UNI-T®

UT3500 Series
Battery Internal Resistance Tester
User Manual

Preface

Thank you for purchasing this brand new product. In order to use this product safely and correctly, please read this manual thoroughly, especially the safety notes.

After reading this manual, it is recommended to keep the manual at an easily accessible place preferably close to the device, for future reference.

Copyright Information

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Warranty Service

The instrument has a warranty period of one year from the date of purchase. If the instrument is damaged due to improper operation by the user during the warranty period, the maintenance fee and the costs caused by the maintenance shall be borne by the user, and the instrument shall be maintained by the company for life.

If the original purchaser sells or transfers the product to a third party within one year from the date of purchase of the product, the warranty period of one year shall be from the date of the original purchase from UNI-T or an authorized UNI-T distributor. Power cords, accessories and fuses, etc. are not included in this warranty.

If the product is proved to be defective within the warranty period, UNI-T reserves the rights to either repair the defective product without charging of parts and labor, or exchange the defected product to a working equivalent product (determined by UNI-T). Replacement parts, modules and products may be brand new, or perform at the same specifications as brand new products. All original parts, modules, or products which were defective become the property of UNI-T.

The "customer" refers to the individual or entity that is declared in the guarantee. In order to obtain the warranty service, "customer" must inform the defects within the applicable warranty period to UNI-T, and perform appropriate arrangements for the warranty service. The customer shall be responsible for packing and shipping the defective products to the

designated maintenance center of UNI-T, pay the shipping cost, and provide a copy of the purchase receipt of the original purchaser. If the product is shipped domestically to the location of the UNI-T service center, UNI-T shall pay the return shipping fee. If the product is sent to any other location, the customer shall be responsible for all shipping, duties, taxes, and any other expenses.

Guarantee Limit

This warranty shall not apply to any defects, malfunction or damages caused by accidental, machine parts' wear and tear, using outside the product's specifications, improper use, and improper or lacking of maintenance. UNI-T under the provisions of this warranty has no obligation to provide the following services:

a) Any repair damage caused by the installation, repair, or maintenance of the product by non UNI-T service representatives;

b) Any damage caused by improper use or connection to an incompatible device;

c) Any damage or malfunction caused by the use of a power source not provided by UNI-T;

d) Any maintenance on altered or integrated products (if such alteration or integration leads to an increase in time or difficulty of product maintenance).

This warranty is written by UNI-T for this product and it is used to substitute any other express or implied warranties. UNI-T and its distributors do not offer any implied warranties for merchantability or applicability purposes. For violation of this guarantee, UNI-T is responsible for the repair or replacement of defective products as the only and complete remedy available to customers. Regardless of whether UNI-T and its distributors are informed that any indirect, special, incidental, or consequential damage may occur, the UNI-T and its distributors shall not be responsible for any of these damages.

Safety Information

⚠️Warning ⚡Danger: To avoid possible electric shock and personal safety problem, please follow the instructions below.

Disclaimer:

Please read the following safety information carefully before starting to use the instrument. Uni-Trend will not be responsible for the personal safety and property damage caused by the user's failure to comply with the following terms.

Instrument Grounding:

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

Do not use the instrument in an explosive atmosphere:

Do not use the instrument in flammable and explosive gas, steam or dusty environment. The use of any electronic equipment in such an environment is a risk to personal safety.

Do not open the housing of the instrument:

Non-professional maintenance personnel should not open the housing of the instrument to try to repair the instrument. The undischarged charge still exists for a period of time after the instrument is turned off, which may cause electric shock.

Do not use instruments that work abnormally:

If the instrument does not work properly and its danger is unpredictable, please disconnect the power cord, do not use it, and do not try to repair it yourself.

Do not use the instrument beyond the way specified in this user manual:

If it exceeds the range, the protective measures provided by the instrument will become invalid.

⚠	Warning: 1. For the instrument model UT3562, do not apply AC voltage and DC voltage exceeding 100V to the test terminal, otherwise the instrument will be damaged. 2. For the instrument model UT3563, do not apply AC voltage and DC voltage exceeding 400V to the test terminal, otherwise the instrument will be damaged.
🔄40	Environmental Protection Use Period Sign: This symbol means that within the indicated time, hazardous or toxic substances will not leak or be damaged. The product's environmental protection use period is 40 years. During this period, it can be used with confidence. After the specified time, it should enter the recycling system.
🗑	Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC must not be discarded in the trash can

Table of Contents

1. Product Overview

Thank you for purchasing the Uni-Trend battery internal resistance tester. This chapter mainly covers the following:

● Features and Functions of Product Series

● Front Panel

● Rear Panel

1.1 Product Series

UT3500 series battery internal resistance tester contains two models: UT3562 and UT3563, the measurement voltage range of which is 100V and 400V respectively. The measurement accuracy is shown in the table below, and the complete technical specifications can be found in the last chapter.

Model	Accuracy	Measurement Range
UT3562	Resistance: 0.5%	Resistance: 0.0001mΩ~3.2kΩ
	Voltage: 0.01%	Voltage: 0.00001~101.000V
UT3563	Resistance: 0.5%	Resistance: 0.0001mΩ~3.2kΩ
	Voltage: 0.01%	Voltage: 0.00001~404.000V

1.1.1 Features of Product Series

● 4.3 inch large screen and LCD display, the battery internal resistance and the voltage can be displayed at the same time.

● It can test resistance ranges from 0.0001mΩ~3.2kΩ, and can measure high voltage battery pack up to 400V (UT3563).

● With measurement characteristics including high precision, high resolution and ultra-high-speed, it provides 0.5% resistance accuracy and 0.01% voltage accuracy. The maximum measurement speed can reach 65 times per second, which improves the efficiency of mass production inspection of small batteries.

● It configures general data acquisition software according to the standards, so it can read the test data to the computer, and record these data in the general form software and CSV file. It is suitable for time interval measurement and manual measurement using trigger keys and external triggers. It can be effectively used for remote control, data acquisition and data analysis.

- It can be used for professional sorting function, independent comparison function of resistance and voltage, and judgment of HI/IN/LO. The judgment result can be displayed on the screen, buzzer, and external I/O output. It can automatically judge whether the battery parameters meet the standards and count the pass rate, which is suitable for the detection and sorting of various batteries.

- The instrument uses an enhanced command for computer remote control which is compatible with SCPI (Standard Command for Programmable Instrument) and can efficiently complete remote control and data acquisition function.

- The instrument is used for battery internal resistance test, including battery module inspection, battery R&D measurement, high-voltage battery pack inspection, lithium battery, lead-acid battery, button battery and other high-speed mass production line inspections.

1.1.2 Main Functions of the Product

Function	UT3562	UT3563
Measurement Range	Voltage Range: 0.00001~ 101.000V, 3 Ranges	Voltage Range: 0.00001~ 404.000V, 3 Ranges
	Resistance Range: 0.0001mΩ~3.2kΩ, 7 Ranges	
	The modes of resistance and voltage range selection are divided into automatic and manual.	
Test Speed	The instrument has four test speeds: SLOW, MED, FAST, and EXFAST. All channels are turned on, and the test speeds in manual range mode are as follows: ➢ SLOW: 3 Times/Second ➢ MED: 14 Times/Second ➢ FAST: 25 Times/Second ➢ EXFAST: 65 Times/Second	
Basic Accuracy	Resistance: 0.5% Voltage: 0.01%	
Maximum Reading	Resistance: 31,000 Voltage: 606,000	
Calibration	Short-Circuit and Set Zero	
Comparator Sorting	Instrument Sorting Function: ➢ R-HI/R-LO/R-IN Output: The Resistance Exceeds the Upper Limit/Lower Limit/Compliance ➢ V-HI/V-LO/V-IN Output: The Voltage Exceeds the Upper Limit/Lower Limit/Compliance	

	➢ There are two sorting results: PASS and FAIL, outputting in ✅ and ❌ symbols respectively.
	Comparison Method: ➢ Absolute value tolerance ± TOL sorting: The absolute deviation of the measured value and the nominal value is compared with the limits of each range. ➢ Percent tolerance ± TOL sorting: The percentage deviation of the measured value and the nominal value is compared with the limits of each range. ➢ Direct reading comparison sorting: the measured value is directly compared with the upper and lower limits.
	Beep: three options: OFF, PASS, FAIL.
Interface	RS-232/USB Remote Control: It supports a baud rate up to 115200bps and is compatible with SCPI protocol/Modbus.
	Handler Interface: I/O port with full opto-coupler isolation and built-in pull-up resistor. It supports internal 5V and external maximum 35V power supply. Input: trigger signal, output: all sorting comparison result signals; measurement synchronization signal (EOC); high current drive output, direct drive relay.
Test Frequency	1kHz, Frequency Stability: 20ppm
Test Terminal	Four Terminal Method
Trigger Mode	INT and EXT (including manual and remote trigger)
Communication Protocol	SCPI and Modbus (RTU)

1.2 Front Panel

1.2.1 Description of the Front Panel
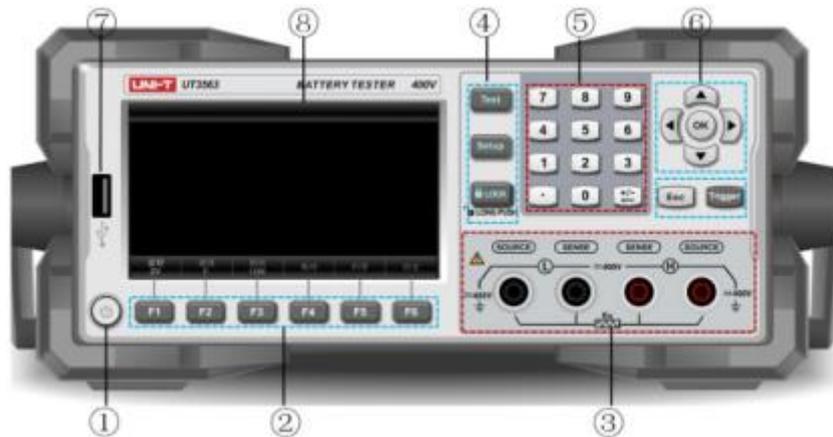
Figure 1-2-1 Front Panel, Take UT3563 as an Example

Serial Number	Picture	Description of Function
1		Power switch (touch switch); When the power supply is ON, the button light is yellow. When OFF, it is red.
2		The function keys F1~F6: According to the menu displayed on the screen, the function of the keys will change.
3		4 test terminals, SOURCE (measuring terminal) and SENSE (sensing terminal)
4		The test key is used to display the result of the measurement object (internal resistance, voltage), etc.
		The setup key is used to set measurement parameter configuration.
		The key LOCK can disable other keys. Long press for 1s to unlock.
5		The numeric keyboard: The number keys are used to enter numeric values; the plus, minus, and delete key is used to enter and delete plus and minus signs.
6		The cursor keys are used to move the cursor up and down, left and right.
		① It is used to confirm the value entered by the numeric keyboard.

		② When inserting the U disk, the screen image can be captured and saved.
	Esc	The esc key: It is used to cancel/return.
	Trigger	The trigger key is used to trigger a measurement when the trigger source is external.
7	▮	U disk interface
8		4.3 inch LCD display window

Table 1-2-2 Introduction of Interface Display Symbols (the following symbols will be displayed on the tester screen interface)

	Description
🖫	It means that the U disk has been inserted into the instrument and can save data or screenshots.
•)))	The beep function turns on.
COMP	The comparator turns on.
🔒	The key lock turns on.
- - - - - - -	No measured value is displayed. The test lead and the object under test are not effectively connected to form a measurement.
OL	When the measurement interface displays OL, it means that the measured value is out of the range.
IN	It means that the measured value meets the required setting range of the comparator.
HI	It means that the measured value exceeds the required setting range of the comparator.
LO	It means that the measured value is lower than the required setting range of the comparator.
✖	The symbol means that the measurement result is judged as unqualified after setting the comparator.
✔	The symbol means that the measurement result is judged as qualified after setting the comparator.
●	The twinkling green cursor means that the instrument is collecting data. It is normal that the green cursor will always exist after the instrument is turned on.

