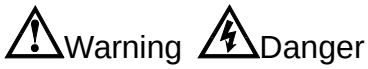
CHT3540B Ultra Low-ohm DC Battery Internal Resistance Meter

User Manual

Jun, 2013

Rev1.0.0

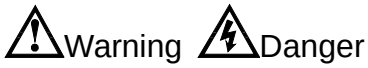
Safety Tips



When the following abnormal situations occur, do stop operating and turn off the power immediately, otherwise, fire and electric shock would be caused. Call your dealer or Hope Electronics representative for help.

- Improper device operation
- Abnormal noise, odors, smoke or flash occurred in operation
- The device produces a high temperature or electric shocks during the operation
- Damage of power cord, power switch or power socket
- Impurities or liquid enter the device

Safety Information



Mishandling during using could result in injury or death, as well as damage to the product. Be certain that you understood the instructions and precautions in the manual before use.

Disclaimer	Before using the product, be sure to carefully read the following safety notes. If users do not observe the following instructions, Hope Electronic Science and Technology will not blame for any of users' loss.
Instrument grounding.	In order to avoid electric shock, please ground the instrument.
Avoid using instrument in the environment with explosive gas	Avoid using the instrument in the environment with explosive gas, vapor or dust environment. Using any electronic instrument in such environment is dangerous.
Do not open the instrument cover	Only authorized service personnel should remove the cover and have internal access to the instrument for repairing. The instrument still has residual charge, which may cause electric shock, after its shut down in a period of time.

Do not use damaged the instrument	If the instrument has been damaged, the risk will be unpredictable. Please disconnect the power cord and no longer use the instrument. Do not attempt to maintenance the device by yourself.
Do not use unusual instrument work	If the instrument is not working properly, the risk will be unpredictable. Please disconnect the power cord and no longer use the instrument, Do not attempt to maintenance the device by yourself.
Do not exceed the designated use of instrument in manual	Beyond the scope, the protection of instrument provided will be ineffective.

Statement

Table of Content

Limited Security and Responsibility Scope

Hope Electronics Science and Technology Co., Ltd ensure that each HK3563 you purchased is fully qualified in terms of quality and measurement. This guarantee does not include fuses.

Hope Electronics commits that the instrument has no defects in materials and process, such as product quality problems under warranty. If the product is proved to be defective, Hope Electronics will repair or replace it free of charge.

Since the date of delivery, Hope Electronics commits that the product has two years guarantee, while other accessories have one year. Under warranty, any failure of hardware or software of the product will be due to the quality of the product itself. Users provide the product warranty and maintenance card to get free maintenance which provides from the maintenance department or its authorized maintenance agent of Hope Electronics. Any maintenance beyond the warranty period should be at user's own expense.

For free maintenance product, Hope Electronics commits that it would be repaired and returned to customer within five working days on receipt of the equipment unless otherwise specified. Hope Electronics affords the cost of the return transportation.

Any of the following circumstances occurred; Hope Electronics will not repair for free.

1) Accidental damage caused by transportation
2) Improper installation or instrument failure or damage is caused by non-use work environment
3) Artificial damage to the appearance of the products (such as surface scratches, deformation, etc.)
4) Unauthorized repair, alteration, replacement of instrument and product has been tearing up the warranty seal
5) The fault or damage is caused by irresistible factors (such as lightning strikes)
6) Directly or indirectly damage is caused by improper operation of the user

If mismeasurement or immeasurable is caused by the improper operation of the user, but not the problem of the instrument itself, the cost of transit should be paid by user.

Installation and Setup Wizard

Chapter 1	Thank you for purchasing our products. Please read this manual before use, and keep it handy for future reference. In this chapter you will learn the following: ▪ Primary function packing list ▪ Power Requirements

	❙ Fuse replacement ❙ Operating Environment ❙ Cleaning

1.1 Packing List

Before initial use of the product, please carefully check it to ensure that there are no damages occurred during shipping. If there are any damages, call your dealer or Hope Electronics representative.

Table1-1 Instrument accessories

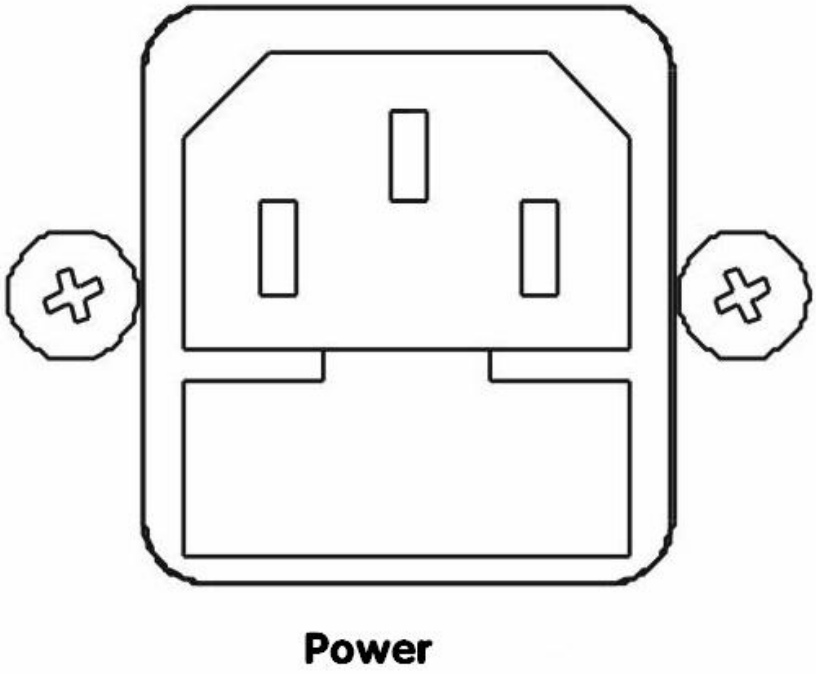
NAME	AMOUNT	REMARK
Instruction manual	1	
Three-core power cord	1	
Fuse		0.25A slow-blow
Kelvin clip	1	CHT9340A
Temperature probe	1	CHT9702
Handler interface	1	
Test Report	1	
Product Certificate	1	
Warranty Certificate	1	

1.2 Power Requirement

Only be used in the following power conditions:
Voltage: 100-240 V AC
Frequency: 50 Hz/60Hz
Power: 60VA (max)

	**Danger**: In order to avoid electric shock, please connect the power ground carefully. If you have replaced the power cord, make sure that the power cord grounded.

