User's Manual

3544

Multichannel series

MULTI-CHANNEL DC resistance tester

2021-01-19

Version 2.2

Table of contents

Introduction

Thank you for purchasing 3544 multi-channel series DC resistance tester. To obtain maximum performance from the product, please read this manual first, and keep it handy for future reference.

Registered trademarks

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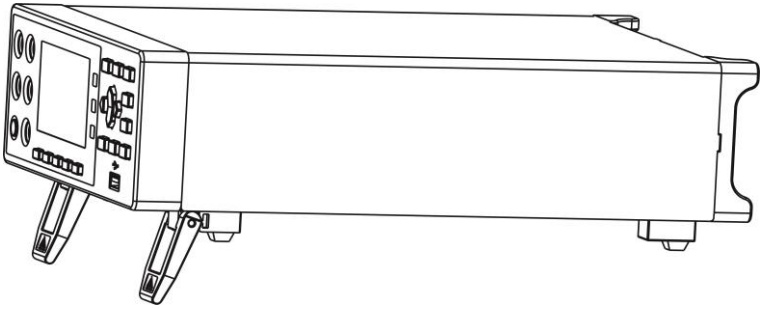
Checking Package Contents

When you receive the instrument, inspect it carefully to ensure that no damage occurred during shipping. In particular, check the accessories, panel switches, and connectors. If damage is evident, or if it fails to operate according to the specifications, contact your authorized distributor or reseller.

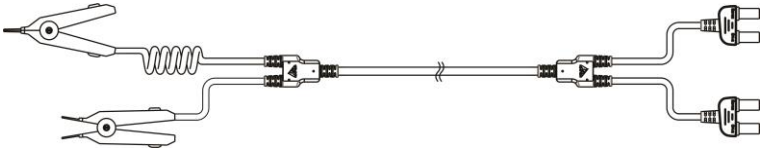
To transport this instrument, use the original packaging and wrap it in a double carton. Damage in transit is not warranty.

Check the package contents as follows:

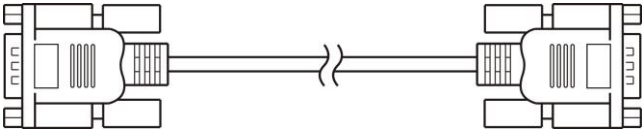
No.	Item	Quantity
1	3544 MULTI-CHANNEL DC resistance tester	1
2	RS232 communication cable	1
3	Test lead	1
4	Power cord	1



3544 MULTI-CHANNEL DC resistance tester



Test lead



RS232 communication cable

Security information

The instrument is designed to conform to IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, if it is used improperly, it may cause injury or death and damage the instrument. Be sure to read through this manual and its precautions before use. Our company does not assume any responsibility for accidents and injuries not caused by defects in the instrument itself.

Safety Symbols

This manual contains information and warnings essential for safe operation of the instrument and for maintaining it in safe operating condition. Before using the instrument, be certain to read the following safety notes carefully.

	Indicates very important message in this manual. When the symbol is printed on the instrument, refer to a corresponding topic in the Instruction Manual.
	Indicates DC (direct current)
	Indicates a fuse
	Indicates earth terminal

In this manual, the risk seriousness and the hazard levels are classified as follows:

	Indicates an imminently hazardous situation that will result in death or serious injury to the operator.
	Indicates a potentially hazardous situation that will result in death or serious injury to the operator.
	Indicates a potentially hazardous situation that may result in minor or moderate injury to the operator or damage to the instrument or malfunction.
	Indicates functions of the instrument or relative suggestion of a correct operation.

Accuracy

We define measurement tolerances in terms of f.s. (full scale), rdg. (reading) and dgt. (digit) values, with the following meanings:

f.s. (Maximum display value)

This is usually the maximum display value. In the instrument, this indicates the currently used range.

rdg. (Reading or displayed value)

The value currently being measured and indicated on the measuring instrument.

dgt. (Resolution)

The smallest displayable unit on a digital measuring instrument, i.e., the input value that causes the digital display to show a “1”.

Usage Notes

Installation environment

- ✧ Operating temperature and humidity range:
  0°C to 40°C 80%RH or less (no condensation)
- ✧ Ideal working temperature and humidity range:
  23 ±5°C 80%RH or less (no condensation)

To avoid failure or damage to the instrument, do not place the tester in the following places:

- ✧ Places exposed to direct sunlight or high temperatures
- ✧ Places exposed to high humidity or condensation
- ✧ Places exposed to large amounts of dust particles
- ✧ Places exposed to water, oil, chemicals or solvents
- ✧ Places exposed to corrosive or combustible gases
- ✧ Places with strong electromagnetic fields or electromagnetic radiation
- ✧ Places where mechanical vibration is frequent

Checking before use

Before using the instrument the first time, verify that it operates normally to ensure that no damage occurred during storage or shipping. If you find any damage, please contact us.

	Before using the instrument, check that the coating of the test leads or cables are not torn and that no metal parts are exposed. Using the instrument under such conditions could result in electrocution. Contact your authorized distributor or reseller in this case.

Use of instruments

	To avoid electric shock, do not disassemble the instrument electronic enclosure. There are high pressure and high temperature parts inside the instrument during operation.
	To avoid any damage to the instrument, avoid any vibration or shock during transport or handling. Pay particular attention to avoid collision caused by falling.

Measurement precautions

	To avoid electric shocks and short circuits, the following procedures must be followed: Do not allow the instrument to get wet, and do not use it with wet hands. This may cause electric shock accident. Do not modify, disassemble, or repair the instrument. This may result in fire, electric shock accident, or injury.
	Do not place the instrument on an unstable or slanted surface. It may drop or fall, causing injury or instrument failure. To avoid any damage to the

	instrument, do not input voltage or current to any measuring terminal, TC terminal, or External I/O terminal.

Use of test leads and cables

	To avoid electrical shock accident, do not short test leads where voltage is applied.
	Do not use any test lead or temperature sensor other than the ones specified by our company. It may result in inaccurate measurement due to poor contact or other reasons. To avoid damaging the cables, do not bend or pull the base of cables and the leads. The ends of pin type leads are sharp. Be careful to avoid injury. To avoid damage to the test leads, when plug/pull the test line, don't hold the cable but connector.

Chapter I Overview

1.1 Introduction

The 3544 is a resistance tester with high precision and wide range and high performance microprocessor. The 3544 has a measuring range from 3mΩ to 3MΩ to test resistors from 0.1uΩ to 3MΩ with a maximum display of 32000. At a test speed of 20 times/second, 0.02% accuracy is still guaranteed, and the reading jitter can be controlled within 3 words. Its unique OVC test mode can be adapted to high-precision test requirements. Since the instrument incorporates a temperature correction function, it is particularly well suited to the measurement of targets whose resistance values vary with temperature.

The 3544 series instruments support scan test function. With the company's multi-channel scanning tester, it is possible to simultaneously scan and measure multiple resistors.

The instrument has sorting function, with 10 sets of panel storage and various sorting beeper setting, and can also be equipped with Handler interface, which is applied to the automatic sorting system to complete the automatic pipeline test. It is equipped with RS232, RS485 and Ethernet interfaces for remote control and data acquisition and analysis.

The computer remote control command is compatible with SCPI (Standard Command for Programmable Instrument), which can efficiently perform remote control and data acquisition functions.
The instrument can measure a variety of high, medium and low value resistors; various switch contact resistors; connector contact

resistors; relay wire packs and contact resistors; transformer, inductor, motor, deflection coil winding resistance; wire resistance; metal riveting resistance of cars, ships, aircraft; printed lines and pore resistance, etc.

1.2 Features

Appearance

- Display with 3.5-inch high-resolution TFT screen display, easy to operate
- Compact design

Reliable specifications even if the body is small and light weight

- High resolution of 32,000 dgt.
- 0.1μΩ resolution at 1 A measuring current

Quick test

- Minimum test cycle only 20ms

Four-terminal test

- High precision measurement of low resistance

Various interface configuration

- External I / O port
- RS232 interface
- RS485 interface

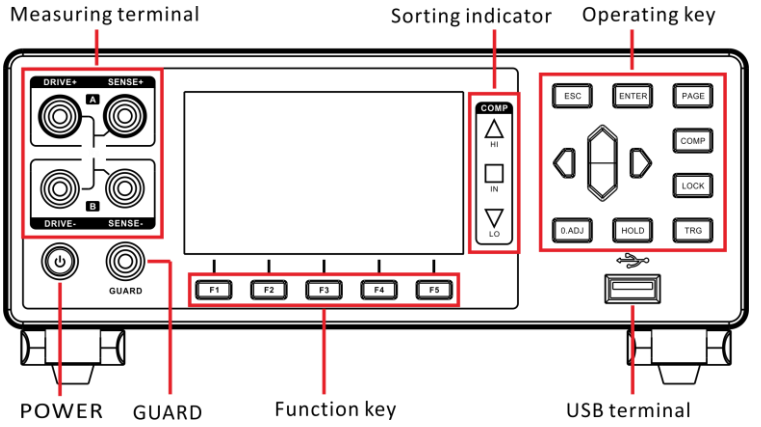
- Ethernet interface
- Temperature test interface
- U disk interface

Power supply

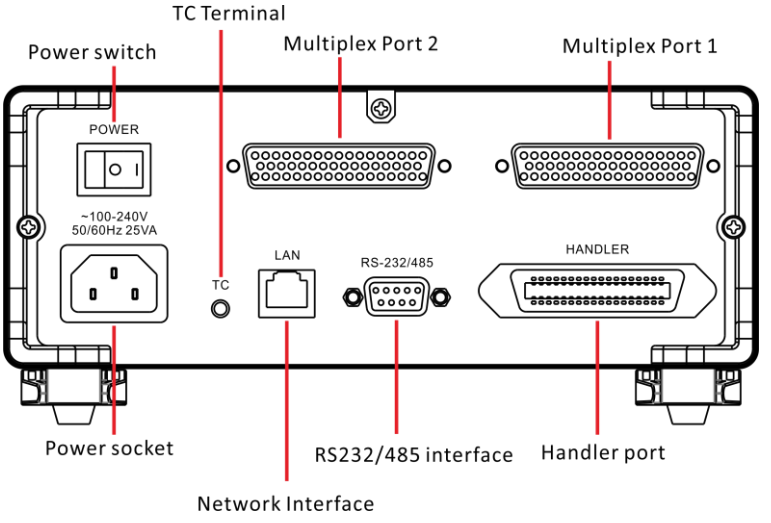
- 100~256 V wide power supply
- Power frequency 50Hz/60Hz automatic identification
- Maximum power consumption 10W

1.3 Component name and functionality

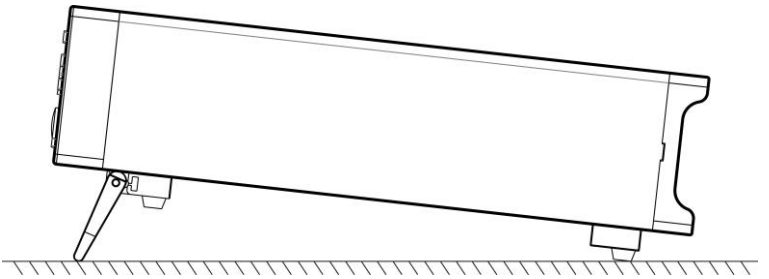
Front Panel



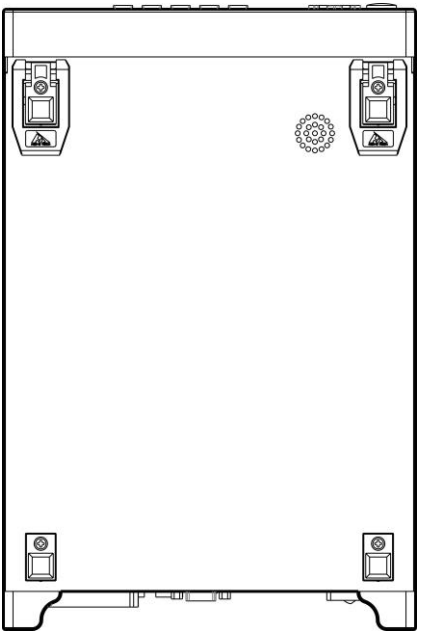
Rear Panel



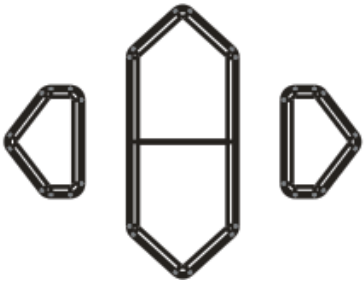
Side view



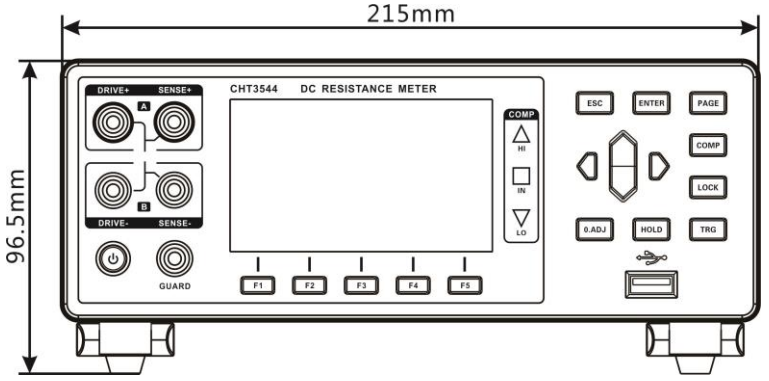
Bottom

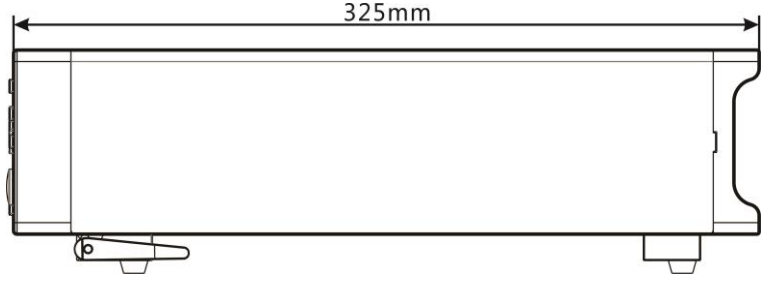


Keys	Description
	**Function key F1**
	**Function key F2**
	**Function key F3**
	**Function key F4**
	**Function key F5**
	**Function key Escape** Cancellation of operation
	**Function key Enter** Acceptance of settings and manual trigger input
	**[Page Switch]** Switch to [Test Page] <-> [Setup Page] <-> [Panel Page] <-> [Communication Settings Page] <-> [Sort Settings Page] <-> [I/O Settings page]

	**Comparator on/off key**
	**Lock key** Short press [LOCK] key to lock the current page and the other keys get invalid. Long press to unlock.
	**[0.ADJ] key** Short press to zero-adjustment function, Long press to release the zero-adjustment function.
	**[HOLD] key** Hold the current measurement during the test
	**[Trigger] key** Single trigger test to the instrument in manual trigger mode
	**[Direction] key** Select menu items or set values

