



User's Manual

CKT3545



DC Resistance Meter

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Introduction

Thank you for purchasing CKT3545 precision resistance meter. To obtain maximum performance from this product, please read this manual first before operation, and keep it handy for future reference

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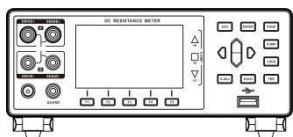
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Checking Packing Contents

When receiving instrument, please check carefully to ensure that the instrument is not damaged during transit. In addition, special inspections of accessories, panel switches and connectors are required. If the instrument is found to be damaged or it fails to operate as described in the user manual, please contact us.

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

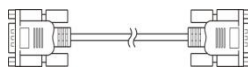
Packing List



CKT3545*1 unit



Kelvin test leads*1pc



Communication cable*1pc



Temperature probe*1pc



AC power cord*1pc

User manual*1 copy

Safety Notes

The instrument is designed to comply with the IEC 61010 safety standard 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 caused by non-defects in the instrument itself. This manual marks the relevant signs for safe operation of the instrument. In order to ensure the safety of the instrument and its users, please read the following safety signs and operating precautions carefully before use.

Safety Signs



The sign in this manual is particularly important and should be read carefully before using this machine.



Stands for DC (Direct Current).



Stands for fuse



Stands for ground terminal


Operation Notes

Installation Environment





- Operating temperature and humidity:
0 to 40 ° C, below 80% RH (no condensation)
- Temperature and humidity range that can ensure accuracy:
-10-50°C, below 80% RH (no condensation)
- To avoid malfunction or damage to the instrument, do not place the tester in the following situations:
 - Places where the sun is shining directly at high temperatures
 - It will splash to the place where the liquid temperature is high and condensation occurs.
 - Exposed to dusty places
 - Locations where corrosive or explosive gases are flooded
 - Locations with strong electromagnetic fields and electromagnetic radiation
 - Places where mechanical vibration is frequent

Checking before Use



Before using this instrument, verify that the operation is normal and that there is no damage during storage or transportation. If you find any damage, please contact us.

 WARNING	Before using the instrument, make sure that the AC power cord and test leads are well insulated and whether there are conductors are exposed. If a similar situation occurs, there is a danger of electric shock when using this instrument. Please contact us.
--	---

Handling Precautions

 DANGER	Do not wet the instrument or use wet hands for operating it. Do not modify or disassemble it yourself. Otherwise, it may cause fire, electric shock or other accidents.
 CAUTION	There are high pressure and high temperature parts inside the instrument during operation, in order to avoid electric shock, do not disassemble instrument electronic enclosure.
 CAUTION	To avoid damage to the instrument, physical shock should be prevented when handling and operating the instrument. Special care should be taken to prevent the instrument from falling.
 NOTE	Be sure to turn the power off after using it.

Handling Leads and Cables

 DANGER	To prevent an electric shock, do not short-circuit the top of the test leads and the lines with voltage.
 CAUTION	<ul style="list-style-type: none">• For safety, please use the test leads which are supplied with the instrument when testing.• To avoid damaging test leads, do not bend or stretch the test leads.• To avoid damage to the test leads, do not take the cables while you are plugging or unplugging the test leads. Hold the connectors.• The probe at the front of the test leads is sharp, taking care not to be scratched.

Accuracy

We use the f.s. (full range), rdg. (reading) and dgt. (resolution) values to define measurement tolerances, which have the following meanings:

f.s. (Maximum display value or measurement range)

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 the value 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" .

1.1 Introduction

The basic accuracy of CKT3545 DC resistance tester is 0.01%, and the measurable range is $0.01\mu\Omega\sim 1200M\Omega$. With high-speed test line anomaly detection and extremely short measurement cycle, the highest sorting speed is up to 2.2mS per meas, ensuring high-speed and reliable sorting every time. CKT3545 can be freely configured for multi-stage sorting, and external control interface can be configured as NPN/PNP. It is suitable for various signal interfaces of Automatic production line

The CKT3545 uses four-terminal test method to measure DC resistance of various materials such as winding resistance of motors and transformers, contact resistance of relays and switches, pattern resistance of printed circuit boards, fuses, resistors and conductive rubber at high speed and high precision. Since the instrument is equipped with a temperature compensation function, it is most suitable for measuring the object whose resistance value changes due to temperature. In addition, it is equipped with comparator functions, communication, external control, etc., and can be used in various situations such as development and production lines. CKT3545 cooperates with multi-channel scanning tester to test PCB vias and traces in aerospace, automotive electronics and other fields, and can scan and switch at a speed of 1ms.

1.2 Characteristics

☐ Exterior

- 3.5-inch high-resolution TFT LCD display, easy to operate
- Compact and powerful

☐ High technical specifications

- $0.01\mu\Omega \sim 1200M\Omega$, 6.5 digits display, basic accuracy 0.01%
- The highest resolution is $0.01\mu\Omega$

☐ Quick Measurement

- Minimum test cycle only needs 2.2ms

☐ Rich interface

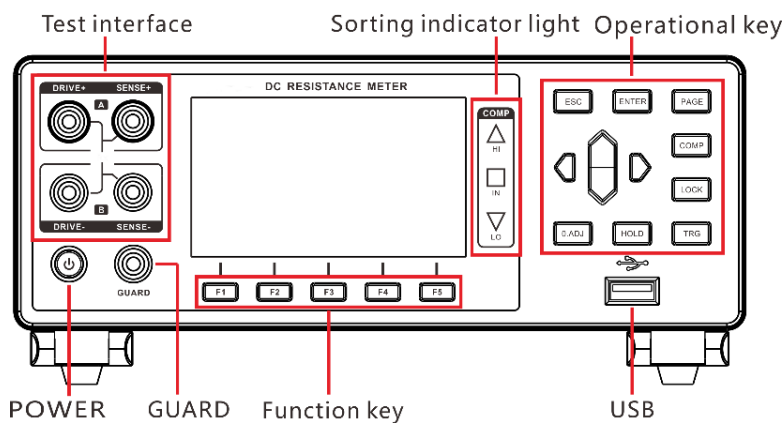
- External control I/O port
- RS-232 interface
- Ethernet interface
- Temperature test interface
- Analog output port

☐ powered by

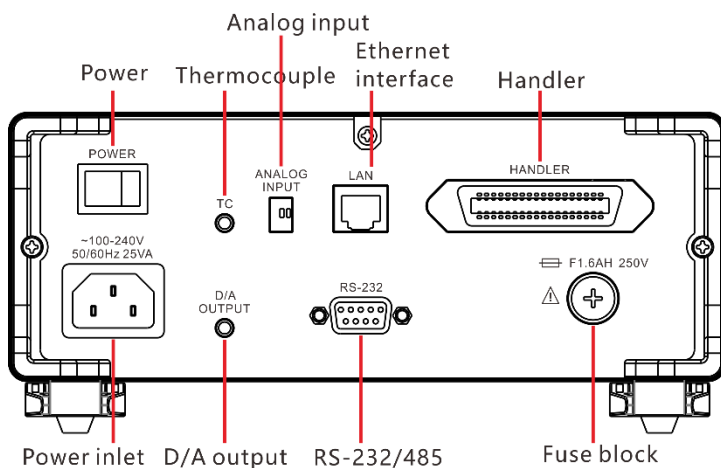
- 100~240V power supply
- Power frequency 50/60Hz

1.3 Component Names and Operation Overview

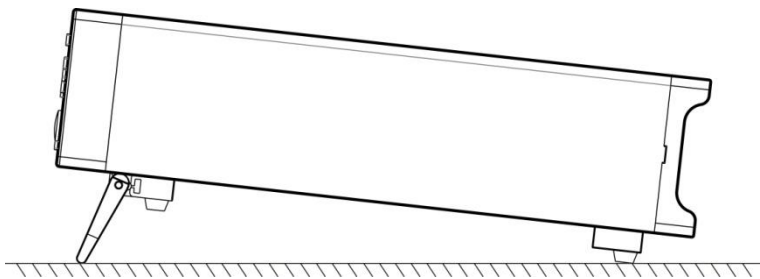
Front Panel



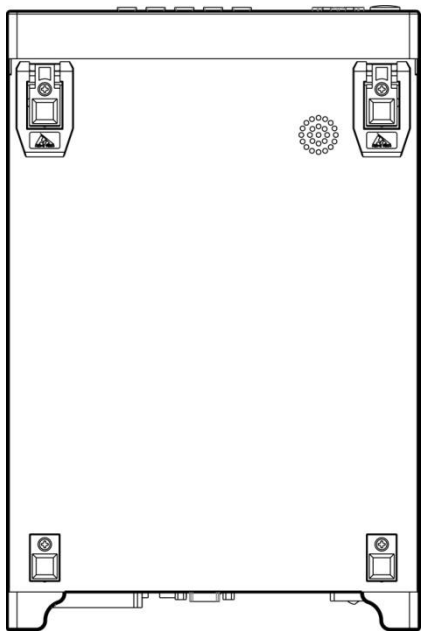
Rear Panel














Side View



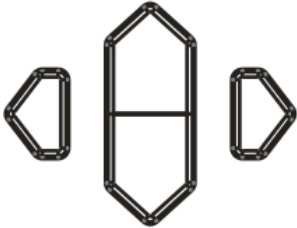


Bottom

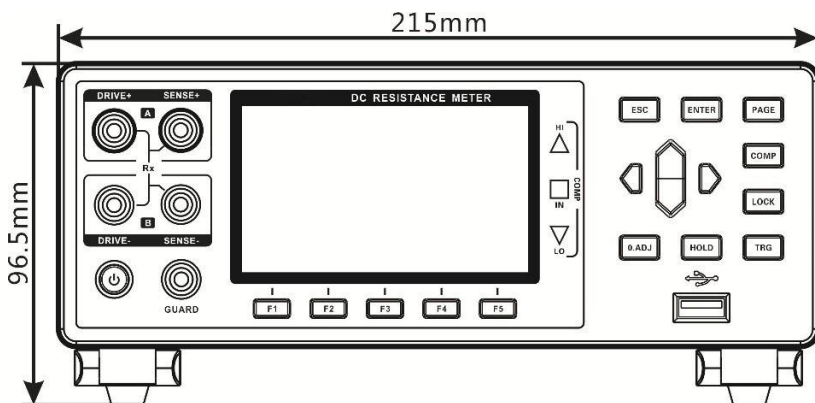


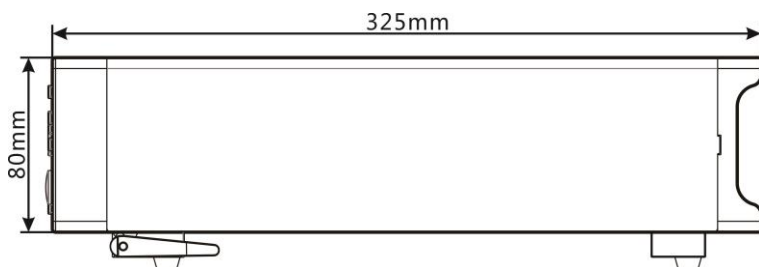
Keys

Keys	Description
	Function key F1
	Function key F2
	Function key F3
	Function key F4
	Function key F5
	Function key Escape
	Function key Enter
	[Page Switch] Switches [Measurement Page] <-> [Comparator Page] <-> [Setup Page] <-> [Panel Page] <-> [System Page] <-> [I/O Page]
	Comparator on/off button
	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 for clear zero function. Long press to release clear zero function

	<p>[HOLD] key</p> <p>Hold the current measurement during the test</p>
	<p>[Trigger] key</p> <p>Single trigger test to the instrument in manual trigger mode</p>
	<p>[Direction] key, Select menu items or set values</p>


1.4 Dimension






1.5 Screen Composition

Measurement Display

					
MEAS	COMP	SET	PANEL	SYS	I/O
Range	20mΩ	Auto Range	OFF	RATE	FAST
					25.0°C
1.0000mΩ					
Range↑	Range↓	AUTO	Speed	TEMP	

Comparator Display

					
MEAS	COMP	SET	PANEL	SYS	I/O
Beep	OFF				
Mode	ABS				
Range	10mΩ				
BIN	OFF				
Upper	10.0000mΩ				
Lower	01.0000mΩ				
OFF	PASS	FAIL	BEEP A	BEEP B	

Measuring Parameter Setting Display

MEAS		COMP		SET		PANEL		SYS		I/O	
TC		OFF		ΔT		OFF					
Average		OFF		Delay		PRESET					
Auto hold		OFF		Error mode		CurErr					
OVC		OFF		Low power		OFF					
Display		7 Bit		MEAS Current		HIGH					
Contact check		OFF		Contact improve		OFF					
100M Precision		OFF									
OFF		ON		SET							


Parameter Saving Display

MEAS		COMP		SET		PANEL		SYS		I/O	
No.	Name										
01	-----	Empty									
02	-----										
03	-----										
04	-----										
05	-----										
06	-----										
07	-----										
08	-----										
09	-----										
10	-----										
Save											

System Parameter Setting Display

MEAS		COMP		SET		PANEL		SYS		I/O	
Key click		OFF									
Calibration		AUTO									
Power FREQ		AUTO									
Radio		OFF									
Interface		RS232									
Baud rate		9600									
OFF		ON									

I/O Setting Display

					
MEAS	COMP	SET	PANEL	SYS	I/O
Trig source	INT				
Trig Edge	UP				
I/O level mode	NPN				
EOC Mode	LEVEL				
Output mode	JUDGE				
I/O Test	START				
INT		EXT			

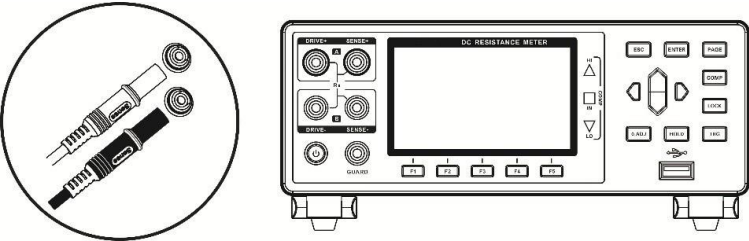
Chapter 2

Preparing for Measurement

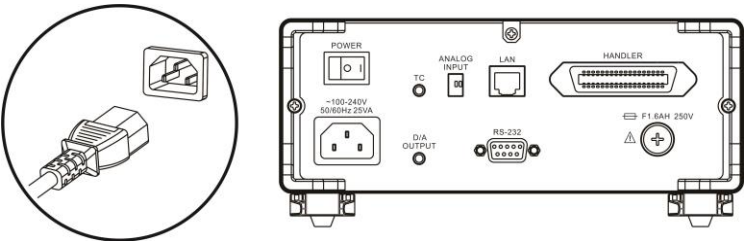
2.1 Measurement Process Overview

The instrument is kept power off, the following steps are taken to prepare for testing.

1. Turn off the instrument and connect the test leads.

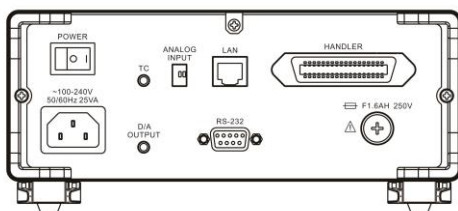
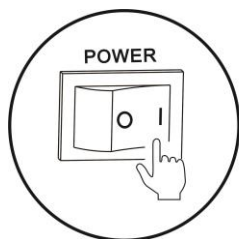


2. Plug AC power cord into the mains outlet



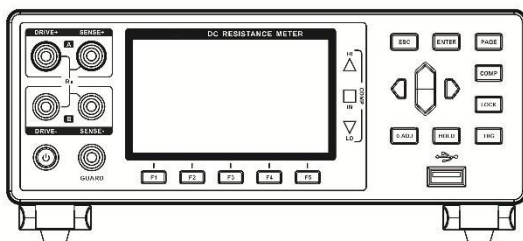
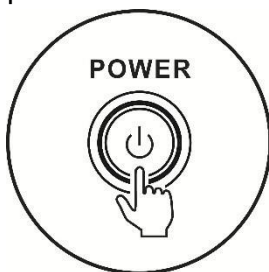
Ensure that the power cord is well grounded, which is conducive to the stability of the test.