1.3 Replace the Fuse



Picture1-1 Fuse Location in the Rear Panel

⚠	Warning: Please use 250V, 0.5A slow-blow fuse.

1.4 Operating Environment

CHT3540B must be used under the following conditions:
Temperature: 0°C~55°C,
Humidity: less than 95%RH at 40 °C

1.5 Clearing

In order to prevent risk of electric shock, please unplug the power cord before washing. Please use a clean cloth moistened with water to wipe the device gently.

Do not clean the equipment internal.

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

Overview

Chapter 2	In this chapter, you will learn the following: l Introduction l Model Description l Main Specifications l Main function

2.1 Introduction

Thank you for purchasing CHT3540B!

Incorporating high-performance chip, the CHT3540B delivers wide measurement range of 3mΩ~300 mΩ, used in 0.01μΩ~300Ω resistance, with maximum reading 300000 counts. At 2 times/sec, CHT3540B offers accuracy of 0.05% and reading floating can be controlled less than 5 counts.

Professional 3-bin sorting, diverse sorting beeper configuration and standard Handler interface enable the CHT3540B can be used in automatic sorting system to complete the automated assembly line testing.

CHT3540B has wide application in a variety of high, medium and low value resistors, switch contact resistance, socket contact resistance, relay contact resistance, lead resistance, riveted metal resistance for cars, ships, planes, PCB line resistance and so on.

2.2 Main Specifications

CHT3540B technical specifications include the basic technical indicators and equipment allowable scope of measurement. These specifications have been achieved before delivery.

Reference:	The whole technical specifications in Appendix A refer to page 20.

Resistance measurement

- Basic resistance accuracy: 0.3%
- Maximum displayed number: 300000
- Six automatically or manually measurement ranges
- Providing range from 0.01μΩ to 300Ω
- Precision test
- At 2 times/sec, the meter accuracy keeps the accuracy of 0.05% and maximum readings 30000 counts.
- 3 displays

Direct reading/ the compensation temperature/ the resistance after the temperature compensated

- Temperature test
  Temperature test can be carried out by an external resistor Pt.
- Temperature compensation
  No matter how much room temperature is, this function helps to compensate for the resistance value at your specified temperature

2.4 Main Functions

- **Display**
  LCD display
  480x272 resolution display, 24- color,4.3”
- **Thermoelectric power compensation**
  Current pulse test mode to compensate for thermoelectric power, minimize thermoelectric potential impact
- **Keyboard lock function**
- **Optional interfaces**:

Handler interface: Output the compare results, input comparison gear, input the trigger signal and output EOC signal

IEEE-488 interface: SCPI-compatible, bus data and commands using the ASCII code transmission, complete all instrument functions. Compatible with IEEE-488.1 and IEEE-488.2

RS232C interface*:* using three-wire simple serial interface, compatible with SCPI protocol. Using ASCII code transmission to complete all functions of the instrument.

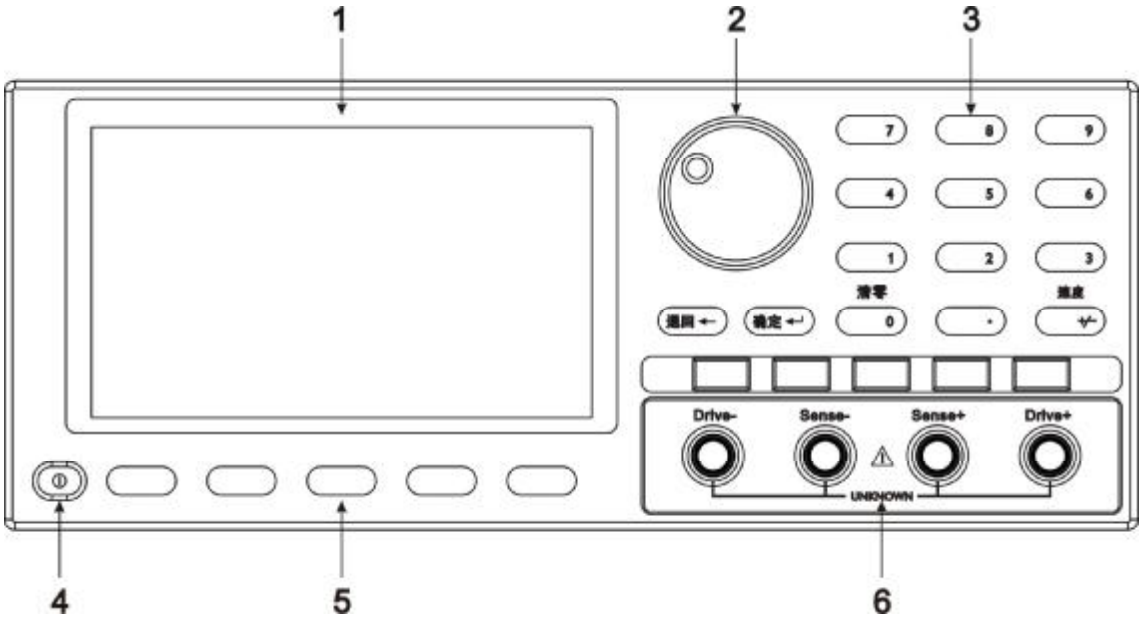
Starting

Chapter 3	In this chapter, you will learn the following: - Front panel introduction: keys,VFD and measurement terminals - Back panel introduction: power source and interface - Instrument handle: teach you how to use the handle - Power to start: including the power on and self-check process, equipment default and warm-up time - Display information: the message encountered on the process of starting and using equipment - Preparation before measurement: how to connect to the measurement terminal,

	equipment feature set

3.1 Front Panel

3.1.1 Front Panel Description



Picture 3-1 the front panel

1: Display window

Screen: TFT, 480x272 screen resolution, 24- color,4.3”

2: Encoder knob

Used to select the function or input values

3: Keypad 2

A group of multi-function keys including the main function keys, the second function keys and numeric keys

Reference:	Details please refer to Section 3.1.2 "key area”.