1.3 Rear Panel
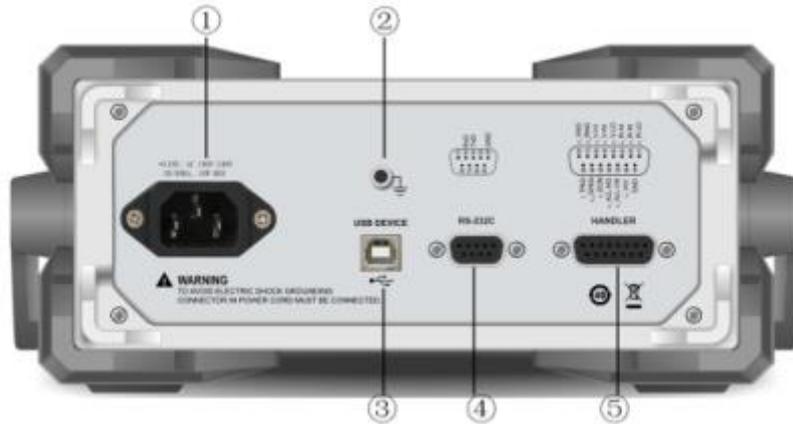
Figure 1-3-1 Rear Panel

1. AC power socket (without fuse, it is inside the instrument). The power supply's voltage and frequency are marked above the socket.
2. Ground Terminal
3. USB Communication Interface
4. RS-232C Interface
5. HANDLER Interface

2. Inspection and Installation

This chapter mainly covers the following:
- Packing List
- Requirements of Power Supply
- Operating Environment
- Cleaning
- Handle of Instrument

2.1 Packing List

Before using the instrument, please first:

1. Check whether the appearance of the product is damaged, scratched or has other defects;
2. Check whether the instrument accessories are missing according to the instrument packing list.
   If it is damaged or the accessories are missing, please contact Uni-Trend Instrument Sales Department or the distributor immediately.

Components	Quantity	Remarks
Battery Internal Resistance Tester	1	
Power Cord	1	There are specified power cords for different countries and regions.
UT-L80 Battery Internal Resistance Test Pen	1	They are dedicated to all UT3500 series battery internal resistance testers, including UT3562 and UT3563.
UT-L82 Battery Internal Resistance Kelvin Test Lead	1	
Factory Qualified Report	1	
Certificate of Conformity and Warranty	1	
User Manual	1	It is an electronic file which can download from the official website.

2.2 Requirements of Power Supply

UT3500 series can only be used under the following power supply conditions:

Voltage: 100VAC~240VAC

Frequency: 50Hz~60Hz

Warning: In order to prevent the risk of electric shock, please connect the ground wire of the power supply.

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

2.3 Operating Environment

UT3500 series must be used under the following environmental conditions:

Temperature: 0℃~55℃

Humidity: less than 70%RH at 23℃

2.4 Cleaning

To prevent the risk of electric shock, please unplug the power cord before cleaning.

Please use a clean cloth dipped in clean water to clean the housing and panel.

Do not clean the inside of the instrument.

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

2.5 Handle of Instrument

The handle of the instrument can be adjusted. Hold both sides of the handle at the same time with hands, gently pull it to both sides, and then rotate the handle. The handle can be adjusted to four positions, as shown in the figures below:
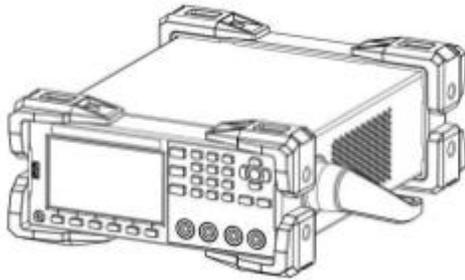
Figure 2-5-1 Original Position of Instrument Handle
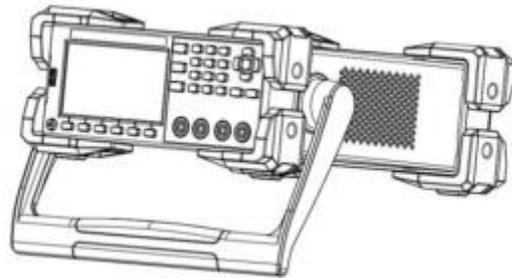
Figure 2-5-2 Position of Instrument Handle in Test Status
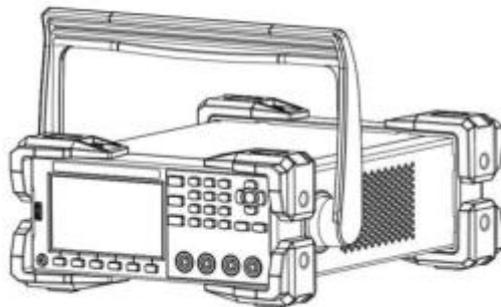
Figure 2-5-3 Handle Removal Position

Figure 2-5-4 Handle Lift Position

3. Preparation before Measurement

This chapter mainly covers the following:

- Power on and Run

- Connection of Test Terminals

- Measurement Method of DUT (Device under Test)

- Set Zero and Calibrate

3.1 Power on and Run

3.1.1 Power on and off

Connect the power cord in standard accessories to ensure that the instrument is normally powered.

Turn on the power switch with the symbol ⏻ at the bottom left of the panel. This power switch is a light touch electronic switch. When the indicator light turns yellow, it indicates that the power of the instrument is turned on.

After confirming that the instrument is powered on normally, please turn off the power button. At this time, the indicator light is red, and then you can proceed to the next step: the connection of the test lead and the instrument test terminals.

⚠️ Warning: Please make sure that the power supply voltage is consistent with the supply voltage before turning on the power, otherwise the instrument will be burnt out. Please be sure to connect the main power plug to a power socket with ground protection. Do not use a wiring board without ground protection. Before operating the instrument, you should first make sure that the instrument is well grounded.

3.2 Connection of Test Terminals

3.2.1 Introduction of Test Lead

UT3500 series battery internal resistance tester is equipped with UT-L80 crown probe test pen and UT-L82 Kelvin test lead specially used for battery internal resistance test according to the standards, which is convenient for users to measure more professionally. At the same time, the product can be equipped with UT-L81 alligator clip test lead, and users can contact salesmen to purchase it separately.

The relevant information of the test lead is as follows:

Figure 3-2-1 A UT-L80 Battery Internal Resistance Test Pen-Crown Probe (Standard Accessory)

Figure 3-2-1 B UT-L82 Battery Internal Resistance Kelvin Test Lead- Nipper Clip (Standard Accessory)
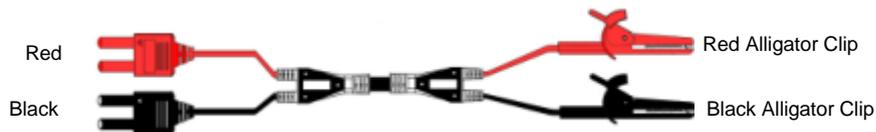
Figure 3-2-1 C UT-L81 Battery Internal Resistance Test Lead- Alligator Clip (Optional Accessory)

3.2.2 Connection of Test Lead

From the perspective of safety and test accuracy, it is recommended to use the standard test lead for measurement. Before measurement, follow the steps below to connect the test lead to the test terminals of the instrument.

1. Before connecting the test line, please make sure that the power switch of the instrument is OFF.

2. Make sure there is no connection at the top of the test leads of the four terminals.

3. Connect the test leads of the four terminals to the input terminals of the instrument according to the method shown in Figure 3-2-2. The specific operations are as follows:

   Connect the black test lead to the black terminal hole of the instrument and the red test lead to the red terminal hole.

   The ▲ symbol of the black test lead must match the black SENSE hole on the front panel of the instrument, and the ▲ symbol of the red test lead must match the red SENSE hole.
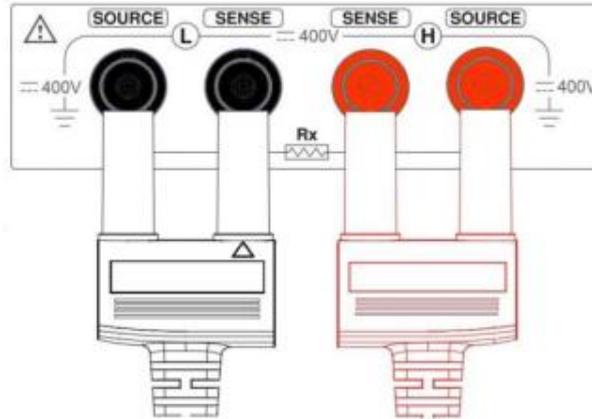
Figure 3-2-2 Schematic Diagram of the Connection between the Test Lead and the Terminal Hole of the Instrument (Take the UT3563 Panel as an Example)

The red test lead has only one side with the red ▲ symbol, when it is correctly connected, the red ▲ symbol of the test lead should be exactly on the bottom of the test lead, so it is not shown in the figure above. It is necessary to correctly connect the test lead to the test hole of the instrument; otherwise it will affect the output of test results.

⚠ Note: In order to ensure the accuracy of the instrument, please use the attached test lead for testing.

⚠ Warning: It is prohibited to connect the AC current source and voltage source directly to the test terminals.

3.3 Measurement Method of DUT

After correctly connecting the test leads to the Sense and Source test terminals of the instrument, please correctly connect the test leads to the DUT as follows. Note that the red test pen or test clip should be connected to the positive electrode of the battery, and the black test pen or test clip should be connected to the negative electrode. As shown in Figure 3-3-1.

If the positive and negative poles of the terminal of the DUT are connected reversely, and the test voltage value is negative, please exchange positions of the red and black test pens or test clip.

Figure 3-3-1 Connect the Test Lead to the DUT

If you are testing with an alligator clip, you can use the test lead to directly clamp the terminal of the DUT for four-terminal testing.

If you are testing with a crown probe test pen, you can put the red and black test lead probes against the corresponding positive and negative terminals of the DUT for four-terminal testing, as shown in Figure 3-3-2.

Figure 3-3-2 Schematic Diagram of Crown Probe Test Pen Measurement

⚠ Note: When a negative voltage appears, it is caused by the reverse connection of the test leads, and the positions of the red and black test pen need to be changed.

3.4 Set Zero and Calibrate

Before testing, please perform the short circuit zeroing step to remove the stray resistance and bias voltage caused by the test lead or external environmental factors.

The measured resistance value may be very small, such as 3mΩ and 30mΩ range. When the test current flows through the resistance, the voltage signal generated will be very weak, and the maximum is only a few mV, so the position, length and shape of the test lead may all have effects on the measurement. Therefore, the positions and conditions during setting zero should be the same as those during subsequent measurement.

⚠ Note: In order to ensure the accuracy of the measured value during setting zero and normal measurement process, the test pen or test lead must be kept away from any metal parts, instruments running on electricity or other environments with magnetic fields.

3.4.1 Short-Circuit Test Leads

Before setting zero, please short-circuit the test clip as follows.

Correct Short Circuit Method of the Alligator Clip

1. Hold an alligator clip in each hand, and press the upper handle of each alligator clip at the same time, so that the red and black alligator clips are opened as shown in Figure 3-4-1.

Figure 3-4-1 Alligator Clips Are Opened before Engaging

2. As shown in Figure 3-4-2, make the first row of teeth of one of the alligator clips properly engage with the first row of tooth recesses of the other alligator clip. The state after proper engagement should be the same as Figure 3-4-3. The two alligator clips must be on a horizontal line after being engaged.

3. It is necessary to ensure that the metal teeth of the two alligator clips are correctly engaged before performing the next step of setting zero and calibrating.
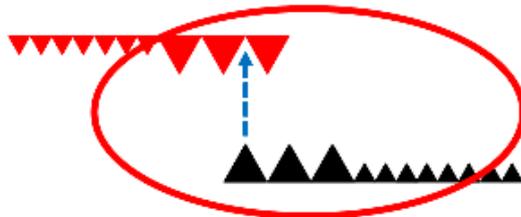
Make the first row of teeth of one of the alligator clips properly engage with the first row of tooth recesses of the other alligator clip.

Figure 3-4-2 Description of Alligator Clip Teeth Engagement

Figure 3-4-3 Parallel Status after the Red and Black Alligator Clips Are Engaged

Correct Short Circuit Method of the Crown Probe Test Pen

The center probe of the crown probe test pen is the Sense end, and the outer cylindrical probe is the Source end.