3. Turn on the power at back of instrument.



At the time being, internal power of the instrument has been turned on and the instrument is in standby mode.

4. Press and hold POWER button on panel to turn on the power.



When instrument is in the standby mode, POWER button at panel light is red, long press POWER button, the power is turned on, the screen is lit, and light of button at panel turns green.

5. Setting test parameters

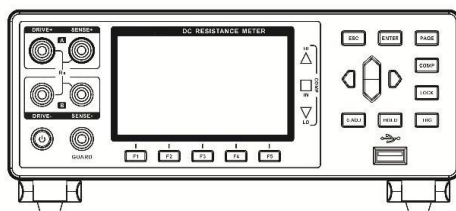
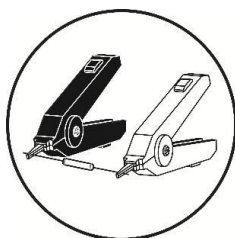
Trigger mode setting, INT/EXT

Resistance range setting, 10m Ω /100m Ω / 1000m Ω / 10 Ω /100 Ω /1000 Ω /10k Ω /100k Ω /1000k Ω /10M Ω /100M Ω /1000M Ω /AUTO range

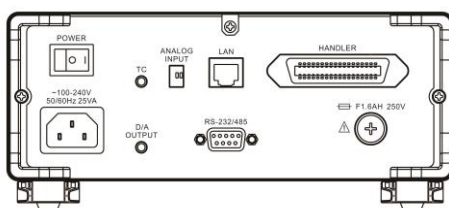
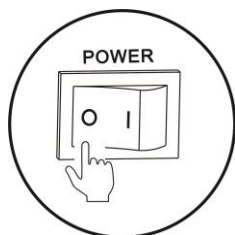
Test speed setting, Fast/Medium/Slow 1/Slow2

Comparator setting, upper limit/lower limit/turn off comparator

6. Start to test



7. Complete test, turn off the power



2.2 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 us.

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.
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. It is recommended to replace the intact wire.

Power-on checking

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

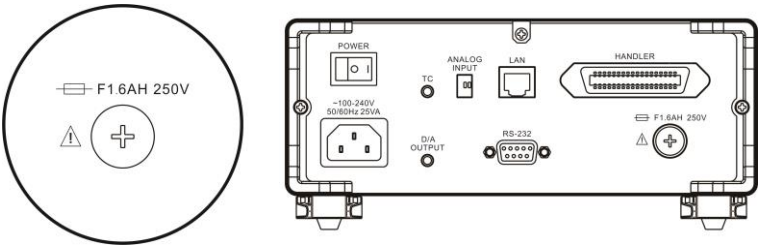
2.3 Replace the Fuse for Measuring Circuit Protection

When the measuring circuit protection fuse is blown, please

replace it as described in below.

note:

- To avoid electric shock, turn off the power and replace the fuse after removing the test leads.
- Use fuses with specified shapes, characteristics, current ratings and voltages. Do not use a fuse other than the specified one (especially a fuse with a large rated current), or continue to use the fuse box in a short-circuited state. Failure to do so may result in damage to the instrument and personal injury.
- Specified fuse: F1.6AH/250V $\phi 5 \times 20$, mm



Use a Phillips screwdriver to remove the fuse cover, insert a new fuse and secure the fuse cover with a screwdriver.

2.4 Confirm the Measured Object

Please change the measurement conditions appropriately according to the object to be measured to reliably measure the resistance. Please refer to the recommended examples shown in the table below to start measurement after setting up instrument.

Measured object	Recommended setting
-----------------	---------------------

	Low current	Test current	TC/ ΔT	OVC	Contact detection
Motor, solenoid, choke, transformer	OFF	High	TC	OFF	ON
Signal contact harness, connector, relay contact, switch	ON	–	TC	–	OFF *3
Power contact harness, connector, relay contact, switch	OFF	High	TC	ON	ON
Fuse, resistor	OFF	Low *1	–	ON	ON
Conductive coating, conductive rubber	OFF	High	–	OFF	OFF
Other, common resistance measurement heaters, wires, welded parts	OFF	High	*2	ON	ON
Temperature rise test motor, choke, transformer	OFF	High	ΔT	OFF	ON

*1 When the rated power has a margin, select High

*2 When the temperature dependence of the measured object is large, use temperature compensation

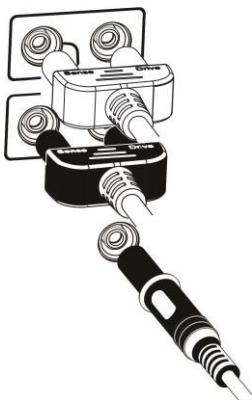
*3 When the allowable voltage is allowed to have a margin, select ON.

2.5 Test leads Connection Method



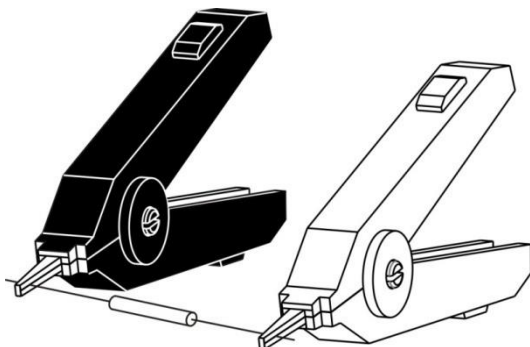
- The test leads port is sharp, taking care not to be scratched.
- For safety reasons, test leads supplied with the instrument should be used.
- To avoid electric shock, make sure the test leads are properly connected

Front panel connection

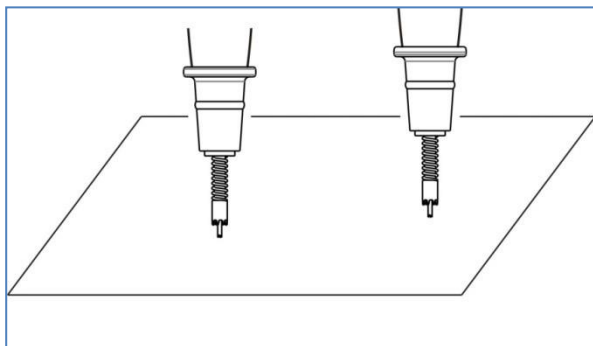


Test leads connection

1. Test clip type test leads



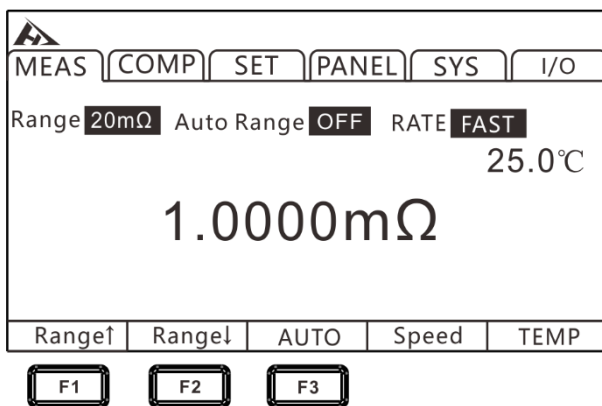
2. Test probe type test leads



Chapter 3 Basic Settings

3.1 Setting Test Range

The range setting is divided into manual range and auto range. When auto range is selected, the instrument automatically selects an appropriate range to test based on the value of the measured resistance.



3.1.1 Manual Range Setting

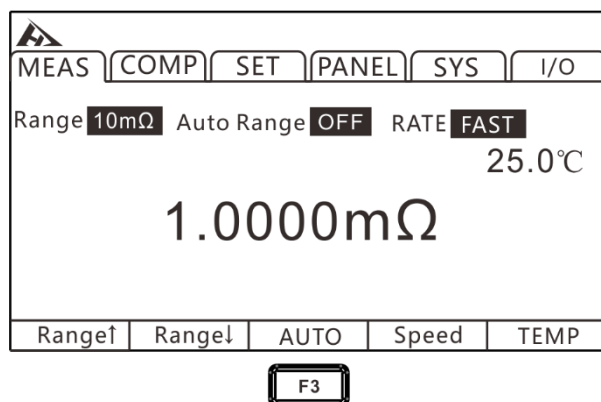
Under measurement state, press [F1] or [F2] to switch the range. Even if auto range function is turned on, manual range switching is also valid (when the auto range is turned on, auto range function will be automatically turned off when the range is manually switched).

Range:

10mΩ ↔ 100mΩ ↔ 1000mΩ ↔ 10Ω ↔ 100Ω ↔ 1000Ω ↔
10kΩ ↔ 100kΩ ↔ 1000kΩ ↔ 10MΩ ↔ 100MΩ ↔ 1000MΩ

3.1.2 Auto-Range Setting

Under measurement state, press [F3] to switch to auto range.

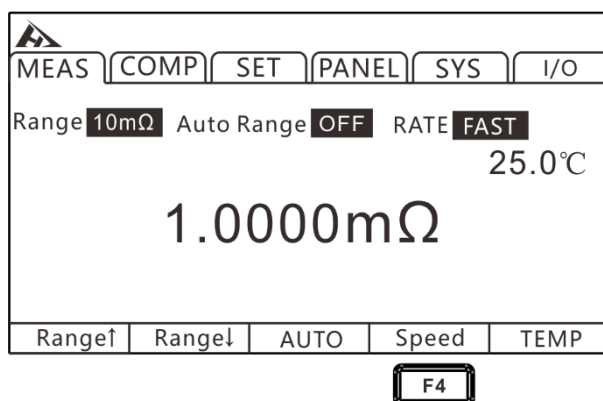


Note:

- If the range is changed while the auto range is ON, the auto range is automatically canceled and is changed to manual range .
- If the comparator function is set to ON, the range is fixed and cannot be changed (it cannot be switched to auto range). To change the range, set the comparator function to OFF or change the range in the comparator settings.
- The auto range may become unstable due to the measured object. In this case, manually specify the range or extend the delay time.

3.2 Setting Measurement Speed

The measurement speed is divided into four levels: fast, medium, slow 1, and slow 2. Press [F4] to switch. The test accuracy of medium speed, slow speed 1 and slow speed 2 is higher than fast speed and is not easily affected by the external environment. When it is susceptible to the external environment, please fully shield the test object from the test leads and wrap the cable.

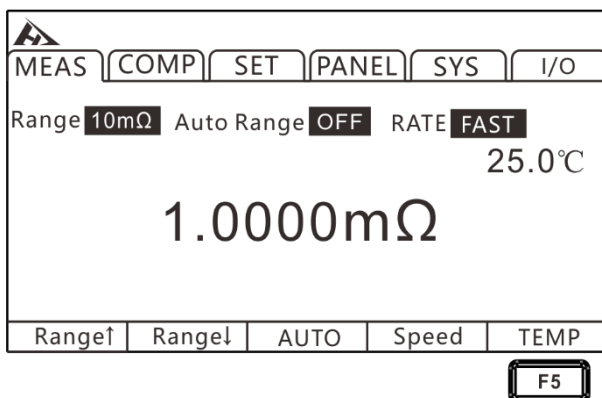


Note:

- 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.
- Perform a self-calibration of approximately 5ms between measurements. To shorten the measurement interval, set the self-calibration to manual.

3.3 Temperature Setting

Press [F5] on measurement page to switch whether the current temperature is displayed.



If temperature probe is not connected, temperature measurement is not possible. When the TC or ΔT is not used, there is no need to connect a temperature probe. If users do not want to display the temperature, please switch the display.

3.3.1 Temperature Compensation

Resistance value is converted to reference temperature for display. When need compensating for temperature, please connect the temperature probe to the TC terminal on the rear panel of the instrument.

1. Select parameter setup page



Press **[PAGE]** Button
to parameter setting page

2. Select related menu items

Press [F2] to turn on temperature compensation. After the temperature compensation is set to ON, users need to press [F3] to set the reference temperature and temperature coefficient.

MEAS		COMP		SET		PANEL		SYS		I/O	
TC		OFF		ΔT		OFF					
Average		OFF		Delay		PRESET					
Auto hold		OFF		Error mode		CurErr					
OVC		OFF		Low power		OFF					
Display		7 Bit		MEAS Current		HIGH					
Contact check		OFF		Contact improve		OFF					
100M Precision		OFF									
OFF		ON		SET							

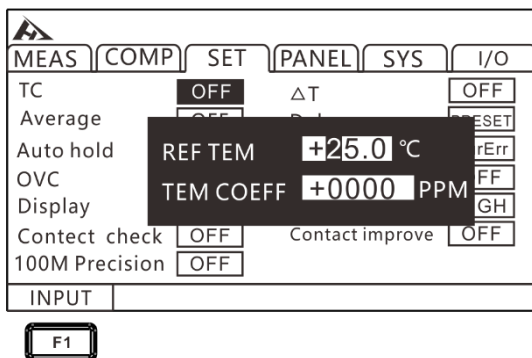
F1

F2

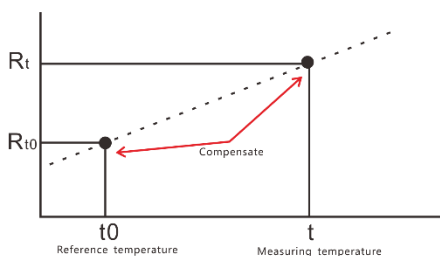
F3

3. Related values setting

Press [F3] to enter reference temperature and temperature coefficient setup page, press [F1] to enter setting, use left and right cursor keys to move the cursor to the position to be set, and use the up and down cursor keys to change value.



The principle of temperature compensation is as follows:



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

R_t : Actual resistance value

R_{t0} : compensation resistance value

t : Measuring temperature

t_0 : Reference temperature (setting range from -10°C~99.9°C)

α_{t0} : Temperature coefficient at t_0 of the material being tested
(setting range from -9999ppm/°C~9999ppm/°C)

Note:

When "t.error" is displayed, it indicates that the temperature probe is not connected; if temperature is displayed as ---., please confirm connection of the temperature probe.

3.3.2 Temperature Conversion

When performing temperature conversion, connect temperature probe to TC terminal on rear panel of the instrument. The temperature rise value can be converted according to the principle of temperature conversion, and the temperature at time of energization stop can be estimated.

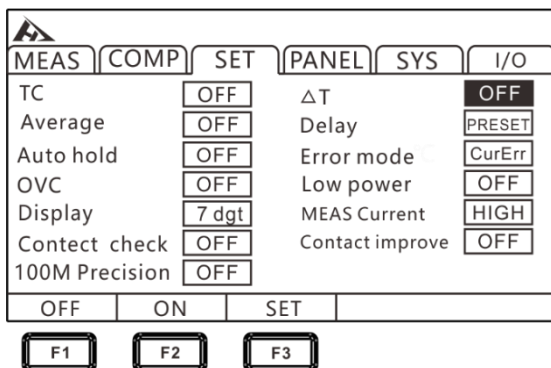
1. Select parameter setup page



Press **[PAGE]** Button
to parameter setting page

2. Select related menu items

Press **[F2]** to turn on temperature conversion. After temperature conversion is set to ON, users need to press **[F3]** to set relevant value.



3. Related values setting

Press [F3] to enter setup page of initial resistance value, initial temperature, and inverse of the temperature coefficient (K) at 0 °C.

MEAS		COMP		SET		PANEL		SYS		I/O	
TC	OFF	ΔT		ON							
Average		R1	+00.0000m Ω								
Auto hold		T1	+00.0 °C								
OVC		K	+000.0								
Display											
Contact check											
100M Precision	OFF										
INPUT											
F1											



Press up/down/left/right to choose the parameter

Press [F1] input key to start setting, use left and right cursor keys to move cursor to the position to be set, and use up and down cursor keys to change the value.

MEAS		COMP		SET		PANEL		SYS		I/O	
TC	OFF	ΔT		ON							
Average		R1	+00.0000m Ω								
Auto hold		T1	+00.0 °C								
OVC		K	+000.0								
Display											
Contact check											
100M Precision	OFF										
X10	1/10										
F1 F2											



Press up/down/left/right to choose the parameter

Setting range:

Initial resistance: 0.001 Ω ~ 9000.000 M Ω

Initial temperature: -10.0 ~ 99.9 °C

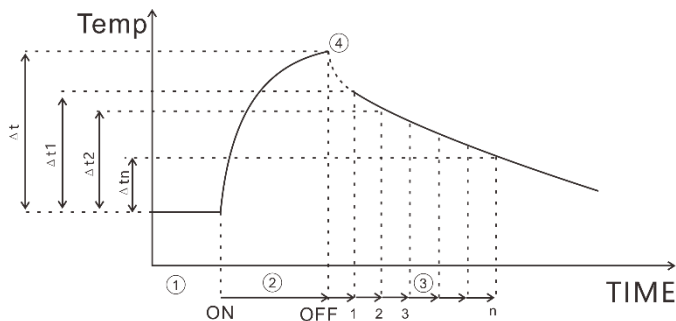
Reference value of k:

The following values are recommended in the JIS C4034-1 standard.

