byte floating-point number	Read/write register
3240	2	4	List sweep row 1 lower limit	4-byte floating-point number	Read/write register
3242	2	4	List sweep row 2 lower limit	4-byte floating-point number	Read/write register
3244	2	4	List sweep row 3 lower limit	4-byte floating-point number	Read/write register
3246	2	4	List sweep row 4 lower limit	4-byte floating-point number	Read/write register
3248	2	4	List sweep row 5 lower limit	4-byte floating-point number	Read/write register
3250	2	4	List sweep row 1 upper limit	4-byte floating-point number	Read/write register
3252	2	4	List sweep row 2 upper limit	4-byte floating-point number	Read/write register
3254	2	4	List sweep row 3 upper limit	4-byte floating-point number	Read/write register
3256	2	4	List sweep row 4 upper limit	4-byte floating-point number	Read/write register
3258	2	4	List sweep row 5 upper limit	4-byte floating-point number	Read/write register
4000	1	2	Save settings to the	Fixed value: 0001	Write-only register, data

			current file		2 bytes
4001	1	2	Read the current file data	Fixed value: 0001	Write-only register, data 2 bytes
4002	1	2	Save settings to the specified file	0000~0009	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 power-on recall	0000: File 0 0001: Current file	Read/Write register, 2-byte integer
4021	1	2	Auto save	0000: Forbid 0001: Allow	Read/Write register, 2-byte integer
4022	1	2	System language	0000: English 0001: Simplified Chinese	Read/Write register, 2-byte integer
4023	1	2	Power-line frequency	0000: 50Hz 0001: 60Hz	Read/Write register, 2-byte integer
5002	1	2	Key lock	0000: unlocked 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 setting	0000: stop 0001: start	Write-only register, 2 bytes

16.2 Acquiring Measurement Data

16.2.1 [2000][2001] Acquiring Resistance Measurement Results

Registers 2000~2001 acquire the instrument resistance value.

Command:

1	2	3	4	5	6	7	8
01	03	2200		0002		CFCB	
Slave	Read	Registers		No. 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	Bytes	Single-precision floating-point number				CRC-16	

- Acquiring the measurement data:

Here B4~B6 are a single-precision floating point, byte order AA BB CC DD

Measurement data: 4B 18 E5 26 converts to floating point: 0x4B18E526 = 1.0020134E7 (decimal)

For online floating-point conversion refer to the websitehttps://www.anbai.cn/Support/IEEE754.aspx

16.2.2 [2002] Acquiring Voltage Measurement Results

Register 2002 acquires the instrument resistance value.

Command:

1	2	3	4	5	6	7	8
01	03	2002		0001		2E0A	
Slave	Read	Registers		No. of Registers		Check Code	

Response

1	2	3	4	5	6	7
01	03	02	**00**	**64**	**B9**	**AF**
Slave	Read	Bytes	Integer		CRC-16	

Here B4~B5 are an integer: 0x0064 = 100 (decimal)

16.2.3 [2003] Acquiring the Comparator Result

Register 2003 acquires the comparator result. The returned 2-byte integer represents the comparator result:

0000: OK

0001: NG LO

0002: NG HI

0003: OFF

0004: SHORT

■ Read

1	2	3	4	5	6	7	8
01	03	20	03	00	01	7F	CA
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**03**	**F8**	**45**
Slave	Read	Bytes	Integer		CRC-16	

16.2.4 [2000]~[2003] Acquiring All Results at Once

■ Read

1	2	3	4	5	6	7	8
01	03	20	00	00	04	4F	C9
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4-5	6-7	8-9	10-11	12-13
01	03	08	4B18	C297	0000	0003	6D6B
Slave	Read	Bytes	Resistance floating point		Voltage	Comparator	CRC16

Here,

B4-B7: 4B18C297 resistance value (floating point) = 1.0011287E7Ω

B8-B9: 0000 voltage value (integer) = 0V

B10-B11: 0003 comparator=OFF

16.2.5 Acquiring Measurement Results (CCDD AABB) [2200]

Registers 2200~2201 acquire the instrument resistance value.

Command:

1	2	3	4	5	6	7	8
01	03	2200		0002		CFCB	
Slave	Read	Registers		No. 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	Bytes	Single-precision floating-point number				CRC-16	

Here B4~B6 are the measurement data: C2 97 4B 18 is a single-precision floating point, high word first, byte order CC DD AA BB.

After swapping the word order, 4B18C297 converts to 1.0011287E7 in decimal

16.2.6 Trigger Once and Return Measurement Results (AABBCCDD) [2300]-[2303]

Registers 2300~2303 acquire the instrument measurement data; the resistance floating-point format is AABBCCDD.