First, place the probes of the crown probe test pen as shown in Figure 3-4-4-a. Make sure that the surface of the object at the red dot is in contact, that is, the center probe is in contact with the center probe (Sense and Sense), and the center probe is in contact with the peripheral probe (Sense and Source).
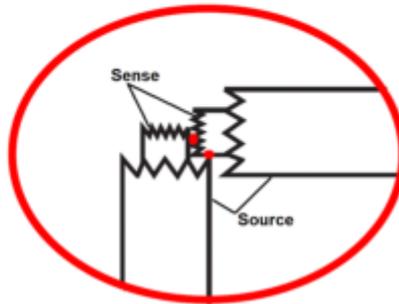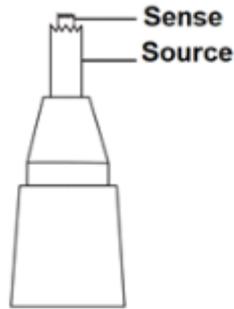
Figure 3-4-4-a Crown Probe Test Pen Short Circuit Diagram a

Second, apply force in the direction of the arrow shown in Figure 3-4-4-b to make the surface of the object at the third red point contact, that is, the periphery probe is in contact with the peripheral probe (Source and Source).
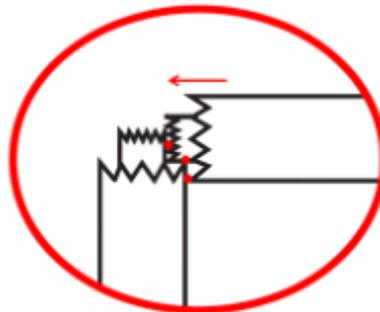
Figure 3-4-4-b Crown Probe Test Pen Short Circuit Diagram b

Finally, only when the three red dots as shown above are actually touched, the next setting zero step can be performed.

Correct Short Circuit Method of the Kelvin Test Lead

Lay the tip end of the test clip of the Kelvin test lead crosswise as shown in Figure 3-4-5. Note: The short upper handle of the red test clip and the short upper handle of the black test clip must maintain the same sequence and position, that is, the short upper handle of

the red test clip is located above the grip direction, and the short upper handle of the black test clip is located above the grip direction of the other hand.

Do not cross the left, right, up and down handles.

Figure 3-4-5 Short Circuit Method of the Kelvin Test Lead

3.4.2 Set Zero
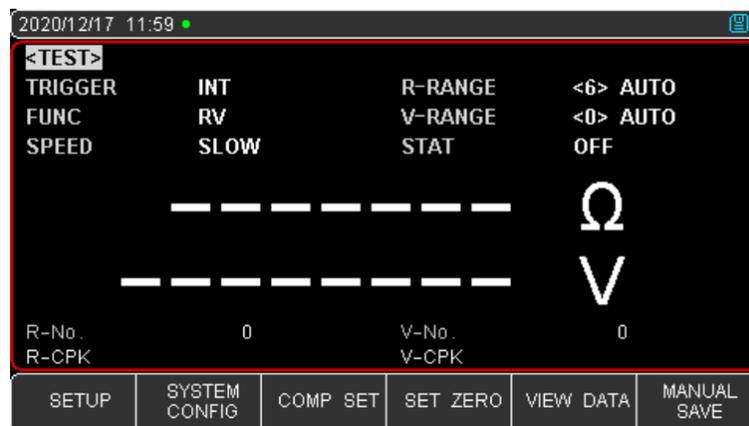
Figure 3-4-6 <SET ZERO> Page

Steps:

1. Turn on the power button and the instrument will load the <TEST> page. If the instrument is turned on and is not on the <TEST> page, please press the [Test] button on the instrument panel, and the screen will enter the <TEST> page.

2. On the lower side of the <TEST> page, select the function key corresponding to [SET ZERO] to enter the <SET ZERO> page.

3. Use the arrow key ▼ to move the cursor from [SET ZERO] to the "ON" field.

4. Press the function key to select [SET ZERO], and there will be a reminder of "short-circuit the test terminals" at the bottom of the screen. Please correctly short-circuit the test terminal according to the above section 3.4.1 and execute the confirmation command, and the system will execute the setting zero procedure. After setting zero is completed, the word "calibration completed" will flash on the top of the screen, and the screen will return to the <TEST> page.

5. If you do not need to set zero, you can select the "OFF" function key.

6. If setting zero fails, there will be a warning message "Correction fail" on the top of the screen. Please check whether the test terminals are properly short-circuited, and perform the setting zero step after the test terminals are correctly short-circuited according to step 4 above.

4. [Test] Measurement Page

4.1 <Test> Page

The <TEST> page is mainly used to display the measurement results and sorting results. Five common functions can be set on this page, including:

- TRIGGER - The Trigger Mode of the Measurement
- FUNC - Parameters of Measurement
- RANGE - Setting and Display of Resistance and Voltage Range
- SPEED - Test Speed
- LOG/STAT - Please Refer to Chapter 6 " Log/Stat"
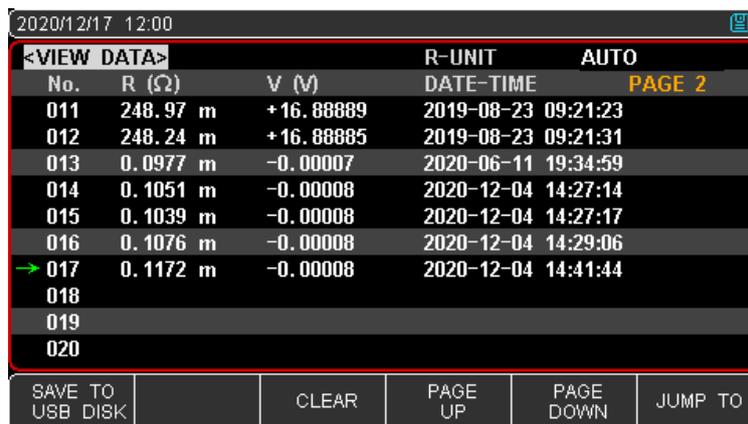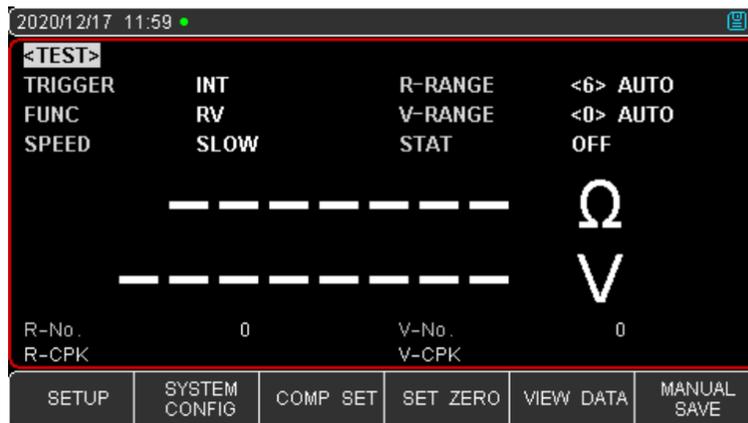
Figure 4-1 <TEST> Page

4.1.1 [Trigger]

The instrument has 2 trigger modes: internal trigger and external trigger (including manual/HANDLER/remote).

Function	Description of Function
INT	Also called continuous test, the trigger signal is continuously tested by the internal of the instrument according to inherent cycle. Generally choose this method for measurement.
EXT	Manual: Each time you press the [Trigger] key, the instrument will execute a measurement cycle, and the instrument is in a waiting state at other times.
	Handler: Upon receiving a rising edge pulse from the Handler interface on the rear panel, the instrument executes a measurement cycle. At other times, the instrument is in the waiting state. Please refer to the Handler Interface.
	Remote: Send the command TRIGGER to measure once and return the measured value.

Setting Steps:

1. Press [Test] key to enter the main page of <TEST>;
2. Use the cursor key ▼ to move the cursor to the [TRIGGER] field;
3. According to your own needs, use the function keys at the bottom of the screen to select the desired trigger mode.

4.1.2 [Function]

The instrument has 3 measurement functions: RV, R, and V.

Function	Description of Function
RV	Measure and display resistance and voltage values at the same time.
R	Only measure and display the resistance value.
V	Only measure and display the voltage value.

Setting Steps:

1. Press [Test] key to enter the main page of <TEST>;
2. Use the cursor key ▼ to select the [FUNC] field;
3. According to your own needs, use the function keys at the bottom of the screen to select the desired measurement items.

4.1.3 [R-Range]

The resistance of the UT3500 series battery internal resistance tester has 7 ranges, divided into manual and automatic mode, as shown in the following table 4-1-2:

Table 4-1-2 Range Selection Method and Variation Range

Range Mode	Description of Function	
AUTO	The instrument automatically selects the corresponding best test range name.	
MANUAL	The instrument will always use the user-specified range for testing.	
Manual Range Name	Automatic Range Name	Range
<6>3kΩ	<6> AUTO	300Ω~3.2kΩ
<5>300Ω	<5> AUTO	30Ω~310Ω
<4>30Ω	<4> AUTO	3.0Ω~31Ω
<3>3Ω	<3> AUTO	300mΩ~3.1Ω
<2>300mΩ	<2> AUTO	30mΩ~310mΩ
<1>30mΩ	<1> AUTO	3.0mΩ~31mΩ
<0>3mΩ	<0> AUTO	0.0001mΩ~3.1mΩ

Setting Steps:

1. Press the [Test] key to enter the <TEST> page or press the [Setup] key to enter the <Setup> page;

2. Use the cursor key ▼ to move the cursor to the [R-RANGE] field;

3. According to your own needs, use the function keys at the bottom of the screen to select the desired range method and range. If you select AUTO, the instrument will automatically select the corresponding best test range name and range; if you select MANUAL, the instrument will always use the user-specified range for testing; INC + means increase the range, while the range is changed to lock; DEC - means decrease the range, and the range is changed to lock at the same time.

⚠ When the range is automatic, the instrument will predict the range in each measurement period, so the test speed will be slightly slower than the locked range. Moreover, in the case of automatic measurement, frequently changing the range will slow down the response. Usually when the instrument is used as a sorting measurement, the automatic range mode is not suitable. For sorting measurement, it is recommended to select manual range mode.

4.1.4 [V-Range]

Voltage range setting: The voltage of the UT3500 series battery internal resistance tester has 3 ranges and two range selection modes: automatic and manual.

Table 4-1-4 Range Selection Mode and Variation Range

Range Method	Description of Function	
Automatic	The instrument automatically selects the corresponding best test range name.	
Manual	The instrument will always use the user-specified range for testing.	
Manual Range Name	Automatic Range Name	Range
<2>400V	<2> AUTO	0.001~404.000V [UT3563]
<2>100V	<2> AUTO	0.001~101.000V [UT3562]
<1>60V	<1> AUTO	0.0001~60.6000V
<0>6V	<0> AUTO	0.00001~6.06000V

Setting Steps:

1. Press the [Test] key to enter the <TEST> page or press the [Setup] key to enter the <Setup> page;

2. Use the cursor key ▼ to move the cursor to the [V-RANGE] field;

3. According to your own needs, use the function keys at the bottom of the screen to select AUTO, MANUAL, INC + or DEC -.

   When the measured value exceeds the setting range, OL is displayed on the test interface.

4.1.5 [Speed]

The UT3500 series battery internal resistance tester has 4 test speeds (SLOW, MED, FAST and EXFAST). The slower the speed, the more accurate and stable the test result will be. In the R V function and manual range mode, the sampling time when the comparator is turned on is as follows:

● SLOW: 3 times/second

● MED: 14 times/second

● FAST: 25 times/second

● EXFAST: 65 times/second

Setting Steps:

1. Press the [Test] key to enter the <TEST> page or press the [Setup] key to enter the <Setup> page;

2. Use the cursor key ▼ to move the cursor to the [SPEED] field;

3. According to your own needs, use the function keys at the bottom of the screen to select the desired test speed.

4.2 Manual Save and View Data

The measured display value can be manually saved (up to 500 sets of data can be stored) and quickly browsed on the instrument screen. Press the function key [MANUAL SAVE] at the bottom of the screen to manually save the data. Each time you press the key, the data will be saved manually. Via the function key [VIEW DATA], you can view the manually saved measurement data on the instrument screen, as shown in Figure 4-2-1.

Figure 4-2-1 <VIEW DATA> Page

On the <VIEW DATA> page, you can also use the function keys at the bottom of the screen to perform the following operations on the data:

● Save to USB Disk: After inserting the U disk, this function key can save the data in the U disk.

● Clear: This function key can clear all data.

● Page Up/ Page Down/ Jump to: This function key can realize the page up and down or jump of multiple pages of data.

Set [Unit of Resistance] Display Mode:

Use the right arrow key to move the cursor to [R-UNIT]. There are five display modes for selection: AUTO, mΩ, Ω, kΩ, SCI. NOTE. (refer to https://baike.baidu.com/item).

If you want to delete a row of data, you can press the arrow keys to stop the cursor on a specific row, and select the [DELETE] function key at the bottom of the screen to delete

this row of data.