4: Power switch

Press: Open; Pop: Off

⚠	Warning: Do not fast and continuously turn on/off the instrument, the instantaneous impact current may shorten the equipment life or even damage the equipment.

5: Keypad 1

A set of main function keys

Reference:	Details please refer to Section "key areas"

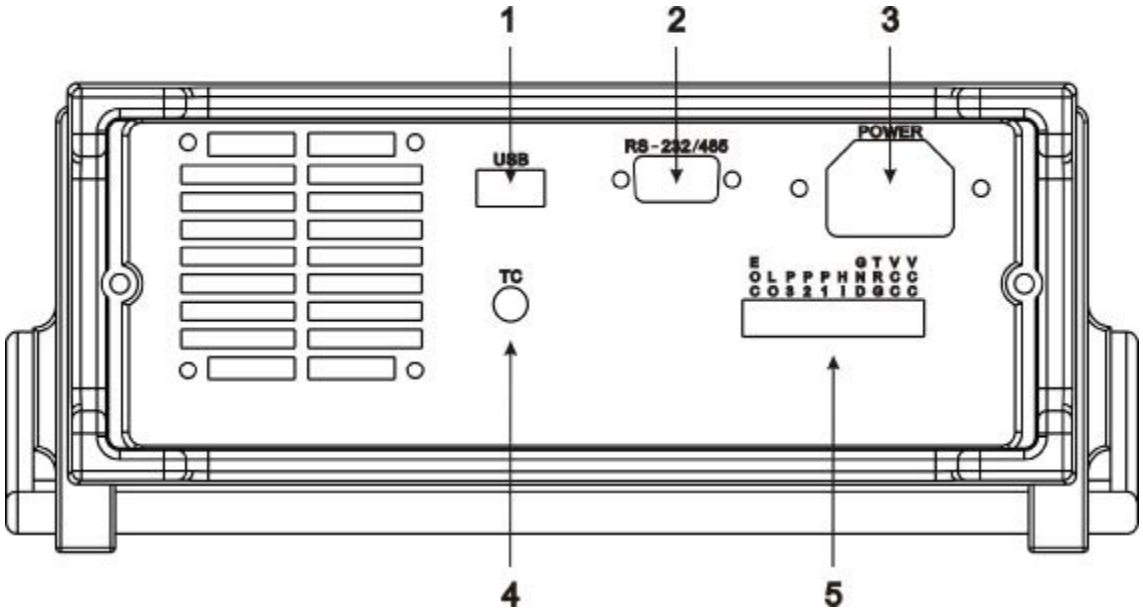
6: Input

Input is used for connecting the four-terminal Kelvin clip.

Drive+ current output high side
Sense+ voltage sampling high side
Sense- voltage sampling low side
Drive- current output low side

⚠	Warning: Do not add too high DC voltage or current to the measurement sides, otherwise it will damage the instrument. Before testing the capacitor, make sure the capacitor has been discharged completely.
Reference:	Details please refer to the “Connection of Test Sides " section 4.2.1.

3.2 Back Panel



Picture 3-2 Keypad

1 —— U disk socket

Export data in the instrument

⚠	Note: Please use the U disk equipped with instrument, 2GB in size.

2 —— RS232/RS485 interface

3 —— Socket

Voltage: AC 100V~ 240V

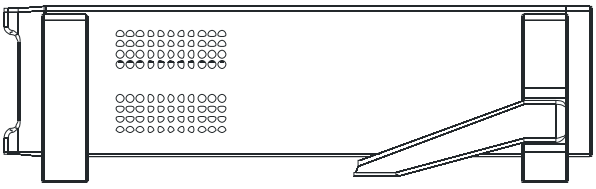
Frequency: 50Hz/60Hz

4 ——Temperature probe connector

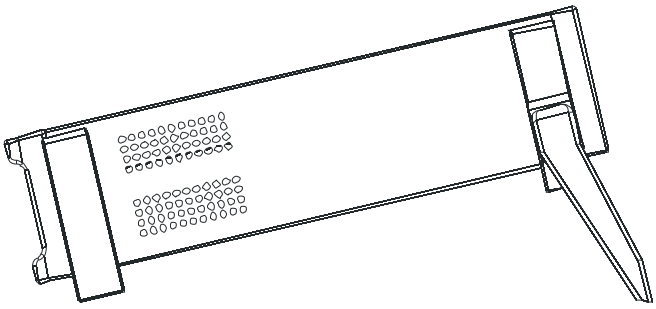
5 ——Sense

3.3 Bench Operation

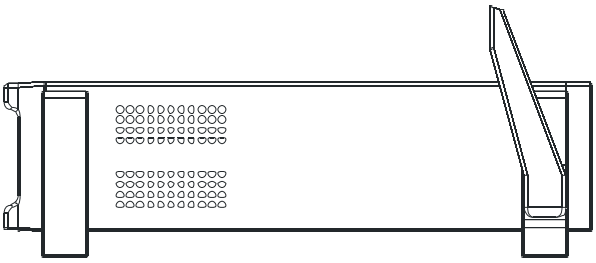
The CHT3540B is provided with a carrying handle. The following pictures show various ways to the use of the handle. The handle may be removed if desired.