■ Read

1	2	3	4	5	6	7	8
01	03	2300		0004		4F8D	
Slave	Read	Registers		No. 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 (floating point)		Voltage	Comparator	CRC16

Here B4~B7 are the resistance value: 4B18C1EA is a single-precision floating point. Byte order AA BB CC DD converts to1.0011114E7

B8-B9 voltage value: 0x0064 = 100 (decimal)

B10-B11 comparator value: 0x0003 = OFF

■ This command is valid under the following conditions:

□ Charge timer on

□ <Measurement Display> page

□ Trigger set to [Remote]

■ After the command is issued, wait for one measurement to complete before the data is returned; therefore at slow speed the response is slightly delayed.

16.2.7 Trigger Once and Return Measurement Results (CCDD AABB) [2400]

Registers 2400~2403 acquire the instrument measurement data; the resistance floating-point format is CCDDAABB.

■ Read:

1	2	3	4	5	6	7	8
01	03	2400		0003		4EF9	
Slave	Read	Registers		No. 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 (floating point)		Voltage	Comparator	CRC16

Here B4~B7 are the resistance value: C160 4B18 is a single-precision floating point. Byte order CCDDAABB; adjusting the byte order to 4B18C160 converts to1.0010976E7

B8-B9 voltage value: 0x0064 = 100 (decimal)

B10-B11 comparator value: 0x0003 = OFF

> This command is valid under the following conditions:
> ■ Charge timer on
> ■ <Measurement Display> page
> ■ Trigger set to [Remote]

16.3 Parameter Settings

16.3.1 [3000] Test Range

■ Writing:

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	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: range No. 1~4

Write return:

1	2	3	4	5	6	7	8
01	10	30	00	00	01	0E	C9
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3000		0001		8B0A	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**04**	**B9**	**87**

Slave	Read	Bytes	Integer	CRC-16

B4-B5: 0004 range 4.

16.3.2 [3001] Ranging Mode

■ Writing:

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	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: ranging mode

0000: auto

0001: Manual

0002: nominal

Write return:

1	2	3	4	5	6	7	8
01	10	30	01	00	01	5F	09
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3001		0001		DACA	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**02**	**39**	**85**
Slave	Read	Bytes	Integer		CRC-16	

B4-B5: 0002=nominal

16.3.3 [3002] Speed

■ 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	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: speed

0000: Slow

0001: Medium

0002: Fast

Write return:

1	2	3	4	5	6	7	8
01	10	30	02	00	01	AF	09
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3002		0001		2ACA	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slave	Read	Bytes	Integer		CRC-16	

B4-B5: 0001 medium

16.3.4 [3003] Test Voltage

■ Write

1	2	3	4	5	6	7	8	9	10	11
01	10	3003		0001		02	0064		978B	
Station No.	Write	Registers		No. of Registers		Bytes	Data		CRC16	

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

Write return:

1	2	3	4	5	6	7	8
01	10	30	03	00	01	FE	C9
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3003		0001		7B0A	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**64**	**B9**	**AF**
Slave	Read	Bytes	Integer		CRC-16	

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

16.3.5 [3004] Trigger Mode

■ Write

1	2	3	4	5	6	7	8	9	10	11
01	10	3004		0001		02	0001		5617	
Station No.	Write	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: trigger mode

0000: internal trigger

0001: manual trigger

0002: remote trigger

0003: external trigger

0004: internal semi-auto trigger

Write return:

1	2	3	4	5	6	7	8
01	10	30	04	00	01	4F	08
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3004		0001		CACB	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slave	Read	Bytes	Integer		CRC-16	

B4-B5: 0001 =manual trigger

16.3.6 [3005] Contact Check Switch

■ Write

1	2	3	4	5	6	7	8	9	10	11
01	10	3005		0001		02	0001		5617	
Station No.	Write	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: contact check switch

0000: Off

0001: On

Write return:

1	2	3	4	5	6	7	8
01	10	30	05	00	01	1E	C8
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3005		0001		9B0B	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**00**	**B8**	**44**
Slave	Read	Bytes	Integer		CRC-16	

B4-B5: 0000 =off

16.3.7 [3006] Source Resistance

■ Write

1	2	3	4	5	6	7	8	9	10	11
01	10	3006		0001		02	0001		57F5	
Station No.	Write	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: source resistance

0000: normal

0001: current-limited

Write return:

1	2	3	4	5	6	7	8
01	10	30	06	00	01	EE	C8
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3006		0001		6B0B	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**00**	**B8**	**44**
Slave	Read	Bytes	Integer		CRC-16	

B4-B5: 0000 =off

16.3.8 [3010] Charge Time

> Charge timer minimum: 0.1s, maximum: 999s; 0 means the timer is off.
> If the timer time is out of range, error code 90 is 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	Registers		No. of Registers		Bytes	Floating point				CRC16	

B8-B11: charge time, floating-point format

3F 80 00 00 = 1 (decimal)

Write return:

1	2	3	4	5	6	7	8
01	10	30	10	00	02	4F	0D
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3010		0002		CACE	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7	8	9
01	03	04	**3F**	**80**	**00**	**00**	**F7**	**CF**
Slave	Read	Bytes	Floating point				CRC-16	