4.3 Screen Capture Function

The instrument provides a screen capture function. Insert a USB storage device into the USB interface on the front panel of the instrument, and press the [OK] key on the panel to save the current screen capture to the USB storage disk for subsequent reference.

If you need to save data, it is recommended to use a branded U disk to insert the instrument interface. The format and capacity can refer to FAT, FAT32, EXFAT, and the maximum capacity is 128G.

When the data is being collected, it may cause the screen capture to fail, which can be executed after the collection is completed.

5. [Setup] Setting

5.1 Parameters of Measurement

All the settings related to the measurement are operated on the <SETUP> page. [TRIGGER], [FUNC], [R-RANGE], [V-RANGE] and [SPEED] can also be set on the <TEST> page. For the setting of these parameters, please refer to chapter 4.1 [Test] Measurement Page.

The rest of the settings include the following parameters:

- AVG - Average number of measurement results
- DELAY - Delay before external trigger measurement
- SELF-CAL - Whether the instrument executes the calibration routine regularly
- CURRENT - Test current output mode
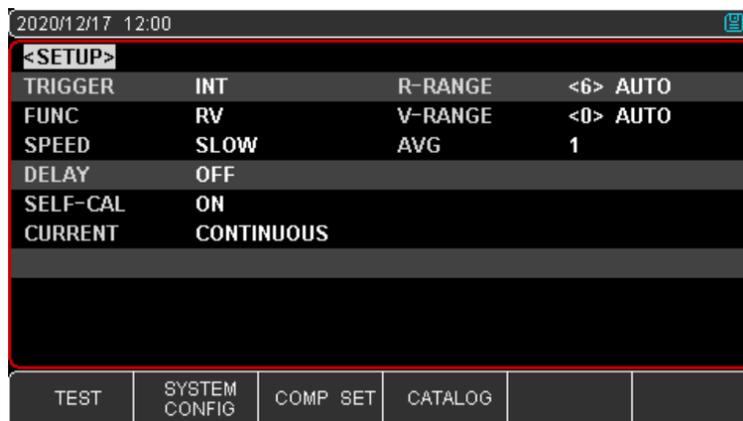
Figure 5-1 <SETUP> Page

5.1.1 [Average] Times

"Average" is one of the most commonly used digital filter, and the "number" is the depth of the filter. Its purpose is to perform multiply measurements and take the average result as the final display value, which can improve the stability and reliability of the measurement results. The range of average times is a positive integer from 1 to 256.

Setting Steps:

1. Press the [Setup] key to enter the <SETUP> page;

2. Use the cursor key ▼ to move the cursor to the [AVG] field;

3. According to your own needs, use the function keys at the bottom of the screen to choose to INC + (with stepping of 1, 2, 4, 8, 16, 32, 64, 128, 256 to increase the average times) or DEC - (with stepping of 256, 128, 64, 32, 16, 8, 4, 2, 1 to decrease the average times) or use the keyboard to directly enter the value.

5.1.2 Trigger [Delay]

The instrument can set the delay time before each test by triggering the [DELAY] timer, which is used to wait for the station to be ready before testing. The maximum delay time is 10s, and the minimum delay time is 1ms.

Setting Steps:

1. Press the [Setup] key to enter the <SETUP> page;

2. Use the cursor key ▼ to move the cursor to the [DELAY] field;

3. According to your own needs, use the function keys at the bottom of the screen to select the delay function, and use the numeric keyboard to enter the delay time.

5.1.3 [Self-Calibration] Switch

The self-calibration function can remove the bias voltage and gain drift of the internal circuit of the instrument to improve the measurement accuracy. The instrument will always perform self-calibration at slow speed, regardless of whether this switch is turned on. For speeds above medium speed, if the [SELF-CAL] switch is turned on, the instrument will automatically perform a calibration every 30 minutes.

Setting Steps:

1. Press [Setup] key to enter the <SETUP> page;

2. Use the cursor key ▼ to move the cursor to the [SELF-CAL] field;

3. According to your own needs, use the function keys at the bottom of the screen to select OFF or ON.

⚠ When the self-calibration is executed, the measurement of the instrument will temporarily pause to respond to the self-calibration. A self-calibration will take 40ms. For high-speed measurement, the self-calibration needs to be turned off and the external IO

control lead is used for self-calibration. To ensure accuracy, the instrument will perform a self-calibration every time it is turned on.

5.1.4 Measurement [Current] Output Mode

When multiple identical instruments measure in parallel at the same time, the measurement signals will interfere with each other, causing sudden changes in the measured value. In order to prevent measurement errors, the instrument can set the current output mode to [PULSE] by setting the [CURRENT] output mode, and turn off the current signal source after the test is completed to minimize multi-machine interference.

Setting Steps:

1. Press [Setup] key to enter the <SETUP> page;
2. Use the cursor key ▼ to move the cursor to the [CURRENT] field;
3. According to your own needs, use the function keys at the bottom of the screen to select CONTINUOUS (continuous current output) or PULSE.

5.2 Catalog

Press the [Setup] button to enter the <SETUP> page, and press the function key corresponding to the [CATALOG] at the bottom of the screen to enter the <CATALOG> page.

Catalog allows users to save settings to 10 files, which is convenient for reading when starting up or changing specifications.
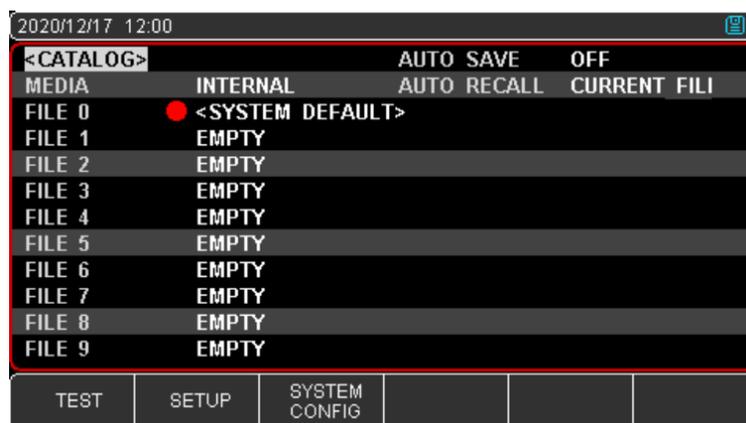
Figure 5-2 <CATALOG> Page

5.2.1 [Auto Recall]

The Auto Recall option can specify the file to be called at startup. There are two choices: FILE 0 and CURRENT FILE. If FILE 0 is selected, the setting value of file 0 will be loaded at startup; if CURRENT FILE is selected, the setting value of the current file number will be loaded at startup.

Setting Steps:

1. Enter the <CATALOG> page through the function key at the bottom of the <SETUP> or <COMP SET> page;

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

3. According to your own needs, use the function keys at the bottom of the screen to select File 0 or CURRENT FILE.

5.2.2 [Auto Save]

There are two options: ON and OFF. If you choose ON, the parameters set by the user will be automatically saved to the current file after shutting down; if you choose OFF, the parameters set by the user can only be manually saved to the file, otherwise these parameters will be lost next time you turn on the instrument.

Setting Steps:

1. Enter the <CATALOG> page through the function keys at the bottom of the <SETUP> or <COMP SET> page;

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

3. According to your own needs, use the function keys at the bottom of the screen to select ON or OFF.

5.2.3 [File 0] ~ [File 9]

The user can specify a total of 10 files from 0 to 9 to save, load and delete.

Function Keys	Description of Function
SAVE	Save all settings to the current file.
RECALL	Read the parameters of the file to the system.
ERASE	File data will be deleted.
MODIFY DES	To modify the file name, you can customize the file name.

Setting Steps:

1. Enter the <CATALOG> page through the function keys at the bottom of the <SETUP> or <COMP SET> page;

2. Use the cursor keys to select any field in [FILE 0] ~ [FILE 9] that needs to be set;

3. According to your own needs, use the function keys at the bottom of the screen to choose to SAVE, RECALL, ERASE or MODIFY DES.

6. Log/Stat

6.1 Data Log

6.1.1 Enable Log Function

The instrument has a data [LOG] function, which can log 10,000 sets of data. Through the data logging function, the measurement data can be stored in the instrument buffer in time. These data can be sent to the computer through the communication interface, or directly save the CSV format text to the U disk.

Figure 6-1-1-1 Enable [LOG] in the <SYSTEM CONFIG> page

Setting Steps:

1. From the <SETUP> page or the <TEST> page, select the [SYSTEM CONFIG] function key to enter the <SYSTEM CONFIG> page;

2. Use the cursor keys to move the cursor to the [LOG/STAT] field;

3. Use the function key to select logging, open the data logging function, and set the data record buffer to the maximum: 10000 groups. You can also directly use the numeric keyboard to input the required buffer size. For example: 50<In> to set the buffer size to 50 groups.

4. After enabling, there will be a [LOG] field on the <TEST> page. If you need to log, please enter the <TEST> page, move the cursor to the [LOG] field, and press the function key [START] at the bottom of the screen, as shown in Figure 6-1-1-2.

5. After the data logging is automatically started, you can use the function key to stop the current logging at any time; you can also save the data to the U disk at any time; you can also stop and clear the data buffer.
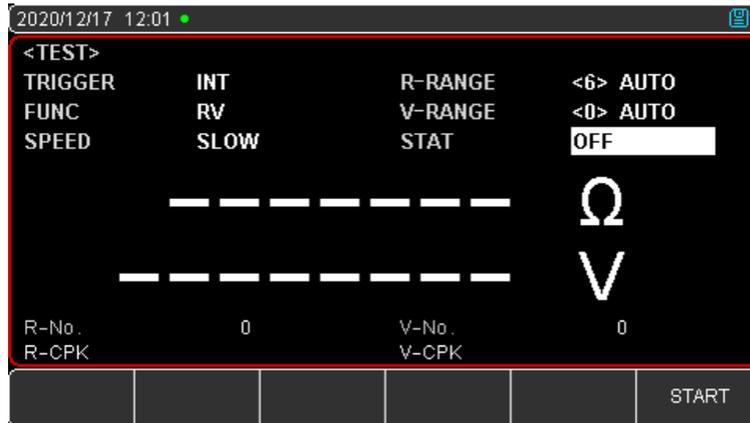
Figure 6-1-1-2 Start Logging

⚠ Once the data logging is started, the test page will be locked and cannot be switched to other pages. In the external trigger state, before switching to other pages, data logging must also be closed. If switching from other pages to the <TEST> page, data logging will automatically start.

6.1.2 Save Data

After the data logging is turned on, you can save the data to the U disk at any time, as shown in Figure 6-1-2. The test data is saved in the "TEST DATA" directory of the model folder, and the file format is CSV.
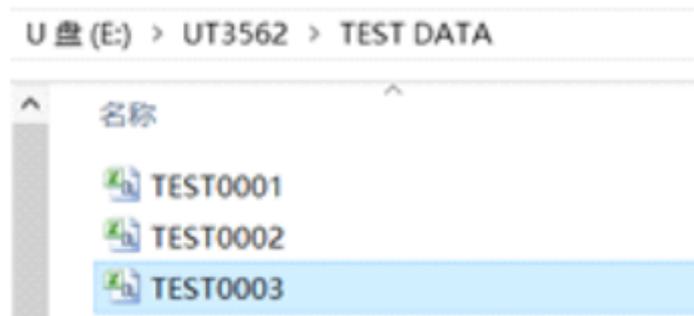
Figure 6-1-2 Data Folder in U Disk

In the Windows operating system, use Excel to open the file. Due to the default format of Excel, you need to correctly modify the cell properties according to the three operation steps, and the time/resistance/voltage field (the yellow part of the figure below) can be displayed correctly.

Figure 6-1-3 is the effect after opening the data, and Figure 6-1-4 is the effect after modifying the cell.

Figure 6-1-3 Before Modifying   **Figure 6-1-4 After Modifying**

The specific cell modification steps are as follows:

1. You need to modify the format of the TIME field, select the time row and column, right-click to select "Set Cell Format", select "Custom" on the left side of the opened cell format window, and enter yyyy-m-d hh:mm:ss in the red box. As shown in Figure 6-1-5.

2. Select the resistance field, and set its cell properties to: scientific notation, 4 decimal places, as shown in Figure 6-1-6.