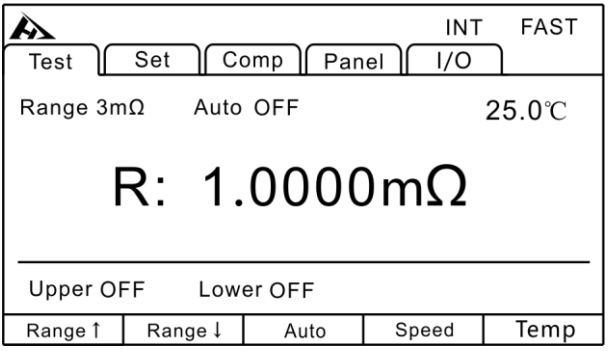
1.4 Dimensions



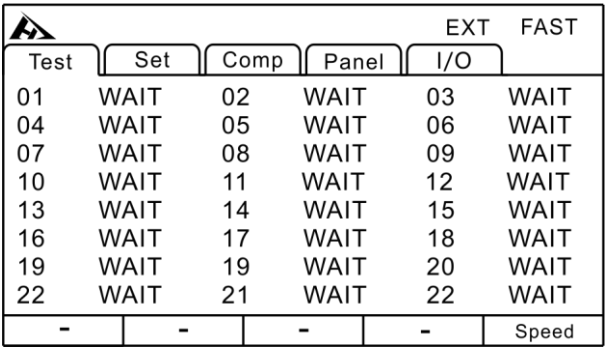


1.5 Page composition

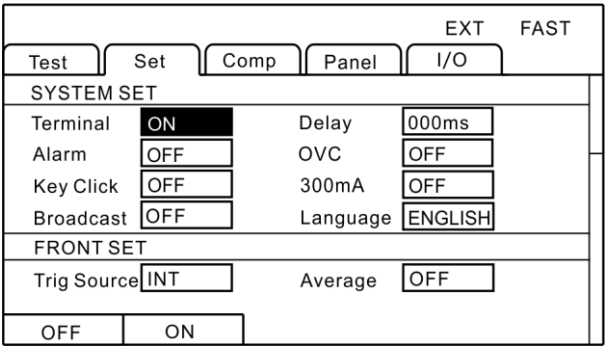
Single Channel measurement page



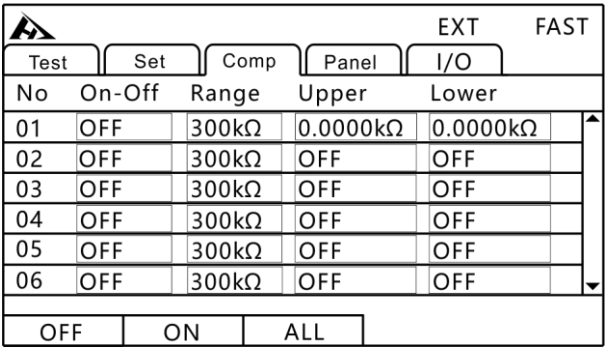
Multiplexed measurement page



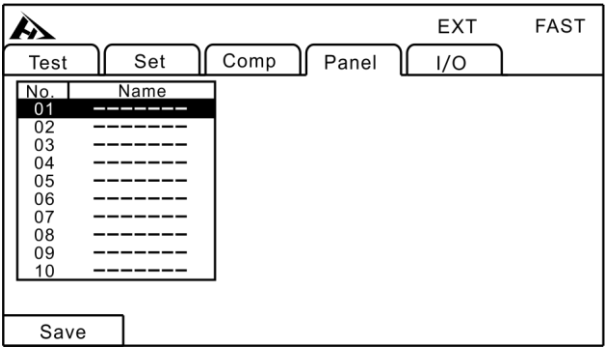
Settings page



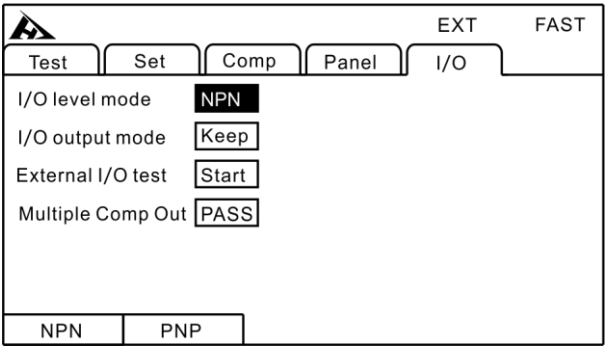
Multipath comparison page



Panel page



I/O settings page

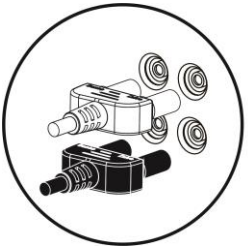


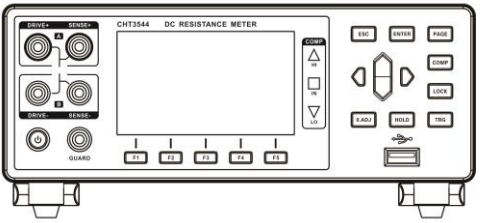
Chapter II Preparing for Measurement

2.1 Measurement process overview

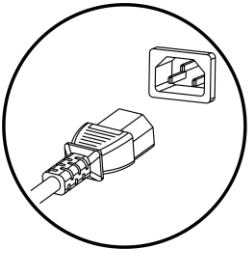
Follow these steps to prepare for measurement.

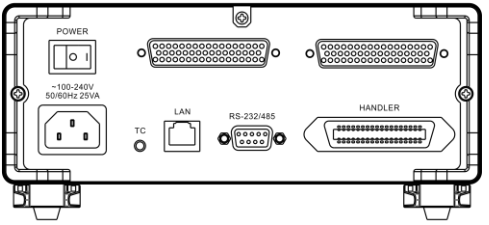
1. Power off the instrument and connect the test wire





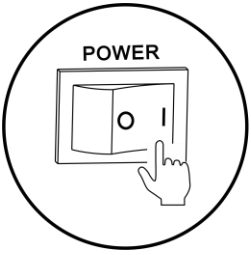
2. Plug in the power cord

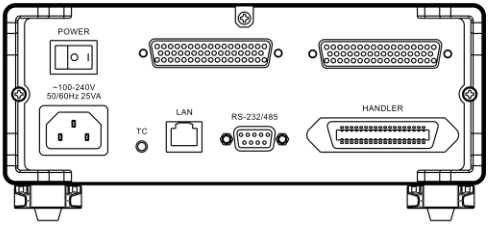




The good grounding of the power supply wire is beneficial to the stability of the test.

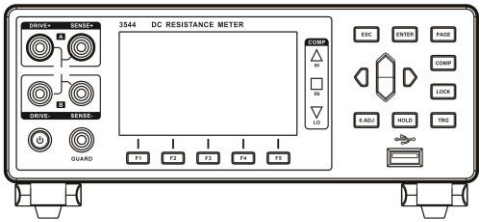
3. Turn the power on at the back of the instrument





At this point, the internal power supply of the instrument has been connected, the instrument is in a standby state.

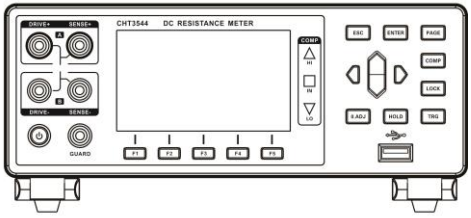
4. Long press the panel power button to turn on the power



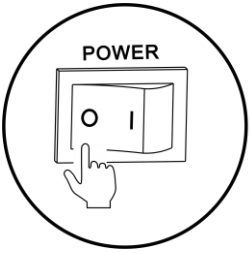
In the standby state, the panel power button light is red, long press the panel power button, power on, the screen lights up, the panel button light turns green.

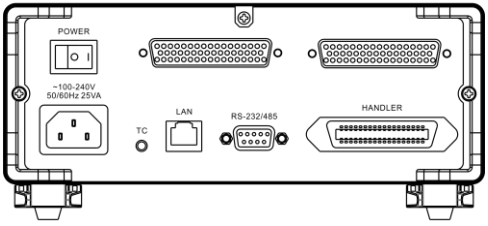
5. Set Test Parameters (see section 2.2 for details)

6. Start to test

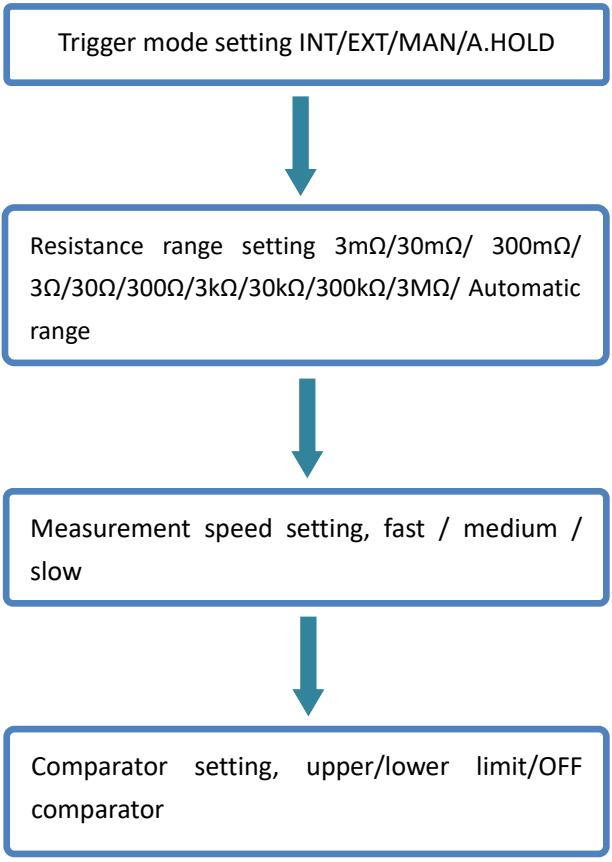


7. Test complete, power off





2.2 Basic parameter setting process



2.3 Pre-measurement Inspection

Before using the instrument, inspect it to verify that no damage has occurred during storage or transportation and it operates normally. If you find any damage, contact your authorized distributor or reseller.

Instrument and peripheral checking

Inspection item	Action
Is there any damage or a crack in the instrument? Are the internal circuits exposed?	If any damage is found, do not use it. Return it for repair.
Is there any dust or contamination, such as pieces of metal, on any terminals?	If dust or contamination is adhered to a terminal, clean the terminal with a swab or the like.
Is the test lead coating broken or is the metal exposed?	If the coating of a test lead is broken, the measured value may become unstable or have an error. Replace the damaged test lead.

Power-on checking

Inspection item	Action
After turn on the power on at the back of the instrument, check instrument POWER button lit or not?	Return the instrument for repair, if the POWER button is not lit.
When you turn the power on, does the entire display turn on and then the model name and a measurement screen appear on the screen?	If the screen does not behave like this, the instrument may be damaged internally. Return it for repair.

2.4 Confirming the measured object

It is necessary to appropriately change the measurement conditions according to the object to be measured in order to reliably measure the resistance. Please refer to the recommended example shown in the table below to start measuring after setting up the instrument.

Measured object	Recommended setting		
	Temperature compensation temperature conversion	OVC function	Measuring current at 300mΩ range
Coil products	TC	OFF	Lo
Contact products	*1	ON	Lo
Conductive coating, conductive rubber	--	OFF	Lo
Metal wire, profile	*1	ON	Lo
Car grounding resistance	*1	ON	Hi

Coil products:

Coil products has large inductance components such as inductors, coils, transformers, and motor speakers. Under normal circumstances, when testing such products, avoid using the OVC function, because its inductance component will suppress the OVC current pulse. If the delay is not enough, the measurement will fail. Temperature compensation is required in some cases.

Contact products:

Relays, contactors, switches, etc. These products have a thermoelectric potential effect at the contacts due to the presence of contacts. The OVC function is recommended to eliminate the thermoelectric potential effect.

Metal wire, profile:

Such as metal wire, metal profiles, metal welded parts. Especially for wire rods, since the resistance value is relatively temperature dependent, it is recommended to use a low power test while using temperature compensation.

*1 When the temperature dependence of the object to be measured is large, use temperature compensation.

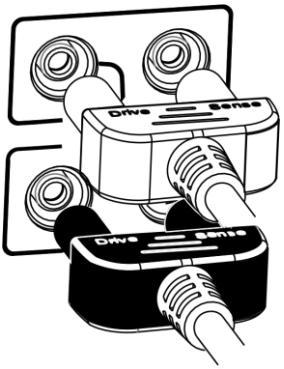
*2 Measurement values can be saved at regular intervals by using the interval measurement function.

2.5 Connecting Measurement Leads

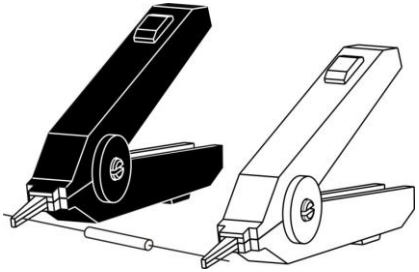
- To avoid electric shock accident, connect the test leads correctly.

- To be safe, do not use any test lead other than the ones specified by our company.
- The ends of leads are sharp. Be careful to avoid injury.

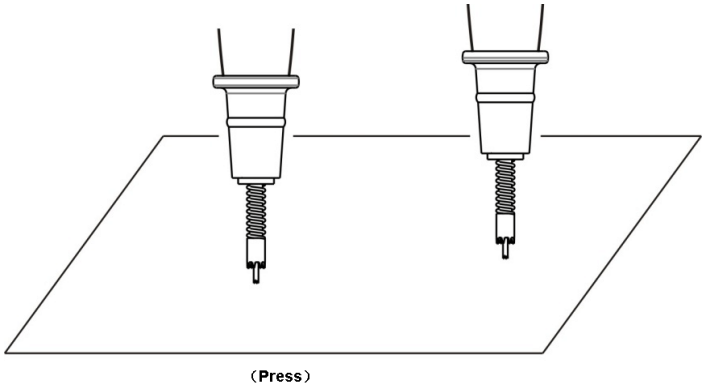
Front panel connection



Example 9363-A Test clip



Example 9363-B Test Probe

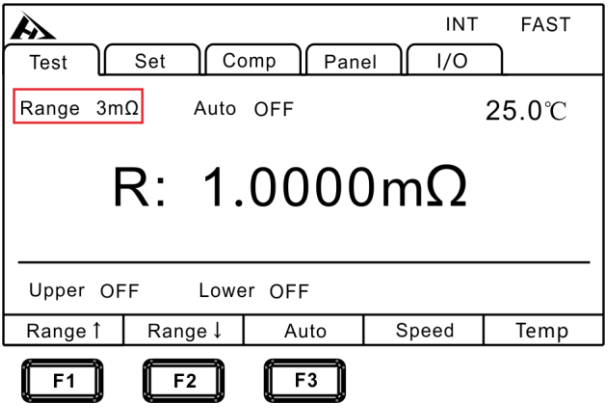


Chapter III Basic Settings

In order to use the instrument correctly, you should read this chapter before performing the test.

3.1 Setting the test range

The range setting includes manual range and automatic range. The automatic range instrument will automatically select an appropriate range to test based on the value of the resistance being measured.



Manual Range Setting

In the measurement interface, press the [F1] or [F2] keys to switch the range, even when the automatic range function is turned on, the manual range switch is also effective (when the automatic range is turned on, the automatic range function is automatically turned off when the manual range is switched on) .

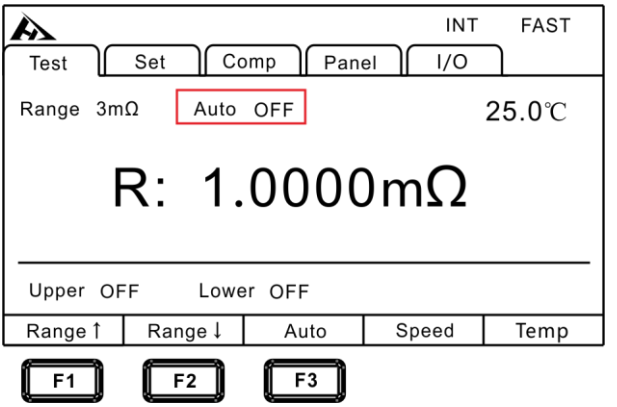
Ranges

3mΩ ↔ 30mΩ ↔ 300mΩ ↔ 3Ω ↔ 30Ω↔ 300Ω ↔ 3kΩ↔ 30kΩ↔ 300kΩ↔ 3MΩ

Auto-Ranging:

In the measurement interface, press [F3] to switch the auto range.