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

16.3.9 [3012] Test Time

> Test timer minimum: 0.05s, maximum: 999s; 0 means the timer is off.
> If the timer time is out of range, error code 90 is 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	Registers		No. of Registers		Bytes	Floating point				CRC16	

B8-B11: test time, floating-point format

00 00 00 00: means off

3F 00 00 00 = 0.5 (decimal)

Write return:

1	2	3	4	5	6	7	8
01	10	30	12	00	02	EE	0D
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3012		0002		6B0E	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7	8	9
01	03	04	**3F**	**00**	**00**	**00**	**F6**	**27**
Slave	Read	Bytes	Floating point				CRC-16	

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

16.3.10[3014] Short-Circuit Check

> Trigger delay timer minimum: 1ms, maximum: 9.999; 0 means the timer is off.
> If the timer time is out of range, error code 90 is 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	Registers		No. of Registers		Bytes	Floating point				CRC16	

B8-B11: short-circuit check time, floating-point format

00 00 00 00 : (decimal 0) means off

41 10 00 00 : (decimal 9) means auto

Write return:

1	2	3	4	5	6	7	8
01	10	30	14	00	02	0E	CC
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3014		0002		8B0F	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7	8	9
01	03	04	**41**	**10**	**00**	**00**	**EF**	**0A**
Slave	Read	Bytes	Floating point				CRC-16	

B4-B7: 41 10 00 00 (decimal 9) means auto.

16.3.11[3016] Trigger Delay

> Trigger delay timer minimum: 1ms, maximum: 9.999; 0 means the timer is off.
> If the timer time is out of range, error code 90 is 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	Registers		No. of Registers		Bytes	Floating point				CRC16	

B8-B11: trigger delay setting, floating-point format

00 00 00 00 : (decimal 0) means off

3D CC CC CD = (decimal) 0.1

Write return:

1	2	3	4	5	6	7	8
01	10	30	16	00	02	0E	CC
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3016		0002		2ACF	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7	8	9
01	03	04	**3D**	**CC**	**CC**	**CD**	**A3**	**35**
Slave	Read	Bytes	Floating point				CRC-16	

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

16.4Comparator Settings

The comparator parameter setting register addresses start from 3100.

16.4.1 [3100] Comparator Status

■ 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	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: comparator status

0000: Off

0001: On

Write return:

1	2	3	4	5	6	7	8
01	10	31	10	00	01	0F	35
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3010		0001		8AF6	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slave	Read	Bytes	Integer		CRC-16	

B4-B5: 0001 on

16.4.2 [3101] Comparator Beeper

■ Write

1	2	3	4	5	6	7	8	9	10	11
01	10	3101		0001		02	0001		4682	
Station No.	Write	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: beeper status

0000: Off

0001: PASS beep

0002: FAIL beep

Write return:

1	2	3	4	5	6	7	8
01	10	3101		0001		5EF5	
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3101		0001		DB36	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slave	Read	Bytes	Integer		CRC-16	

B4-B5: 0001 PASS beep

16.4.3 [3102] Beeper Volume

■ Write

1	2	3	4	5	6	7	8	9	10	11
01	10	3102		0001		02	0002		06B0	
Station No.	Write	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: beeper volume

0000: Invalid

0001: weak

0002: loud

Write return:

1	2	3	4	5	6	7	8
01	10	3102		0001		AEF5	
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3102		0002		2B36	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**02**	**39**	**85**
Slave	Read	Bytes	Integer		CRC-16	

B4-B5: 0002 loud

16.4.4 [3110-3113] Comparator Limits

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

The comparator upper limit uses 2 registers [3112]~[3113], 4-byte floating point type.

> Comparator limit maximum: 10G; out of range returns error code 90
> Setting the upper limit to 60 AD 78 EC = 1E20 (decimal) means infinity; the upper limit does not participate in comparison.

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

a) Lower limit 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	Registers		No. of Registers		Bytes	Floating point				CRC16	

B8-B11: lower limit, floating-point format

4B 18 96 80 = 1E7 (decimal 10M)

Write return:

1	2	3	4	5	6	7	8
01	10	31	10	00	02	4E	F1
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3010		0002		CB32	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7	8	9
01	03	04	**4B**	**18**	**96**	**80**	**F7**	**CF**
Slave	Read	Bytes	Floating point				CRC-16	

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

b) Upper limit 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	Registers		No. of Registers		Bytes	Floating point				CRC16	

B8-B11: lower limit, floating-point format

60 AD 78 EC = 1E20 (decimal): means infinity.

Write return:

1	2	3	4	5	6	7	8
01	10	31	12	00	02	EF	31
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3012		0002		CB32	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7	8	9
01	03	04	**60**	**AD**	**78**	**EC**	**56**	**5F**
Slave	Read	Bytes	Floating point				CRC-16	

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

c) Setting both limits:

■ Write (10M~∞)

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	Registers		No. of Registers		Bytes	Lower limit and upper limit	CRC16	

B8-B11: 4B 18 96 80 lower limit 10MΩ,

B12-B15: 60 AD 78 EC upper limit 1E20 : means infinity.