3. Select the voltage field and set its cell properties to: scientific notation, 5 decimal places.
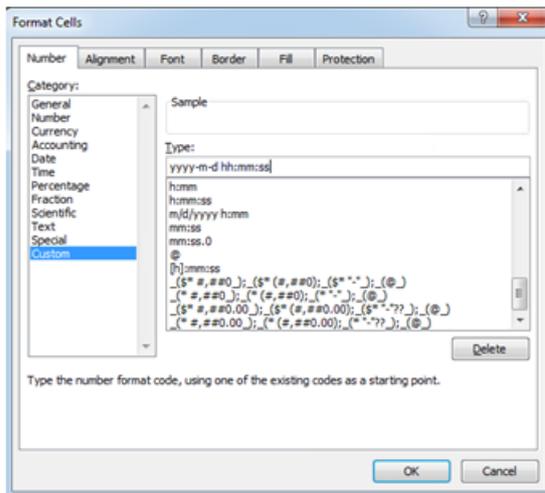
Figure 6-1-5 Custom Time Format   **Figure 6-1-6 Scientific Notation**
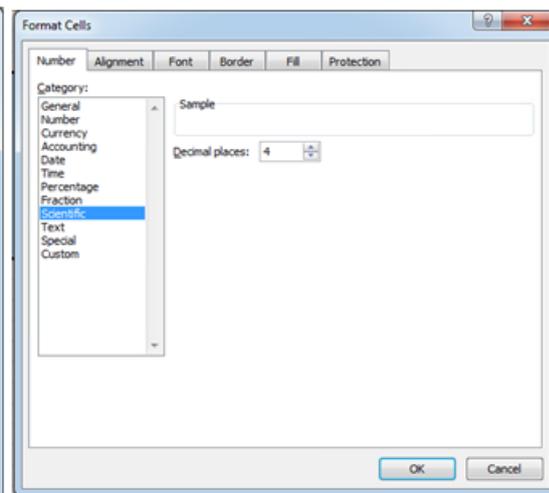
6.2 Stat

6.2.1 Process Capability Index

Process capability refers to the ability of process processing to meet processing quality. It measures the internal consistency of process processing and the smallest fluctuation in the most stable state. When the process is in a steady state, 99.73% of the product quality characteristic values are scattered in the interval [μ-3σ, μ+3σ] (μ is the overall mean value of the product characteristic values, and σ is the overall standard deviation of the product characteristic values). Almost all product characteristic values are within the range of 6σ. Therefore, 6σ is usually used to represent process capability and the smaller the value, the better.

Generally

Cp, CpK > 1.33   Process capability is sufficient.

1.00 < Cp, CpK $\leqq$ 1.33   Process capability is appropriate.

Cp, CpK $\leqq$ 1.00   Process capability is insufficient.

Process capability index and some related formulas:

Process Capability Index	Formulas
Average (Mean)	$$\overline{x} = \frac{\sum_{n=1}^{n} x}{n}$$
Population Standard Deviation σ_n	$$\sigma_n = \sqrt{\frac{\sum(x-\overline{x})^2}{n}} = \sqrt{\frac{\sum x^2 - n\overline{x}^2}{n}}$$
Sample Standard Deviation $s(=\sigma_{n-1})$	$$s = \sigma_{n-1} = \sqrt{\frac{\sum(x-\overline{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - n\overline{x}^2}{n-1}}$$
Process Capability Index (Deviation) Cp	$$Cp = \frac{|Hi - Lo|}{6\sigma_{n-1}}$$
Process Capability Index (Offset) CpK	$$CpK = \frac{|Hi - Lo| - |Hi + Lo - 2\overline{x}|}{6\sigma_{n-1}}$$

In the above formulas:

a) n represents valid data, that is, the value excluding overflow and open circuit. As long as the data can be displayed on the screen, they are valid values.

b) Variable Hi and Lo in the Cp and CpK formulas are the actual value of the upper and lower limits of the comparator. In the PER and ABS comparison mode, the actual value will be converted from the nominal value. This value will participate in the calculation regardless of whether the comparator is turned on.

c) When the sample standard deviation $\sigma_{n-1}=0$, Cp=99.99, CpK=99.99.

d) When CpK <0, CpK = 0.

6.2.2 Turn on the Stat Function

Setting Steps:

1. Press the [Setup] button to enter the <Setup> page, select the function key corresponding to the [SYSTEM CONFIG] at the bottom of the screen and press it to enter the <SYSTEM CONFIG> page (or select [SYSTEM CONFIG] function key to enter on the <TEST> page).

2. Use the cursor keys to move the cursor to the [LOG/STAT] field;

3. Use the function key to select stat, open the data stat function, and set the data record buffer to the maximum: 10000 groups. You can also directly use the numeric keyboard to input the required buffer size. For example: 50<In> to set the buffer size to 50 groups.

4. After enabling, the [STAT] field will appear on the <TEST> page, and the following fields will be displayed at the bottom of the test page: The fields [R-No] and [V-No] are valid quantities and cannot be changed.

● The fields [R-CpK] and [V-CpK] are the statistical parameter settings, and there are other statistical parameters that can be selected as listed in the following table.

Function Key	Function
MEAN($\bar{x}$)	Average
MAX	Maximum
MIN	Minimum
σ	Population Standard Deviation
s	Sample Standard Deviation
Cp	Process Capability Index (Deviation)
CpK	Process Capability Index (Offset)

5. Use the keyboard arrow keys to move the cursor to the fields to select other statistical parameters: MEAN($\bar{x}$), MAX, MIN, σ, s, Cp, as shown in Figure 6-2-2. After determining the required statistical parameters, use the cursor keys to move the cursor to the [STAT] field and select the start function key at the bottom of the screen.
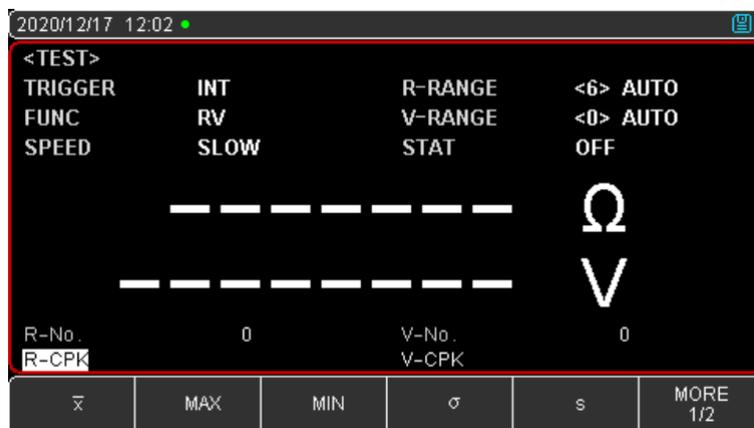
Figure 6-2-2 Setting Page of Statistical Parameters

6. After the data statistics are automatically started, you can use the function key to stop the current statistics at any time; you can also save the data to the U disk at any time; you can also stop and clear the cached data, as shown in Figure 6-2-3.
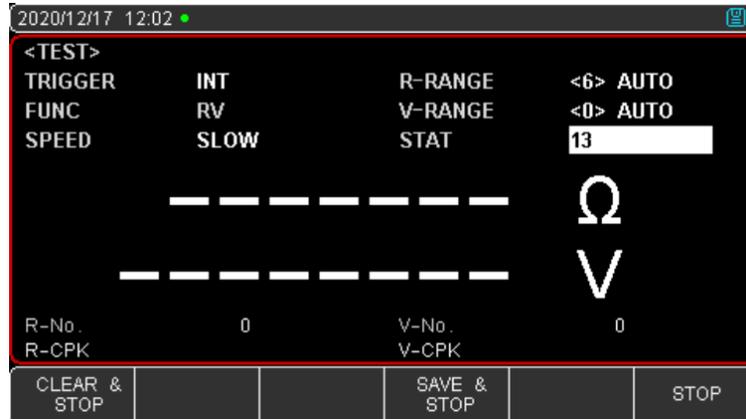
Figure 6-2-3 Statistical Operation Interface Display

6.2.3 Save Data to U Disk

After the data stat is enabled, use the same operation method as the above [LOG]. The data cache can be cleared through the function keys at the bottom of the screen, and the data can also be saved to a U disk at any time.

⚠ The data statistics function can only be set after opening [LOG/STAT] on the <SYSTEM CONFIG> page. After the data statistics function is turned on, the instrument needs to perform complex calculations on multiple parameters, and the measurement speed will drop slightly. Once the data recording is started, the test page will be locked and cannot be switched to other pages. In the external trigger state, before switching to other pages, data logging must also be closed. If switching from other pages to the <TEST> page, data logging will automatically start.

7. Comparator Sorting

This chapter mainly introduces how to use the beep and the comparator setting to realize the production line judgment and prompt whether the product meets the specification requirements. This is an important process for the realization of automatic assembly line test screening.

7.1 Comparator Setting
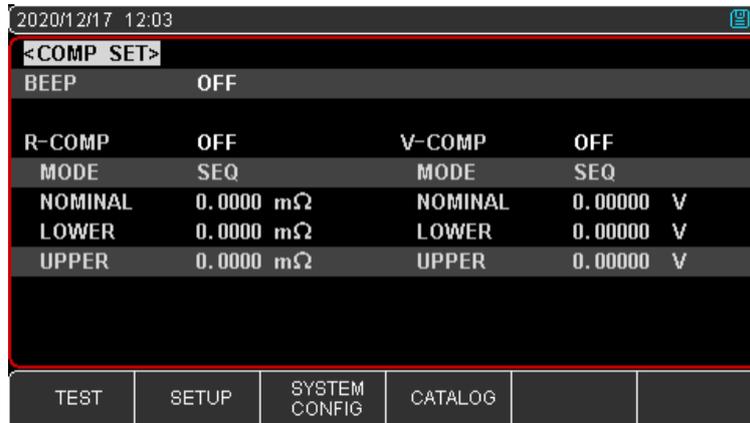
Figure 7-1 <COMP SET> Page

7.1.1 [Beep] Setting

The beep function is effective only after the comparator function is turned on.

There are three types of beep settings: PASS, FAIL, OFF.

PASS: the buzzer will sound when the sorting result is qualified. FAIL: the buzzer will sound when the sorting result is unqualified.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [COMP SET] with the function keys at the bottom of the screen to enter <COMP SET> page;

2. Use the cursor keys to move the cursor to the [BEEP] field;

3. According to your own needs, use the function keys at the bottom of the screen to select PASS, FAIL or OFF.

7.1.2 Comparison Mode Selection

The instrument can compare resistance and voltage simultaneously or separately. There are 3 comparison modes to choose from:

a) Absolute Value Comparison ABS ($\triangle$): Absolute Value $\triangle$ = Measured Value-Nominal Value

b) Percentage Comparison PER ($\triangle$%): Percentage $\triangle$% = (Measured Value-Nominal Value) / Nominal Value $\times$ 100 %

c) Direct-Reading Comparison (SEQ): The direct-reading value SEQ comparison uses the direct-reading measurement value to compare with the upper and lower limit ranges, so the nominal value is not required to participate in the calculation.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [COMP SET] with the function keys at the bottom of the screen to enter <COMP SET> page;

2. Use the cursor keys to move the cursor to the [R-COMP] or [V-COMP] field to select ON;

3. Move the cursor to the [MODE] field, and use the function keys at the bottom of the screen to select the desired comparison mode among the three according to your needs.

7.1.3 [Nominal Value] Input

The absolute value and percentage comparison mode must enter the nominal value. As for direct reading value comparison mode, the nominal value does not participate in calculation.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [COMP SET] with the function key at the bottom of the screen to enter the <COMP SET> page;

2. Use the cursor keys to move the cursor to the [R-COMP] or [V-COMP] field to select ON;

3. Move the cursor to the [MODE] field, select the absolute value or percentage comparison method, use the number keys to enter the data, and the unit should use the function keys to select.

7.1.4 [Lower] and [Upper] Setting

Setting Steps:

1. Press the [Test] or [Setup] key, and select [COMP SET] with the function key at the bottom of the screen to enter the < COMP SET> page;

2. Use the cursor keys to move the cursor to the [R-COMP] or [V-COMP] field to select ON;

3. Move the cursor to the corresponding [UPPER] or [LOWER] field, use the number keys to directly enter the data, and use the function keys to select the unit;

4. Note: The percentage △% mode does not need to select the unit magnification, please enter the percentage value; for the absolute value △ and the direct reading value SEQ mode, please use the function keys to select the unit.

⚠ The instrument shares the same storage space for the three comparison modes, so the comparator data needs to be reset after switching the comparison mode.