- Copper: $k = 235$
- Aluminum: $k = 225$

Temperature conversion test example:

- 1 Make motor and coil fully adapt to room temperature, then measure resistance value (R_1) and ambient temperature (t_1) before power-on and input value into the instrument.
- 2 Remove the test leads from the object under test.
- 3 After power is turned OFF, connect test leads to the object to be measured again, and measure the temperature rise value ($\Delta t_1 \sim \Delta t_n$) at regular intervals.
- 4 Connect collected temperature data (Δt_1 to Δt_n) and estimate maximum temperature rise value (Δt).



Note:

- When ΔT is ON, comparator cannot be set to ON.
- If TC and multi-sorting functions are set to ON, ΔT will automatically turn into OFF status.

3.4 Average Number of Times Setting

A plurality of measured values are averaged and displayed. By using this function, the jitter of measured value can be reduced and interference can be suppressed.

When internally triggered, (free measurement) is calculated by moving average.

When externally triggered, (non-free measurement) is a

Average method	1 st	2 nd	3 rd
Free measurement (moving average)	$(D1 + D2)/2$	$(D2 + D3)/2$	$(D3 + D4)/2$
Non-free measurement (simple average)	$(D1 + D2)/2$	$(D3 + D4)/2$	$(D5 + D6)/2$

simple average.

Average number of times:

OFF ↔ 2 ↔ 3 ↔ 4 ↔ 5 ↔ 6 ↔ 7 ↔ 8 ↔ 9 ↔ 10

The average value when average number of times is set to 2:

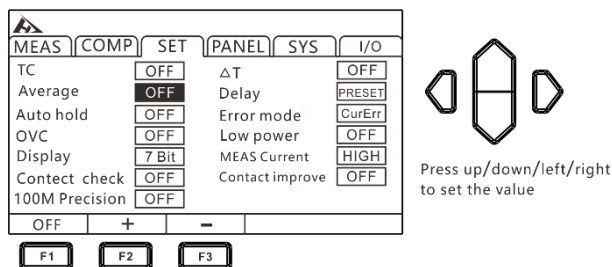
When low current resistance measurement is ON, and test speed is slow 2, even if the average function is set to OFF, the internal average processing is performed twice. When average function is set to ON, averaging process is performed by the set number of times.

1. Select parameter setup page



Press[PAGE]Button
to parameter setting page

2. Select related menu items



Press [F2], average number of times increases, press [F3] to decrease the average number of times, maximum average number of times is 10 times, and minimum is 2 times.

3.5 Measurement Delay Setting

Set waiting time after the OVC (Thermal Compensation Function) is turned on and measurement current is changed under the auto range to adjust the measurement stabilization time. By using this feature, even if reactance component of the object to be measured is large, the measurement can be started after internal circuit is stabilized. Preset settings vary depending on the range or offset voltage compensation function.

The delay setting can be selected from the preset (internal fixed value) and any 2 type of set value.

(1) The preset (internal fixed value) value will vary according to the range or OVC function.

LP OFF (unit: ms)

Range	100 MΩ range High accuracy mode	Test current	Delay		Delay
			OVC: OFF	OVC: ON	
10 mΩ	–	–	75	25	1
100 mΩ	–	High	250	25	
	–	Low	20	2	
1000 mΩ	–	High	50	2	
	–	Low	5	2	
10 Ω	–	High	20	2	
	–	Low	5	2	
100 Ω	–	High	170	2	
	–	Low	20	2	
1000 Ω	–	–	170	2	
10 kΩ	–	–	180	–	
100 kΩ	–	–	95	–	
1000 kΩ	–	–	10	–	

10 MΩ	—	—	1	—
100 MΩ	ON	—	500	—
100 MΩ	OFF	—	1	—
1000 MΩ	OFF	—	1	—

(2) Arbitrarily set value

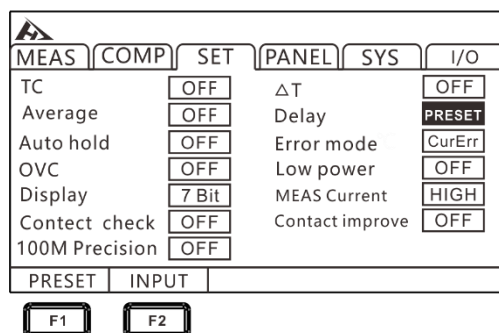
Setting range is 0 to 9999 ms, which is the value set for all ranges.

1. Select parameter setup page



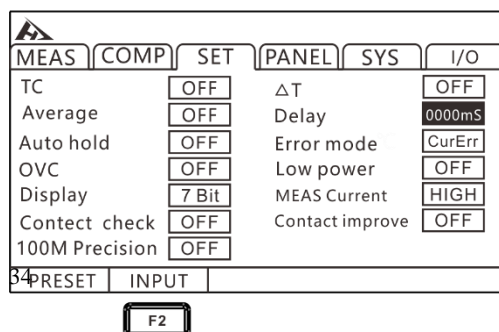
Press **[PAGE]** Button
to parameter setting page

2. Select related menu items



Press up/down/left/right
to set the value

3. Press [F2] to enter delay time



Press up/down/left/right
to set the value

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 initial state (preset), 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 update of the measured value will become slower.

3.6 Auto Hold Settings

It is very convenient to use hold function when confirming the measured value. When measured value is stable, buzzer will sound and be automatically held.

1. Select parameter setup page



Press **PAGE** Button
to parameter setting page

2. Select related menu items

MEAS	COMP	SET	PANEL	SYS	I/O
TC		OFF	ΔT		OFF
Average		OFF	Delay		0100mS
Auto hold		OFF	Error mode		CurErr
OVC		OFF	Low power		OFF
Display		7 Bit	MEAS Current		HIGH
Contact check		OFF	Contact improve		OFF
100M Precision		OFF			
OFF		ON			
F1		F2			



Press up/down/left/right
to set the value

About automatic hold release:

When test leads are removed from the object to be measured and brought into contact with the object to be measured again, the hold is automatically released. Changing range and measuring speed or pressing [ESC] can also cancel the hold. If the hold is released, HOLD indicator will go out.

3.7 Abnormal Mode Setting

The abnormal mode can be set to [current abnormality] and [overrange]

1. Select parameter setup page

MEAS	COMP	SET	PANEL	SYS	I/O
PAGE					



Press [PAGE] Button
to parameter setting page

2. Select related menu items

MEAS		COMP		SET		PANEL		SYS		I/O	
TC		OFF		ΔT		OFF					
Average		OFF		Delay		PRESET					
Auto hold		OFF		Error mode		CurErr					
OVC		OFF		Low power		OFF					
Display		7 Bit		MEAS Current		HIGH					
Contact check		OFF		Contact improve		OFF					
100M Precision		OFF									
CurErr		OvrRng									
F1		F2									



Press up/down/left/right to set the value

Overrange detection example

Overflow Detection	Measurement Example
When overrange	13 k Ω measurement on a 10 k Ω range
Deviation of the measured value is displayed (% display) when the display range (999.999%) is exceeded	500 Ω (+2400%) measured at a standard value of 20 Ω
When the result of clear zero operation is out of the display range	0.5 Ω zero adjustment in 1 Ω range \rightarrow 0.1 Ω measurement \rightarrow operation result -0.4 Ω , out of display range
When the input of the A/D converter is out of range during measurement	High-resistance measurement, etc. in environments with high external noise
When the current does not flow to the measured object normally (only when the current abnormal mode is set to overrange output)	If the current is abnormally displayed as "- - - - -" when the SOURCE A terminal or SOURCE B terminal is defective when the target is defective, set the current abnormal mode to current abnormality.

Examples of current anomalies:

- Place SOURCE A, SOURCE B probes in an open status
- The measured object is disconnected, etc. (Open circuit components)
- SOURCE A, SOURCE B wiring disconnection, poor connection

Note:

- If SOURCE wiring resistance exceeds the following value, a current abnormality will occur and measurement will not be possible. Under measurement current range of 1 A, control the contact resistance between the wiring resistance and the object to be tested and test leads to a low level.

3.8 OVC (thermoelectric compensation) Function Setting

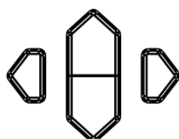
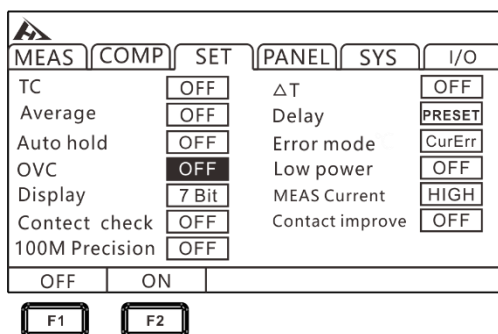
Automatically compensates for the thermoelectric potential or the internal bias voltage of the instrument. (OVC: Offset Voltage Compensation)

1. Select parameter setup page



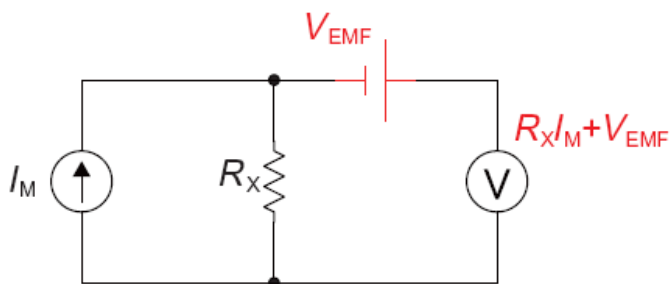
Press **[PAGE]** Button
to parameter setting page

2. Select related menu items



Press up/down/left/right
to choose the parameter

When OVC function is turned on, the measured value RP when the measured current flows and the measured value RZ when the measured current does not flow are displayed in the upper right corner of the page **[OVC]**, RP-RZ is displayed as the true resistance value.



V_{EMF} : The thermoelectric potential, when any metal is in contact, generates an electric potential. The magnitude of electric potential is related to temperature.

R_x : measured resistance

When injection test current is I_M , $V_1 = V_{EMF} + R_x I_M$

When $I_M = 0$, $V_2 = V_{EMF}$, $V = V_1 - V_2 = R_x I_M$

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

Note:

- When bias voltage compensation function is ON (OVC indicator is lit), the display of measured value will be updated slowly.
- When low current resistance measurement is OFF, the bias voltage compensation function can be set to ON, 10 k Ω range in the range of 10 m Ω to 1000 Ω .
- OVC function is unavailable for 1000 M Ω range.
- When bias voltage compensation function has been changed, the zero adjustment function is released.
- When inductance of the measured object is large, delay time needs to be adjusted. (Initially set delay time to be longer, and then gradually reduce the measurement while observing the measurement).
- When measured heat capacity of the object is small, the effect of the bias voltage compensation function may not be seen.
- When low current resistance measurement is ON, the bias voltage compensation function automatically turns ON at all ranges, and this function cannot be released.

3.9 Low Current Setting

For low current resistance measurement, open circuit voltage is controlled to 20 mV and measured with a small current.

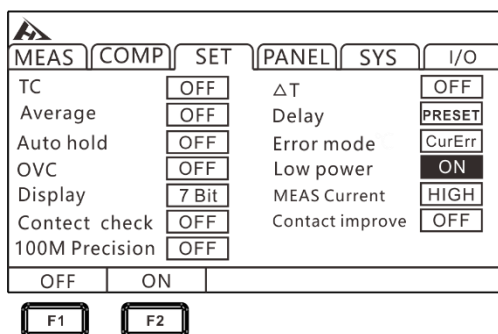
1. Select parameter setup page



Press **[PAGE]** Button
to parameter setting page

2. Select related menu items

When low current function is turned on, the upper right corner will display **低电流**



Press up/down/left/right
to choose the parameter

Range, measurement current, and open circuit voltage that can be used when the low current is ON.

Range	Max. measuring range	Test current	Open voltage
1000 mΩ	1200.00 mΩ	1 mA	20 mV MAX
10 Ω	12.0000 Ω	500 μA	
100 Ω	120.000 Ω	50 μA	
1000 Ω	1200.00 Ω	5 μA	

When measuring signal contacts (harness, connector, relay contact, switch), the measurement can be performed without

changing the state of contact by using low current resistance measurement function.

If the signal contact is measured with low current OFF, oxide film of the contact is easily damaged. If the oxide film of the contact is damaged, there may be a tendency to show a lower resistance value. On the other hand, in the case of a power contact (a contact for a large current), the oxide film is removed in an actual use state. If the measurement is performed with low current being ON, the oxide film will not be damaged and a higher measured value may be displayed.

Note:

- When the low current is ON, the detection voltage becomes small, so it is susceptible to external noise. When the measured value is unstable, please take noise reduction measures (test cable, connect the shield wire to the GUARD terminal of the instrument; wind the test cable; shield the object to be tested, connect the shield wire to the GUARD terminal of the instrument; lower Measuring speed or using the average function).
- When the low current is ON, OVC ON is automatically turned off to eliminate the influence of the electromotive force. When the reactance component of the object to be measured is large, it is necessary to extend the delay.
- When the low current resistance measurement is ON and the measurement speed is slow 2, even if the average function is set to OFF, the measured value is averaged twice and displayed. When the average function is set to ON, the averaging process is performed by the set number of times.
- When the low current is ON, the contact improvement function becomes OFF.
- The contact detection when the low current is ON is initially set to OFF.

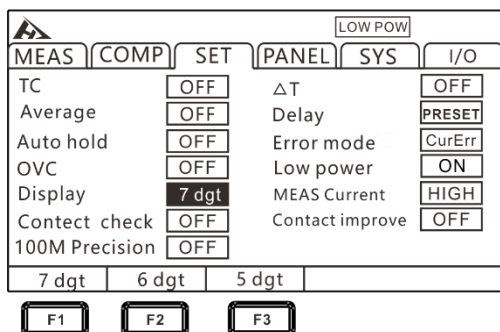
3.10 Display Digit Setting

1. Select parameter setup page



Press **[PAGE]** Button
to parameter setting page

2. Select related menu items



Press up/down/left/right
to choose the parameter

[F1] key: 7 digits (1,000,000dgt.) (initial setting)

[F2] key: 6 digits (100,000dgt.)

[F3] key: 5 digits (10,000dgt.)

3.11 Test Current Setting

1. Select parameter setup page

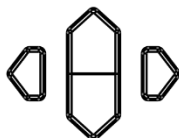


Press **[PAGE]** Button
to parameter setting page

2. Select related menu items

When the power of the resistance value \times (measurement

MEAS	COMP	SET	PANEL	SYS	I/O
TC		OFF	ΔT		OFF
Average		OFF	Delay		PRESET
Auto hold		OFF	Error mode		CurErr
OVC		OFF	Low power		ON
Display		7 Bit	MEAS Current		HIGH
Contact check		OFF	Contact improve		OFF
100M Precision		OFF			
OFF		ON			
F1		F2			



Press up/down/left/right
to choose the parameter

current) 2 is applied to the object to be measured and the following problems are caused by test current, set test current to low current.

- The object to be tested is blown
- The measured object is hot and the resistance value changes.
- The object to be measured is magnetized and inductance changes.

Range	High current		Low current	
	Test current	Maximum measuring range of power	Test current	Maximum measuring range of
10 mΩ	1 A	12 mW	–	
100 mΩ	1A	120 mW	100 mA	1.2 mW
1000 mΩ	100 mA	12 mW	10 mA	120 W
10 Ω	10 mA	1.2 mW	1 mA	12 W
100 Ω	10 mA	12 mW	1 mA	120 W
1000 Ω	1 mA	1.2 mW	–	
10 kΩ	1 mA	12 mW	–	
100 kΩ	100 A	1.2 mW	–	
1000 kΩ	10 A	120 W	–	
10 MΩ	1 A	12 W	–	
100 MΩ (High accuracy mode ON)	100 nA	1.2 W	–	
100 MΩ、 1000 MΩ	<1 A	1.3 W	–	

3.12 Contact Detection Settings

Check for poor contact between test object and probe or the disconnection status of the test cable.