Write return:

1	2	3	4	5	6	7	8
01	10	31	10	00	04	CE	F3
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3010		0004		CB32	
Slave	Read	Registers		No. 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**
Slave	Read	Bytes	Lower limit	Upper limit	CRC-16	

B4~B7: 4B 18 96 80 lower limit 10MΩ

B8~B11: 60 AD 78 EC upper limit 1E20 : means infinity

16.5 File Operations

Since the instrument settings are stored in files, if the [Auto Save] field on the <File> page is not turned on, data set via Modbus commands cannot be stored in the internal FlashRom in real time; at the next power-on the register data will revert to the values of the original file.

The user can use the file operation registers to store all setting values into the current or a specified file; at the same time, the data of a specified file can also be recalled into the setting registers.

> You can also turn on the [Auto Save] field on the <File> page so that every setting is saved automatically; the file commands can then be ignored.

16.5.1 [4000] Save to the Current File

Send the value 0001 to register 4000, and the instrument will perform the file write operation; 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
Slave	Write	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9 data value:

0001: fixed value; other values return error code 90

Response:

1	2	3	4	5	6	7	8
01	10	40	00	00	01	14	09
Slave	Write	Registers		No. of Registers		CRC16	

16.5.2 [4001] Reload the Current File

Send the fixed value 0001 to register 4001; the instrument will load 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	Registers		No. of Registers		Bytes	Data		CRC	

B8-B9 data value:

0001: fixed value; other values return error code 90

Response:

1	2	3	4	5	6	7	8
01	10	40	01	00	01	45	C9
Slave	Write	Registers		No. of Registers		CRC16	

16.5.3 [4002] Save to a Specified File

Send the file number to register 4002; the instrument will perform the file write operation, save all settings to the specified file, and use the specified file as the current system file.

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	Registers		No. of Registers		Bytes	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	02	00	01	45	C9
Slave	Write	Registers		No. of Registers		CRC16	

16.5.4 [4003] Load a Specified File

Send the file number to register 4003; the instrument will load the settings of the specified file into the system and use the specified file as the current system file.

This register cannot be read.

■ Write

1	2	3	4	5	6	7	8	9	10	11
01	10	40	03	00	01	02	00	00	27	85
Slave	Write	Registers		No. of Registers		Bytes	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	03	00	01	E4	09
Slave	Write	Registers		No. of Registers		CRC16	

16.6 List Sweep

16.6.1 [3120] List Sweep Trigger Mode

> *i* The list sweep trigger mode has no auto-trigger option.

■ Write

1	2	3	4	5	6	7	8	9	10	11
01	10	3120		0001		02	0002		0032	
Station No.	Write	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: trigger mode

0001: manual trigger

0002: remote trigger

0003: external trigger

Write return:

1	2	3	4	5	6	7	8
01	10	31	20	00	01	8B	3C
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3120		0001		8B3C	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slave	Read	Bytes	Integer		CRC-16	

B4-B5: 0001 =manual trigger

16.6.2 [3121] List Sweep Mode

■ Write

1	2	3	4	5	6	7	8	9	10	11
01	10	3121		0001		02	0001		41E2	
Station No.	Write	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: trigger mode

0000: sequential sweep

0001: single-step sweep

Write return:

1	2	3	4	5	6	7	8
01	10	31	21	00	01	DA	FC
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3121		0001		DAFC	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slave	Read	Bytes	Integer		CRC-16	

B4-B5: 0001 =single-step sweep

16.6.3 [3122-3223] Discharge Time Setting

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

■ Write

1	2	3	4	5	6	7	8	9	10	11	12	13
01	10	3122		0002		04	3D CC CC CD				70F9	
Station No.	Write	Registers		No. of Registers		Bytes	Floating point				CRC16	

B8-B11: discharge time 0.01~10, floating-point format.

3D CC CC CD = 0.1 (decimal)

Write return:

1	2	3	4	5	6	7	8
01	10	31	22	00	02	EF	3E
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3122		0002		6AFD	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7	8	9
01	03	04	**3D**	**CC**	**CC**	**CD**	**A3**	**35**
Slave	Read	Bytes	Floating point				CRC-16	

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

16.6.4 [3124] Triggering a Sweep

Sending the fixed value 0001 to register 3124 executes one sweep.