Interface display: Auto ON/OFF



Note:

If the range is changed while the auto range is ON, the auto range is automatically canceled and the manual range is set.

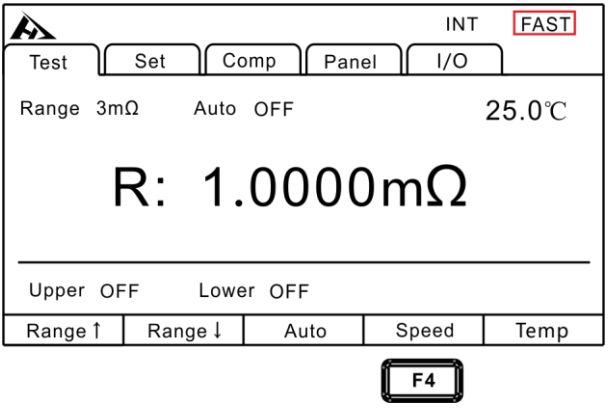
When the comparator function is turned ON, the range cannot be changed from fixed (it cannot be switched to auto-ranging). To change the range, turn OFF the comparator function or change the range from within the comparator settings.

The automatic range may become unstable due to the subject under test. At this point, specify the range or extend the delay time manually. Please refer to “resistance measurement accuracy” for the measurement accuracy of each range.

3.2 Setting the Measurement Speed

The measurement speed can be set to FAST (50 mea/sec), MED (medium (20 mea/sec)), or SLOW (2 mea/sec).

The top right of the screen shows: FAST/MED/SLOW



Note:

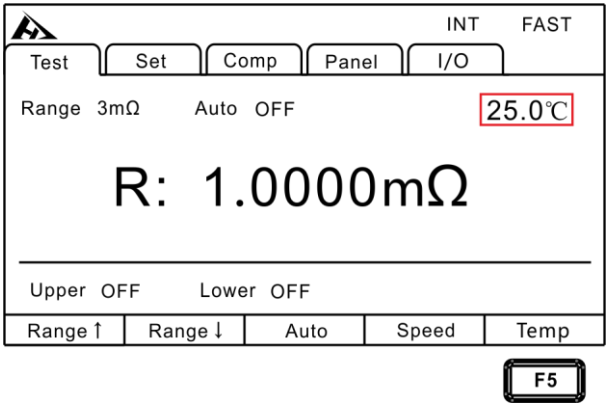
• When the measurement delay is set, the sampling period becomes slower.

• Test time includes ADC sampling, sorting output, and display time.

• In the test environment, when the electric field interference is relatively large, or when the test is difficult to stabilize, a slow test is recommended.

3.3 Temperature display settings

Press the [Temperature] key on the test page to switch whether the current temperature is displayed.



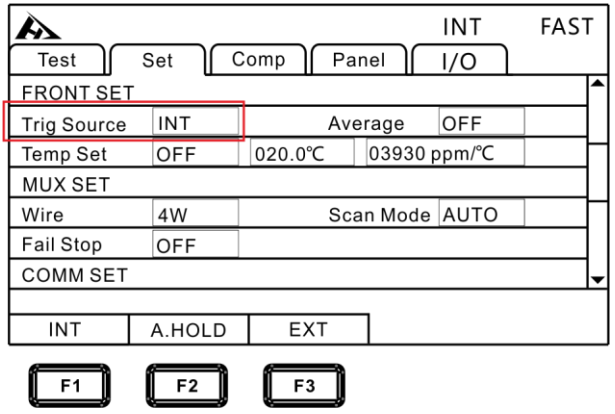
3.4 Setting the test trigger mode

The user can select internal trigger/external trigger/manual trigger/auto hold.

1. Select the parameter setting screen

Press [PAGE] Button to parameter setting page

2. Select the relevant menu items



Press the Arrow keys to select the menu items to be set;

Menu item	Meaning
[INT]	Internal
[EXT]	External
[MAN]	Manual
[A.HOLD]	Auto hold

3.5 Measurement delay setting

Set the delay time after changing the measurement current under OVC and auto range to adjust the measurement stabilization time. By using this function, even if the reactance component of the object to be measured is large, measurement can be started after the internal circuit is stabilized. The preset settings vary depending on the range or offset voltage compensation function.

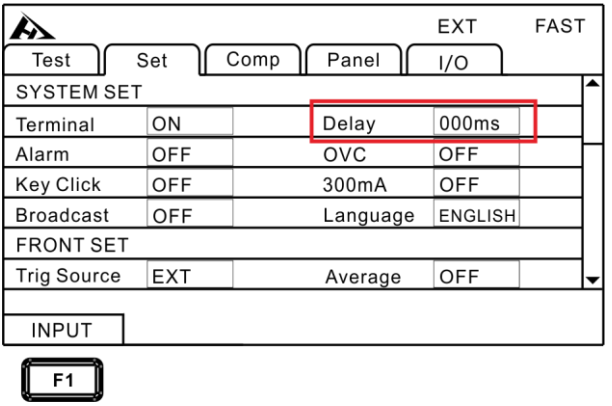
Preset set OVC delay value (internal fixed) (unit: ms)

Measuring current	Range	Delay time (ms)
Lo	3mΩ ~ 30mΩ	200
	300mΩ ~ 3Ω	50
	30Ω ~ 300Ω	30
Hi	300mΩ	200

1. Select the parameter setting page

Press [PAGE] Button to parameter setting page

2. Select the relevant menu item



Press the Arrow keys to select the menu items to be set;

Approximate calculation criteria for inductive load delay time

• When applying a measurement current to an inductive load, it takes a certain amount of time to stabilize. When it is not possible to make measurements in the initial state (preset), please adjust the delay. Set the delay time to approximately 10 times the following calculated value to ensure that the reactance components (inductors, capacitors) do not affect the measured value.

$$t = -\frac{L}{R} \ln\left(1 - \frac{IR}{V_o}\right)$$

L : inductance of the measured object

R : resistance of the object to be measured + wire resistance + contact resistance

I : Measuring current

Vo: open circuit voltage

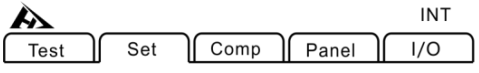
• Initially set the delay time to a longer time and then gradually reduce the delay time while observing the measured value.

• If the delay time is extended, the display of the measured value will be slower.

3.6 OVC (thermal electromotive force compensation) function setting

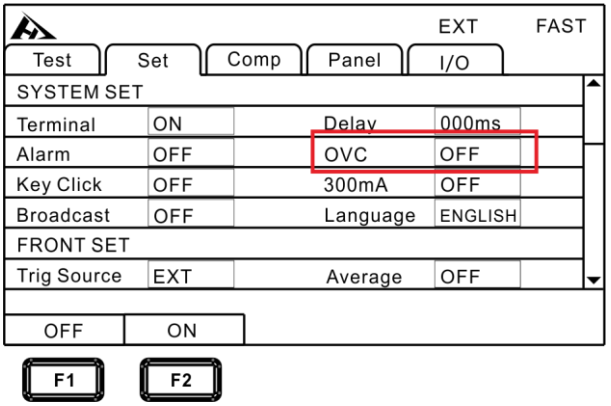
OVC function automatically compensates for the electromotive force or the bias voltage inside the instrument. (OVC: Offset Voltage Compensation)

1. Select the parameter setting page



Press [PAGE] Button to parameter setting page

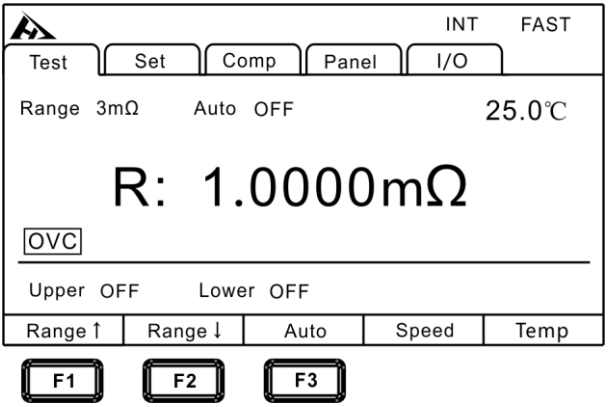
2. Select the relevant menu item



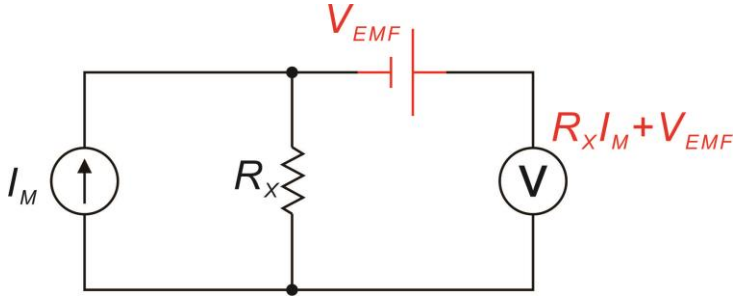
Menu item	Meaning
[OFF]	Turn on OVC function
[ON]	Turn off OVC function

3. OVC-on measurement page

When the OVC function is turned on, the OVC will be displayed on measurement page.



RP-RZ is displayed as the true resistance value based on the measured value RP when the measured current flows and the measured value RZ when the measured current does not flow.



VEMF: It is a thermoelectric potential. When any metal is in contact, it will generate an electric potential. The magnitude of the electric potential is related to the temperature.

RX: measured resistance

When the injection test current is IM, V1 = VEMF+RX*IM

When IM = 0, V2 = VEMF

V = V1- V2 = RX*IM

The effect of the thermoelectric potential can be offset by a simple subtraction operation.

Note:

• When the offset voltage compensation function is ON (the OVC indicator is lit), the display of the measured value updates slowly.

• The OVC function cannot be used when the range is 3kΩ or more. It automatically changes to the OFF state.

• When the offset voltage compensation function has been changed, the zero adjustment function is released.

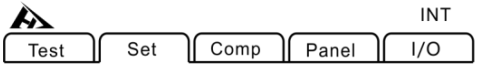
• When the inductance of the measured object is large, the delay time needs to be adjusted. (Initially set the delay time to a longer time and then gradually reduce it while observing the measured value.

• When the measured heat capacity of the object is small, the effect of the offset voltage compensation function may not be seen.

3.7 Switching measurement current 300mA (300mΩ range)

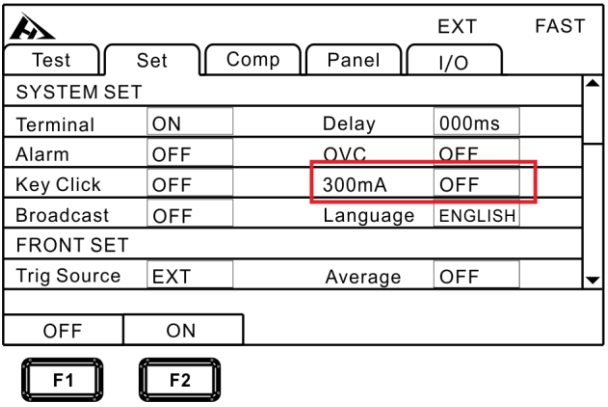
The instrument is able to change the measurement current of the 300mΩ range to 300 mA (100 mA at the factory). It is good to measure large current wiring under conditions close to the actual use state, it also helps to measure in an environment with large external noise.

1. Select the parameter setting interface



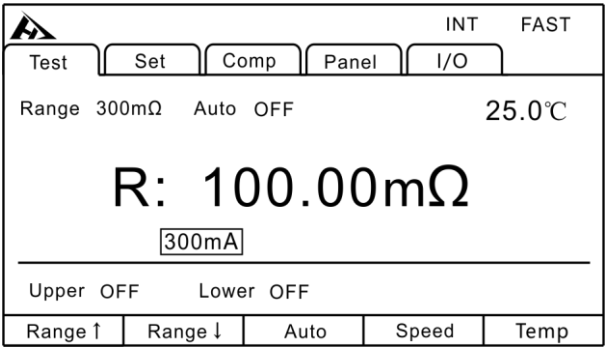
Press [PAGE] Button to parameter setting page

2. Select the relevant menu item



Menu item	Meaning
[OFF]	300mΩ range test current 100mA
[ON]	300mΩ range test current 300mA

3. The measurement page when 300mA measurement current is turned on



Note:

• When the measurement current is set to 300 mA, the power consumption of the object to be measured increases.

• When high-precision measurement is required, please use the 100 mA measurement current.

• If the measurement current is changed, the zero adjustment will be cleared.

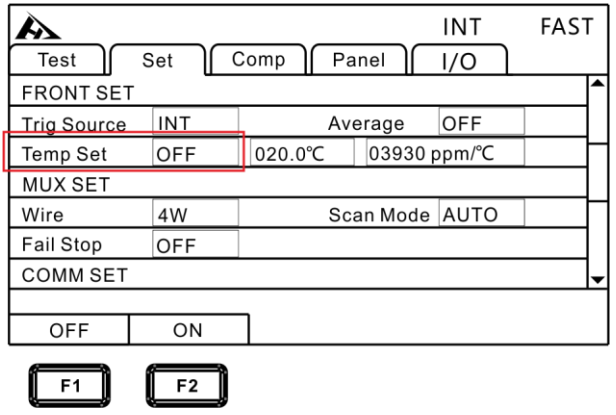
3.8 Temperature compensation setting

The resistance value is converted to the reference temperature for display. When performing temperature compensation, connect the temperature probe to the TC terminal on the rear panel of the instrument.

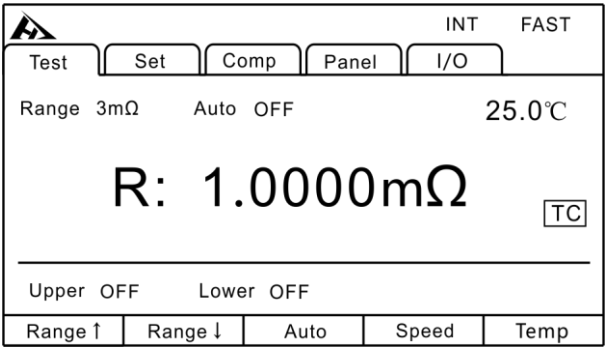
1. Select the parameter setting page

Press [PAGE] Button to parameter setting page

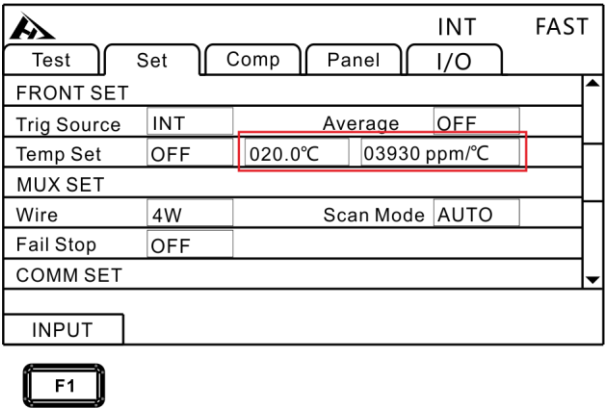
2. Select the relevant menu item



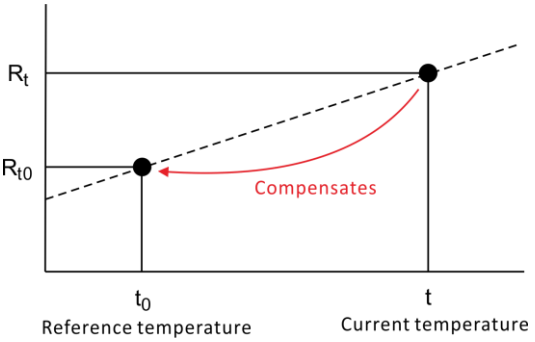
3. The measurement page when the temperature compensation is on.