1. Select parameter setup page



Press **[PAGE]** Button
to parameter setting page

2. Select related menu items

MEAS		COMP		SET		PANEL		SYS		I/O	
TC	OFF			ΔT	OFF						
Average	OFF			Delay	PRESET						
Auto hold	OFF			Error mode	CurErr						
OVC	OFF			Low power	ON						
Display	7 dgt			MEAS Current	HIGH						
Contact check	ON			Contact improve	OFF						
100M Precision	OFF										
OFF		ON									

F1

F2



Press up/down/left/right to choose the parameter

During period from response time to measurement period, instrument always monitors resistance between SOURCE A - SENSE A and SOURCE B - SENSE B. When resistance value exceeds threshold, it is judged as a contact error. When a contact error occurs, CONTACT TERM.A and CONTACT TERM.B errors are displayed. The comparator judgment of measured value is not performed. When this error is displayed, check the contact of probe and disconnection of test cable. The object to be measured is a conductive paint, conductive rubber, etc. When the resistance between SENSE-SOURCE is too large, it will always be in an error state and measurement will not be possible. In this case, set the touch detection function to OFF.

3.13 Contact Improvement Settings

Improve the probe contact state by flowing current from SENSE A terminal to SENSE B terminal before starting measurement. If contact improvement function is used, a voltage is applied to the object to be measured. Please pay attention to the object to be measured (magnetoresistive element, signal relay, EMI filter, etc.) whose measurement characteristics are likely to change.

The contact improvement current is up to 10 mA and the applied voltage is up to 5 V.

When low current is ON, the contact improvement

function becomes OFF.

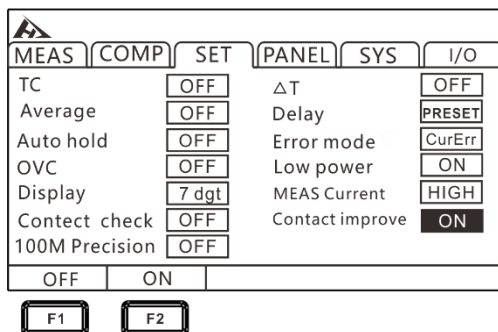
If contact improvement function is used, measurement end time is extended by 0.2 ms.

1. Select parameter setup page



Press **PAGE** Button
to parameter setting page

2. Select related menu items



Press up/down/left/right
to choose the parameter

3.14 100M Accurate Test

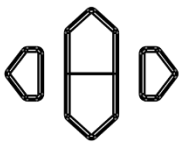
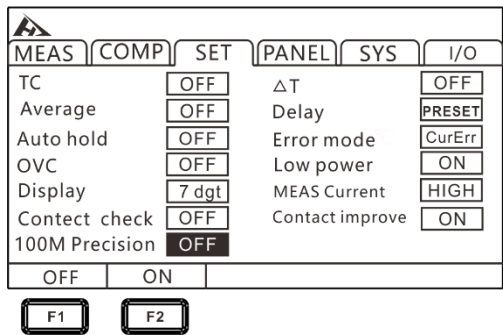
It can improve the accuracy of the 100MΩ range. If 100M accurate test is set to ON, 1000 MΩ range cannot be used. It takes a certain time for the measured value to reach a stable state. To adjust time to reach the steady state, set delay in advance.

1. Select parameter setup page



Press **PAGE** Button
to parameter setting page

2. Select related menu items



Press up/down/left/right
to choose the parameter

Chapter 4 **Comparator Settings**

4.1 Comparator Function

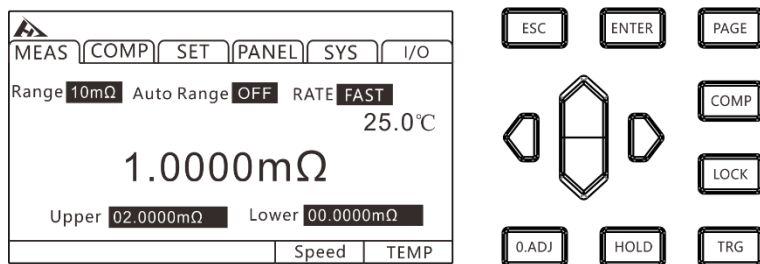
Before using the comparator function, when the range is exceeded (displays OvrRng) and when the test is abnormal (CONTROLTION TERM or - - - - - is displayed), the judgment of the comparator is displayed as shown below

Measured value display	Comparator decision display (COMP Indicator)
+OvrRng	Hi
- OvrRng	Lo
CONTACT TERM or - - - - -	Extinguished (no decision)

If the power is turned off during setup, the value being set becomes invalid and becomes the previous setting value. To confirm the settings, press [ENTER] key.

The initial setting sets the comparator function to OFF. When the function is set to OFF, even if the parameter value of the comparator is set, it is an invalid value. Press [COMP] button to turn comparator on/off.

Measurement page when the comparator function is turned on



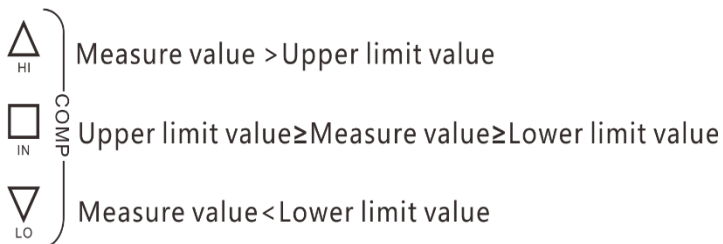
- If ΔT or multi-step sorting function is set to ON, comparator function is automatically turned OFF.
- The range cannot be changed while using the comparator function. To change the range, use the change on comparator setting screen. To use auto range, set comparator function to OFF.

4.1.1 Comparison Result Signal Output Method

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

1. Panel LED light alarm

2.

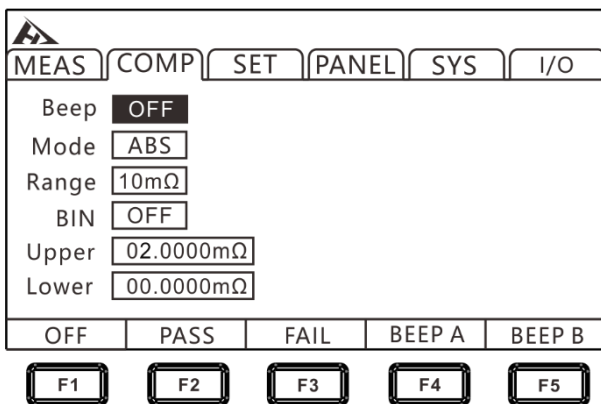


3. Beep alarm

2.1 Select parameter setup page



2.2 Select related menu items



3. External IO port, signal output (refer to Chapter 9)

4.2 Comparison Mode

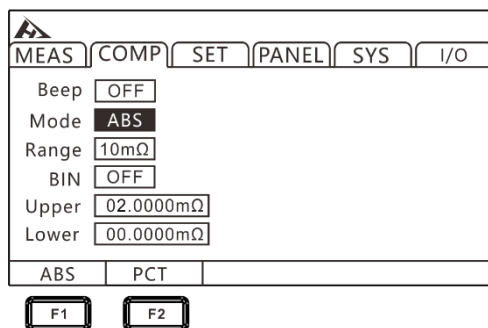
4.2.1 Absolute Value Mode

1. Select parameter setup page



Press **PAGE** Button
to COMP setting page

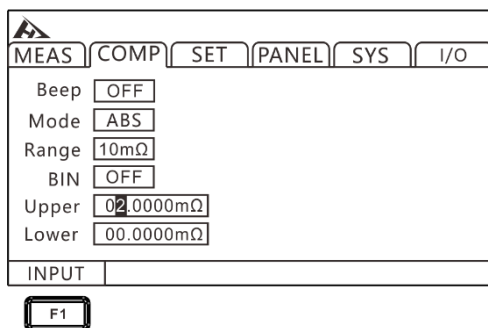
2. Select related menu items



Press up/down/left/right
to choose the parameter

3. Upper limit setting


Press [F1] input key, use left and right cursor keys to move cursor to the position to be set, and use up and down cursor keys to change value.



Press up/down/left/right
to set the value

4. Lower limit setting

Press [F1] input key, use left and right cursor keys to move cursor to the position to be set, and use up and down cursor keys to change value.



MEASCOMPSETPANELSYSI/O

BeepOFF

ModeABS

Range10mΩ

BINOFF

Upper02.0000mΩ

Lower00.0000mΩ

INPUT



Press up/down/left/right to set the value

To interrupt setting, press [ESC] key to return to original page.

[Upper and lower limit comparison]

Example:

Absolute value mode	Upper limit value	Lower limit value	Pass	Fail
Comparison of upper and lower limits	100Ω	10Ω	$10\Omega \leq \text{test value} \leq 100\Omega$	$\text{test value} > 100\Omega$ or $\text{test value} < 10\Omega$

4.2.2 Percentage Mode

1. Select parameter setup page




MEASCOMPSETPANELSYSI/O



Press **PAGE** Button to COMP setting page

2. Select related menu items


	MEAS	COMP	SET	PANEL	SYS	I/O
Beep	OFF					
Mode	PCT					
Range	10mΩ					
BIN	OFF					
REF	00.0000mΩ					
RET%	00.000%					
ABS		PCT				
F1						



Press up/down/left/right
to choose the parameter

3. Standard value setting

Press [F1] input key, use left and right cursor keys to move cursor to the position to be set, and use up and down cursor keys to change value.


	MEAS	COMP	SET	PANEL	SYS	I/O
Beep	OFF					
Mode	PCT					
Range	10mΩ					
BIN	OFF					
REF	00.0000mΩ					
RET%	00.000%					
INPUT						
F1						



Press up/down/left/right
to set the value

4. Deviation value setting

Press [F1] input key, use left and right cursor keys to move cursor to the position to be set, and use up and down cursor keys to change value.

	MEAS	COMP	SET	PANEL	SYS	I/O
Beep	OFF					
Mode	PCT					
Range	10mΩ					
BIN	OFF					
REF	00.0000mΩ					
RET%	00.000%					
INPUT						
F1						



Press up/down/left/right
to set the value

To interrupt setting, press [ESC] key to return to the original page.
If percentage mode is set, the measured value becomes deviation display (%).

$$\text{Relative Value (tolerance)} = \left(\frac{\text{Measured Value}}{\text{Reference Value}} - 1 \right) \times 100[\%]$$

Display range: -99.999% ~ +99.999%

The standard value is 10 mΩ, set the allowable range relative to the standard value to ± 1%.

4.3 Multi-bins Sorting Function

A comparison judgment is made between top measurement (absolute value mode) or the standard deviation (percent mode) in one measurement by classification in 1 test up to 10 sets of upper and lower limits, and the measurement result is displayed. All items listed for BIN are judged as NG. The sorting result can also be output via EXT I/O terminal.

4.3.1 Sorting Function Turn on Settings

1. Select parameter setup page



Press **[PAGE]** Button
to COMP setting page

2. Select related menu items

MEAS		COMP		SET		PANEL		SYS		I/O	
Beep	<input type="button" value="OFF"/>										
Mode	<input type="button" value="ABS"/>										
Range	<input type="button" value="10mΩ"/>										
BIN	<input type="button" value="OFF"/>										
Upper	<input type="button" value="00.0000mΩ"/>										
Lower	<input type="button" value="00.0000mΩ"/>										
OFF		ON									
<input type="button" value="F1"/>		<input type="button" value="F1"/>									



Press up/down/left/right to choose the parameter

Note:


- The comparator cannot be set to ON when multi-bins sorting function is ON
- If ΔT is set to ON, classification measurement function is automatically turned OFF.
- To use auto range, set multi-bins sorting function to OFF.

4.3.2 Sorting Function Range Setting

In multi-bins sorting open page, press up and down keys to select the mode and change the range.


Range:

10mΩ ↔ 100mΩ ↔ 1000mΩ ↔ 10Ω ↔ 100Ω ↔
 1000Ω ↔ 10kΩ ↔ 100kΩ ↔ 1000kΩ ↔ 10MΩ ↔

																													
MEAS	COMP	SET	PANEL	SYS	I/O																								
Beep	OFF	<table border="1"> <thead> <tr> <th>BIN</th> <th>Upper</th> <th>Lower</th> </tr> </thead> <tbody> <tr><td>0</td><td>-----</td><td>-----</td></tr> <tr><td>1</td><td>-----</td><td>-----</td></tr> <tr><td>2</td><td>-----</td><td>-----</td></tr> <tr><td>3</td><td>-----</td><td>-----</td></tr> <tr><td>4</td><td>-----</td><td>-----</td></tr> <tr><td>5</td><td>-----</td><td>-----</td></tr> <tr><td>6</td><td>-----</td><td>-----</td></tr> </tbody> </table>				BIN	Upper	Lower	0	-----	-----	1	-----	-----	2	-----	-----	3	-----	-----	4	-----	-----	5	-----	-----	6	-----	-----
BIN	Upper	Lower																											
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2	-----	-----																											
3	-----	-----																											
4	-----	-----																											
5	-----	-----																											
6	-----	-----																											
Mode	ABS																												
Range	10mΩ																												
BIN	ON																												
Range↑		Range↓																											
F1		F2																											


4.3.3 Sorting Function Upper and Lower Limit Settings

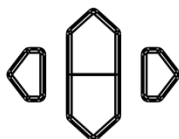
After select absolute value mode and determine range, the corresponding upper and lower limits can be set, unit for upper and lower limit units are consistent with the range.

																													
MEAS	COMP	SET	PANEL	SYS	I/O																								
Beep	OFF	<table border="1"> <thead> <tr> <th>BIN</th> <th>REF</th> <th>REF%</th> </tr> </thead> <tbody> <tr><td>0</td><td>-----</td><td>-----</td></tr> <tr><td>1</td><td>-----</td><td>-----</td></tr> <tr><td>2</td><td>-----</td><td>-----</td></tr> <tr><td>3</td><td>-----</td><td>-----</td></tr> <tr><td>4</td><td>-----</td><td>-----</td></tr> <tr><td>5</td><td>-----</td><td>-----</td></tr> <tr><td>6</td><td>-----</td><td>-----</td></tr> </tbody> </table>				BIN	REF	REF%	0	-----	-----	1	-----	-----	2	-----	-----	3	-----	-----	4	-----	-----	5	-----	-----	6	-----	-----
BIN	REF	REF%																											
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3	-----	-----																											
4	-----	-----																											
5	-----	-----																											
6	-----	-----																											
Mode	PCT																												
Range	10mΩ																												
BIN	ON																												
ON/OFF		SET																											
F1		F2																											



Press up/down/left/right to choose the parameter

																													
MEAS	COMP	SET	PANEL	SYS	I/O																								
Beep	OFF	<table border="1"> <thead> <tr> <th>BIN</th> <th>Upper</th> <th>Lower</th> </tr> </thead> <tbody> <tr><td>0</td><td>-----</td><td>-----</td></tr> <tr><td>1</td><td>-----</td><td>-----</td></tr> <tr><td>2</td><td>-----</td><td>-----</td></tr> <tr><td>3</td><td>-----</td><td>-----</td></tr> <tr><td>4</td><td>-----</td><td>-----</td></tr> <tr><td>5</td><td>-----</td><td>-----</td></tr> <tr><td>6</td><td>-----</td><td>-----</td></tr> </tbody> </table>				BIN	Upper	Lower	0	-----	-----	1	-----	-----	2	-----	-----	3	-----	-----	4	-----	-----	5	-----	-----	6	-----	-----
BIN	Upper	Lower																											
0	-----	-----																											
1	-----	-----																											
2	-----	-----																											
3	-----	-----																											
4	-----	-----																											
5	-----	-----																											
6	-----	-----																											
Mode	ABS																												
Range	10mΩ																												
BIN	ON																												
		00.0000mΩ		00.0000mΩ																									
		3																											
		4																											
		5																											
		6																											



Press up/down/left/right to set the value

4.3.4 Sorting Function Standard Difference Value Setting

After selecting percentage mode and determining the range, users can set the corresponding standard value and deviation value. The standard value and deviation value unit are consistent with range.