7.2 Display and Discrimination

7.2.1 Display after Opening the Comparator

When the comparator setting is completed, press [Test] to enter the main page of <TEST>, as shown in Figure 7-2-1.
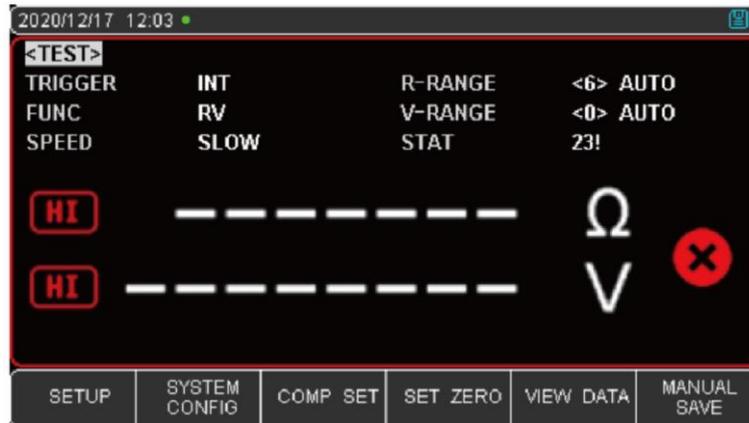
Figure 7-2-1 Page to Be Measured after the Comparator Is Turned on

- After the comparator is turned on, the "COMP" logo will appear at the top of the screen, which means that the comparator function has been turned on at this time. Because the comparator has been turned on and the system has started to run, the discriminating symbol ▨ ⊗ is displayed on the screen, which is a normal interface.

- ▬▬▬▬▬▬ means that the test clip or test pen is not properly connected to the object under test. Please connect the test clip or test pen to the object under test correctly to enter the state to be measured.

7.2.2 Example of Qualified Discrimination

Figure 7-2-2 Example of Qualified Discrimination Page

- When the voltage or resistance measurement value is within the setting range of the comparator, the judgment symbol ▨ of the test value will be displayed on the screen, indicating that the measured value is within the specification range. Only when the resistance and voltage are within the range, the instrument will judge the total result

of this group of test data as qualified, and a qualified mark ✅ will appear on the screen.

● If the buzzer is set to "beep when qualified" at this time, the instrument will emit a qualified buzzer for the qualified situation.

● If the buzzer setting is OFF at this time, there will be no buzzer sound.

7.2.3 Example of Unqualified Discrimination

Figure 7-2-3 Example of Unqualified Discrimination Page

● When the voltage or resistance measurement value exceeds or falls below the comparator setting value, in any of these situations, the instrument determines that the test result is unqualified, the symbol is ❌. LO means the measurement value is lower than the comparator setting specification requirements, and HI indicates that the measured value exceeds the specifications set by the comparator.

● If the buzzer is set to "unqualified buzzer" at this time, the instrument will emit a disqualified buzzer for this unqualified situation.

● If the buzzer setting is OFF at this time, there will be no buzzer sound.

8. System Configuration

This chapter mainly covers the following:
● System Configuration Page
● System Information Page

8.1 System Configuration Settings

<SYSTEM CONFIG> page mainly includes system configurations such as language, date, time, key beep, remote control, and default setting.

At any time, just press the [Test] or [Setup] key, and the [SYSTEM CONFIG] will appear at

the bottom of the screen. Press the corresponding function key can enter the <SYSTEM CONFIG> page.

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

Figure 8-1 <SYSTEM CONFIG> Page

8.1.1 [LANGUAGE] Setting

The instrument supports two languages, Chinese and English.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the < SYSTEM CONFIG> page;

2. Use the cursor keys to move the cursor to [LANGUAGE];

3. According to your own needs, press the function key at the bottom of the screen to select Chinese [CHN] or ENGLISH (English).

8.1.2 [Key Beep] Setting

The instrument keys can be set with or without key prompt sound.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the < SYSTEM CONFIG> page;

2. Use the cursor keys to move the cursor to [Key Beep];

3. According to your own needs, press the function key at the bottom of the screen to select ON or OFF. ON means that the key beep is on; OFF means that the key beep is off.

8.1.3 Date and Time Setting

The instrument uses a 24-hour clock, and it can modify the date and time.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at

the bottom of the screen to enter the < SYSTEM CONFIG> page;

2. Use the cursor keys to move the cursor to the [Date] or [TIME] field;

3. According to your own needs, press the function keys at the bottom of the screen to select the year, month, day, hour, minute and second that you want to set. + means the value plus 1 and - means the value minus 1. For example, year+, month+, day+, hour+, minute+, and second+ represent +1 year, +1 month, +1 month, +1 hour, +1 minute, and +1 second respectively and vice versa.

8.1.4 Account Setting

The instrument has two user modes for selection:

Administrator - Except for the [SYSTEM SERVICE] page, other functions are open to the administrator, and the parameters set by the administrator are saved in the system memory after a delay of 5 seconds, so that they can be loaded after the next startup.

User - In addition to the [SYSTEM SERVICES] and [CATALOG] pages, the user can operate other functions, and the data modified by the user will be restored to the value set by the administrator after the next startup.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the < SYSTEM CONFIG> page;

2. Use the cursor keys to move the cursor to the [ACCOUNT] field;

3. According to your own needs, press the function key at the bottom of the screen to select administrator or user;

4. Regarding the account password, you can choose to delete the password and the administrator will not be protected by the password, or you can choose to change the password and enter a numeric password up to 9 digits, and the password only includes numbers and symbols.

8.1.5 [Remote Communication] Setting

The instrument has built-in RS-232 interface and USB communication interface, [REMOTE] allows you to choose one of them.

If you choose RS232 interface, please insert the communication cable into the RS-232C interface on the rear panel of the instrument. If you choose the USB interface, please insert the communication cable into the USB interface on the rear panel of the instrument.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the < SYSTEM CONFIG> page;

2. Use the cursor keys to move the cursor to the [REMOTE] field;

3. According to your own needs, press the function key at the bottom of the screen to select RS-232 interface or USB communication interface.

8.1.6 [Baud] Setting

The instrument has built-in RS-232 and USB-232 interfaces. After the instrument senses the signal conversion of the RS-232 or USB interface, it immediately communicates with the host at the set baud rate and the keyboard is locked. In order to communicate correctly, it is necessary to confirm whether the baud rate and stop bit are set correctly, otherwise the upper computer cannot communicate correctly.

The RS-232 configuration is as follows:

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

Usually communicate with PC, using 1 stop bit.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the < SYSTEM CONFIG> page;
2. Use the cursor keys to move the cursor to the [BAUD] field;
3. According to your own needs, press the function key at the bottom of the screen to select different baud rates, 4800, 9600, 19200, 38400, 57600, 115200;
4. To communicate with the host computer, it is recommended to use 115200 high-speed baud rates.

8.1.7 [Communication Protocol] Setting

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

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the < SYSTEM CONFIG> page;
2. Use the cursor keys to move the cursor to the [PROTOCOL] field;
3. According to your own needs, press the function key at the bottom of the screen to select SCPI or Modbus.

8.1.8 Modbus [Address] Selection

If you use Modbus (RTU) protocol, you need to set the address of the computer.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at

the bottom of the screen to enter the <SYSTEM CONFIG> page;

2. Use the cursor keys to move the cursor to the [ADDRESS] field;

3. According to your own needs, press the function keys at the bottom of the screen to select different addresses from 01 to 15.

In order to facilitate the simultaneous operation of multiple identical instruments, the instrument allows using the address 00 for broadcast communication. Using address 00 for communication, the instrument only receives commands and cannot return response codes.

8.1.9 [End Mark], [Hand Shake], [Error Code] Setting

The instrument RS-232 uses SCPI language for programming. To use the SCPI protocol, please set up SCPI first. There must be an end mark in the communication command between the instrument and the host to facilitate mutual recognition of the end of the command.

The instrument supports the following end marks:

End Mark	ASCII Name	ASCII Hexadecimal	Bytes	Description
LF(0x0A)	Newline	0x0A	1 Byte	Instrument Default
CR(0x0D)	Carriage Return	0x0D	1 Byte	
CR+LF	Carriage Return+ Newline	The First Byte 0x0D	2 Bytes	
		The Second Byte 0x0A		
NUL(0x00)	Null Character	0x00	1 Byte	

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the <SYSTEM CONFIG> page;

2. Use the cursor keys to move the cursor to the [END MARK] field;

3. According to your own needs, press the function key at the bottom of the screen to select the desired end mark.

Hand Shake:

After turning on the hand shake, all commands sent by the host to the instrument will be returned to the host as they are before returning data. After closing the hand shake, the command sent by the host to the instrument will be processed immediately. (Hand shake is not used. If there is no special requirements, please set hand shake to OFF.)

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the <SYSTEM CONFIG> page;

2. Use the cursor keys to move the cursor to the [HAND SHAKE] field;

3. According to your own needs, press the function key at the bottom of the screen to select ON or OFF.

Error Code:

After turning on the error code, the instrument will return an error code after receiving the command. If it is a query command, only the command error will return an error code.

After closing the error code, the host can send the command ERR? To query the error code generated during the last command execution.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the <SYSTEM CONFIG> page;

2. Use the cursor keys to move the cursor to the [ERROR CODE] field;

3. According to your own needs, press the function key at the bottom of the screen to select ON or OFF. ON means that the error code will return to the execution error code after the single-line instruction is executed. OFF means that the error code does not return automatically.

8.1.10 SCPI [Upload] Mode

The instrument supports the function of automatically sending data to the host. The data will be automatically sent to the host after each test is completed, without the host sending FETCH? instruction.

The instrument sends the test result and the comparator result to the host after each test is completed, please refer to Fetch? subsystem.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the <SYSTEM CONFIG> page;

2. Use the cursor keys to move the cursor to the [UPLOAD] field;

3. According to your own needs, press the function key at the bottom of the screen to select FETCH or AUTO. The former means to use the command FETCH to obtain all measurement data, and the latter means to automatically send to the host after each test is completed.

8.1.11 [Log] and [Stat]

Please refer to Chapter 6 Log/Stat.

8.1.12 [Filter] Selection

The measurement stability of the instrument depends on the filter. Please select according to the filter of the current region. If you are not sure, please select AUTO. The instrument will automatically set the filter of the current region. The filter in China is 50 Hz.

Setting Steps:

1. Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the <SYSTEM CONFIG> page;

2. Use the cursor keys to move the cursor to the [FILTER] field;

3. According to your own needs, press the function key at the bottom of the screen to select AUTO or 50Hz or 60Hz.

8.1.13 [Default Setting]

After performing the default setting, all the settings of the instrument will be restored to the parameters preset at the factory, including:

1. All the settings of the <SYSTEM CONFIG> page are restored to factory values:
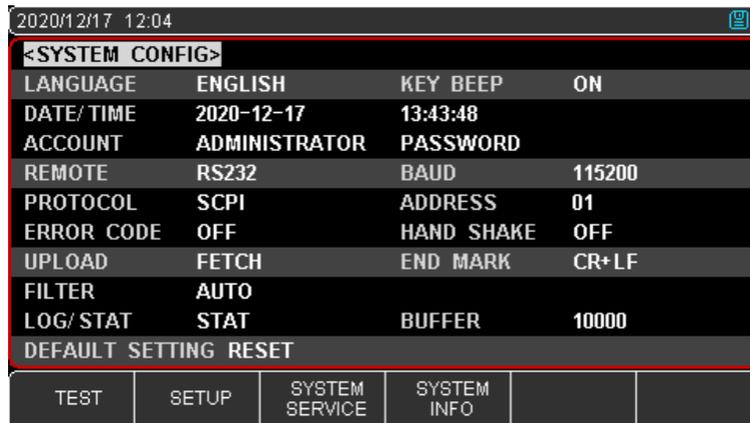
2. The <SETUP> page is preset to factory values:
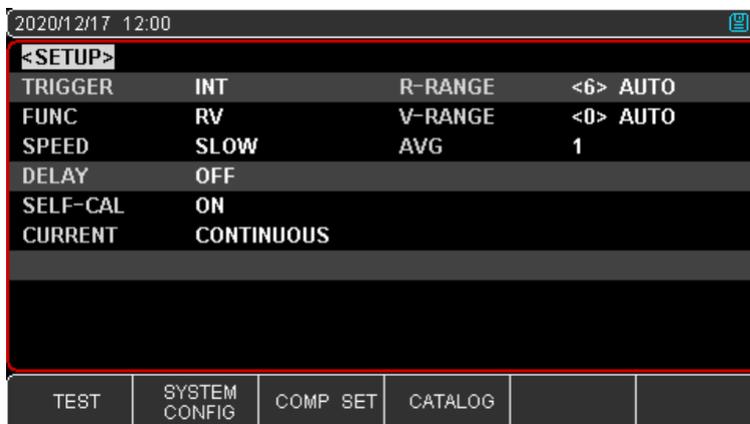
3. The <CATALOG> page is preset to file 0: the shutdown save is set to be prohibited:
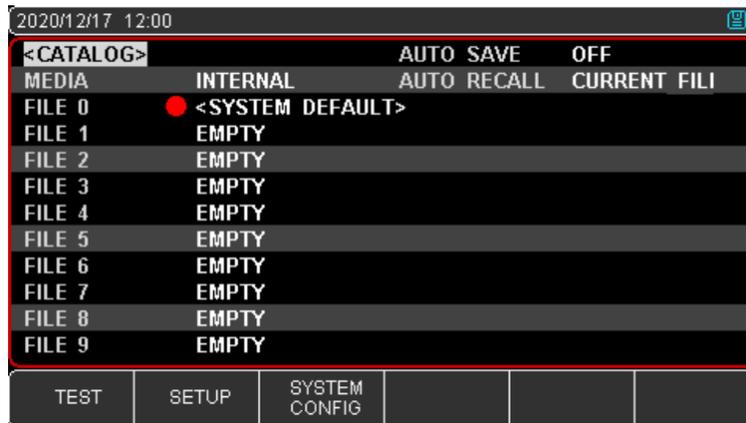
8.2 System Info

Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the <SYSTEM CONFIG> page; press the function key to select [SYSTEM INFO]. This part contains the model, the serial NO. and FW version.