■ Write

1	2	3	4	5	6	7	8	9	10	11
01	10	3124		0001		02	0001		41 not	
Station No.	Write	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: trigger mode

0001: fixed value

Write return:

1	2	3	4	5	6	7	8
01	10	31	24	00	01	4F	3E
Slave	Write	Registers		No. of Registers		CRC16	

16.6.5 [3200]~[3204] List Status Settings

Each list row corresponds to one register:

3200: row 1 status

3201: row 2 status

3202: row 3 status

3203: row 4 status

3204: row 5 status

■ Writing 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	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: list status

0000: Off

0001: On

Write return:

1	2	3	4	5	6	7	8
01	10	32	00	00	01	0F	71
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3200		0001		8AB2	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**01**	**79**	**84**
Slave	Read	Bytes	Integer		CRC-16	

B4-B5: 0001 on

16.6.6 [3210]~[3214] List Voltage Settings

Each list row corresponds to one voltage register:

3210: row 1 voltage

3211: row 2 voltage

3212: row 3 voltage

3213: row 4 voltage

3214: row 5 voltage

■ Writing 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	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: voltage value, integer type 10~1000

000A = 10 (decimal)

Write return:

1	2	3	4	5	6	7	8
01	10	32	10	00	01	0E	B4
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3210		0001		8B77	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7
01	03	02	**00**	**0A**	**38**	**43**
Slave	Read	Bytes	Integer		CRC-16	

B4-B5: voltage value, integer type 10~1000

000A = 10 (decimal)

16.6.7 [3220-3221]~[3228-3229] List Charge Time Settings

Each row charge time corresponds to 2 voltage registers:

3220-3221: row 1 charge time

3222-3223: row 2 charge time

3224-3225: row 3 charge time

3226-3227: row 4 charge time

3228-3229: row 5 charge time

■ Writing row 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	Registers		No. of Registers		Bytes	Data	CRC16	

B8-B11: charge time, floating-point type, 0.1~99s

3F 80 00 00 = 1.0 (decimal)

Write return:

1	2	3	4	5	6	7	8
01	10	32	20	00	02	4E	BA
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3220		0001		CB79	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7	8	9
01	03	04	**3F**	**80**	**00**	**00**	**F7**	**CF**
Slave	Read	Bytes	Floating point				CRC-16	

B4-B7: charge time, floating-point type, 0.1~99s

3F 80 00 00 = 1.0 (decimal)

16.6.8 [3230-3231]~[3238-3239] List Test Time Settings

Each row charge time corresponds to 2 voltage registers:

3230-3231: row 1 test time

3232-3233: row 2 test time

3234-3235: row 3 test time

3236-3237: row 4 test time

3238-3239: row 5 test time

■ Writing row 1 test 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	Registers		No. of Registers		Bytes	Data	CRC16	

B8-B11: test time, floating-point type, 0.1~99s

3F 00 00 00 = 0.5 (decimal)

Write return:

1	2	3	4	5	6	7	8
01	10	32	30	00	02	0E	B4
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3230		0002		CABC	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7	8	9
01	03	02	**3F**	**00**	**00**	**00**	**F6**	**27**
Slave	Read	Bytes	Floating point				CRC-16	

B4-B7: test time, floating-point type, 0.1~99s

3F 00 00 00 = 0.5 (decimal)

16.6.9 [3240-3241]~[3248-3249] List Comparator Lower Limit Settings

Each row charge time corresponds to 2 voltage registers:

3240-3241: row 1 comparator lower limit

3242-3243: row 2 comparator lower limit

3244-3245: row 3 comparator lower limit

3246-3247: row 4 comparator lower limit

3248-3249: row 5 comparator lower limit

■ Writing row 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	Registers		No. of Registers		Bytes	Data	CRC16	

B8-B11: comparator lower limit, floating-point type

49 74 24 00 = 1E6 (decimal)

Write return:

1	2	3	4	5	6	7	8
01	10	32	40	00	02	4E	A4
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3240		0002		CB67	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7	8	9
01	03	02	**49**	**74**	**24**	**00**	**B7**	**75**
Slave	Read	Bytes	Floating point				CRC-16	

B4-B7: test time, floating-point type, 0.1~99s

49 74 24 00 = 1E6 (decimal)

16.6.10[3250-3251]~[3258-3259] List Comparator Upper Limit Settings

Each row charge time corresponds to 2 voltage registers:

3250-3251: row 1 comparator upper limit

3252-3253: row 2 comparator upper limit

3254-3255: row 3 comparator upper limit

3256-3257: row 4 comparator upper limit

3258-3259: row 5 comparator upper limit

■ Writing row 1 comparator upper limit

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	Registers		No. of Registers		Bytes	Data	CRC16	

B8-B11: comparator upper limit, floating-point type

60 AD 78 EC = 1E20 (decimal): means ∞

Write return:

1	2	3	4	5	6	7	8
01	10	32	50	00	02	4F	61
Slave	Write	Registers		No. of Registers		CRC16	

■ Read:

1	2	3	4	5	6	7	8
01	03	3250		0002		565F	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7	8	9
01	03	02	**60**	**AD**	**78**	**EC**	**B7**	**75**
Slave	Read	Bytes	Floating point				CRC-16	

B4-B7: test time, floating-point type, 0.1~99s

60 AD 78 EC = 1E20 (decimal): means ∞

16.6.11[2500]-[2509] Reading Resistance Measurement Results

i

A resistance value of BF 80 00 00 (decimal -1) means the current row is off.

A resistance value of 00 00 00 00 (decimal 0) means the data has not been updated.

a) Reading the resistance measurement result of a specified row

2500 – 2501 resistance of row 1

2502 - 2503 resistance of row 2

2504 – 2505 resistance of row 3

2506 – 2507 resistance of row 4

2508 – 2509 resistance of row 5

Each row measurement result uses 2 registers, in floating-point format.