MEAS		COMP	SET	PANEL	SYS	I/O
Beep	OFF		BIN	REF	REF%	
Mode	PCT		0	-----	-----	
Range	10mΩ		1	-----	-----	
BIN	ON		2	-----	-----	
			3	-----	-----	
			4	-----	-----	
			5	-----	-----	
			6	-----	-----	
ON/OFF		SET				
F1		F2				



Press up/down/left/right to choose the parameter

MEAS		COMP	SET	PANEL	SYS	I/O
Beep	OFF		BIN	REF	REF%	
Mode	PCT		0	-----	-----	
Range	10mΩ		00.0000mΩ	00.000%		
BIN	ON		3	-----	-----	
			4	-----	-----	
			5	-----	-----	
			6	-----	-----	

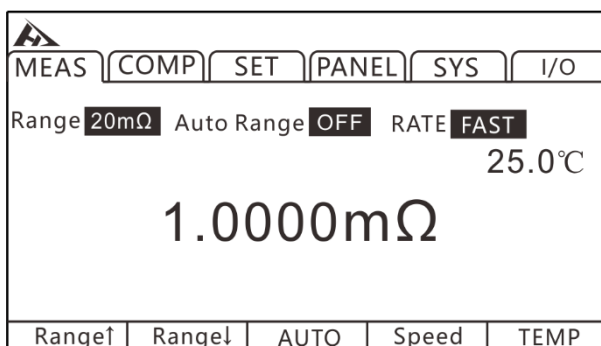


Press up/down/left/right to set the value

This chapter provides a step-by-step description of the functions used for proper measurement, including start-up settings, range scope, protection function start-up and zero adjustment.

5.1 Start Test

1. Set relevant parameters
2. Connect test leads correctly
3. Start measurement



Trigger Mode	Meaning
Internal trigger	Automatic trigger test inside the instrument
External trigger	Trigger test via external EXT IO terminal TRG signal

Note:

- Users cannot start another test again when the test has not ended.
- When the EOC signal at EXT I/O port is LOW, the test cannot be triggered.

5.2 Measuring Value Display

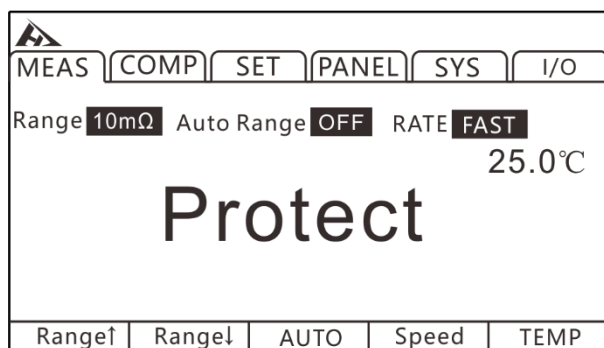
The following is test range. Once the following range is exceeded, OF is displayed (overrange)

Test current and range maximum display value:

Resistance range		Measurement current		Maximum display value	Resolution (Ω)
10mΩ		1 A		12.00000mΩ	10nΩ
100mΩ	High	1 A		120.0000mΩ	100nΩ
	Low	100 mA			
1000mΩ	High	100 mA		1200.000mΩ	1μΩ
	Low	10 mA			
10Ω	High	10 mA		12.00000Ω	10μΩ
	Low	1 mA			
100Ω	High	10 mA		120.0000Ω	100μΩ
	Low	1 mA			
1000Ω		1 mA		1200.000Ω	1mΩ
10kΩ		1 mA		12.00000kΩ	10mΩ
100kΩ		1 mA		120.0000kΩ	100mΩ
1000kΩ		100 μA		1200.000kΩ	1Ω
10MΩ		10 μA		12.00000MΩ	10Ω
100MΩ	ON	1 μA		120.0000MΩ	100Ω
	OFF	100 nA		120.00MΩ	10kΩ
1000MΩ	OFF	<1 μA		1200.0MΩ	100kΩ

5.3 Automatic Protection Function

If an overvoltage is input to measurement terminals, the internal circuit protection function of the instrument is activated. If users input an overvoltage incorrectly, immediately remove test leads from the object under test. Measurements cannot be made during protection function. To release protection function, touch or connect DRIVE+ and DRIVE- of the test leads or reconnect power.



5.4 Perform Clear Zero

Please perform clear zero in the following cases:

- When to improve test accuracy
 - When zero is not adjusted due to the range, addition accuracy is included.
- When residual display contents appear due to influence of electromotive force, etc.
 - Adjust display to zero.
- When it is difficult to perform 4-terminal wiring (Kelvin connection)
 - Cancel the remaining resistance of 2 terminal wiring.

note:

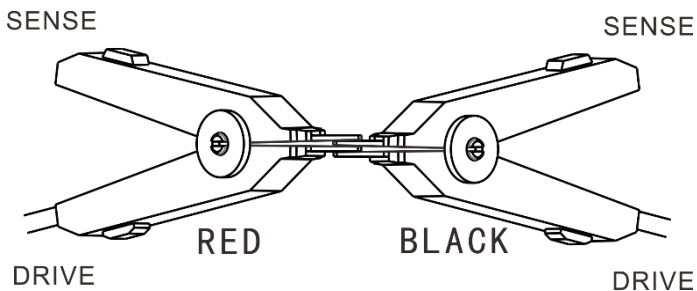
- After zero adjustment has been made, if ambient temperature changes or the test leads are changed, perform clear zero again.
- Perform clear zero for all ranges used. In manual range, clear zero is performed only in the current range; in automatic range, clear zero is performed on all ranges.
- When clear zero is performed in auto range, if delay time is insufficient, zero adjustment cannot be completed normally. In this case, please perform zero adjustment under manual range.
- The zero value is stored internally even when power is turned off, and is also saved to the panel. Sometimes it may not be possible to read the zero value from 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 zero adjustment again.
- Set the 0ADJ signal of EXT I/O to ON (short-circuit to ISO_COM terminal of EXT I/O connector), or perform zero adjustment.
- Although resistance of each range -1%f.s. to 50%f.s. can be canceled, please control it as much as possible within 1%f.s. In addition, when the range is 100 MΩ or higher, zero adjustment cannot be performed.

5.4.1 Perform Clear Zero

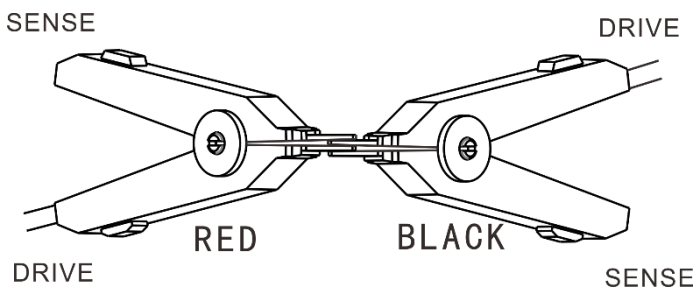
1. Short circuit test leads

Test clip type test leads

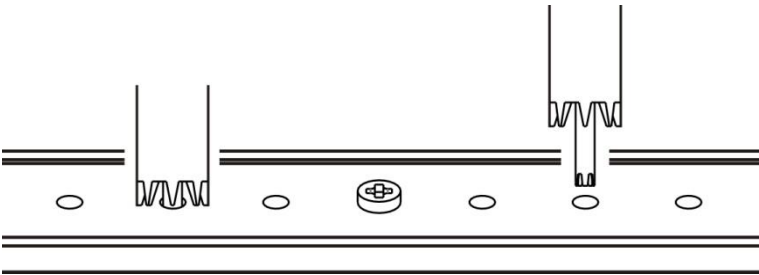
Correct:



Wrong:

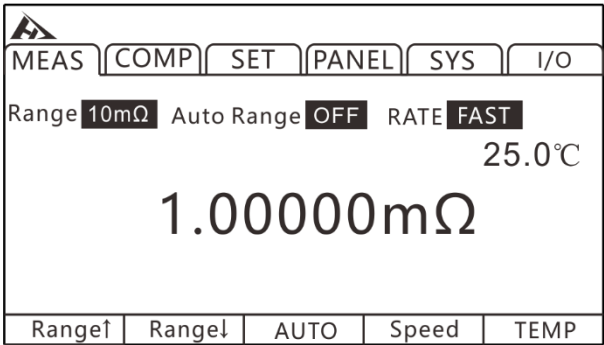


Probe type test leads

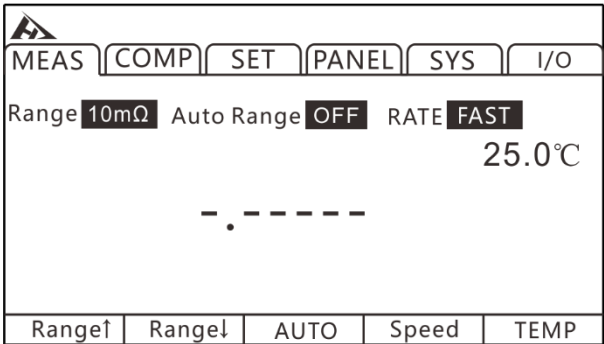


2. Confirm that measured value is within 1%f.s.
If measured value is not displayed, please confirm that the test leads are wired correctly.

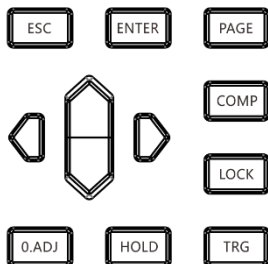
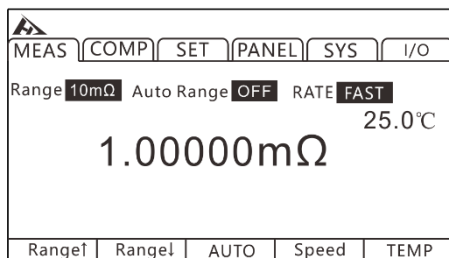
Screen when wiring is correct:



Screen when wiring is wrong:



3. Press [O.ADJ] to clear zero



4.

After performing clear zero

If clear zero is successful, the icon **[O.ADJ]** will be displayed in the lower right corner of the display measurement and then return to measurement interface. If zero adjustment failed, the icon **[O.ADJ]** will not be displayed, and measurement page is returned.

Zero adjustment failed

When zero adjustment is not possible, it may be that the measured value before zero adjustment exceeds $\pm 1\%$ of each range, or it is in a test abnormal state. Please make correct wiring again and re-zero. When resistance value of a self-made cable is high, since it cannot be zeroed, reduce the wiring resistance.

Note:

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

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

Chapter 6

Measurement Panel Save

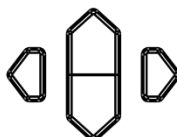
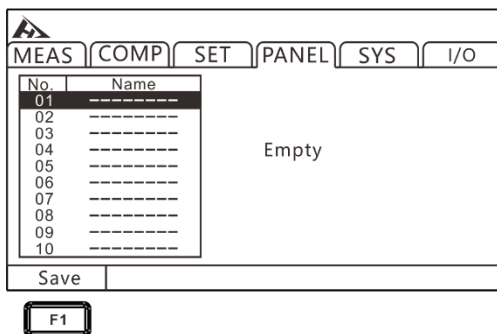
All measurement conditions can be saved, retrieved or deleted in the form of a file. Press [PAGE] to select the panel save page.



Press [PAGE] Button
to Panel page

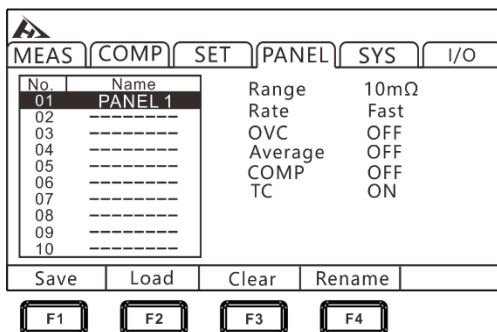
After entering this page, press up and down keys to view the saved record, users can also make performing of save, load, clear, and rename the current record.

6.1 Save Panel Setting



Press up/down/left/right
to choose the parameter

Use up and down keys to browse the current settings and press [F1] key to save the current settings.



Press up/down/left/right
to choose the parameter

6.2 Retrieve Measurement Settings

MEAS				COMP	SET	PANEL	SYS	I/O
No.	Name	Range	10mΩ					
01	PANEL		Fast					
02			OFF					
03			OFF					
04		Average	OFF					
05		COMP	OFF					
06		TC	ON					
07								
08								
09								
10								

press enter to load

1 press **F2** to choose load

2 press **ENTER** to confirm load

Use up and down keys to view through the current settings and press load button to retrieve the current settings.

6.3 Delete Measurement Settings

MEAS				COMP	SET	PANEL	SYS	I/O
No.	Name	Range	10mΩ					
01	PANEL		Fast					
02			OFF					
03			OFF					
04		Average	OFF					
05		COMP	OFF					
06		TC	ON					
07								
08								
09								
10								

press enter to clear

1 press **F2** to choose clear

2 press **ENTER** to confirm clear

Use up and down keys to browse the current settings and press clear key to delete the current settings.

6.4 Rename Measurement Settings

MEAS				COMP	SET	PANEL	SYS	I/O
No.	Name	Range	10mΩ					
01	PANEL		Fast					
02			OFF					
03			OFF					
04		Average	OFF					
05		COMP	OFF					
06		TC	ON					
07								
08								
09								
10								

Input name

PANEL_01



Press up/down/left/right to choose the parameter



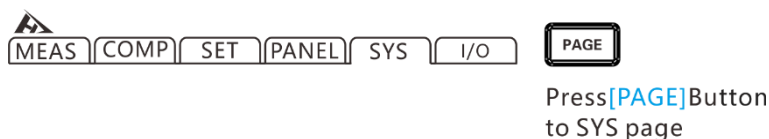
Use up and down keys to browse the current settings and press rename button to modify the current file name.

Chapter 7 System Settings

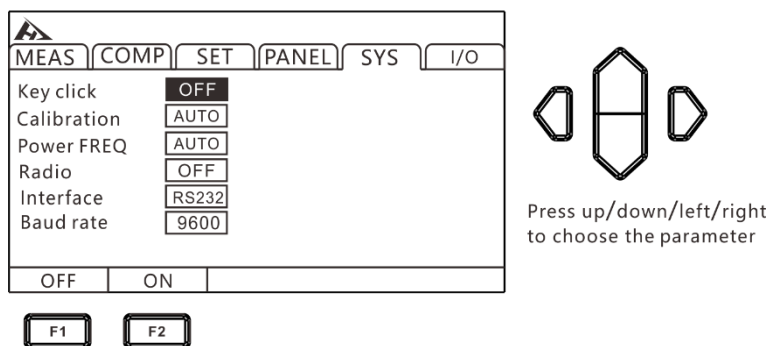
7.1 Button Sound Setting

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

1. Select parameter settings page



2. Select related menu items



Press [F1] to turn off button sound, press [F2] to turn on button sound.

7.2 Self-calibration Function

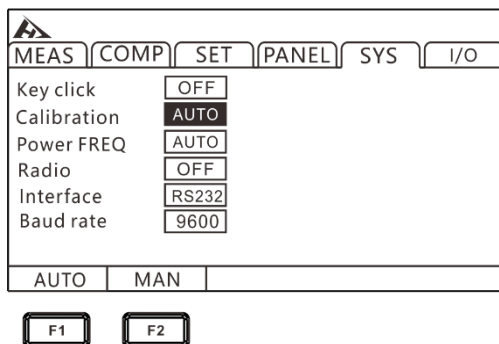
To maintain test accuracy, self-calibration function compensates for bias voltage and gain drift inside the circuit.

1. Select parameter settings page



Press **[PAGE]** Button
to SYS page

2. Select related menu items



Press up/down/left/right
to choose the parameter

Press [F1] to set to Auto. During TRG standby, self-calibration of 5ms is performed for every 1 second. During 5ms self-calibration, if TRG signal is received, self-calibration will stop, and the measurement will start after 0.5ms. When the measurement time is deviated, please set it to manual.