This page does not require the user to set up.

8.3 System Service

Press the [Test] or [Setup] key, and select [SYSTEM CONFIG] with the function key at the bottom of the screen to enter the <SYSTEM CONFIG> page; press the function key to select [SYSTEM SERVICE]. Warning: This page is not open to users. It is used to calibrate data when leaving the factory. Non-professionals cannot enter by force. Otherwise, the calibration data may be lost, resulting in a large deviation of the measurement data.

9. Handler Interface

This chapter mainly covers the following:

- Terminals

- Method of Connecting and Schematic Diagrams of Interfaces

The instrument provides users with a fully functional handler interface, which includes qualified sorting output, HI/IN/LO, EOC (test completion signal), TRIG (external trigger startup) input and other signals. Through this interface, the instrument can easily complete the automatic control function with the user system control components.

9.1 Terminals and Signals

Table 9-1 Definition of Output Terminal Pin

Pin	Name	Description	
1	o_RLO	0: RLO	Table 9-1 Terminals
2	o_RIN	0: RIN	
3	o_RHI	0: RHI	
4	o_VLO	0: VLO	
5	o_VIN	0: VIN	
6	o_VHI	0: VHI	
7	o_RNG	0: RNG	
8	o_VNG	0: VNG	
11	o_ALLOK	0: RV-ALLOK	Output Terminal (All signals
12	o_ALLNG	0: RV-ALLNG	are active low)
13	o_EOM	1: ON TESTING 0: READY	
14	o_OPEN	0: OPEN	

Table 9-2 Definition of Input Terminal Pin

Pin	Name	Description
24	TRIG	The rising edge is valid.

Table 9-3 Definition of Power Terminal Pin

Pin	Name	Description
9	GND	External Power GND Terminal
10	o_VCC	Positive Terminal of Internal VCC Power Supply (5V, 500mA)

9.2 Connection Mode

The instrument has a built-in fully isolated power supply, and there is no need to provide a positive terminal for the external power supply. Please connect the external power supply to the following pins at the same time:

Pin 9: External Power GND

Pin 10: Floating

9.2.1 Use Internal Power Supply

Internal Power Supply: 5V, maximum 0.5A.

Use internal power supply:

10: VCC (5V)

9: GND

⚠️ When the power is unknown or uncertain, the internal power supply cannot be used, otherwise the instrument will not work normally. In known low-power occasions, you can use the internal power supply to work, but the anti-interference ability of the instrument may deteriorate.

9.2.2 Electrical Parameters

Power Requirements: +3.3V~30VDC

Output Signal: Darlington collector output with built-in pull-up resistor. Optical coupler isolation. Active low.

Maximum Voltage: 30VDC, built-in 30V clamping circuit.

Input Signal: Optical coupler isolation. Active low.

Maximum Current: 50mA

⚠️ Note: To avoid damage to the interface, the power supply voltage should not exceed the power supply requirements, and please connect the wiring after the instrument is turned off. The instrument uses Darlington-driven output terminal, which can drive low-power relays and signal relays. The instrument has integrated reverse diodes.

9.2.3 Schematic Diagram of the Input Terminal
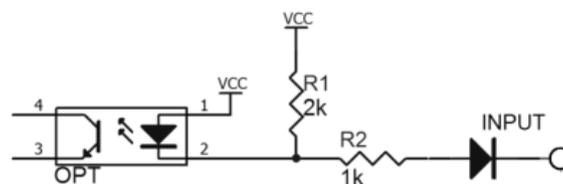
Figure 9-2-3 Schematic Diagram of the Input Terminal (Trig)

9.2.4 Schematic Diagram of the Output Terminal
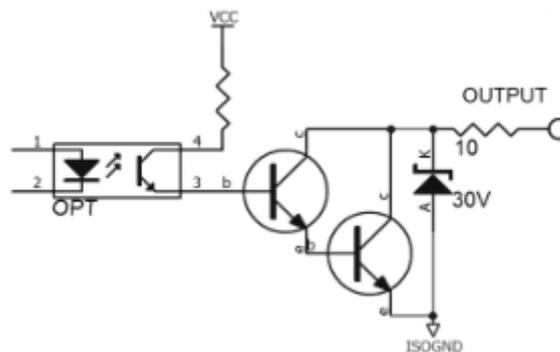
Figure 9-2-4 Schematic Diagram of the Output Terminal

9.2.5 Connection Method of the Input Circuit
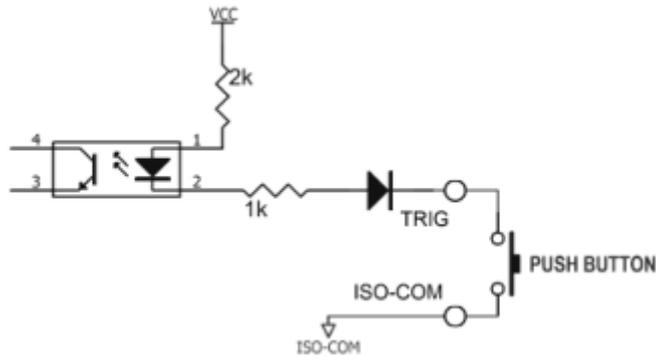
Figure 9-2-5-1 Connection with the Switch
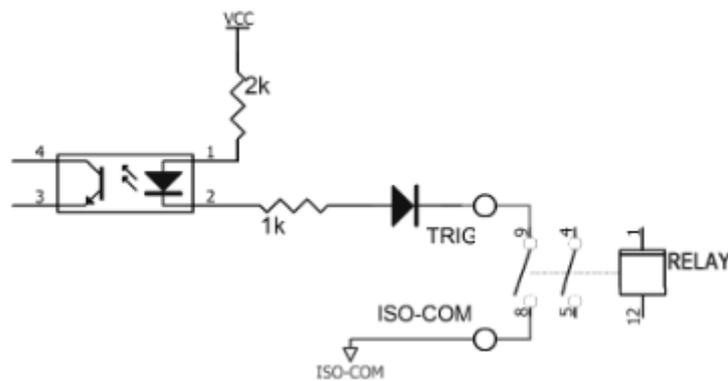
Figure 9-2-5-2 Use Relay to Control
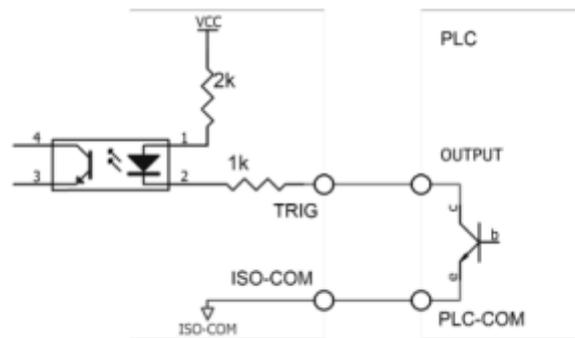
Figure 9-2-5-3 Use PLC Negative Common Terminal to Control
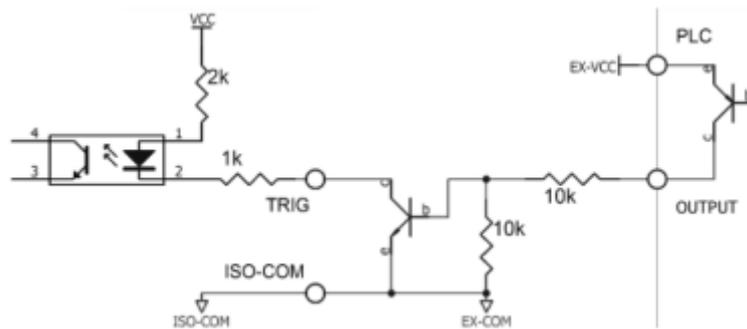
Figure 9-2-5-4 Use PLC Negative Common Terminal to Control

9.2.6 Connection Method of the Output Circuit
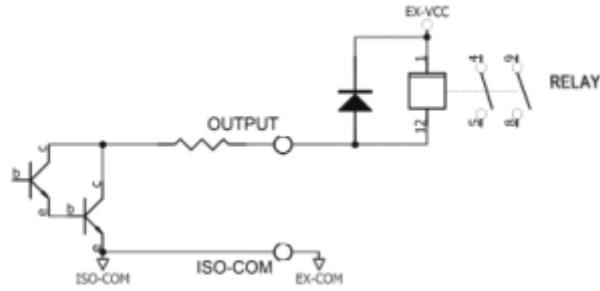
Figure 9-2-6-1 Control Relay
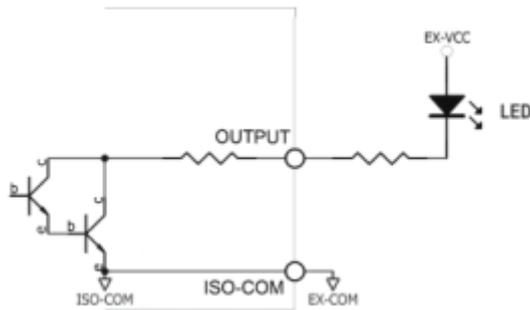
Figure 9-2-6-2 Control Luminous Diode and Optical Coupler
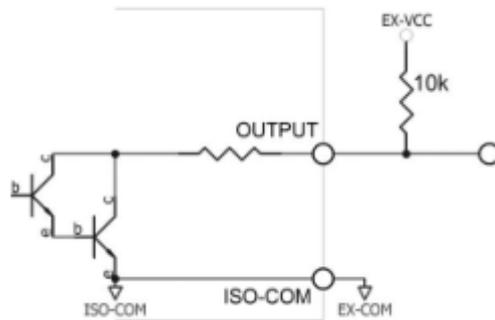
Figure 9-2-6-3 Negative Logic Output
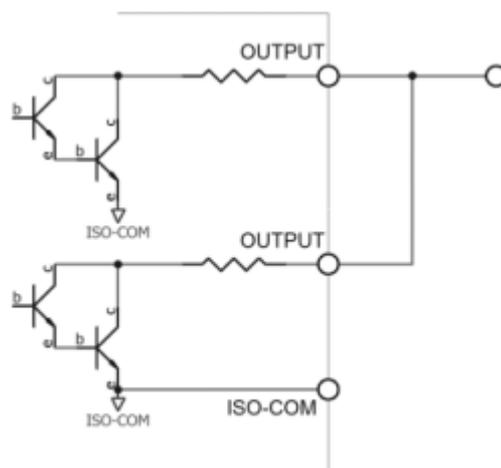
Figure 9-2-6-4 Composition Logic or Circuit of Two-Port Output
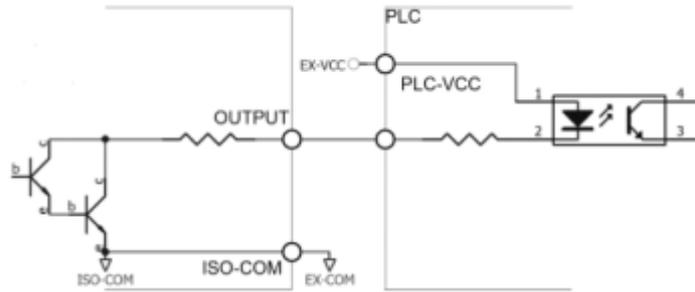
Figure 9-2-6-5 Output to PLC Negative Common Terminal
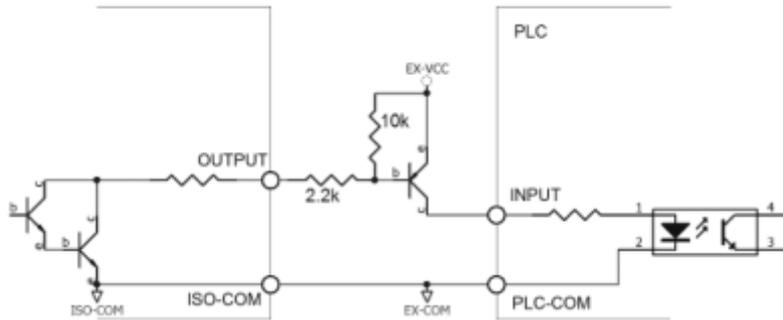
Figure 9-2-6-7 Output to PLC Positive Common Terminal