■ Read:

1	2	3	4	5	6	7	8
01	03	2500		0002		565F	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

1	2	3	4	5	6	7	8	9
01	03	02	**4B**	**25**	**61**	**DB**	**95**	**D7**
Slave	Read	Bytes	Floating point				CRC-16	

B4-B7: resistance measurement value, floating-point type

4B 25 61 DB = 1.0838491E7 (decimal)

b) Reading all list resistance measurement values

■ Read:

1	2	3	4	5	6	7	8
01	03	2500		000A		CEC1	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

Returned data:

1	2	3	04 05 06 07	08 09 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 sweep data groups					CRC

The data of the 5 rows 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 4B 18 33 AF = 9.974703E6 (decimal)

16.6.12[2510]-[2514] Reading Voltage Measurement Results

a) Reading the voltage measurement result of a specified row

2510 voltage of row 1

2511 voltage of row 2

2512 voltage of row 3

2513 voltage of row 4

2514 voltage of row 5

Each row measurement result uses 1 register, in integer format.

■ Read:

1	2	3	4	5	6	7	8
01	03	2510		0001		8EC3	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

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

B4-B5: voltage measurement value, integer type

000A = 10 (decimal)

b) Reading all list voltage measurement values

■ Read:

1	2	3	4	5	6	7	8
01	03	2510		0005		8F00	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

Returned data:

1	2	3	04 05	06 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 sweep data groups					CRC

The data of the 5 rows 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[2520]-[2524] Reading Comparison Results

b) Reading the comparison result of a specified row

2520 comparison result of row 1
2521 comparison result of row 2
2522 comparison result of row 3
2523 comparison result of row 4
2524 comparison result of row 5

Each row measurement result uses 1 register, in integer format.

■ Read:

1	2	3	4	5	6	7	8
01	03	2520		0001		8ECC	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

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

B4-B5: comparison result, integer type
0000 = OK
0001 = NGLO
0002 = NGHI
0003 = OFF

b) Reading all list voltage measurement values

■ Read:

1	2	3	4	5	6	7	8
01	03	2520		0005		8F0F	
Slave	Read	Registers		No. of Registers		Check Code	

Response:

Returned data:

1	2	3	04 05	06 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 sweep data groups					CRC

The data of the 5 rows 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 Functions

16.7.1 [5002] Key Lock

Write-only register.

1	2	3	4	5	6	7	8	9	10	11
01	10	5002		0001		02	0000		F7B7	
Station No.	Write	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9:

0000: unlocked

0001: locked

Write return:

1	2	3	4	5	6	7	8
01	10	50	02	00	01	B1	09
Slave	Write	Registers		No. of Registers		CRC16	

16.7.2 [5004] Trigger

Write-only register. Valid only on the <Measurement Display> page and when 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	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9: 0001 fixed value

Write return:

1	2	3	4	5	6	7	8
01	10	50	04	00	01	51	08
Slave	Write	Registers		No. of Registers		CRC16	

16.7.3 [5006] Start/Stop Test

■ Write

1	2	3	4	5	6	7	8	9	10	11
01	10	5006		0001		02	0002		77F2	
Station No.	Write	Registers		No. of Registers		Bytes	Data		CRC16	

B8-B9:

0000: stop

0002: start

Write return:

1	2	3	4	5	6	7	8
01	10	50	06	00	01	F0	C8
Slave	Write	Registers		No. of Registers		CRC16	

17. Specifications

You will learn about the following:
Technical specifications.
General specifications.
Dimensions.

17.1 Technical Specifications

The following data are measured under the following conditions:
Temperature condition: 23℃±5℃
Humidity: ≤ 65% R.H. non-condensing
Warm-up time: > 30 minutes
Calibration interval: 12 months

17.1.1 Voltage Accuracy

Voltage source	10V~1000V freely settable
Voltage source accuracy	1%±2V
Voltage measurement accuracy	2%±1V (CV, <1.8mA)
Max. charging current	≈1.8mA
Short-Circuit Current	<2mA

17.1.2 Resistance Measurement Accuracy

Basic accuracy:
Measurement data outside the ranges shown in the table is for reference only!