After the temperature compensation is set to ON, the setting requires the reference temperature and temperature coefficient. The default setting is 20°C and the temperature coefficient is 3930ppm/°C (the temperature coefficient of pure copper material at 20°C)



The compensation principle is as follows:



$$R_{t0} = \frac{R_t}{1 + \alpha_{t0}(t - t_0)}$$

Rt : measured resistance value

Rt0 : compensation resistance value

t: measuring temperature

t0: Base stability (Setting range -10°C to 99.9°C)

αt0: temperature coefficient at t0 of the material to be tested (setting range -9999ppm/°C to 9999ppm/°C)

Note:

When “t.error” is displayed, it indicates that the temperature probe is not connected or the temperature is displayed as ---.-. Please confirm the connection of the temperature probe.

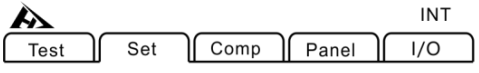
3.9 Average function

The averaging function averages multiple measured values and displays the results. It can be used to reduce variation in measured values

Average times:

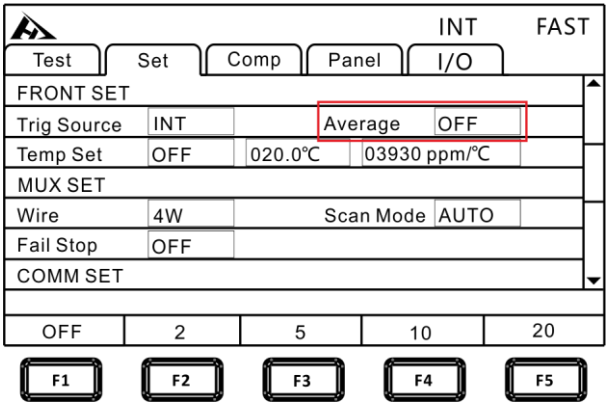
OFF ↔ 2 ↔ 5 ↔ 10 ↔ 20

1. Select the parameter setting page



Press [PAGE] Button to parameter setting page

2. Select the relevant menu item



Menu item	Meaning
[OFF]	Average function is OFF
[2]	Get average of 2 measurements to display
[5]	Get average of 5 measurements to display
[10]	Get average of 10 measurements to display
[20]	Get average of 20 measurements to display

3.10 Setting Beep

After instrument comparator is turned on or test result of sorting opening output is judged, the instrument beep mode can be selected.

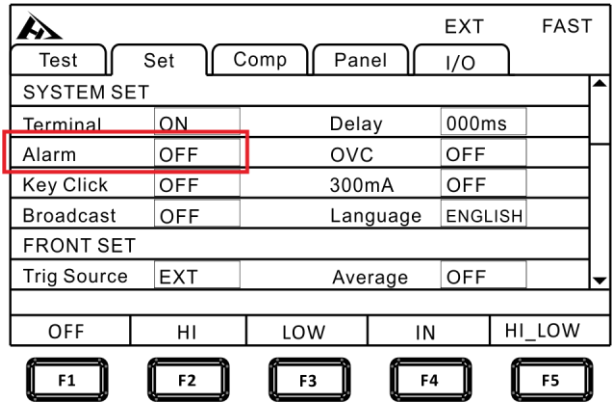
Beep mode：

OFF ↔ HI↔ LOW ↔ IN↔ HI_LOW

1. Select parameter setting menu

Press [PAGE] Button to parameter setting page

2. Select related menu items



Menu	Description
[OFF]	Beep is turned off
[HI]	Beep when exceed upper limit
[LOW]	Beep when less than lower limit
[IN]	Beep when PASS
[HI_LOW]	Beep when exceed upper limit Or less than lower limit

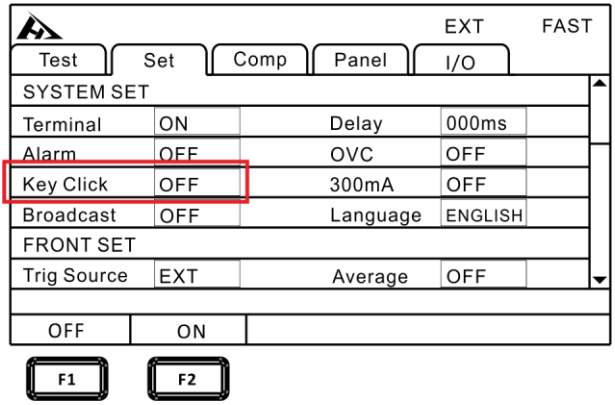
3.11 Button Sound Setting

Users can choose whether to turn on the button sound when operating instrument keys.

1. Select parameter setting menu

Press [PAGE] Button to parameter setting page

2. Select related menu items



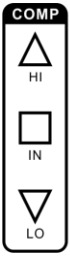
Menu	Description
[OFF]	Sound is turned off
[ON]	Sound is turned on

3.12 Comparator Function

3.12.1 Comparing result signal output method

When comparator function is turned on, instrument provides three alarm outputs:

1. LED light at front panel alarm



Measure value > Upper limit value

Upper limit value ≥ Measure value ≥ Lower limit value

Measure value < Lower limit value

2. Sound alarm

Please refer to chapter 3.10.

3. External IO interface, signal output

Please refer to chapter 6.1

3.12.2 Comparison Mode

There are 3 comparison modes: [upper limit comparing]/[lower limit comparing]/[upper and lower limit comparing]

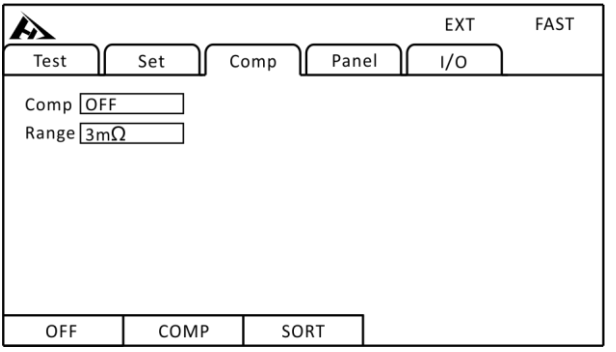
Example:

Sorting mode	Upper limit value	Lower limit value	Pass	Fail
upper limit comparison	100Ω	-----	Measuring value≤100Ω	Measuring value >100Ω
lower limit comparison	-----	10Ω	Measuring value≥10Ω	Measuring value <10Ω
upper and lower limit comparison	100Ω	10Ω	10Ω≤Measuring value≤100Ω	Measuring value≥100Ω Or Measuring value≤10Ω

How to set:

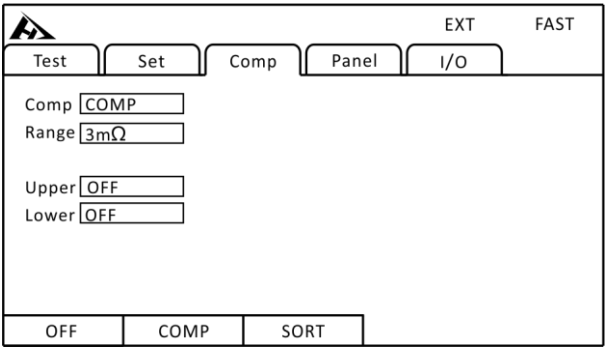
Sorting mode	Setting up procedure
Upper limit comparison	Upper limit ON input value is valid, lower limit turned off (----)
lower limit comparison	Lower limit ON input value is valid,upper limit turned off (----)
upper and lower limit comparison	Both lower limit and lower limit input value are valid

1. Enter comparator to set up



Press **[COMP]** key to enter comparator setting menu

2. Turn on the upper and lower value comparison comparing

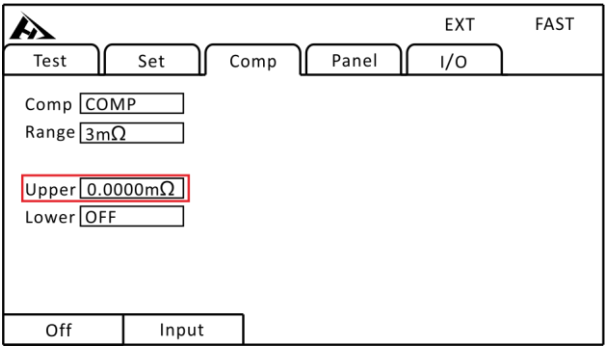


Press **[F2]** to select COMP to turn on the comparator

3.12.3 Setting upper and lower limits & compare mode

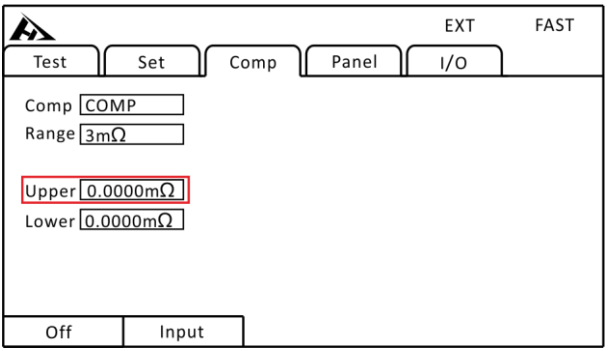
When upper limit comparing mode is turned on,

1. Upper limit value setting



Press **[F2]** to select INPUT, use the Arrow keys to set the value;

2. Lower limit value setting



Press **[F2]** to select INPUT, use the Arrow keys to set the value.

3.13 Sorting Function

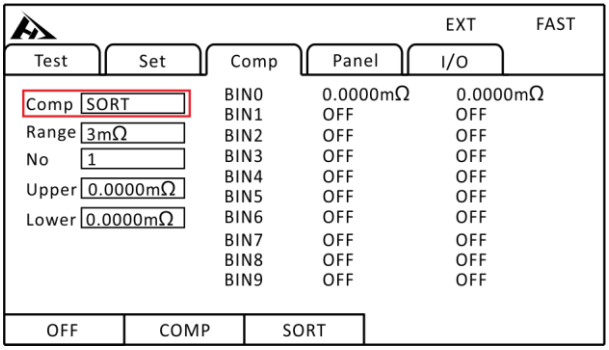
The comparison between the upper and lower limits of one measurement and up to 10 groups (P1~P10) is performed by the classification measurement, and measurement result is displayed. All items not included in the BIN are judged as NG. The sorting result can also be output via EXT I/O terminal.

3.13.1 Sorting Function Opening Setting

1. Select parameter setting menu

Press [PAGE] Button to parameter setting page

2. Select related menu items



[F3] select SORT function;

Tips:

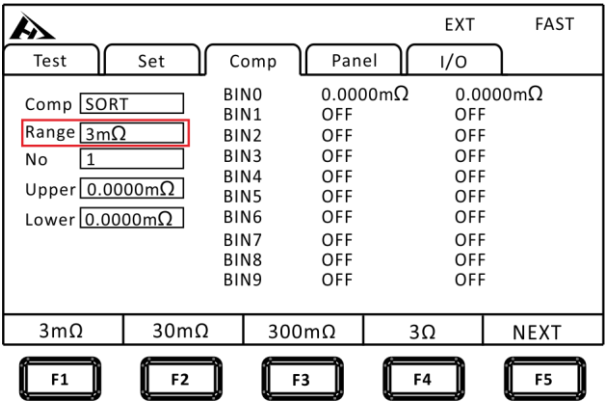
- If sort function is ON, the comparator cannot be set to ON.
- The range cannot be changed while sorting function is in use. To change the range, please make changes on the sorting settings page.

3.13.2 Sorting Function Range Setting

Range:

3mΩ ↔ 30mΩ ↔ 300mΩ ↔ 3Ω ↔ 30Ω↔ 300Ω ↔ 3kΩ↔ 30kΩ↔ 300kΩ↔ 3MΩ

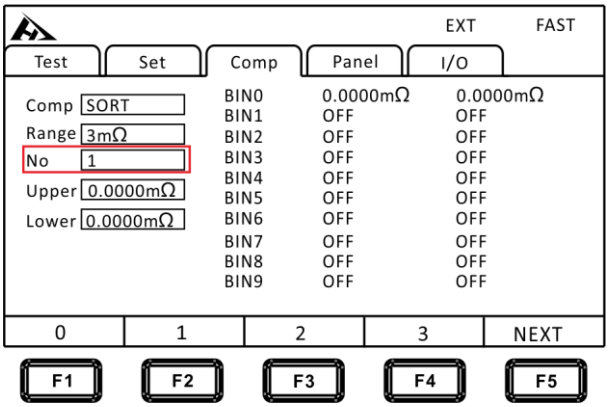
After sorting function is turned on, range is turned off automatically.



3.13.3 Sorting Function Group No. Setting

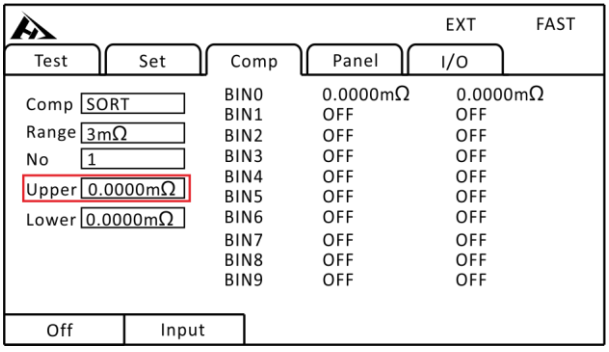
Group no. :

1 ↔ 2 ↔ 3 ↔ 4↔ 5 ↔ 6 ↔ 7 ↔ 8 ↔ 9 ↔10



3.13.4 Sorting Function Upper Limit Setting

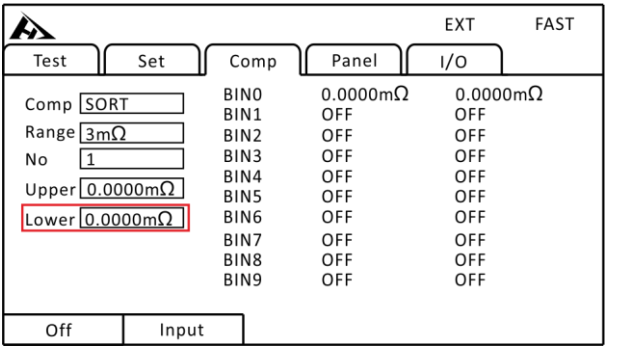
When range and group number settings are completed, corresponding upper limit value can be set. The upper limit unit is the same as that of range.



Press the Arrow keys to select the menu items to be set;

3.13.5 Sorting Function Lower Limit Setting

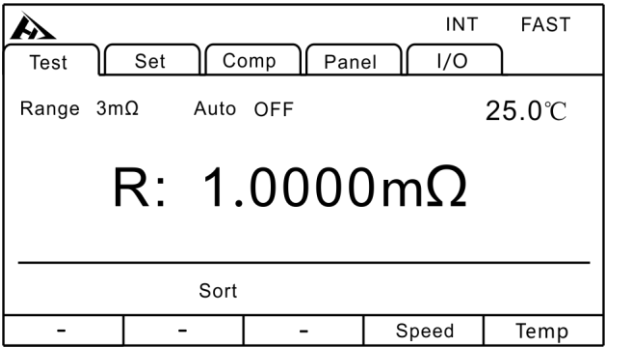
When range and group number settings are completed, corresponding lower limit value can be set. The lower limit unit is the same as that of range.