Press [F2] to set to manual. The calibration time is about 400ms. It is executed at any timing and cannot be automatically executed at timing except the scheduled one. When setting to manual, if temperature of the use environment is changed by 2 °C or higher, be sure to perform self-calibration (the accuracy cannot be guaranteed when it is not executed). When temperature change of the use environment is 2 °C or less, please perform self-calibration at intervals of 30 minutes or less.

7.3 Power Frequency Setting

There are 3 power modes, [50Hz] / [60Hz] / [Auto]. The correct power frequency setting can effectively filter out the noise caused by the power supply frequency. If the power frequency is set incorrectly, the measurement may be unstable.

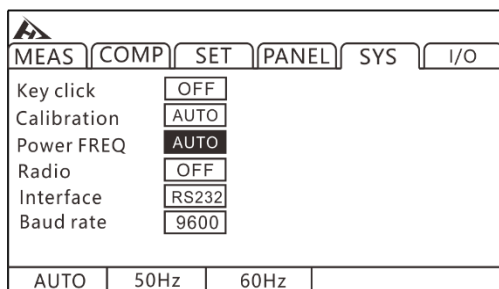
If users do not know the current power supply frequency, please select the [Auto] option. The [Auto] option will not take effect until it is rebooted.

1. Select parameter settings page



Press **[PAGE]** Button to SYS page

2. Select related menu items






Press up/down/left/right to choose the parameter

Note:

When power frequency is in [Auto] mode, sometimes there is power frequency automatic capture failure due to environmental noise, and lead to measurement unstable. In this case it is recommended to manually select the power frequency.

7.4 Radio Mode Setting

Press [F1] to turn it off, press [F2] to turn it on

					
MEAS	COMP	SET	PANEL	SYS	I/O
Key click	OFF				
Calibration	AUTO				
Power FREQ	AUTO				
Radio	OFF				
Interface	RS232				
Baud rate	9600				
OFF		ON			
					



Press up/down/left/right to choose the parameter

7.5 Communication Mode

Communication mode is divided into RS232 and LAN (Ethernet protocol uses TCP protocol), both modes adopt SCPI protocol format.

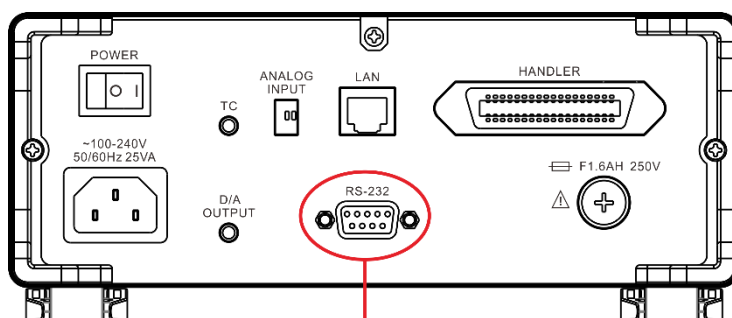


Do not connect communication port to the test port, because this behave will damage the instrument.

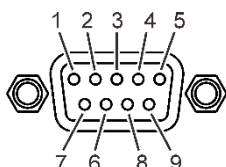
7.5.1 RS232 Communication Mode

RS232 communication uses 3-wire communication method.

Interface and Cable

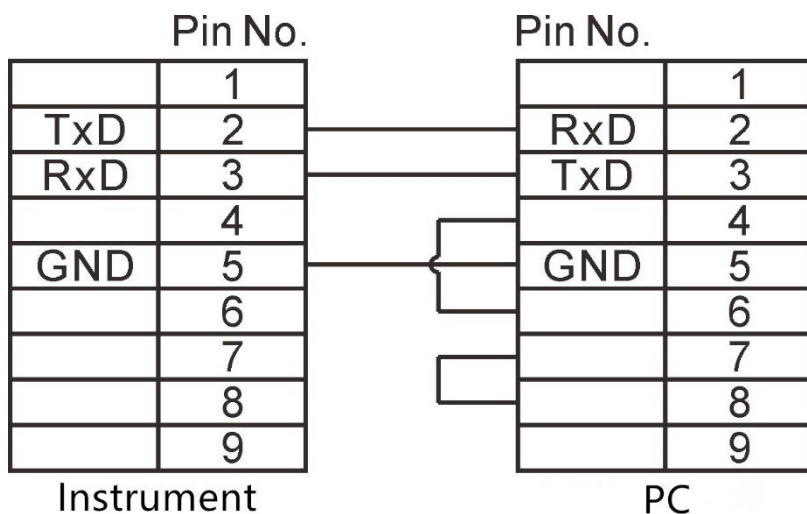


RS232/RS485 Interface



9-pin D-sub Female port

RS232 Connection Method



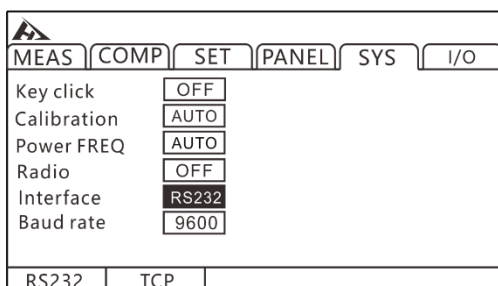
RS232 Communication Setup

1. Select communication setup page



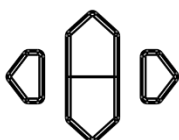
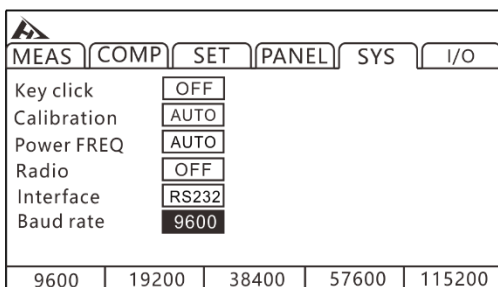
Press **[PAGE]** Button
to SYS page

2. Select related menu items



Press up/down/left/right
to choose the parameter

3. Select communication baud rate



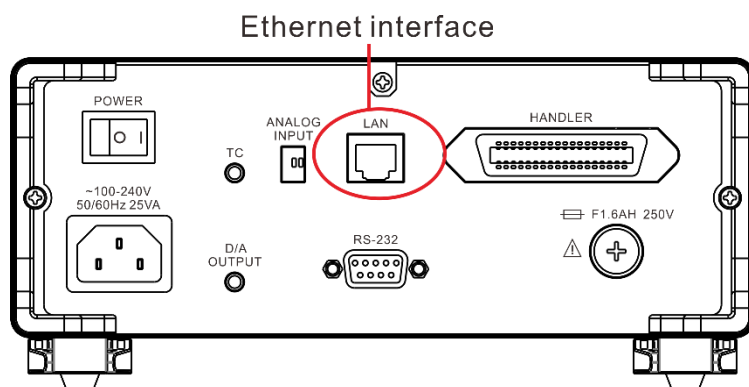
Press up/down/left/right
to choose the parameter

7.5.2 LAN Protocol

LAN communication uses TCP protocol for communication

Interface and Cable

Ethernet interface adopts the standard RJ45 port, the cable uses Category 5 Internet cable.



Connection Method

1. Instrument and computer connection

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

Termination A method uses the 568B standard, termination B method uses the 568A standard:

Orange white	Orange	Green white	Blue	Blue white	Green	Gray white	Gray
-----------------	--------	----------------	------	---------------	-------	---------------	------

2. Instrument and router connection

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

Both terminals use the 568B standard:

Orange	Orange	Green	Blue	Blue	Green	Gray	Gray
--------	--------	-------	------	------	-------	------	------

white		white		white		white	
-------	--	-------	--	-------	--	-------	--

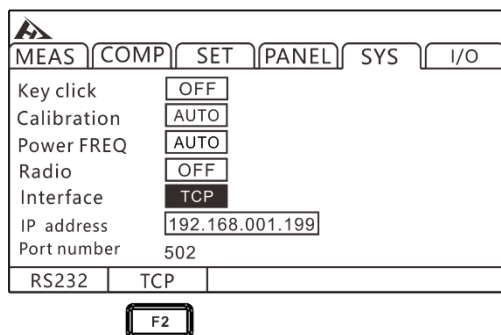
Setup

1. Select communication setup page



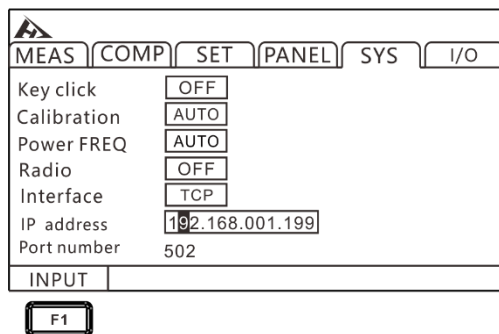
Press **[PAGE]** Button to SYS page

2. Select TCP communication mode



Press up/down/left/right to choose the parameter

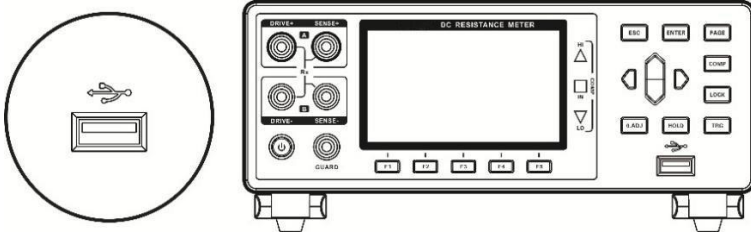
3. Set communication IP



Press up/down/left/right to set the value

7.6 USB Interface

There is an USB interface front panel of the instrument and is used as a HOST function. It is used to upgrade programs.

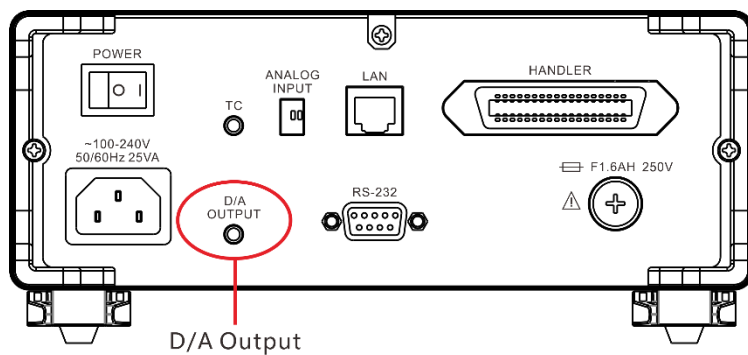


Chapter 8 D/A Output

This instrument can perform D/A output of resistance measurement value. By connecting D/A output to a recorder or the like, the change of resistance value can be simply recorded.

8.1 Connect D/A Output

Connect cable to the D/A OUTPUT terminal of the instrument.



8.2 D/A Output Specification

Output content	Resistance measurement value
Output voltage	<p>DC0 V (corresponding to 0dgt.) to 1.5 V</p> <ul style="list-style-type: none"> • When the measured value is abnormal, the output is 1.5 V; <p>When the measured value is negative, Output 0 V</p> <ul style="list-style-type: none"> • When 1,200,000dgt. is displayed, Corresponds to 1.2 V (1,200,000 dgt.) • When 120,000dgt. is displayed, Corresponds to 1.2 V (120,000dgt.) • When 12,000dgt. is displayed, Corresponds to 1.2 V (12,000 dgt.) • When the display exceeds 1.5 V, it is fixed at 1.5 V
Maximum output voltage	5V
Output impedance	1 k Ω
Number of digits	12 bit
Output accuracy	Resistance test accuracy $\pm 0.2\%$ f.s. (temperature coefficient $\pm 0.02\%$ f.s. / $^{\circ}\text{C}$)
Response time	<p>Measurement time + max 1 ms</p> <p>Minimum: 2.0 ms (allowable tolerance $\pm 10\% \pm 0.2$ ms)</p> <p>Minimum condition:</p>

Trigger source INT

LP: OFF, 1000 k Ω range or below

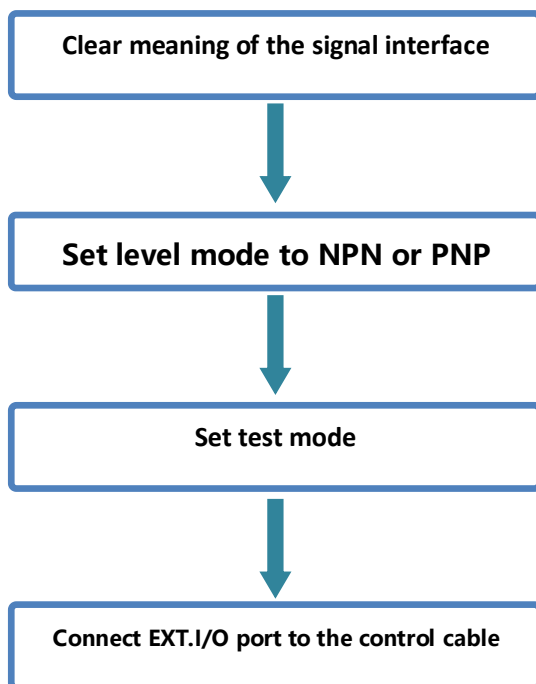
Measurement speed: fast, delay: 0 ms,

Self-calibration: manual

Note:

- The GND terminal of D/A output is connected to the ground (metal part of the case).
- The output impedance is 1 k Ω . Use an input impedance of 10 M Ω or higher to connect to instrument. (The output voltage is divided by output impedance and input impedance. 0.1% reduction at 1 M Ω).
- If connect a cable, it may pick up external noise. Use a bandwidth limiting filter on the connected instrument as needed.
- Update the output voltage by resistance measurement sampling timing.
- The recorded waveform is stepped. (because the response of the output circuit is very fast relative to update cycle)
- In auto range, the output voltage is 1/10 (or 10 times) even if the resistance is the same due to range switching. It is recommended to use it in the manual range.
- When the setting is changed (range switching, etc.) and the power is turned off, the output is set to 0 V. In addition, when the main power switch on the back side is turned ON, an unstable voltage is output at the maximum output voltage.
- To maximize response time of the D/A output, set the measurement speed to fast and set self-calibration to manual.

EXT I / O terminal on the rear panel of the instrument supports external control, provides output for test and comparison judgment signals, and accepts input TRG signal. All signals use an optocoupler. All input/output signals can be configured to (NPN) or (PNP) levels via the instrument panel settings. Understanding the internal circuit structure and paying attention to safety issues will help to better connect the control system.