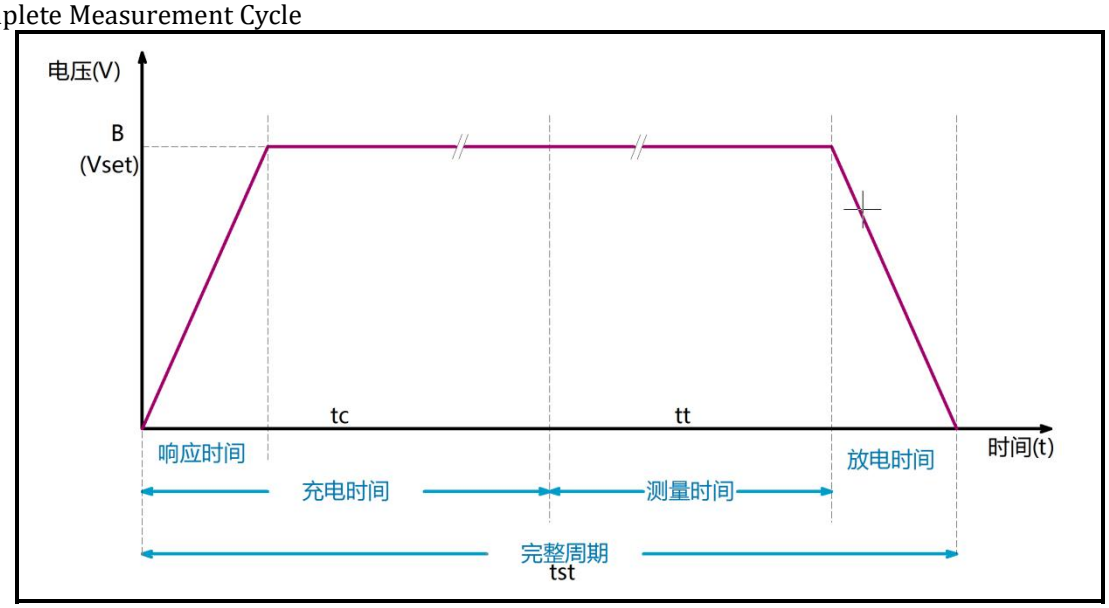
Rated voltage	Range		Display range	Resolution	Accuracy
10V≤Vx<100V	1	2 MΩ	0.000M ~ 4.000MΩ	0.001 MΩ	2%±5 counts
	2	20 MΩ	1.90M ~ 40.00MΩ	0.01 MΩ	2%±5 counts
	3	200 MΩ	19.0M ~ 400.0MΩ	0.1 MΩ	5%±5 counts
			400.0MΩ~400GΩ		
100V≤Vx<500V	1	2 MΩ	0.000M ~ 4.000MΩ	0.001 MΩ	2%±5 counts
	2	20 MΩ	1.90M ~ 40.00MΩ	0.01 MΩ	2%±5 counts
	3	200 MΩ	19.0M ~ 400.0MΩ	0.1 MΩ	5%±5 counts
	4	2 GΩ	190M ~ 4.000GΩ	1 MΩ	5%±10 counts
			4.000GΩ~400GΩ		
500V≤Vx<1000V	1	2 MΩ	0.000M ~ 4.000MΩ	0.001 MΩ	2%±5 counts
	2	20 MΩ	1.90M ~ 40.00MΩ	0.01 MΩ	2%±5 counts

	3	200 MΩ	19.0M ~ 400.0MΩ	0.1 MΩ	2%±5 counts
	4	2 GΩ	190M ~ 4.000GΩ	1 MΩ	5%±5 counts
			4.000G ~ 9999GΩ		

17.2Timer

17.2.1 Measurement cycle

Figure 17- 1 Complete Measurement Cycle



When the charge time is off:

Complete measurement cycle = response time + test time + discharge time

When the charge time is on:

Complete measurement cycle = response time + charge time + test time + discharge time

17.2.2 Charge Time

Charge time range	0.1s~999.9s (can be turned off)
Display	Countdown; enters the testing state after counting to 0.0s
Resolution	100ms

17.2.3 Measurement time

Test time range	0.05s~999.9s (continuous measurement when off)
Display	Timer off: counts up and stops timing after reaching 999.9s
	Timer on: counts down; at 0.00s the measurement ends and enters the discharge state
Resolution	10ms