Press the Arrow keys to select the menu items to be set;

3.13.6 Return to Display Page

The display page after sorting function is turned on

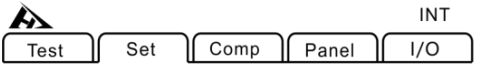


3.14 Multichannel function

HT3544 multi-channel Tester adds the function of multi-channel test on the basis of single-channel test. Multi-way test need to turn on the multi-way function in the setting, multi-way function turn off and return to single-way test.

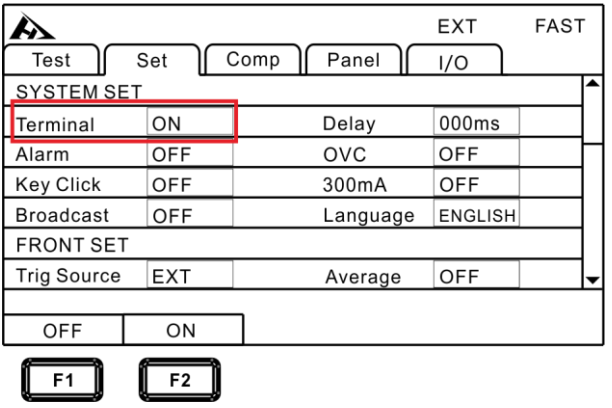
3.14.1 Multi-channel settings on

1. Select parameters to set the interface

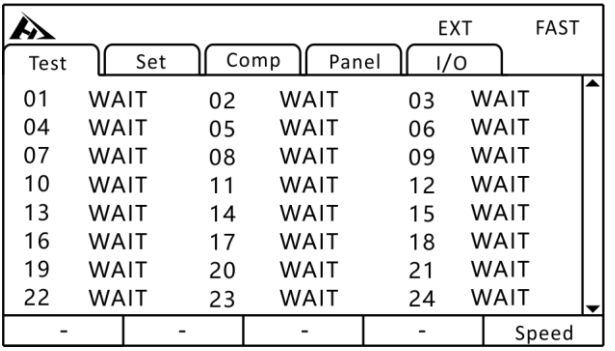


Press [PAGE] Button to parameter setting page

2. Select relevant menu items

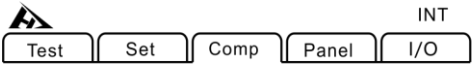


Multi-channel function set to ON, press **[ESC]** to return to the multi-channel test page;



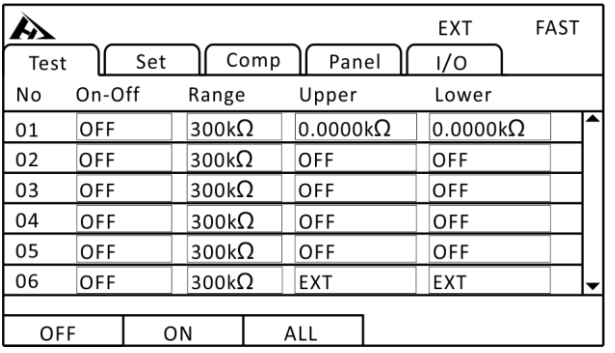
3.14.2 Multipath comparison setting

1. Select the compare interface



Press [PAGE] Button to parameter setting page

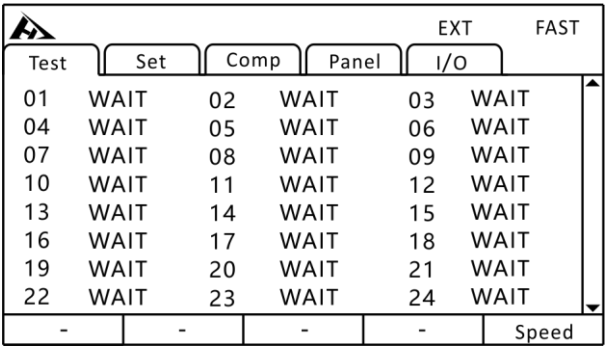
2. Select relevant menu items



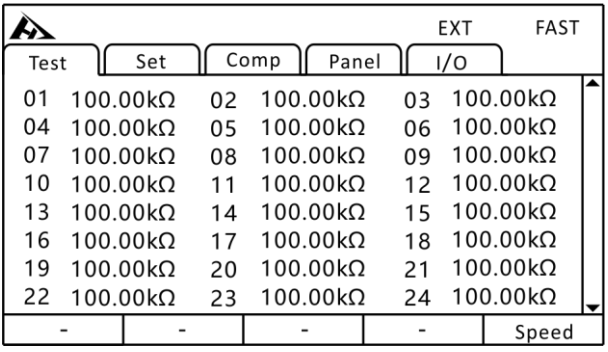
Select the channels that you want to set, such as Channel 01, and set the Range, Upper, Lower limit values. Can be a single channel settings, you can also press [F3] select ALL one key to set ALL channels. Setup complete, press [ESC] to return to the measurement page.

3.14.3 Multi-channel test

On the multipath measurement page, here's the figure:



Press the [TRG] key to start the test and the test results are displayed when the test is complete:

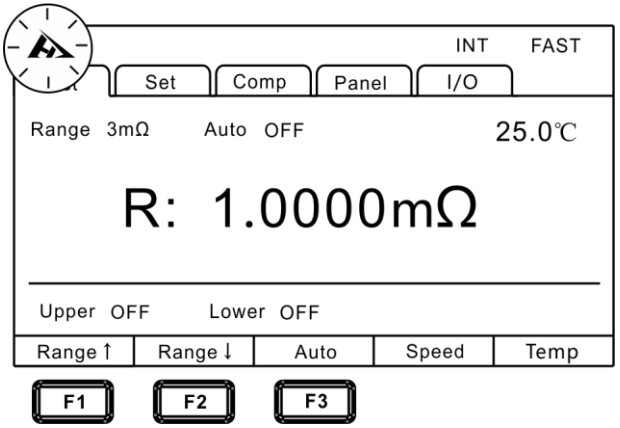


Chapter IV Measuring

This chapter provides step-by-step descriptions of the functions used for proper measurement, including start-up settings, range scopes, and protection function startup.

4.1 Starting test

1. Set relevant parameters
2. Connect test leads correctly
3. When test starts, the logo in the upper left corner of screen will flash according to the test speed.



Trigger Mode	Description
Internal Trigger	Automatic trigger test inside the instrument
External Trigger	Trigger test via external EXT IO terminal TRG signal
Manual Trigger	Manually press [TRG], RS232, LAN port command to trigger the test.
Auto Hold	Automatic test to be measured to maintain the current resistance value

Tips:

- Users cannot start another test when the test has not completed.
- When the EOC signal of the EX.I/O port is LOW, the test cannot be triggered.

4.2 Measuring Value Display

The following is the test range. Once the following range is exceeded, OF is displayed (over the range)

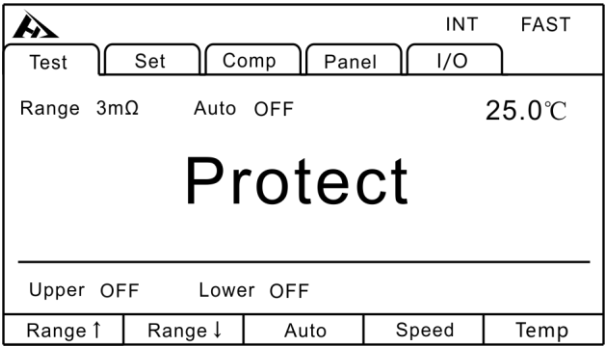
Test current and range:

Resistance Range	Test Current	Max Reading	Resolution (Ω)
3mΩ	1A	3.2000mΩ	0.1μΩ
30mΩ	1A	32.000mΩ	1μΩ
300mΩ	300mA	320.00mΩ	10μΩ
	100mA		
3Ω	100mA	3.2000Ω	100μΩ
30Ω	10mA	32.000Ω	1mΩ
300Ω	1mA	320.00Ω	10mΩ
3kΩ	1mA	3.2000kΩ	100mΩ
30kΩ	100uA	32.000kΩ	1Ω
300kΩ	10uA	320.00kΩ	10Ω
3MΩ	1uA	3.2000MΩ	100Ω

4.3 Automatic Protection Function

If an overvoltage is input to the measurement terminals, internal circuit protection function of the instrument is activated. If users input an overvoltage incorrectly, please remove the test leads

immediately from the object under test. Measurements cannot be made during the protection function action. To release the protection function, please touch the test cable DRIVE+ and DRIVE- or re-energize.



4.4 Perform Clear Zero

Please perform clear zero in the following cases. (Can cancel the resistance below ±3%f.s. for each range)

• When residual display content occurs due to effected by such as electromotive force

→ The display changes to zero.

The accuracy specification does not change no matter it is zeroed or not.
The electromotive force can also be cancelled by the OVC.

• When it is difficult to perform 4-terminal wiring (Kelvin connection)

→ Cancel the remaining resistance of the 2 terminal wiring.

Tips:

• After clear zero has been made, if the ambient temperature changes or the test lead is changed, please perform zero adjustment again.

• Please perform zero adjustments for all ranges used. In the manual range, clear zero is performed only in the current range; in the automatic range, zero adjustment is performed in all ranges.

• The zero value is saved internally even if the power is turned off, but it is not saved to the panel.

• When offset voltage compensation function (OVC) is switched from ON to OFF or from OFF to ON, zero adjustment is released. Please perform clear zero again.

• When measurement current is switched from Lo to Hi or from Hi to Lo, zero adjustment is released. Please perform zero adjustment again.

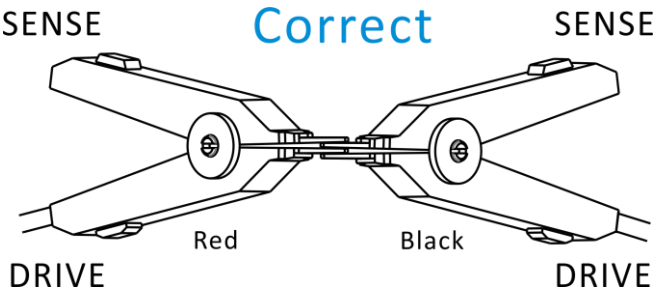
• If the resistance is measured to be smaller than the resistance at zero, the measured value is negative.

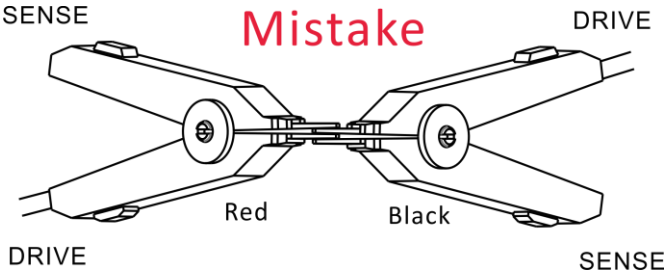
Example: Connect 1mΩ for zero adjustment in the 300mΩ range → If measuring 1mΩ, it shows -1mΩ

Perform Clear Zero

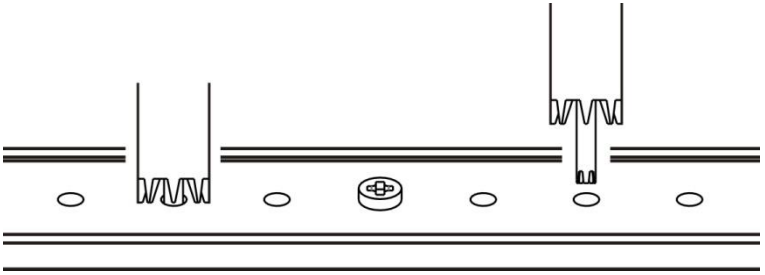
1. Short –circuit test leads

9363-A Clip type test leads





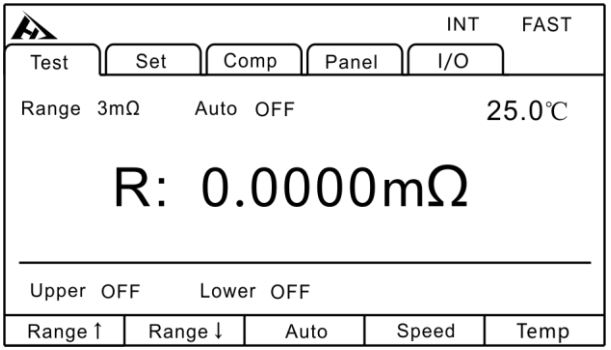
9363-B Probe type test leads



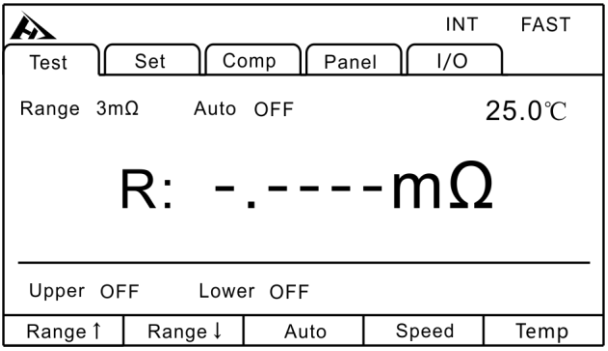
2. Confirm that the measured value is within ±3%f.s.

If measured value is not displayed, check that the test leads are connected correctly.

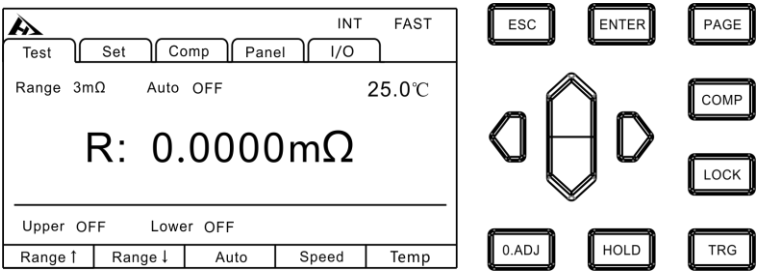
When the wiring is correct



When the wiring is wrong



3. Clear Zero



Press the [O.ADJ] button to perform zero adjustment.

4. After zero adjustment

If clear zero is successful, the icon will be displayed in the lower right corner of the display measurement and then return to the measurement state. If zero adjustment failed, the icon is not displayed, the measurement state is returned.

Zero adjustment failed

When zero adjustment is not possible, it may be that the measured value before zero adjustment exceeds ±3% of the full scale of each range, or it is in a test abnormal state. Please make

the correct wiring again and re-zero. Due to the resistance value of a self-made cable is high, it cannot be zeroed, please reduce the wiring resistance.

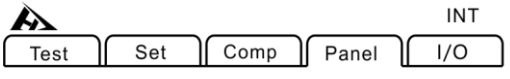
Tip:
When the zero adjustment fails, the zero adjustment of the current range will be released.

5. Contact zeroing

On the measurement page, press and hold the [O.ADJ] button to release the zero value of the current range.

Chapter V Measure Panel Save

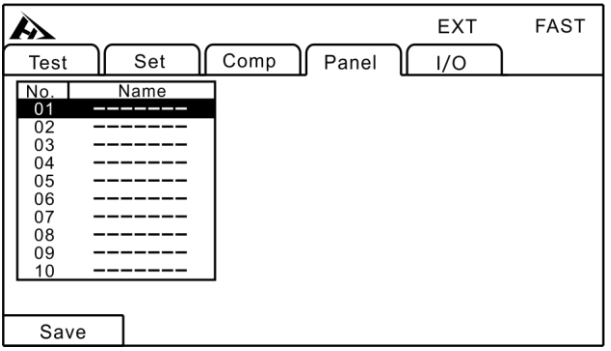
All measurement conditions can be saved, retrieved or deleted in the form of files. Press [PAGE] to enter measurement setting save page.