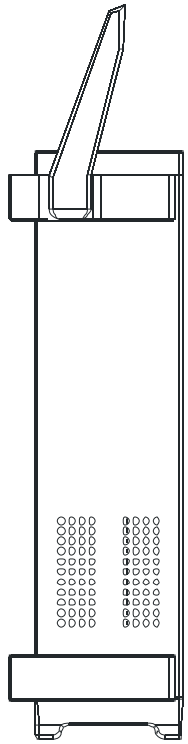
Visual position 1



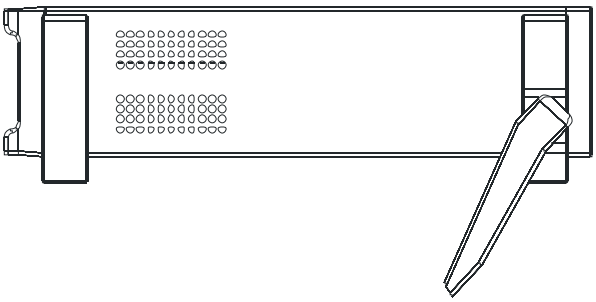
Visual position 2



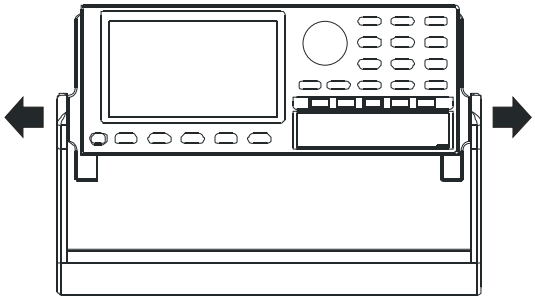
Visual position 3



Mobile location



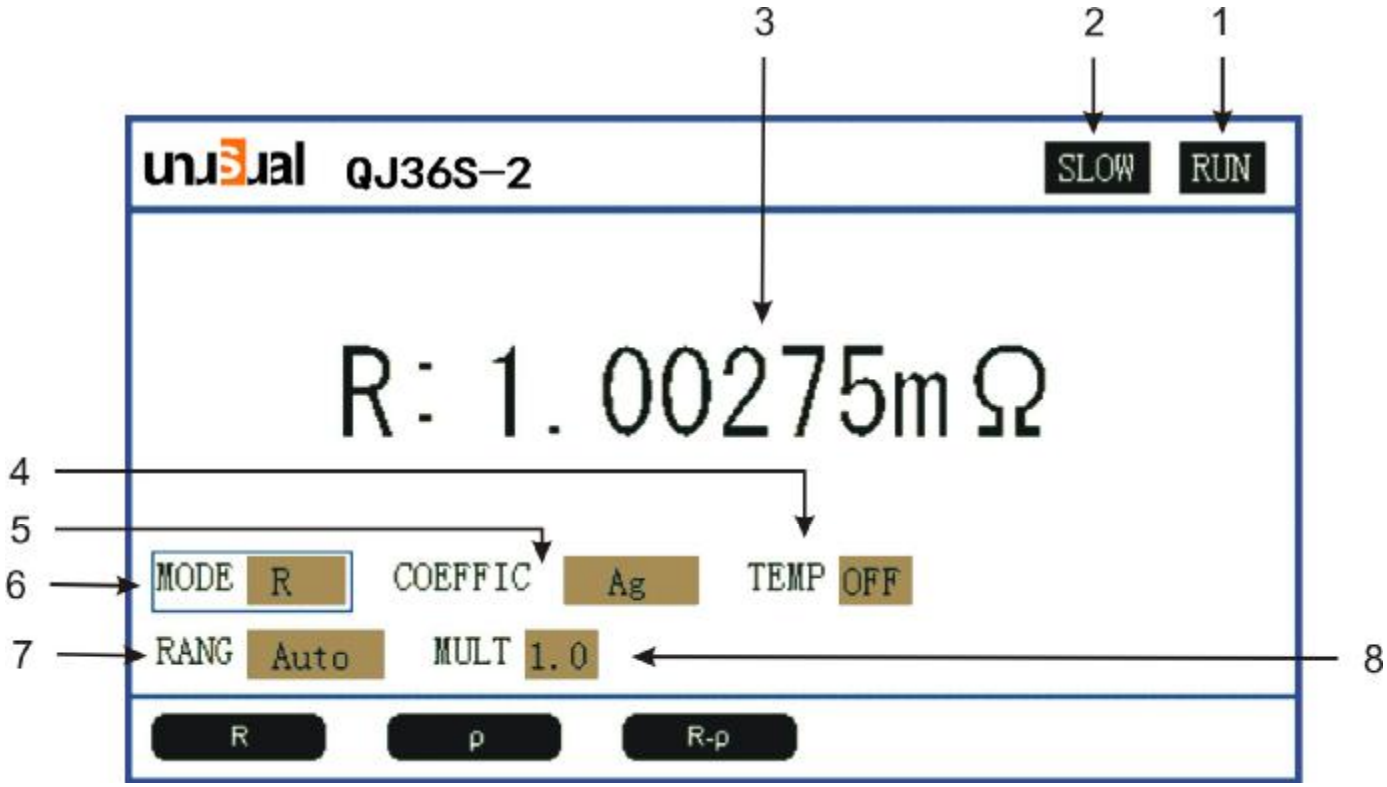
Remove location side view



Remove location front view

3.4 Display

You will enter the test page after booting the instrument. The test page has setting parameters, test status and test result, as shown below:



Picture 3-3 Test Page

1 ——test status

This button flashes during test, the flashing speed reflects the real test speed.

2 ——test speed

There are two kinds of test speed: slow/fast.

3 ——test resistance value

4 ——Temperature compensation switch

OFF*:* Off temperature compensation function

ON: On temperature compensation function

5 ——temperature coefficient

When the temperature compensation function is turned on, the temperature coefficient will be calculated into the formula.

6 ——test parameters

In test result area, Resistance (R) and Resistivity (ρ) will be displayed.

7 ——measurement range

8 ——current ratio

Operation

4.1 Powering ON/OFF

The key"⏻" on the bottom left side of the panel is the power switch.