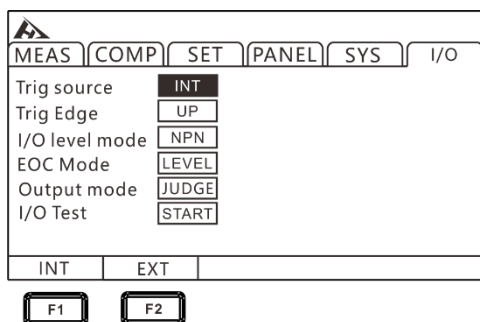
9.1 Trigger Source Settings

1. Select I/O page



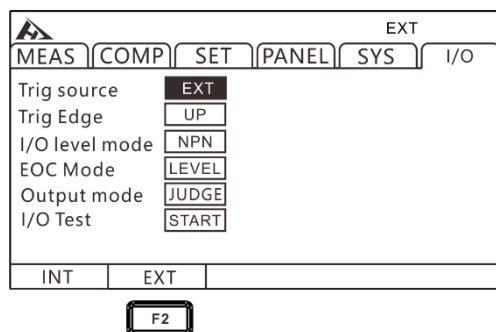
Press **[PAGE]** Button to I/O page

2. Select related menu items



Press up/down/left/right to choose the parameter

3. Press [F2] to select EXT



Press up/down/left/right to choose the parameter

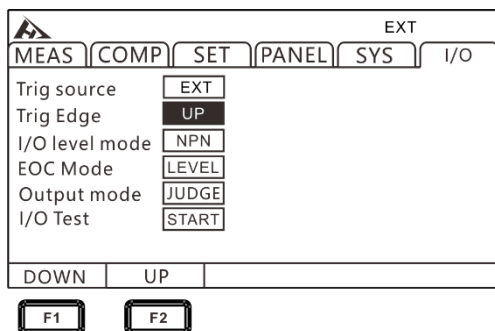
9.2 Trigger Level Setting

1. Select I/O page



Press **[PAGE]** Button
to I/O page

2. Select related menu items



Press up/down/left/right
to choose the parameter

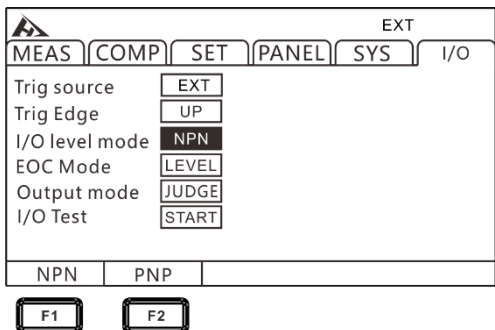
9.3 Level Mode Setting

1. Select I/O page



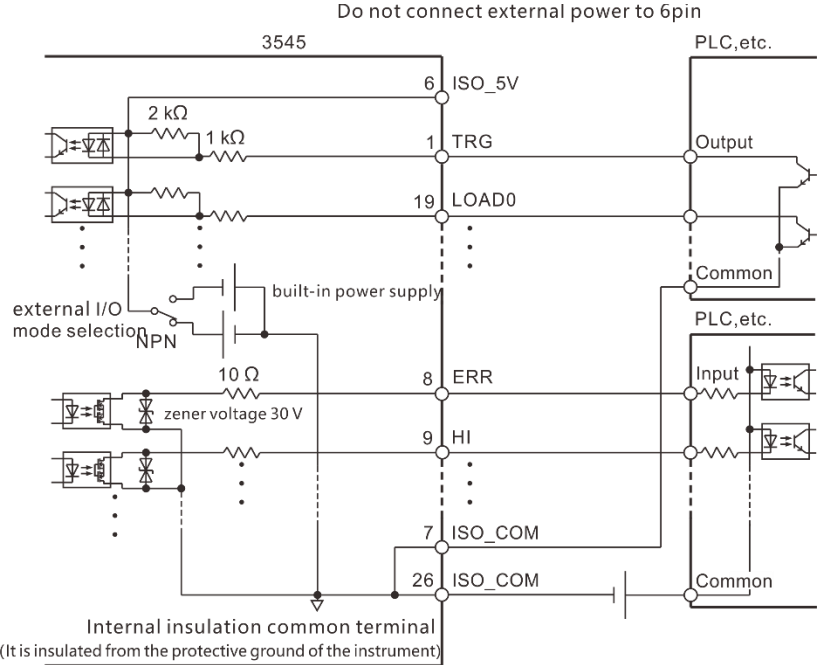
Press **[PAGE]** Button
to I/O page

2. Select level mode, press [F1] to set to NPN, and press [F2] to set to PNP.

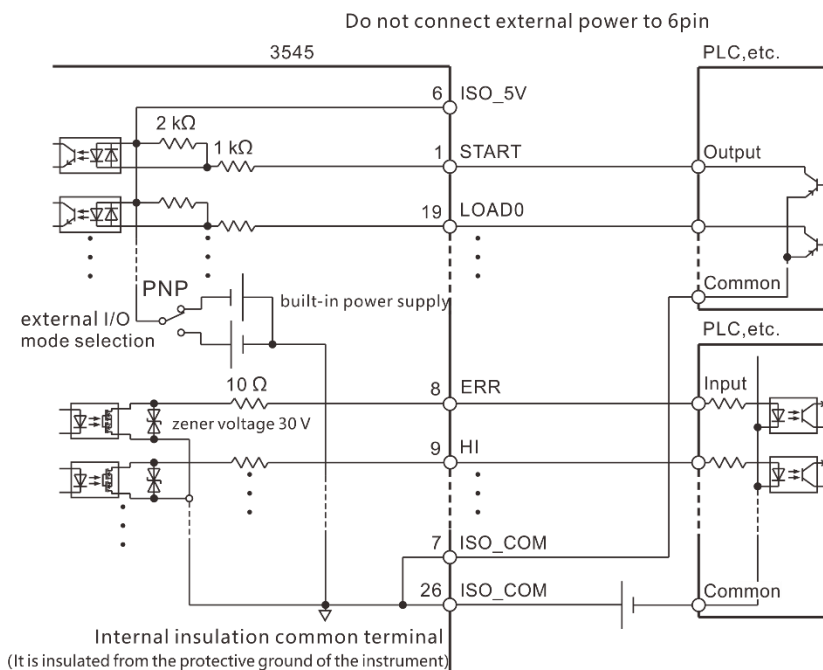


Press up/down/left/right
to choose the parameter

NPN Wiring Method



PNP Wiring Method



9.4 EOC Mode Setting

1. Select I/O page



Press **[PAGE]** Button
to I/O page

2. Select related menu items

EXT	
MEAS	I/O
Trig source	EXT
Trig Edge	UP
I/O level mode	NPN
EOC Mode	LEVEL
Output mode	JUDGE
I/O Test	START
LEVEL	PULSE

F1

F2

3. Press [F2] to select pulse

EXT	
MEAS	I/O
Trig source	EXT
Trig Edge	UP
I/O level mode	NPN
EOC Mode	PULSE 000ms
Output mode	JUDGE
I/O Test	START
LEVEL	PULSE

F2

4. Press [F1] to input time

EXT	
MEAS	I/O
Trig source	EXT
Trig Edge	UP
I/O level mode	NPN
EOC Mode	PULSE 000ms
Output mode	JUDGE
I/O Test	START
INPUT	

F1



Press up/down/left/right to choose the parameter



Press up/down/left/right to choose the parameter



Press up/down/left/right to choose the parameter

9.5 Output Mode Setting

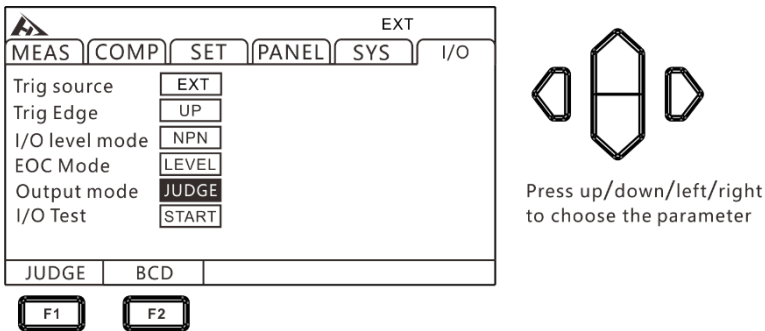
The output signal includes decision mode and BCD mode.

When using and not using a multiplexer, the output signals of decision mode are different. BCD mode uses other functions by high and low positions (with range information).

1. Select I/O page



2. Select related menu items



Terminal function under decision mode

Pin	Function
9	ISO_COM
10	ERR
11	HI
12	LO
13	BIN0
14	BIN2
15	BIN4
16	BIN6

17	BIN8
18	OUT0
19	OUT2
28	EOC
29	INDEX
30	IN
31	OB
32	BIN1
33	BIN3
34	BIN5
35	BIN7
36	BIN9
37	OUT1

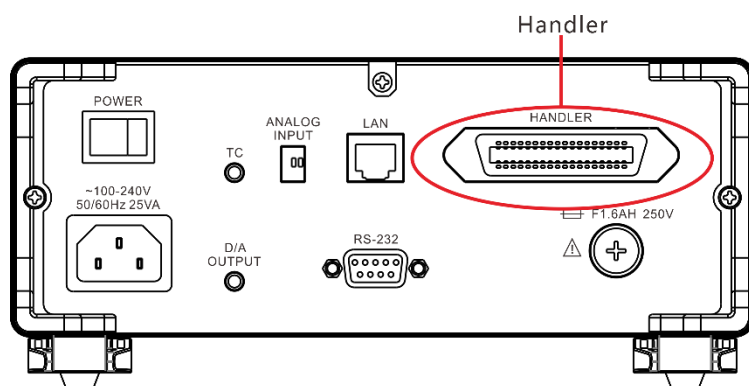
Terminal function under BCD mode

Pin	BCD_LOW	
	OFF	ON
9	ISO_COM	
10	ERR	
11	HILO	
12	BCD4-1	RNG_OUT1
13	BCD4-3	RNG_OUT3
14	BCD5-1	BCD1-1
15	BCD5-3	BCD1-3
16	BCD6-1	BCD2-1
17	BCD6-3	BCD2-3
18	BCD7-1	BCD3-1
19	BCD7-3	BCD3-3

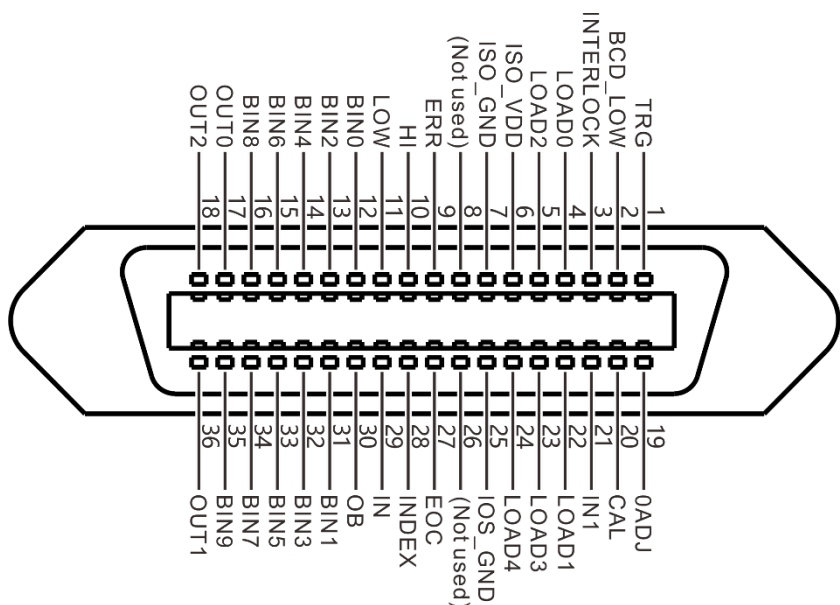
28	EOC	
29	BCD4-0	RNG_OUT0
30	IN	
31	BCD4-2	RNG_OUT2
32	BCD5-0	BCD1-0
33	BCD5-0	BCD1-2
34	BCD6-0	BCD2-0
35	BCD6-2	BCD2-2
36	BCD7-0	BCD3-0
37	BCD7-2	BCD3-2

9.6 Port Signal Details

9.6.1 Port and Signal Description



9.6.2 Port Diagram



(Instrument Terminal)

PIN	Signal	Function	I/O	Logical mode
1	TRG	External trigger	I	Edge
2	BCD_LOW	BCD low byte output	I	Level
3	INTERLOCK	Key lock	I	Level
4	LOAD0	Panel selection, channel assignment	I	Level
5	LOAD2	Panel selection, channel assignment	I	Level
6	ISO_VDD			
7	ISO_GND			
8	Not used	--	--	--
9	ERR	Abnormal test	O	Level
10	HI	Comparator decision	O	Level
11	LOW	Comparator decision	O	Level
12	BIN0	Sorting P0 bin	O	Level
13	BIN2	Sorting P2 bin	O	Level
14	BIN4	Sorting P4 bin	O	Level

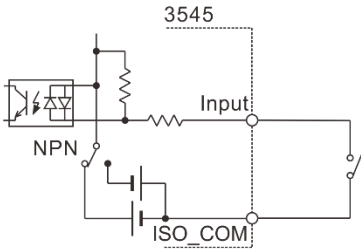
15	BIN6	Sorting P6 bin	O	Level
16	BIN8	Sorting P8 bin	O	Level
17	OUT0	General purpose output Panel selection, channel assignment Panel selection, channel assignment	O	Level
18	OUT2	General purpose output	O	Level
19	0ADJ	Zeroing	I	Edge
20	CAL	Perform self-calibration	I	Edge
21	IN1	Universal input	I	Edge
22	LOAD1	Panel selection, channel assignment	I	Level
23	LOAD3	Panel selection, channel assignment	I	Level
24	LOAD4	Panel selection, channel assignment	I	Level
25	IOS_GND			
26	Not used	--	--	--
27	EOC	End of measurement	O	Level
28	INDEX	End of analog measurement	O	Level
29	IN	Comparator decision	O	Level
30	OB	Sorting NG bin	O	Level
31	BIN1	Sorting P1 bin	O	Level
32	BIN3	Sorting P3 bin	O	Level
33	BIN5	Sorting P5 bin	O	Level
34	BIN7	Sorting P7 bin	O	Level
35	BIN9	Sorting P9 bin	O	Level
36	OUT1	General purpose output	O	Level

9.6.3 Port Signal Connection Method

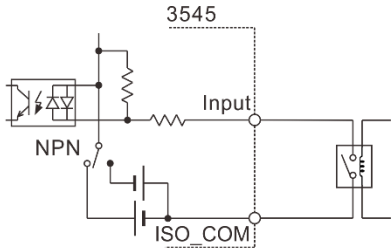
Electrical Performance Parameter

Input signal	Input format	Optocoupler insulation, no voltage contact input (corresponding to sink current / pull current output)
	Input ON	Residual voltage 1 V (input ON stream 4 mA (reference value))
Output signal	Input OFF	OPEN (cut current 100μA or less)
	Output form	Optocoupler insulated open-drain output (no polarity)
	Maximum load voltage	DC30 VMAX
	Maximum output current	50 mA/ch
	Residual voltage	1 V or lower (load current 50 mA) / 0.5 V or lower (load current 10 mA)
Built-in insulated power supply	Output voltage	Corresponding reverse output: 5.0 V \pm 10%, corresponding source output: -5.0 V \pm 10%
	Maximum output current	100 mA
	Insulation	Insulate from protective ground potential and measuring circuit
	Insulation rating value	Ground voltage DC50 V, AC33 Vrms, AC46.7 Vpk or less

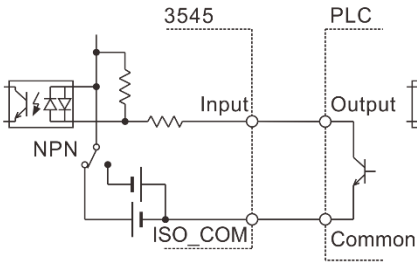
9.6.4 Input Circuit Connection



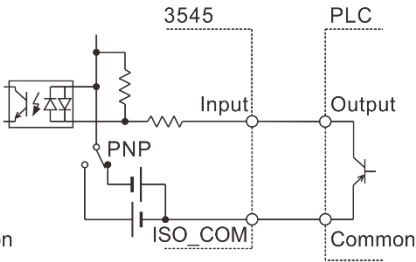
switched input



relay input

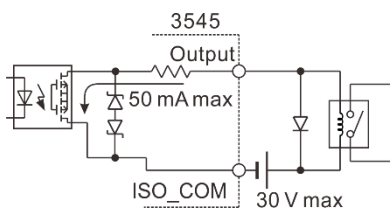


PLC's NPN output

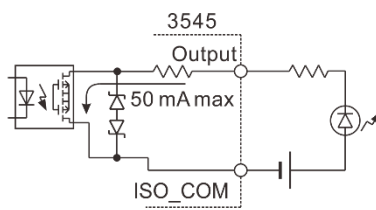


PLC's PNP output

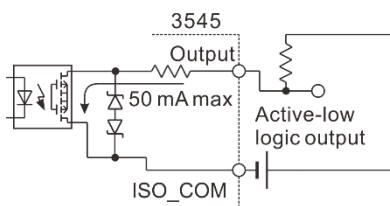
9.6.5 Output circuit connection



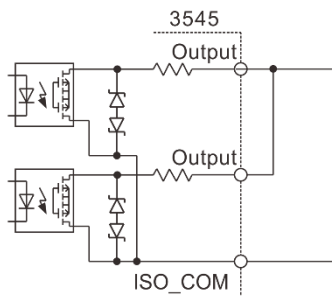
Drive relay



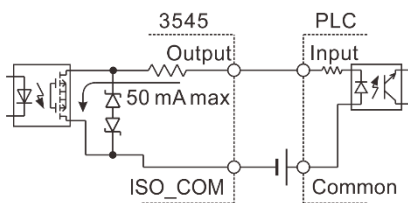
Drive LED lamp



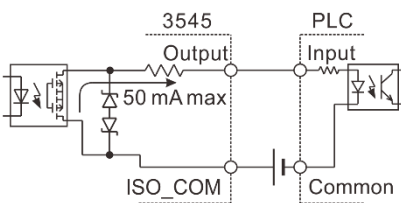
Logic level output



Level or operation



PLC's NPN input



PLC's PNP input

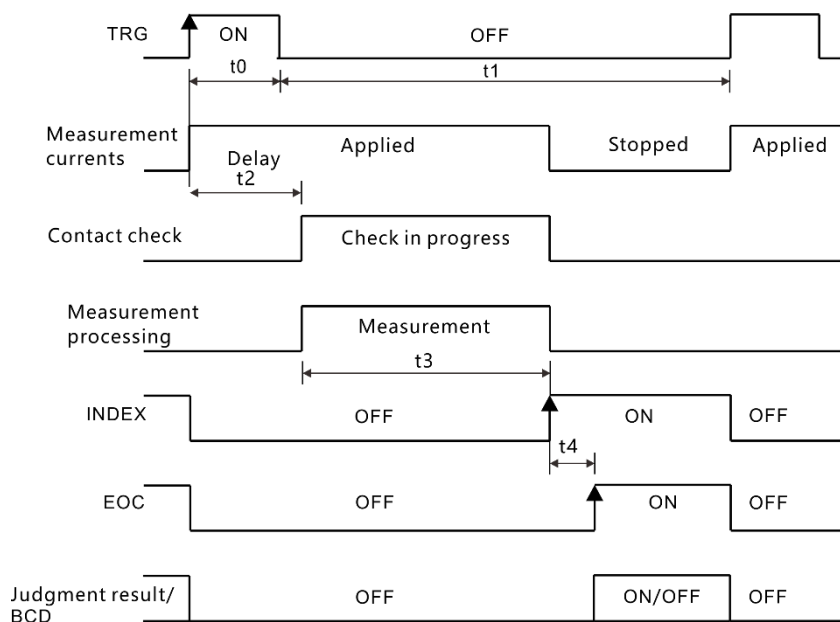
9.7 Timing Diagram

The level of each signal indicates ON/OFF state of the contact, and pull current (PNP) setting value is the same as the voltage level of EXT I/O terminal. The voltage level High in the sink current (NPN) setting is opposite to Low.