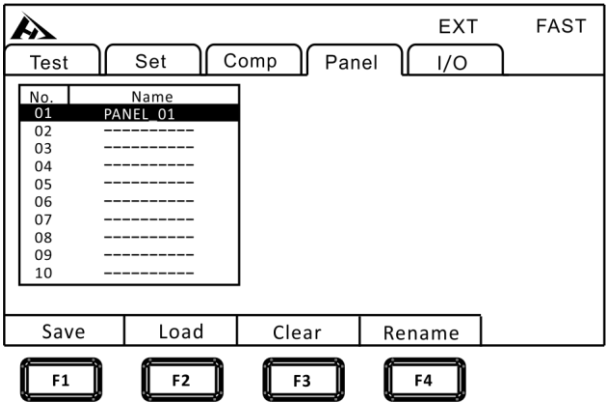
Press [PAGE] Button to panel page

After entering this page, and pressing up and down keys, users can refer to the saved record, which can save, load, clear, rename, etc. the current record.

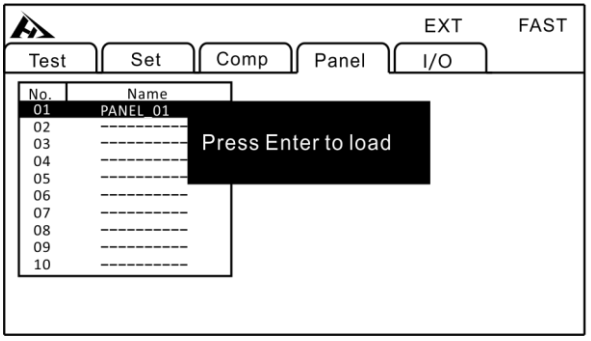
5.1 Save Panel Setting



Use up and down keys to review current settings and press Save button to save current settings.



5.2 Retrieve Measuring Setting

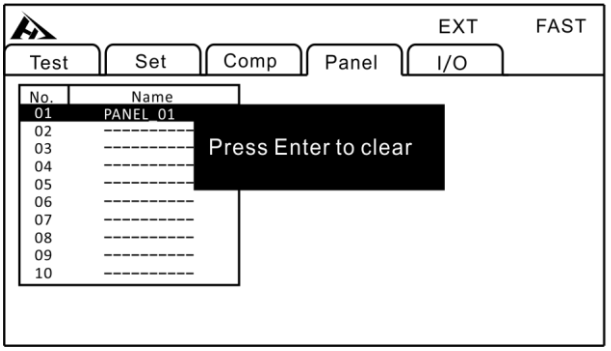


1 press F2 to choose load

2 press ENTER to confirm load

Use up and down keys to review current settings and press Load button to retrieve current settings.

5.3 Delete Measuring Setting

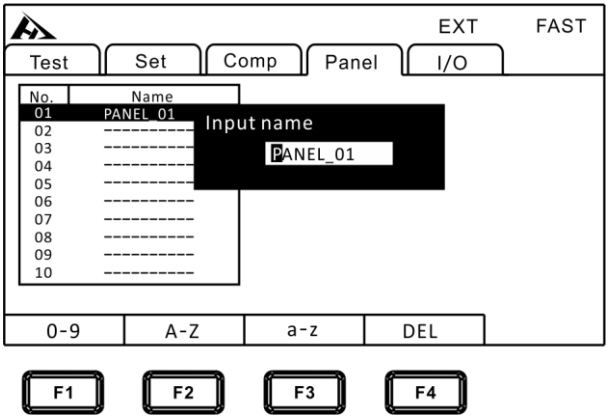


1 press F2 to choose clear

2 press ENTER to confirm clear

Use up and down keys to review current settings and press Clear key to delete current settings.

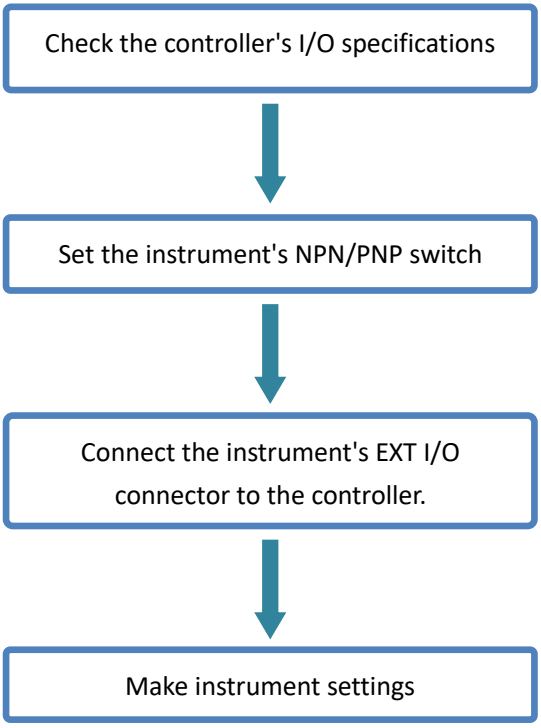
5.4 Rename Measuring Setting



Use up and down keys to review the current settings and press Rename button to modify current file name.

Chapter VI EXT I/O port (Handler)

The EXT I/O connector on the rear of the instrument supports external control by providing output of the EOM and comparator judgment signals, and accepting input of TRIG and KEY_LOCK signals. All signals are isolated from the measurement circuit and ground (I/O common pins are shared). Input circuit can be switched to accommodate either current sink output (NPN) or current source output (PNP).



6.1 EXT I/O port and signal

In this chapter, you will learn about the connection and introduction of EXT I/O.

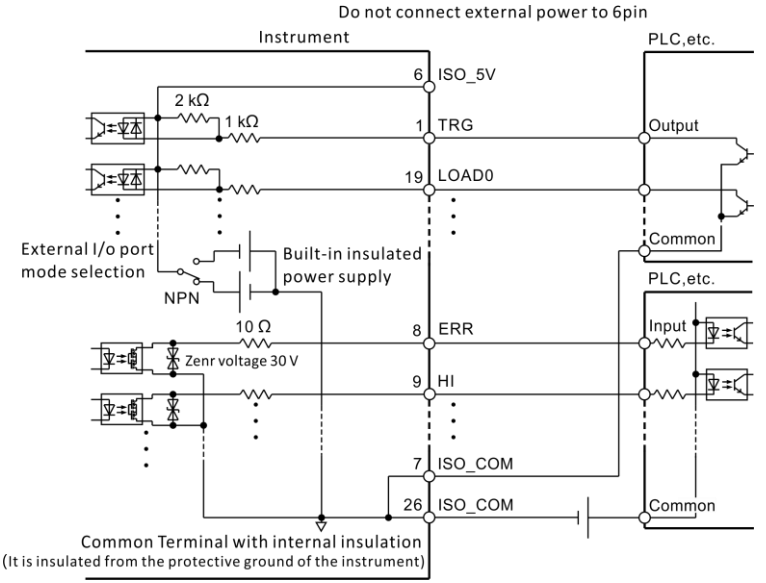
Do not plug or unplug EXT I/O ports during testing

Do not connect the IO port to the test end

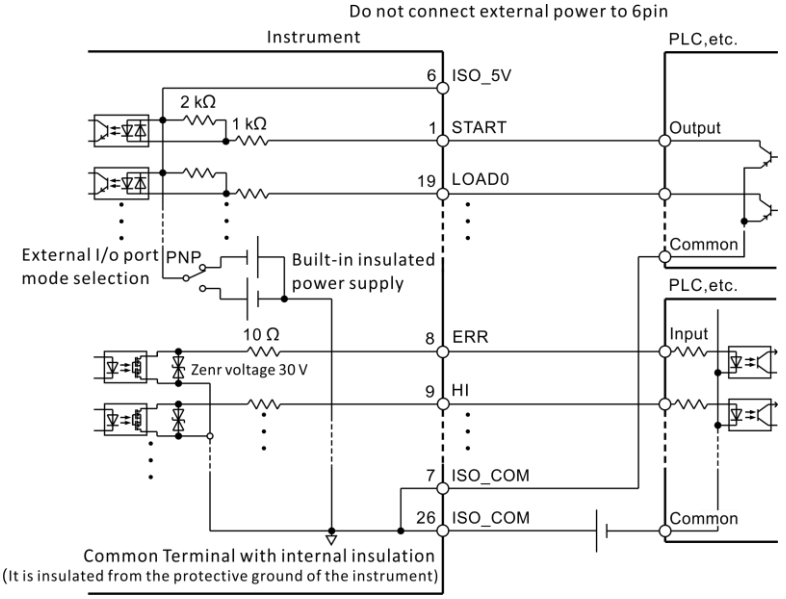
6.1.1 Level Mode Settings

Switching signal level mode NPN (current sink) and PNP (current source)

NPN (current sink) wiring



PNP (current source) wiring

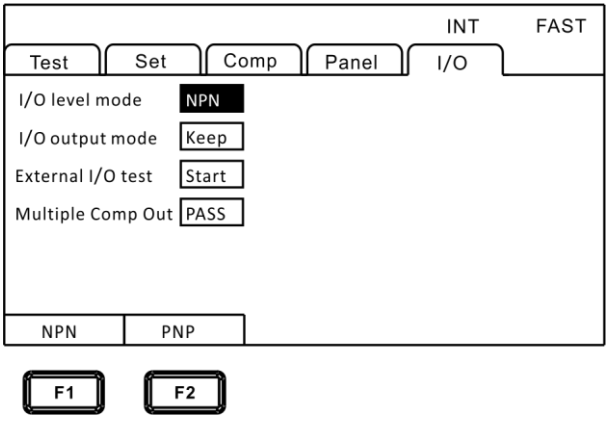


Level mode setting

- Select the I/O page

Press [PAGE] Button to I/O page

- Select I/O level mode

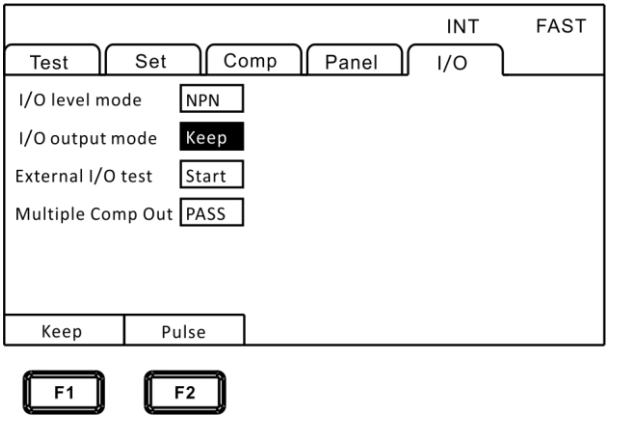


Output mode setting

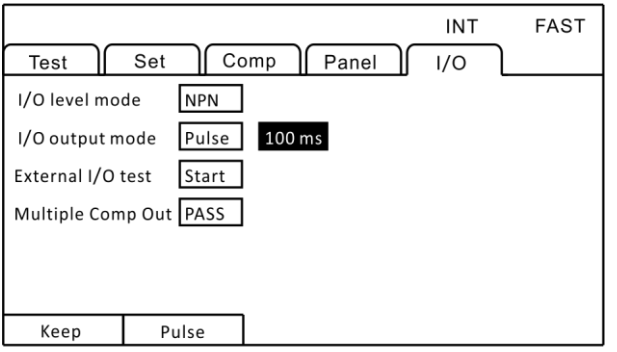
- Select the I/O page

Press [PAGE] Button to I/O page

- Select I/O output mode



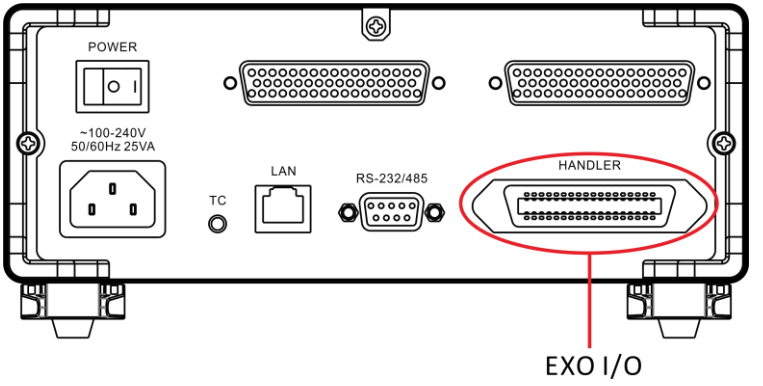
- Select pulse and set the output time



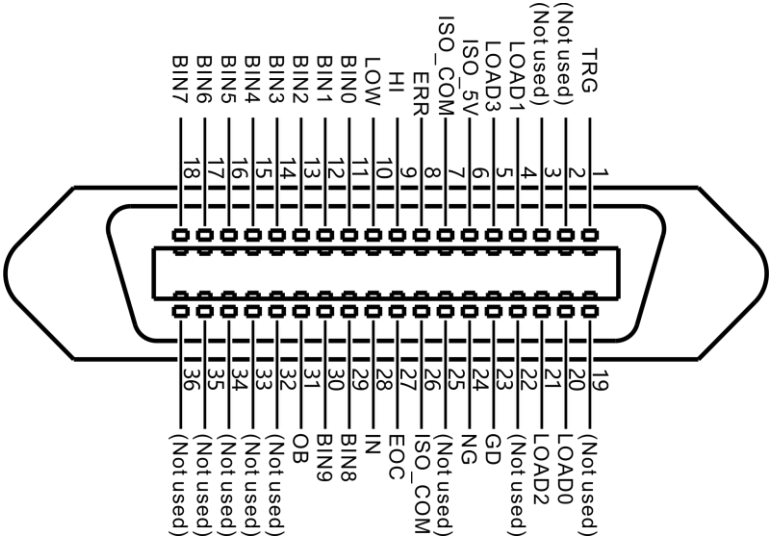
6.1.2 Port Signals description

The EXT I/O port connector uses the D-SUB female terminal of the 36-PIN pin.