9.3 Periodic Table
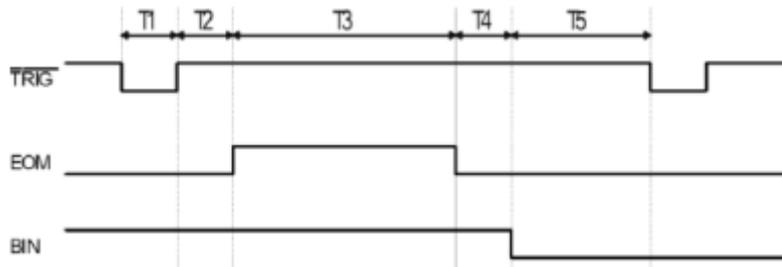
Figure 9-3-1 Periodic Table

Description			Minimum
T1	Trigger Pulse Width		1ms
T2	Measurement Period	Trigger Delay	<10μs
T3		Measurement Time	Related to Settings
T4		BIN Output Delay	200μs
T5	Waiting Time after Triggering		0s

Figure 9-3-2 Time Table

10. Remote Communication

This chapter mainly covers the following:

- RS-232 Interface and Connection
- RS-485 Interface
- USB Interface
- Communication Protocol

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

10.1 RS-232C

RS-232 is a widely used serial communication standard, also known as asynchronous serial communication standard, used to realize data communication between computers and between computers and peripherals. RS is the abbreviation of "Recommended Standard", and 232 is the standard number. This standard is officially published by the Electronic Industry Association (EIA) in 1969. It stipulates that it is transmitted via a data wire one bit at a time.

The configuration of most serial ports is usually not strictly based on the RS-232 standard: each port uses a 25-core connector (now computers basically use a 9-core connector). The most commonly used RS-232 signals are shown in the table:

Table 10-1- Common RS-232 Signals

Signal	Symbol	Pin No. of 25-Core Connector	Pin No. of 9-Core Connector
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
Transmit Data	TXD	2	3
Receive Data	RXD	3	2
Ground	GND	7	5
Request to Send	RTS	4	7

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

Table 10-1-2 Minimum Subset of RS232 Standard

Signal	Symbol	Pin No. of 9-Core Connector
Transmit Data	TXD	2
Receive Data	RXD	3
Ground	GND	5

10.1.1 RS232C Interface
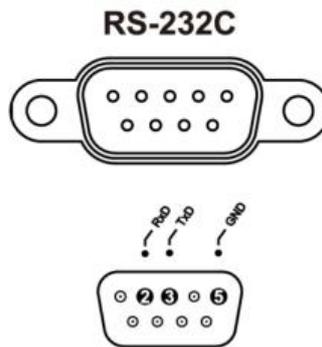
Figure 10-1-1 RS-232 Interface on the Rear Panel [Male]

⚠ Suggestion: To avoid electrical shock, please turn off the power of the instrument when plugging or unplugging the connector.

The default communication settings of the instrument:

Transmission Mode: full-duplex asynchronous communication including start bit and stop bit

Data Bit: 8 bits

Stop Bit: 1 bit

Check Digit: None

10.1.2 Connection Mode
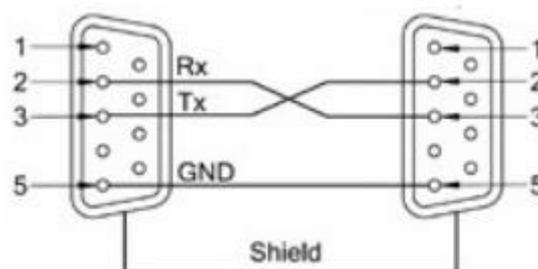
Figure 10-1-2 RS-232 Interface on the Rear Panel [Male]

The RS-232 serial interface can be interconnected with the serial interface of the controller (for example: personal computer or industrial computer) through a 2-3 crossed DB-9 cable.

10.2 RS485 Interface

The instrument is equipped with RS485 interface as standard. The RS485 interface and the RS232 interface of the instrument share the same DB9 terminal:

RS485 is a communication interface that supports multi-machine communication, which can be connected with multiple slaves through one host.

The detailed RS485 specification is not the focus of this user manual, please refer to https://en.wikipedia.org/wiki/RS-485
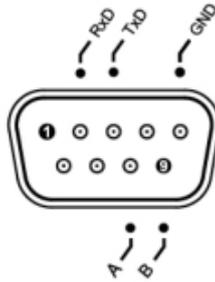
Pin	Function
8	A
9	B

10.3 USB Interface

On some relatively new computers and laptops, the RS232 interface has been cancelled and the USB interface is used for communication. The instrument has a built-in USB-232 interface, and this virtual port can achieve the same function as RS232.

Turn on the USB Function in the Instrument

The instrument's [SYSTEM CONFIG] page has the option of USB/RS232. Before using the USB interface for communication, please set it to USB.

Setting steps: enter the <SYSTEM CONFIG> page, use the cursor keys to select the [REMOTE] field, and then use the function keys to select USB .

Install the Driver on the Computer

The USB interface requires a driver to be installed on the computer to work properly. Steps to install USB driver:

1. Insert the USB cable into the computer and the instrument:

2. In the device manager on the computer, it will be prompted as "other devices". At this time, you need to install the driver.
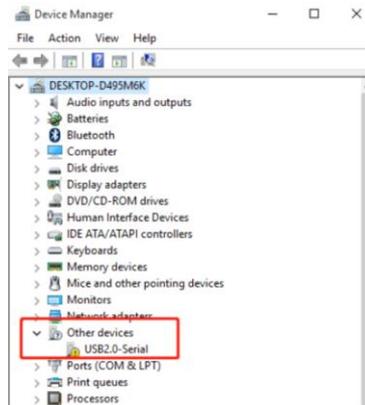
3. You need to download the CH340 driver (you can download it from the browser by yourself). The file is: CH341SER.EXE. Click [Install], and the "Driver Installation Succeed" window will appear after the installation is complete.
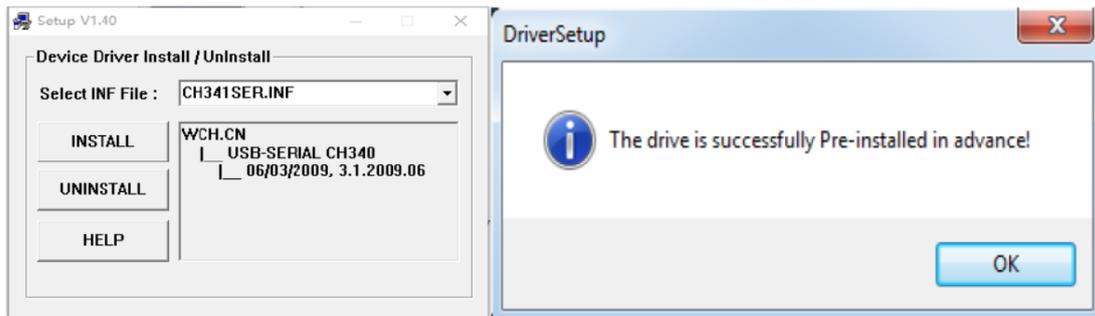
4. Open the device manager on the computer. After the driver installation on Windows is complete, a port number COM17 will appear, as shown in the red box in the figure. This port number needs to be recorded and used for communication.
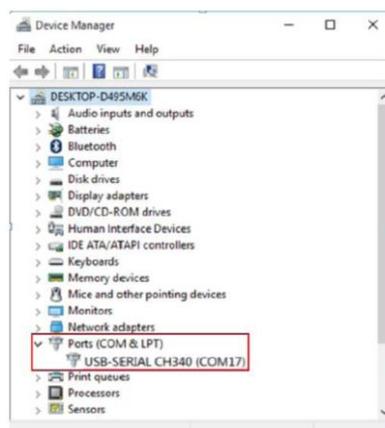
10.4 Communication Protocol

The instrument supports 2 communication protocols: SCPI and Modbus (RTU).

SCPI Protocol:

SCPI is the abbreviation of English Standard Commands for Programmable Instruments.

The SCPI protocol defines a set of standard syntaxes and commands for controlling programmable test and measurement instruments. SCPI commands are transmitted using the ASCII character string and passed into the instrument through the physical transport layer. The command consists of a series of keywords, and some also need to include parameters. In the protocol, the command is specified as the following form: CONFigure. In use, you can either write the full name or an abbreviation containing only uppercase letters. The feedback of the instrument to the query command is also the ASCII code. In fact, for simple applications (such as PLC), you only need to translate instructions into HEX bytes and then transfer them in bytes.

Modbus (RTU) Protocol:

The Modbus protocol is a universal language used in electronic control units, and is mainly used in industrial field bus protocols. It is a communication standard for industrial control equipment such as PLC and touch screen.

11. Technical Index

11.1 Technical Index of the Product

Table 11-1 Measurement Index of Resistance and Voltage

Resistance Measurement							
Resistance Range	<0>3m Ω	<1>30m Ω	<2>300m Ω	<3>3 Ω	<4>30 Ω	<5>300 Ω	<6>3k Ω
Maximum Display Value	3.1000 m Ω	31.000 m Ω	310.00 m Ω	3.1000 Ω	31.000 Ω	310.00 Ω	3200.0 Ω
Resolution	0.1 μ Ω	1 μ Ω	10 μ Ω	100 μ Ω	1m Ω	10 m Ω	100 m Ω
Measurement Current	100mA	100mA	10mA	1mA	100 μ A	10 μ A	10 μ A
Frequency of Measurement Current	1kHz±0.2Hz						
Precision	Slow	± 0.5%rdg. ±10dgt	±0.5%rdg. ±5dgt				
	Medium	± 0.5%rdg. ±15dgt	±0.5%rdg. ±7dgt				
	Fast	±	±0.5%rdg. ±7dgt				

		0.5%rdg. ±20dgt	
	High-Speed	± 0.5%rdg. ±40dgt	±1%rdg. ±8dgt
Temperature Index		(± 0.05%rdg. ± 1dgt)/ ℃	(±0.05%rdg. ±0.5dgt.)/ ℃

Voltage Measurement				
Voltage Range		<0>6V	<1>60V	<2>100V [UT3562]
				<2>400V [UT3563]
Maximum Display Value		±6.06000V	±60.6000V	±101.000V [UT3562]
				±404.000V [UT3563]
Resolution		10μV	100μV	1mV
Precision	Slow	±0.01%rdg. ±3dgt		
	Medium	±0.01%rdg. ±5dgt		
	Fast	±0.05%rdg. ±5dgt		
	High- Speed	±0.1%rdg. ±6dgt		
Temperature Index		(±0.001%rdg. ±0.3dgt.)/ ℃		

Display: true and effective value, suitable for 10% to 100% of range.

Measurement conditions of the above data:

Temperature: 23℃±5℃ Humidity: ≤65%R.H.

Set Zero: Set Zero before Testing

Warm-Up Time: >60 Minutes

Calibration Time: Within 12 Months

Accuracy of Measurement Current: 10%

11.2 Environmental Requirements

Index Environment: Temperature 18℃~28℃ Humidity ≤65%RH

Operating Environment: Temperature 10℃~40℃ Humidity 10~80%RH

Storage Environment: Temperature 0℃~50℃ Humidity 10~90%RH

Power Supply: 100VAC～240VAC

Fuse: 250V 1A Slow Melting

Power: Maximum 20VA

Machine Weight: About 2.6 kg (Net Weight, without Accessories)

Product Size (Width * Height * Depth): 214mm*89mm*340mm