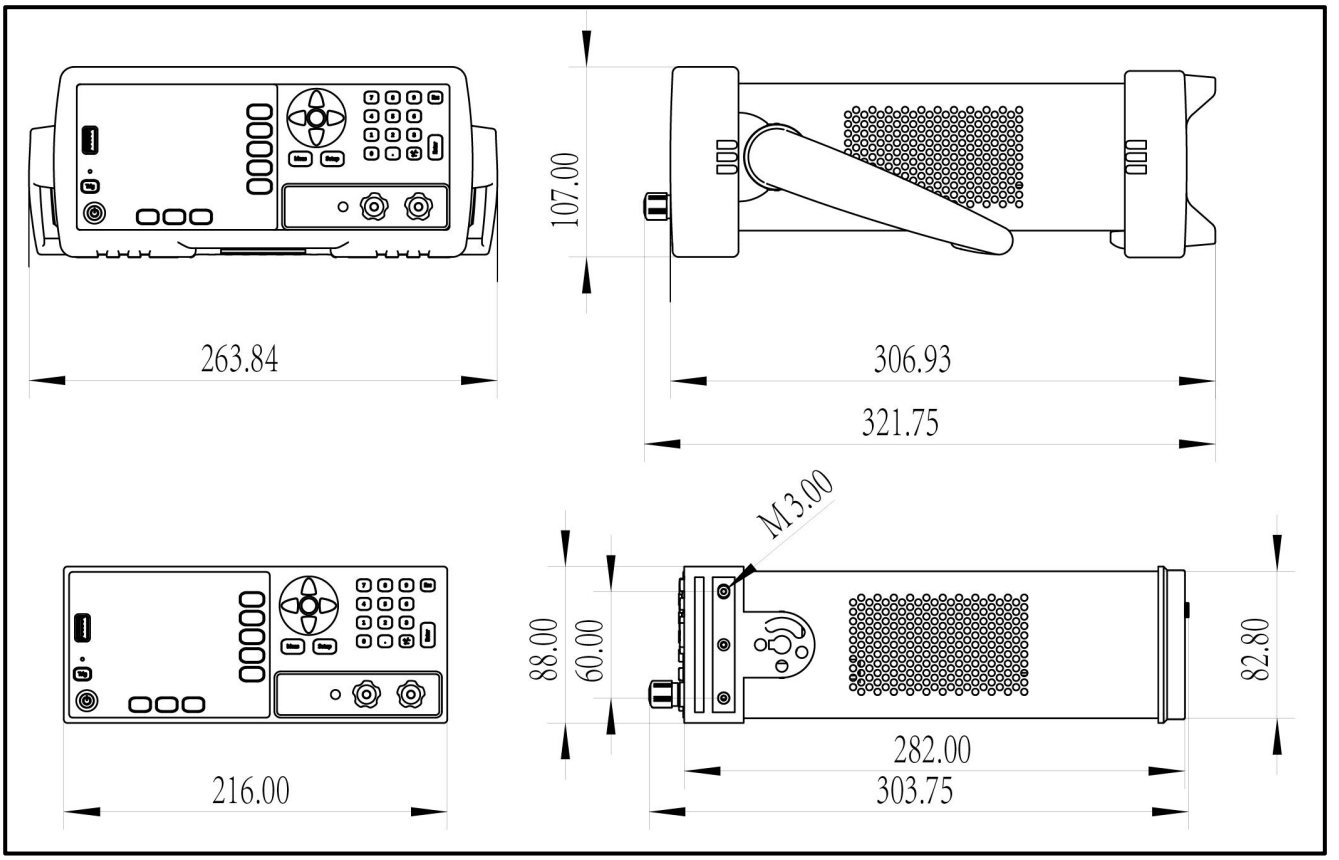
17.3 General Specifications

Screen	3.5-inch TFT-LCD true color display.	
Measurement Range	0.000M ~ 1TΩ	
Test Speed	■ Auto ranging mode: (contact check off) Slow: 2 readings/second Medium: 13 readings/second Fast: 18 readings/second ■ Manual ranging mode: (contact check off) Slow: 2.2 readings/second Medium: 18 readings/second Fast: 29 readings/second ■ Auto ranging mode: (contact check on) Slow: 1.9 readings/second Medium: 11 readings/second Fast: 15 readings/second ■ Manual ranging mode: (contact check on) Slow: 2 readings/second Medium: 15 readings/second Fast: 22 readings/second	
Range mode	Auto, manual and nominal ranging	
List Sweep	Quantity	5 groups
	Discharge Time	Uniform setting: 10ms~10s
	Charge Time	Independent setting: 100ms~99s
	Measurement time	Independent setting: 100ms~99s
	Comparator	Independent setting: 0~10GΩ
Short-circuit check	Mode	Off/auto/preset time
	Preset time	10ms~1.00s
	Auto check	Fast: max. 100ms Medium: max. 250ms Slow: max. 500ms
	Short-circuit output voltage	≈3V
	Action	Shorted within the set time: ends the measurement Not shorted within the set time: enters the normal measurement cycle
Contact check	Method	4-terminal
	Display	CC.HL: both HIGH/LOW in poor contact CC.H: HIGH terminal in poor contact CC.L: LOW terminal in poor contact
Comparator	Setting	0~10GΩ

	range	
	Comparison result	OK: pass NG LO: under lower limit NG HI: over upper limit
	Beeper	OK/NG/OFF
	Beeper volume	Weak/loud
Trigger Mode	Internal, manual, remote and external triggering	
File storage	Parameters saved automatically or manually to memory: 10 files in internal memory and 10 files in USB files	
USB storage	Timed save or triggered save to USB disk, 20 files	
Interfaces	Handler Interface RS232 interface USB Interface RS485 Interface	
Communication Protocol	SCPI/ModBus(RTU)	
Environmental Requirements	Rated	Temperature 18℃~28℃ humidity <65% RH non-condensing
	Operation	Temperature 10℃~40℃ humidity 10~80% RH
	Storage	Temperature 0℃~50℃ humidity 10~90% RH
Power Requirements	Voltage	100V~240VAC
	Fuses	250V/2A slow-blow (installed inside the instrument)
	Power	Max. 20VA
	Weight	≈5kg

17.4 Dimensions

(Schematic Diagram)



Onmeas Ltd.

-AT6820 User Guide-

English Edition

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