Figure:



Port layout



(Instrument side)

PIN	signal	Functions	I/O	Logic
1	TRG	Trigger test	I	Edge trigger
2	--	--	--	--
3	--	--	--	--
4	LOAD1	Panel selection	I	Level
5	LOAD3	Panel selection	I	Level
6	ISO_5V	Isolated power supply 5V	O	--
7	ISO_COM	Isolated power ground	O	--
8	ERR	Automatic protection open	O	Level
9	HI	measurement value>upper limit value	O	Level
10	LOW	measurement value <lower limit value	O	Level
11	BIN0	Bin P0	O	Level
12	BIN1	Bin P1	O	Level
13	BIN2	Bin P2	O	Level
14	BIN3	Bin P3	O	Level
15	BIN4	Bin P4	O	Level
16	BIN5	Bin P5	O	Level
17	BIN6	Bin P6	O	Level
18	BIN7	Bin P7	O	Level
--	--	--	--	--
20	LOAD0	Panel selection	I	Level
21	LOAD2	Panel selection	I	Level

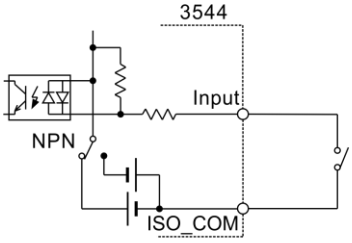
22	--	--	--	--
23	GD	Qualified output	O	Level
24	NG	Unqualified output	O	Level
25	--	--	--	--
26	ISO_COM	Isolated common signal ground	O	--
27	EOC	End of Level measurement	O	Level
28	IN	IN Sort	O	Level
29	BIN8	Bin P8	O	Level
30	BIN9	Bin P9	O	Level
31	OB	Bin NG	O	Level
32	--	--	--	--
33	--	--	--	--
34	--	--	--	--
35	--	--	--	--
36	--	--	--	--

6.1.3 Port Signal Connection Method

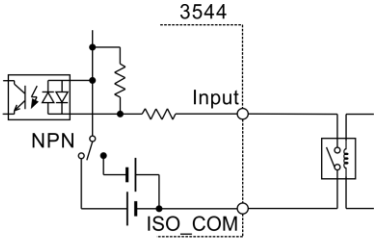
Electrical performance parameter

Input signals	Type	Optocoupler input
	ON	Internal conduction current : 4mA or more the max voltage drop :1V
	OFF	Input current less than 100μA
output signals	Type	Optocoupler output, open drain output
	Maximum load voltage	30V DCMAX
	Maximum output circuit	50mA/channel
	Output voltage drop	1VMIN （at 50mA conditions）
Internal isolated current source	Rated voltage	+5V （NPN）, -5V （PNP）
	Rated current	100mA
	Isolation condition	Isolated from internal circuitry, floating

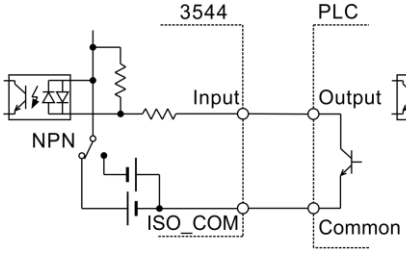
Input circuit wiring



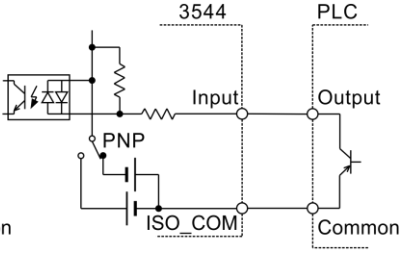
switched input



relay input

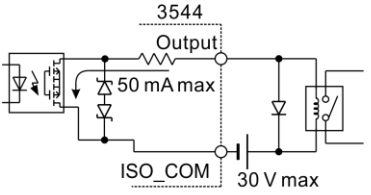


PLC's NPN output

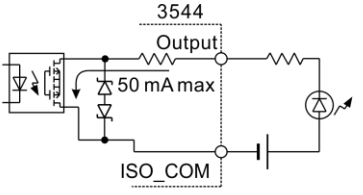


PLC's PNP output

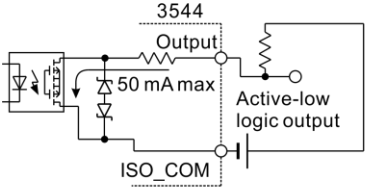
Output circuit wiring



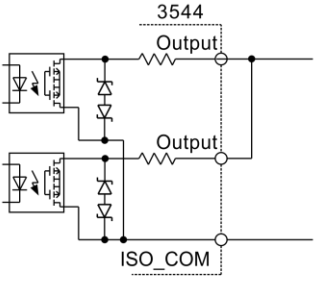
Drive relay



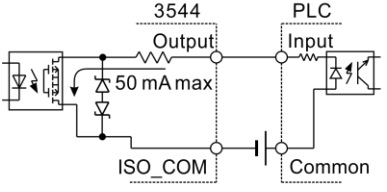
Drive LED lamp



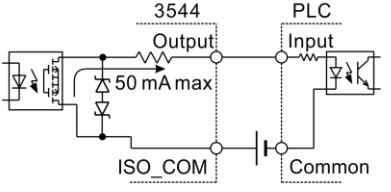
Logic level output



Level or operation



PLC's NPN input



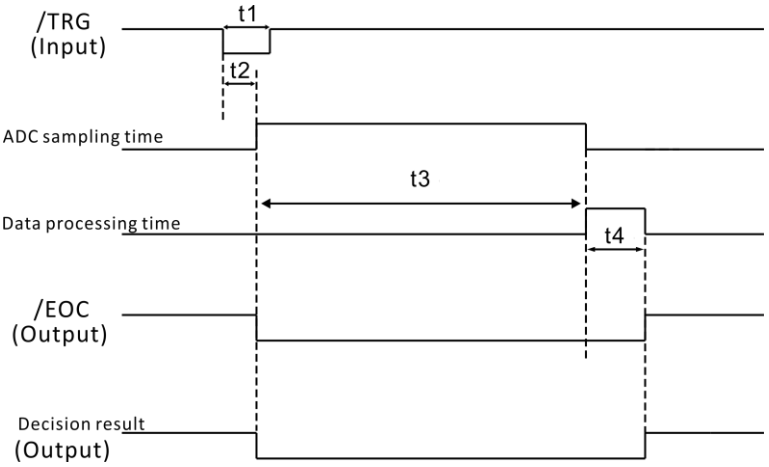
PLC's PNP input

6.2 Timing Chart

Each signal level indicates the ON/OFF state of a contact. When using the current source (PNP) setting, the level is the same as the EXT I/O pin voltage level. When using the current sink (NPN) setting, the high and low voltage levels are reversed.

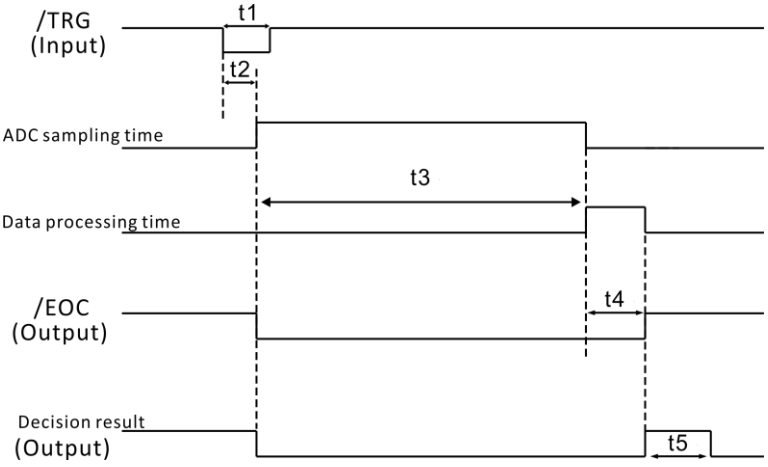
6.2.1 Timing chart for external triggering

External trigger [EXT] setting (I/O output mode for hold)



	Item	Timing
T1	TRG, Signal pulse width	5msMIN
T2	delay	5msMAX
T3	ADC sampling time	Fast 20ms Medium 50ms Slow 500ms
T4	Data processing time	5msMAX

External trigger [EXT] setting (The I/O output mode is pulse)

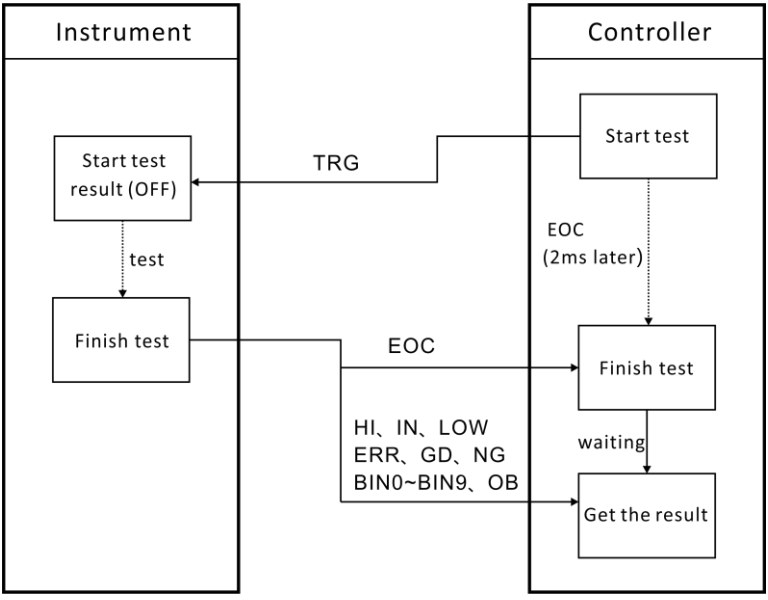


	Item	Timing
T1	TRG, Signal pulse width	5msMIN
T2	delay	5msMAX
T3	ADC sampling time	Fast 20ms Medium 50ms Slow 500ms
T4	Data processing time	5msMAX
T5	Judgment result pulse time	available (1ms~999ms)

6.2.2 Reading process at external triggering

The following table shows from start of measurement to acquisition of judgment results.

The EOC signal is output immediately after the instrument determines the judgment result (HI, IN, LOW, ER, GD, NG). f the controller's input circuit response is slow, it may be necessary to insert wait processing after EOM=ON is received until the judgment results are acquired.



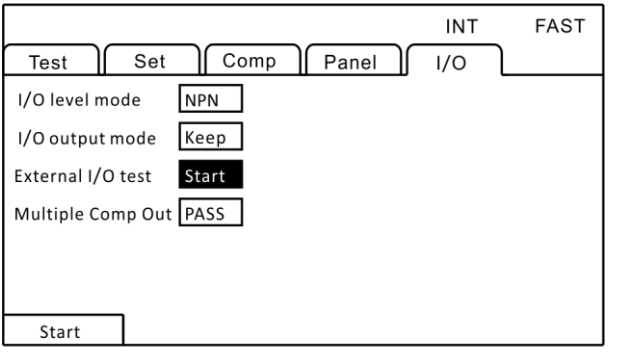
6.3 External Control Checking

In addition to switching output signals ON and OFF manually, you can view the input signal state on the screen.

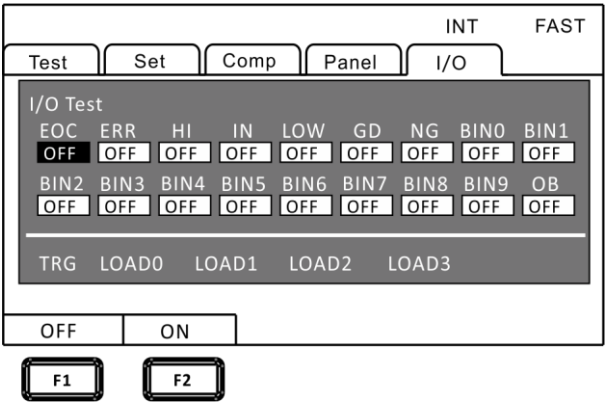
- Select the I/O page

Press [PAGE] Button to I/O page

- Select the I/O settings page



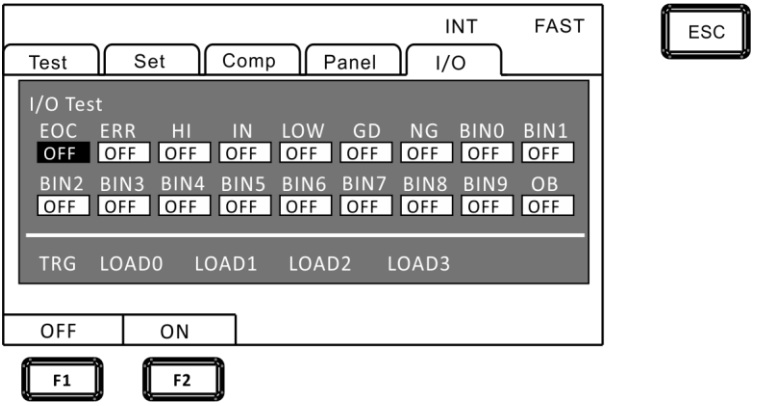
➢ Select the manually I/O test page



Output signal, operable signal (OFF: turn off the output ON: turn on the output)

Input signal, display the status of the signal (ON: reverse display OFF: normal display)

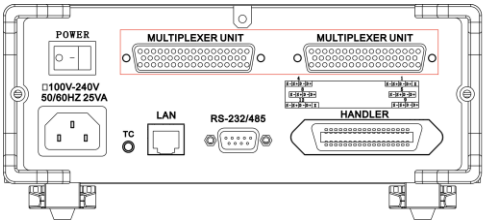
➢ Exit the I/O test page

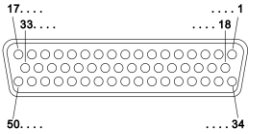


Press [ESC] back to the I/O settings page.

Chapter VII Multi-channel test line

7.1 Connector and terminal configuration





Four-wire test port

NO.	Terminal Name	NO.	Terminal Name
1	Retentions	26	D7+
2	D1+	27	D7-
3	D1-	28	S7+
4	S1+	29	S7-
5	S1-	30	D8+
6	D2+	31	D8-
7	D2-	32	S8+
8	S2+	33	S8-
9	S2-	34	D9+
10	D3+	35	D9-
11	D3-	36	S9+
12	S3+	37	S9-
13	S3-	38	D10+
14	D4+	39	D10-
15	D4-	40	S10+
16	S4+	41	S10-
17	S4-	42	D11+

18	D5+	43	D11-
19	D5-	44	S11+
20	S5+	45	S11-
21	S5-	46	D12+
22	D6+	47	D12-
23	D6-	48	S12+
24	S6+	49	S12-
25	S6-	50	Retentions

7.2 Multi-channel test line definition

Line one

Pin	2	3	4	5	6	7	8	9
Color	Brown	Brown white	Orange	Orange White	Green	Green white	Blue	Blue white
Function	D+	D-	S+	S-	D+	D-	S+	S-

Line two

Pin	10	11	12	13	14	15	16	17
Color	Brown	Brown white	Orange	Orange White	Green	Green white	Blue	Blue white
Function	D+	D-	S+	S-	D+	D-	S+	S-

Line three

Pin	18	19	20	21	22	23	24	25
Color	Brown	Brown white	Orange	Orange White	Green	Green white	Blue	Blue white
Function	D+	D-	S+	S-	D+	D-	S+	S-

Line Four

Pin	26	27	28	29	30	31	32	33
Color	Brown	Brown white	Orange	Orange White	Green	Green white	Blue	Blue white

Function	D+	D-	S+	S-	D+	D-	S+	S-

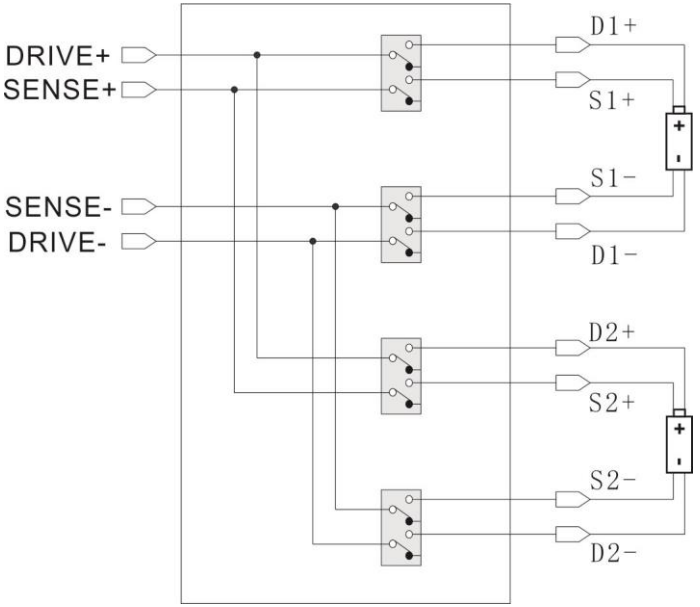
Line Five

Pin	34	35	36	37	38	39	40	41
Color	Brown	Brown white	Orange	Orange White	Green	Green white	Blue	Blue white
Function	D+	D-	S+	S-	D+	D-	S+	S-

Line six

Pin	42	43	44	45	46	47	48	49
Color	Brown	Brown white	Orange	Orange White	Green	Green white	Blue	Blue white
Function	D+	D-	S+	S-	D+	D-	S+	S-

7.3 Internal circuit composition



Chapter VIII Communications

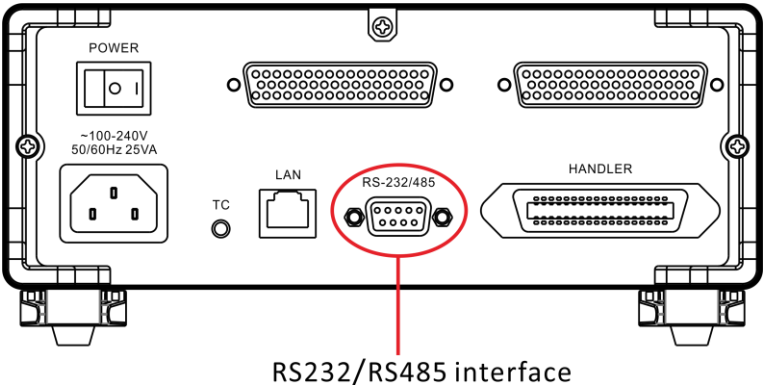
The instrument has three communication modes, one is RS232 communication, one is RS485 communication, the other is LAN (network protocol using TCP) communication mode. The three modes of communication protocol all adopt SCPI protocol.