Powering on

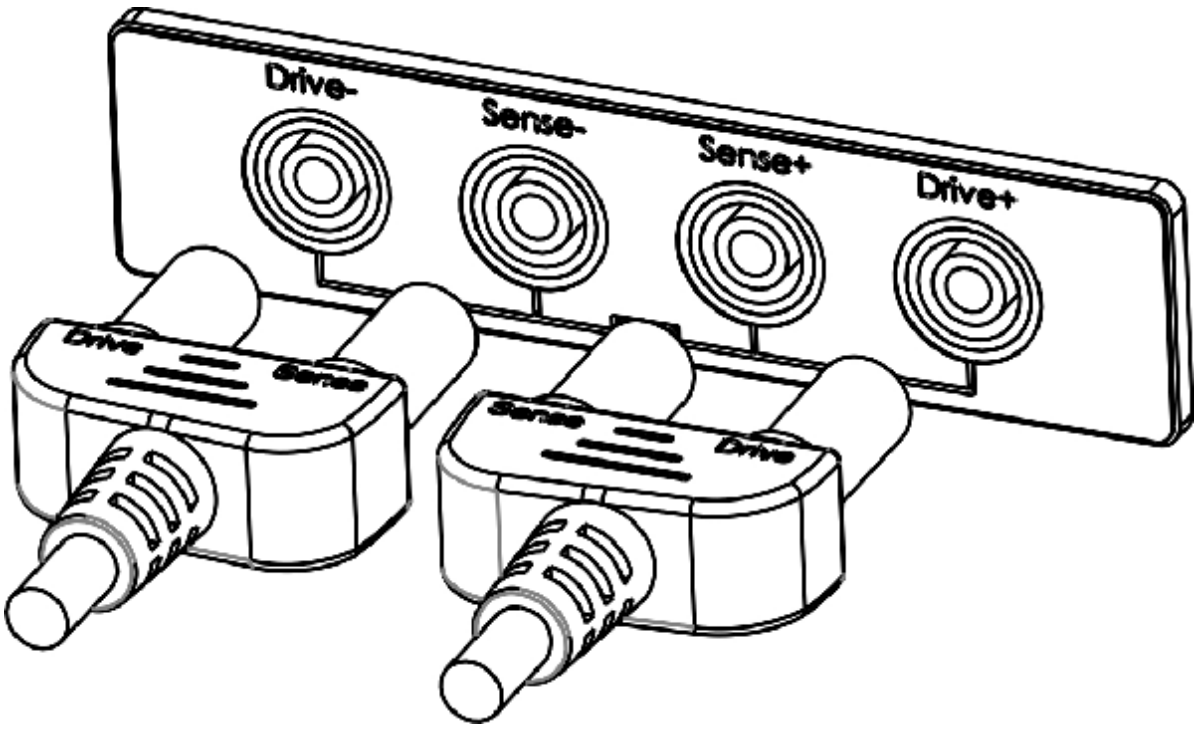

Powering off

4.1.2 Boot parameters: the instrument will load the setup previously set.
4.1.3 Warm-up time: in order to reach the specified accuracy, the instrument needs to be preheated at least 20 minutes.

4.2 Start up

4.2.1 Connecting the Measurement Leads

If you use a random spin-off of "Kelvin" clip to measure, connect the clip in the following way, as shown in the following picture:



Note:

The red cable is the high potential side

The black cable is the low potential side

Make sure to put the power cord marked in red to the socket marked in red

Make sure to put the power cord marked in black to the socket marked in black

⚠	Warning: Forbid putting AC current source or voltage source to access to the measurement client directly. Ensure that the voltage of energy storage element will not exceed the maximum allowable voltage of test terminal.

4.2.2 Selecting Test Parameters

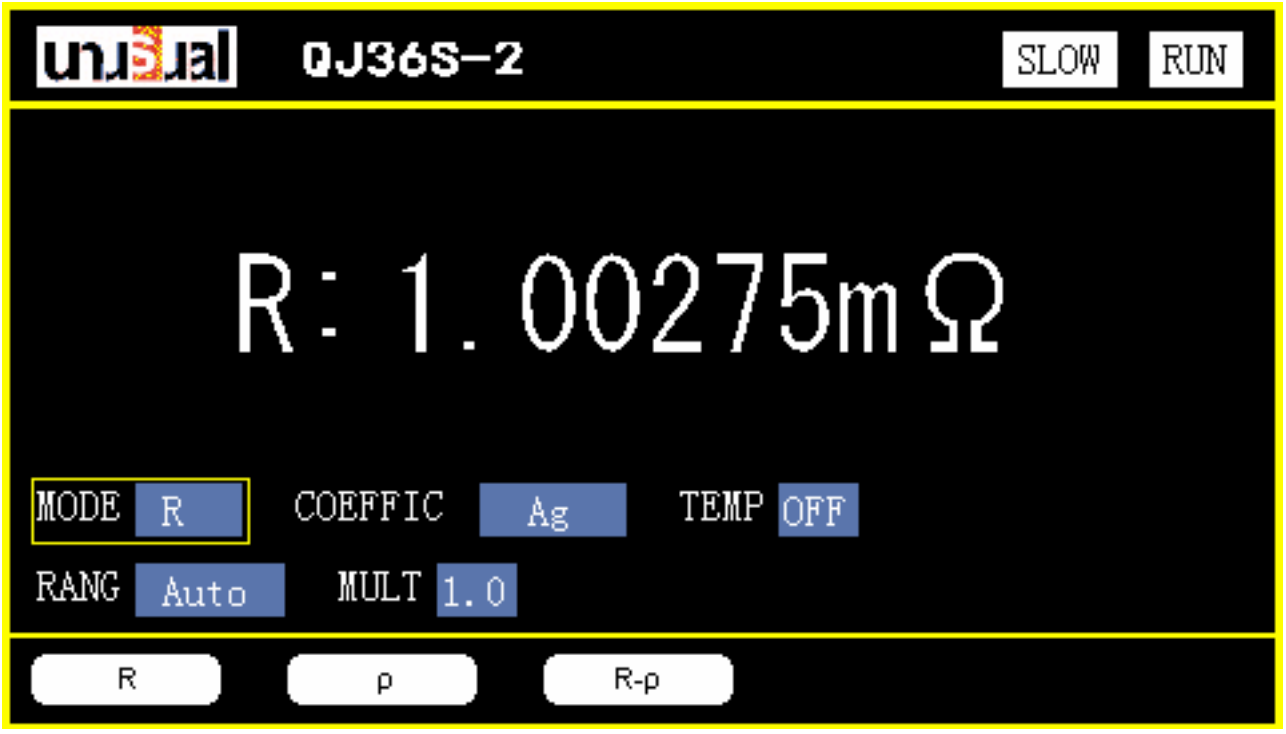
Test parameters of CHT3540B:

●R Resistance

●ρ Resistivity

●R-ρ Resistance- Resistivity

The following steps to set up the test parameters:



Picture 4-1 measurement range setting page

Using the dial to put the parameter in selected area, you will see three test function keys:

R ——Resistance test mode

ρ ——Resistivity test mode

R-ρ ——Resistance- resistivity test mode

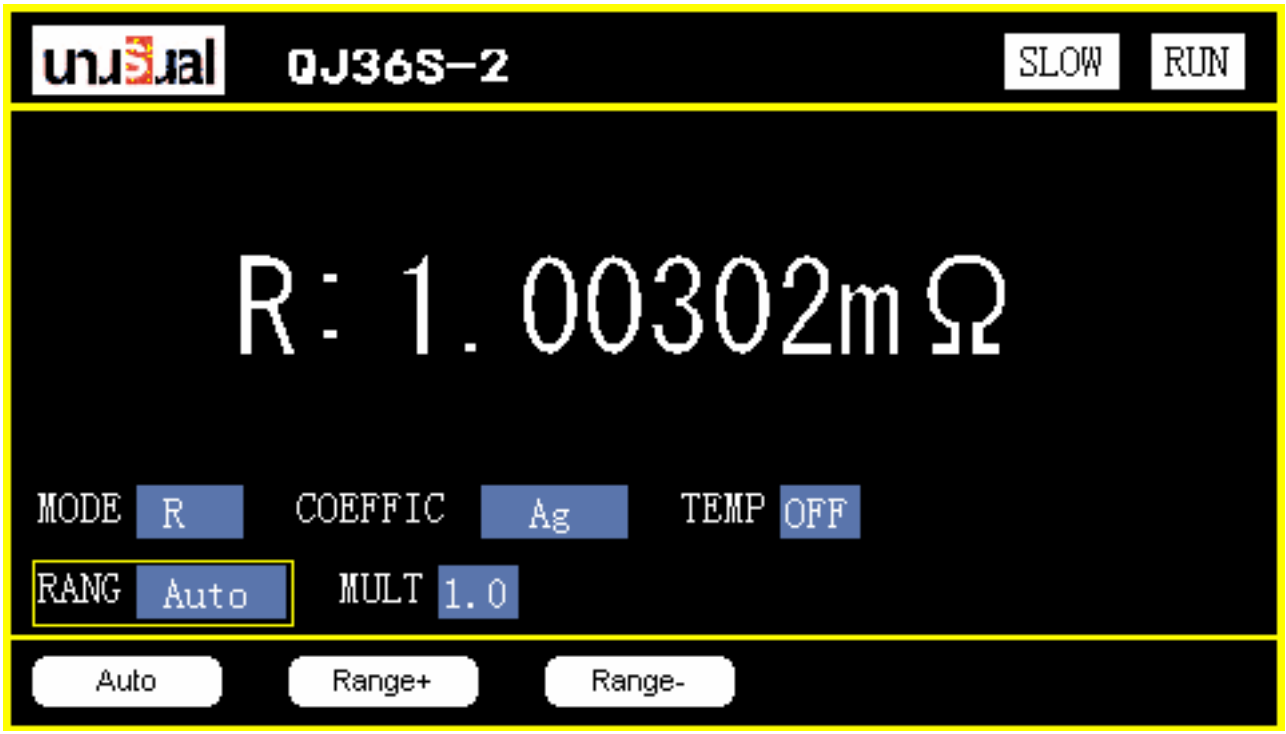
4.2.3 Selecting the Measurement Range

In AUTO measurement page, CHT3540B will automatically select the most appropriate measurement range according to the following table.

Table3-1 Range number, range resistance and range changes process

Range No.	Test current (current ratio :1.0)	Range Resistance	Up range	Down range
1	10A	4.7mΩ	3mΩ ê	2.9mΩ é
2	1A	100mΩ	30mΩ ê	29mΩ é
3	100mA	100mΩ	300mΩ ê	290mΩ é
4	100mA	1Ω	3Ω ê	2.9Ω é
5	10mA	10Ω	30Ω ê	29Ω é
6	1mA	100Ω	300Ω	290Ω

You can set up the measurement range in the following page.



Picture 4-2 measurement page

Using the dial to put the parameter in selected area, you will see three test function keys:

Auto ——the range is set in auto mode

Range+ —— increasing the range

Range- ——decreasing the range

Tips: .	Manual range can be used effectively to improve measurement speed.

4.2.4 Select the Sampling Rate

The sampling process is generated from the measurement – analog - digital conversion - to display the measurement results of operations and sub-election results. This period is known as the sampling time period. Sampling rate refers to the completion of the sampling frequency per second.

CHT3540B provides users two options for rate. It is capable of using the "Rate" key for the loop setting.
FAST:
SLOW:

4.2.5 Zero clearing the resistance

Zero clearing function can offset and deduct the resistance during test.

1. Press the key **“Clear “to** get ready for zero clearing. Connect the leads as shown below.
2. Click the key **“Enter"** to start zero-adjust. In the automatic measurement mode, the instrument will do zero-adjust for all measurement ranges. In manual mode, the instrument only does zero-adjust for current mode.