9.7.1 Timing Diagram for External Trigger

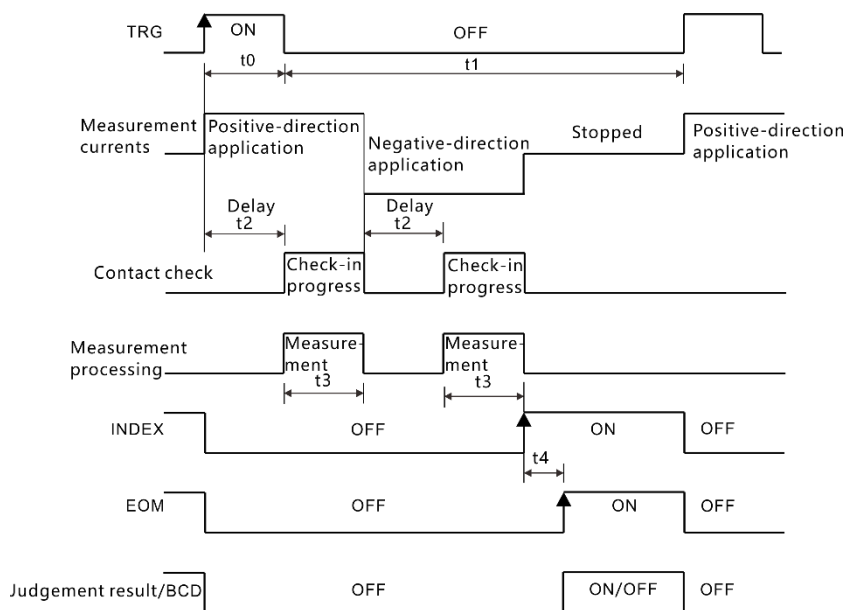
(1) External trigger [EXT] setting (EOC output HOLD)

When OVC is OFF



Judgement result /BCD : HI、IN、LO、ERR、BCDm-n、RNG_OUT0 ~ 3

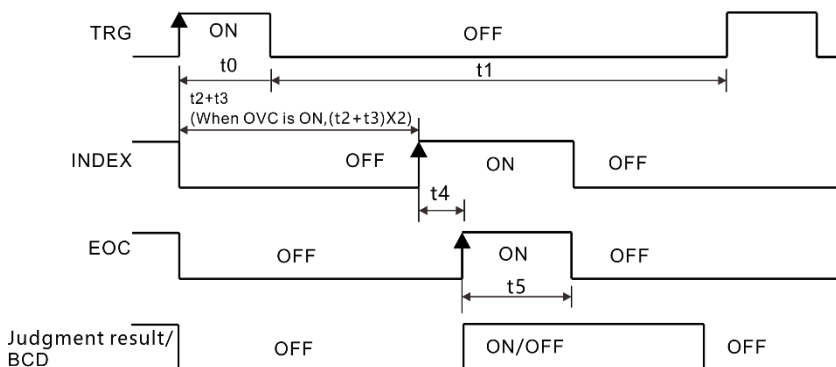
When OVC is ON



Judgement result /BCD : HI、IN、LO、ERR、BCDm-n、RNG_OUT0 ~ 3

(2) External trigger [EXT] setting (EOC output PULSE)

At the end of measurement, EOC signal turns ON, if it is set to EOC pulse width (t_5), it returns to OFF status.



Judgement result /BCD : HI、IN、LO、ERR、BCDm-n、RNG_OUT0 ~ 3

Timing diagram time description

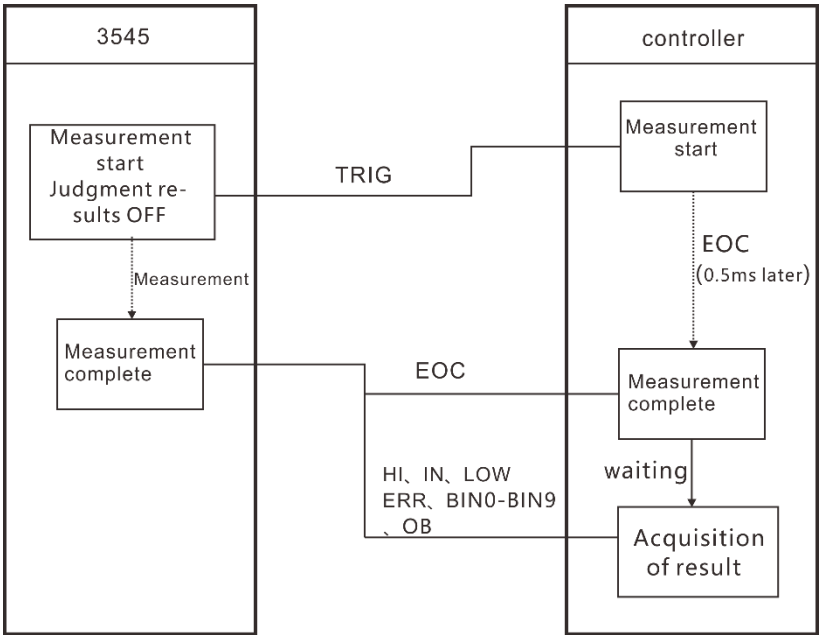
Item	Content	Time	Remark
t0	Trigger pulse ON time	>0.1 ms	Optional ON/OFF edge
t1	Trigger pulse OFF time	>1 ms	
t2	Delay	0 ~ 100 ms	According to the settings
t3	Read processing time	Integration time + internal waiting time	
t4	Operation time	0.3 ms	Delay when statistical operation and storage function are ON
t5	EOC pulse width	1 ~ 100 ms	According to the settings

9.7.2 Read Flow When External Trigger

The following shows the flow from start of measurement to

measurement value when using external trigger.

EOC signal is output immediately after the instrument determines judgment result (HI, IN, LOW, ER, GD, NG). When response of the controller input circuit is slow, it takes a wait time from detecting ON of EOC signal to reading the determination result.



9.8 Timing Diagram External Control Confirmation

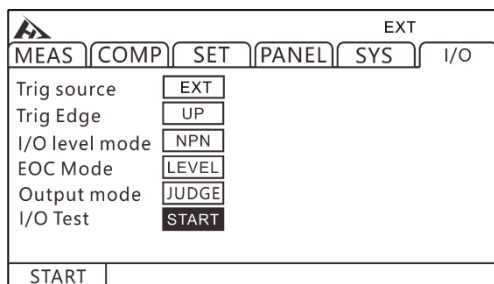
The level of each signal indicates ON/OFF status of the contact, and pull current (PNP) setting value is the same as the voltage level of EXT I/O terminal. The voltage level High in the sink current (NPN) setting is opposite to Low.

1. Select I/O page



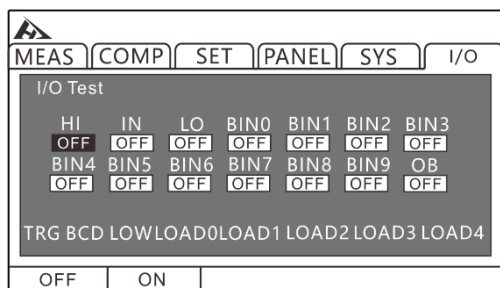
Press **[PAGE]** Button
to I/O page

2. Select I/O test



Press up/down/left/right
to choose the parameter

3. Select I/O test page



Press up/down/left/right
to choose the menu

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

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

4. Exit I/O test page

MEAS COMP SET PANEL SYS I/O

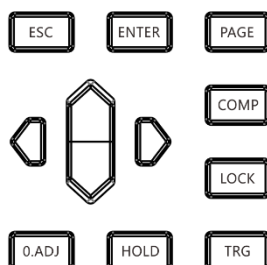
I/O Test

HI	IN	LO	BIN0	BIN1	BIN2	BIN3
OFF	OFF	OFF	OFF	OFF	OFF	OFF
BIN4	BIN5	BIN6	BIN7	BIN8	BIN9	OB
OFF	OFF	OFF	OFF	OFF	OFF	OFF

TRG BCD LOW LOAD0 LOAD1 LOAD2 LOAD3 LOAD4

OFF ON

F1 F2



Chapter 10 Parameter

10.1 General Parameters

Test parameters	DC resistance
Test Range	[LP OFF] Range 10mΩ ~ 1000 MΩ, 12-range switching [LP ON] Range 1000 mΩ ~ 1000 Ω, 4-range switching
Measuring Current	<DC 1A ~ 1μA, [LP ON] 1mA ~ 5μA
Test Speed	Fast speed (2.2ms); medium speed (50Hz: 21ms, 60Hz: 18ms); Slow speed 1 (102ms); slow speed 2 (202ms)

OVC	Thermoelectric culling function
Input Terminal	Banana plug
Operation Key	Rubber key
Display	3.5-inch TFT LCD display
Basic Accuracy	$\pm 0.01\% \text{rdg.} \pm 0.001\% \text{f.s.}$
Precision Guarantee Humidity Range	$< 23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, 80RH
Precision Guarantee Period	1 year
Power Supply	AC 100 ~ 240 V, 50/60 Hz, rated power: 40 VA
Size and Weight	325mm(length) x 215mm (width) x 96 mm (height) 4Kg

10.2 Accuracy

Range	100 MΩ range high precision mode	Maximum measurement range	Test accuracy (%rdg.+%f.s.)			
			Fast	Medium	Slow 1	Slow 2
10 mΩ	—	12.00000mΩ	0.060+0.050 (0.060+0.015)	0.060+0.020 (0.060+0.002)		0.060+0.020 (0.060+0.001)
100mΩ		120.0000mΩ	0.060+0.0100 (0.060+0.003)	0.060+0.010 (0.060+0.001)		0.060+0.010 (0.060+0.001)
			0.014+0.050 (0.014+0.015)	0.014+0.020 (0.014+0.002)		0.014+0.020 (0.014+0.001)
1000mΩ		1200.000mΩ	0.012+0.010 (0.012+0.003)	0.012+0.008 (0.012+0.001)		
			0.008+0.050 (0.008+0.015)	0.008+0.020 (0.008+0.002)		
10 Ω		12.00000 Ω	0.008+0.010 (0.008+0.003)	0.008+0.008 (0.008+0.001)		
			0.008+0.050 (0.008+0.015)	0.008+0.020 (0.008+0.002)		
100 Ω		120.0000 Ω	0.007+0.005 (0.007+0.005)	0.007+0.002 (0.007+0.001)	0.007+0.001 (0.007+0.001)	
			0.008+0.010 (0.008+0.003)	0.008+0.010 (0.008+0.001)		
1000 Ω		1200.000 Ω	0.007+0.005 (0.007+0.005)	0.006+0.002 (0.006+0.001)	0.006+0.001 (0.006+0.001)	
10 kΩ		12.000 00kΩ	0.008+0.005	0.007+0.002	0.007+0.001	
100 kΩ		120.0000kΩ	0.008+0.005	0.007+0.002	0.007+0.001	
1000kΩ	1200.000 kΩ	0.015+0.005	0.008+0.002	0.008+0.001		
10 MΩ	12.000 00MΩ	0.030+0.005	0.030+0.002	0.030+0.001		
100MΩ	ON	120.0000MΩ	0.200+0.005	0.200+0.002	0.200+0.001	
	OFF	120.00MΩ	<10.00 MΩ : 0.50 + 0.02 >10.01 MΩ : 1.00 + 0.02			
1000MΩ	OFF	1200.0 MΩ	<100.0 MΩ : 1.00 + 0.02 >100.1 MΩ : 10.00 + 0.02			

LP: OFF

Range	Maximum measurement range	Test accuracy (%rdg.+%f.s)			
		Fast	Medium	Slow 1	Slow 2
1000 mΩ	1200.00 mΩ	0.200+0.100	0.200+0.010	0.200+0.005	0.200+0.003
10 Ω	12.0000 Ω	0.200+0.050	0.200+0.005	0.200+0.003	0.200+0.002
100 Ω	120.000 Ω	0.200+0.050	0.200+0.005	0.200+0.003	0.200+0.002
1000 Ω	1200.00 Ω	0.200+0.050	0.200+0.005	0.200+0.003	0.200+0.002

SPECIFICATIONS	
Model	CKT3545 DC Resistance Meter
Parameters	DC resistance
Measurement Range	0.01μΩ ~ 1200MΩ
Min Resolution	0.01μΩ
Signal Source	DC: under 1A ~ 1μA, [LP ON]: 1mA ~ 5μA
Basic Accuracy	±0.01%rdg,±0.001%f.s. (accuracy varies based on different ranges, please refer to manual for detailed accuracy description)
Range	10mΩ/ 100mΩ/ 1000mΩ/ 10Ω/ 100Ω/ 1000Ω/ 10kΩ/100kΩ/ 1000kΩ/ 10MΩ/ 100MΩ/ 1000MΩ
Open Circuit	DC 20V (Range 10 kΩ ~), Maximum DC 5.5 V(Range ~ 1000Ω), [LP ON]: ≤20mV
Speed	Fast (2.2ms); Medium (50Hz: 21ms, 60Hz: 18ms); Slow 1(102ms); Slow 2(202ms)
Temperature Compensation	Range: -10℃~99.9℃ Accuracy: ±0.50℃
Display Max	32,00000
Adjustment	Short-circuit clear zero for all ranges
Comparator	10 bins sorting, output HIGH/IN/LOW sorting signal
Trigger	Internal trigger, External trigger, Manual trigger, BUS trigger
Interface	External IO interface, analog output interface, LAN interface, RS232 interface
Others	Temperature compensation function, temperature conversion, cut-off voltage compensation, compensation (ABS/REF%), Keypad lock (OFF/menu locked/all locked), supply frequency setup (AUTO/50Hz/60Hz), judge sound setup, auto hold, average value, front panel save/read, D/A output
GENERAL FEATURES	
Power supply	AC 100 ~ 250 V, 50~60 Hz, rated power: 40 VA
Size	325mm (L)x 215mm (W)x96.5mm (D); Weight: 3.5kg
ORDER ING INFORMATION	
Accessories	Kelvin Test leads; Temperature compensation probe; RS232 communication cable; AC power cord