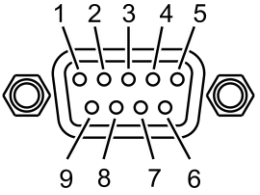
Do not connect the communication port to the measurement port, as this may damage the instrument.

8.1 RS232/RS485 communication

The RS232 communication uses a 3-wire communication method.

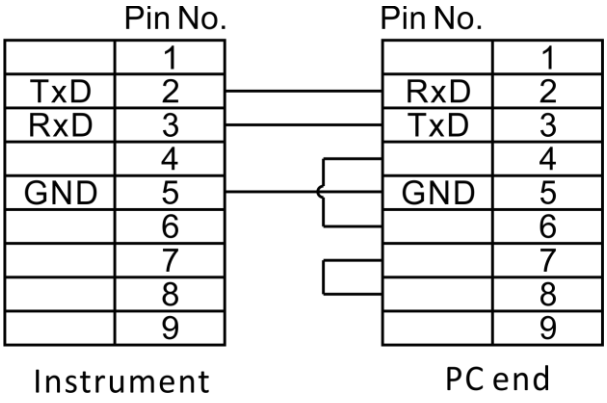
Interface and cable



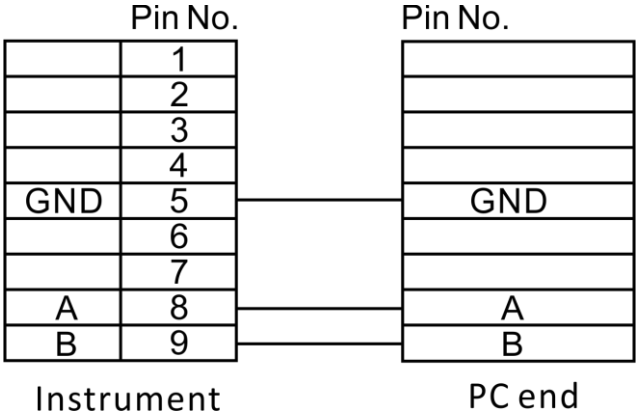


9-pin D-Sub mother port

RS232 Connection Mode

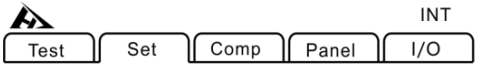


RS485 Connection Mode



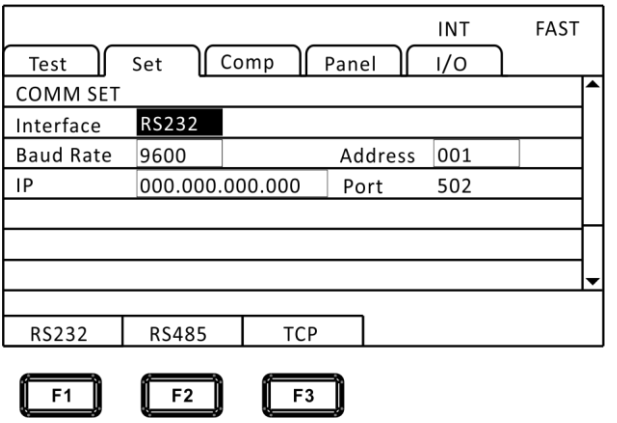
RS232 setting

- Select the Comm page



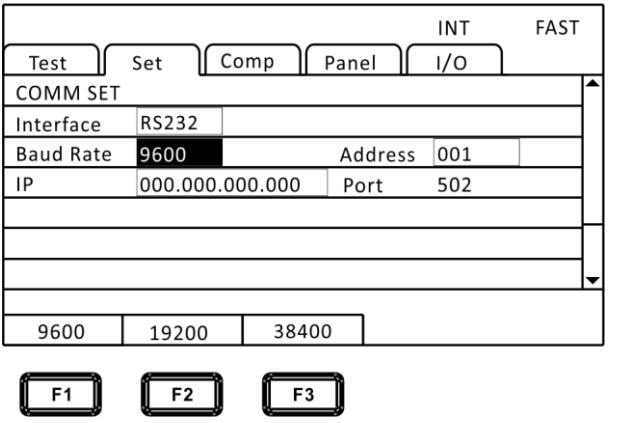
Press [PAGE] Button to parameter setting page

➢ Select RS232 communication mode



Press the Arrow keys to select the menu item you want to set

➢ Select the baud rate

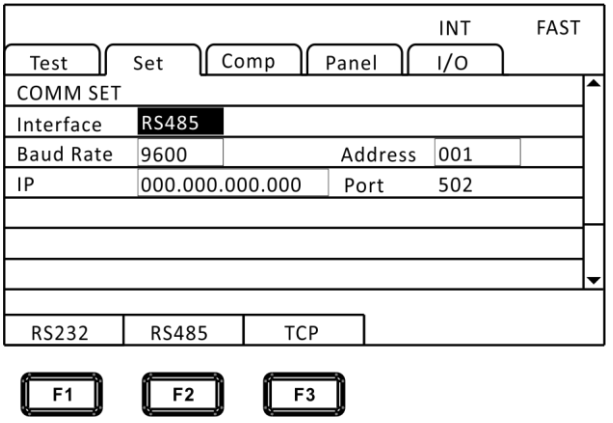


RS485 setting

➢ Select the Comm page

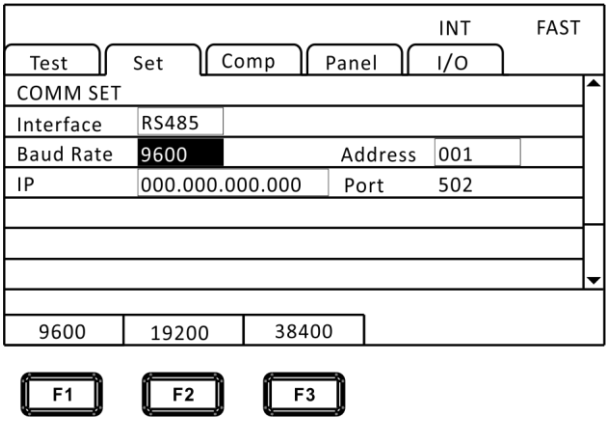
Press [PAGE] Button to parameter setting page

- Select RS485 communication mode

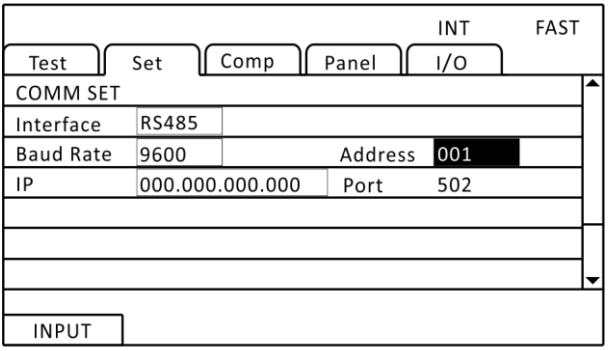


Press the Arrow keys to select the menu item you want to set

- Select the baud rate



➢ Address setting



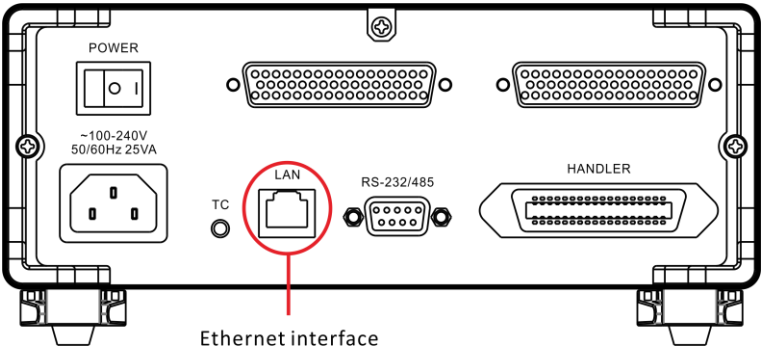
Press the Arrow keys to select the menu item you want to set

8.2 LAN communication

LAN port communication uses TCP protocol communication.

Interface and cable

The Ethernet uses the standard RJ45 port, and the cable uses Category 5 for the Internet cable.



Connection method

- Instrument and computer connection

When the instrument is connected to a computer, the network cable uses a crossover cable.

Using 568B color code wiring standards to connect A side

Orange /White	Orange	Green/ white	Blue	Blue/ white	Green	Brown /white	Brown

Using 568A color code wiring standards to connect B side

Green /white	Green	Orange /White	Blue	Blue/ white	Orange	Brown /white	Brown

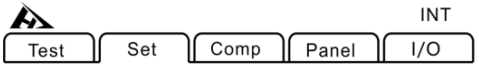
- Instrument and computer connection

When the instrument is connected to the router, the network cable is directly connected.

Orange /White	Orange	Green/ White	Blue	Blue/ White	Green	Green/ White	Brown

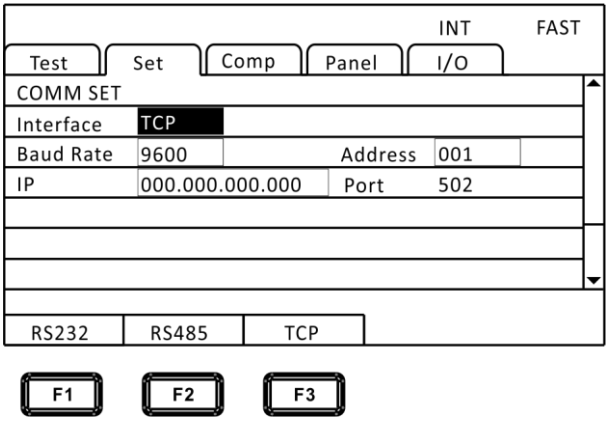
Setting

- Select the communication page



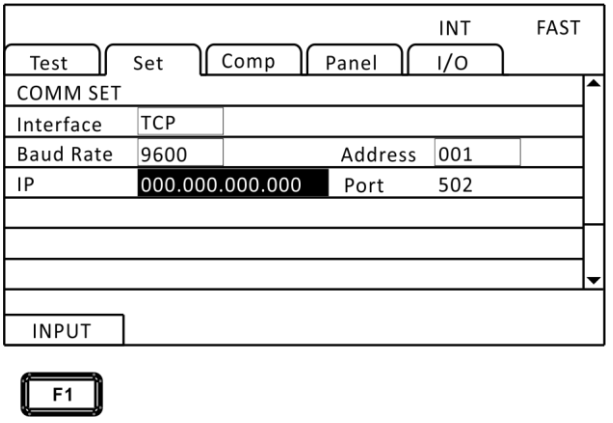
Press [PAGE] Button to parameter setting page

➢ Select TCP communication mode



Press the Arrow keys to select the menu items to be set;

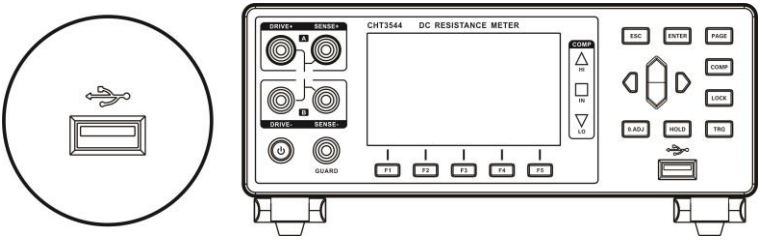
➢ Set the communication address



Press the Arrow keys to set the numeric value.

8.3 USB interface

The Instrument Front panel with USB interface, can be used to upgrade the program.



Chapter IX specifications

9.1 General Specification

General function

Measurement parameters	DC resistance
Basic parameters:	0~3.3MΩ (10 ranges) Max reading:33000 Min resolution: 0.1μΩ
Basic accuracy	0.1%±10 count(3mΩ,30mΩ,3MΩ) 0.05%±4 count(300kΩ) 0.02%±2 count(other range)
Measurement range	3mΩ/30mΩ/300mΩ/3Ω/30Ω/300Ω/3kΩ/30kΩ /300kΩ/3.3MΩ.
Measuring speed	FAST(50Hz:21ms, 60Hz:18ms); SLOW(200ms)
Signal Source	1A DC Max:5.5V
Temperature	Range:-10 °C~60 °C, Accuracy:1 °C
Calibration	Short-circuit reset for all ranges
Comparator	10-bin sorting, output signal HIGH/IN/LOW
Internal data storage	6000 group test data
Trigger mode	IO, bus, manual
Interface	External IO; Analog; LAN; RS-232C
Other	Temperature compensation function; Comparator(ABS/REF%); Lock(OFF/menu lock/all lock); Power frequency setting(auto/50Hz/60Hz), Zoom in/out; Judge sound setting;

	Auto-save; Average function; Panel storage/reading;
Power supply	Voltage:100VAC ~ 240VAC; Frequency: 50Hz ~ 60Hz;Power: max 10VA
Dimension & weight	325 mm (L)x215mm (W)x96mm (D); Weight: 2kg
Max output current	1A
Automatic protection display	“Protect”
Display when Range over limit	Display OF
Input terminal	Banana plug
Operation key	Rubber key
Display screen	3.5 inch TFT
Precision guarantee period	1 year
Operating temperature and humidity	0℃ to 40℃ 80% RH or less (no condensation)
Storage temperature and humidity	-10 to 60℃ 80% RH or less (no condensation)
Operating environment	Indoor, the highest altitude is 2000m

9.2 Accuracy

The following indicators test conditions:

Temperature: 20±3°C

Humidity: <80% RH

Warm-up time is more than 15 minutes

Calibration time is less than 1 year

Resistance measurement accuracy:

Range		Resolution	Fast speed %rdg.+%f.s.	Medium speed, slow speed %rdg.+%f.s.	Test current
1	3mΩ	0.1μΩ	0.1+0.03	0.1+0.03	1A
2	30mΩ	1μΩ	0.1+0.03	0.1+0.03	1A
3	300mΩ	10μΩ	0.1+0.02	0.1+0.02	300mA
			0.1+0.02	0.05+0.02	100mA
4	3Ω	100μΩ	0.1+0.01	0.02+0.01	100mA
5	30Ω	1mΩ	0.1+0.01	0.02+0.01	10mA
6	300Ω	10mΩ	0.1+0.01	0.02+0.01	1mA
7	3kΩ	100mΩ	0.1+0.01	0.02+0.01	1mA
8	30kΩ	1Ω	0.1+0.01	0.02+0.01	100uA
9	300kΩ	10Ω	0.1+0.02	0.05+0.02	10uA
10	3M	100Ω	0.3+0.03	0.2+0.03	1uA