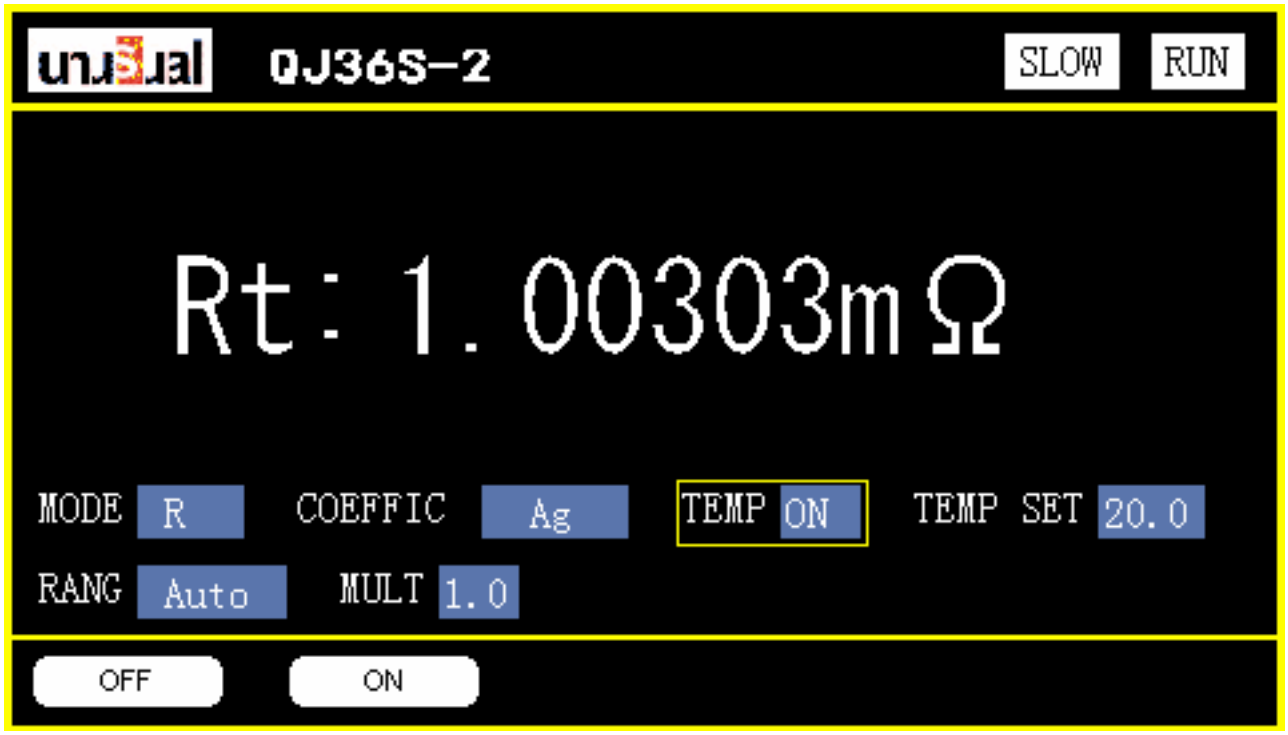
After zero-adjust is completed, the data will be stored in nonvolatile memory.

3. After zero-adjustment, the instrument returns to the measurement mode automatically.

4.2.6 Temperature compensation

Equipped with a temperature probe, the DUT temperature can be compensated by the probe.

The temperature compensation function can be turned on/off by the button COMPENSATION switch. When the character ON appears after the button COMPENSATION on the screen means the temperature compensation function is turned on; When the character OFF appears after the button COMPENSATION on the screen means the temperature compensation function is turned off. After the temperature compensation function is turned on and the temperature probe is connected properly, the temperature will be displayed in the upper right corner of the screen, as shown below:



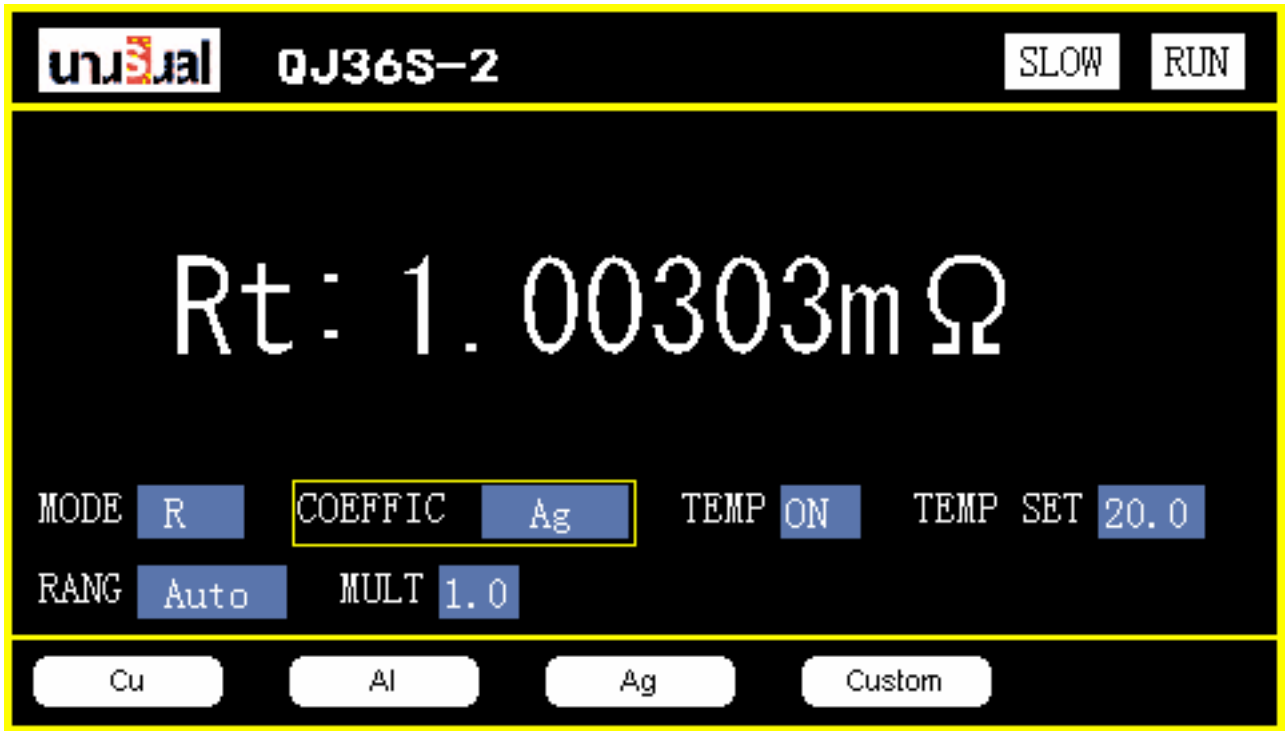
Picture 4-3 Temperature Compensation Page

Compensation formula:

$$Ro = Rx\frac{1}{[1+a\,(T-To)]}$$

T0 - reference temperature (taken 20 °C for example)
T - the current measured temperature
α - temperature coefficient under the reference temperature
Rx - uncompensated value
R0 - the value after the temperature compensated

Set temperature coefficient α: using the dial to put the editing are in the temperature coefficient column, as shown below:



Picture 4-4 Temperature Compensation Coefficient Page

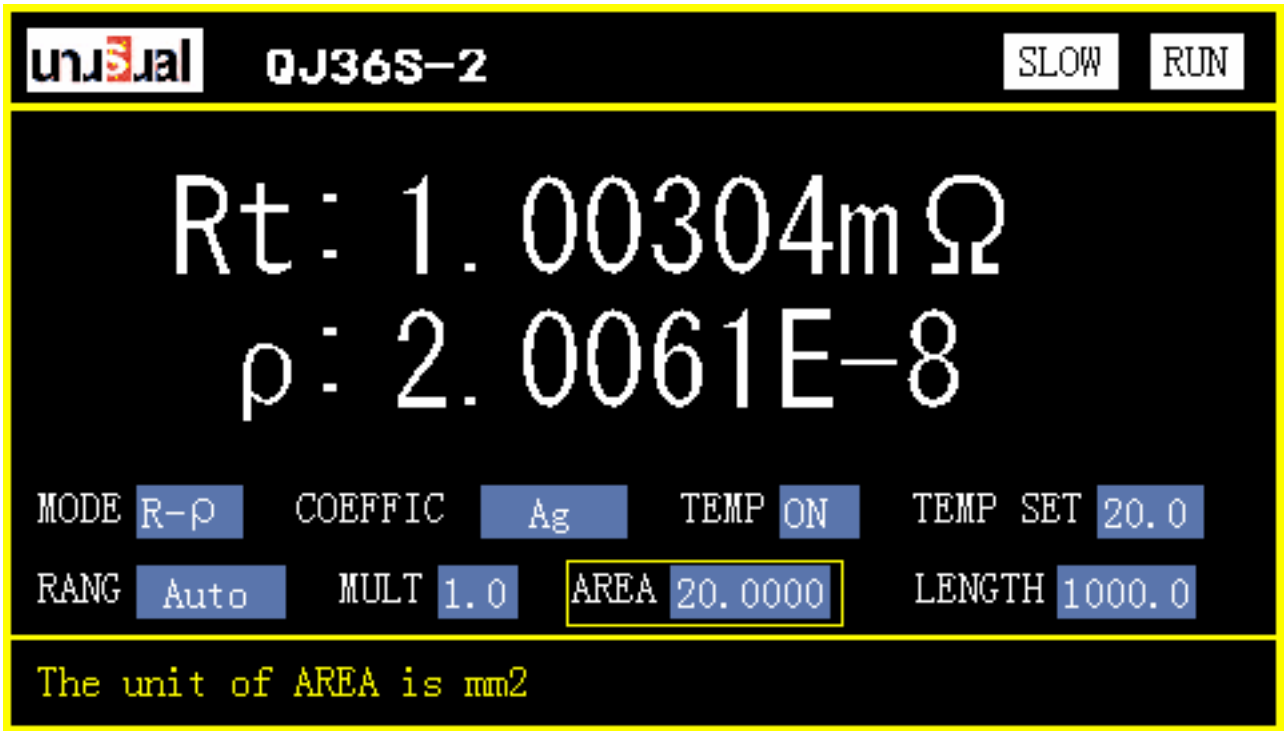
Copper—— 0.00393
Aluminum —— 0.00429
Silver —— 0.0038
Custom——other metals can be set up any temperature coefficient

Take gold for example, its resistivity of 0.00324 at 20 °C, during test, please select the menu **Custom** and input 0.324.

4.2.7 Resistivity

The instrument can directly show the resistivity of the metal by its measured resistance. The detail operation is as follows:

Select the test parameter to "ρ" or "R-ρ",
Set the cross-sectional area and length
Resistivity settings page as follows:



Picture 4-5 Resistivity Settings page

The calculating formula of resistivity is as follows:

ρ = RS/L

R: resistance

S: conductor cross-section area

L: wire length

Ribbon conductor cross-section area calculating formula: S = W（width）*H（height）

Round conductor cross-section area calculating formula = S =πr2

Appendix Specification

Appendix A	Appendix A, you will learn the following: I Specifications I General specifications I Dimensions

Specifications

The following data was obtained under the following conditions:

Temperature condition: 23 °C ± 5 °C

Humidity condition: 80% R.H.

Zero-adjustment: Zeroed before measurement

Warm-up time: > 15 minutes

Calibration Time: 1 year

Pulse current test (only applicable to resistance <30Ω)

Sampling rate

Fast-speed: about 2 times / sec
Slow-speed: 1 times / sec

Test current accuracy: 10%

Range		Max. reading	Resolution	Fast-speed	Slow-speed	Measured current	Open circuit voltage between the test terminals
1	3mΩ	3.00000mΩ	0.01mΩ	0.05%±5 count	0.03%±3 count	10A	<3V
2	30mΩ	30.0000mΩ	0.1mΩ	0.05%± 5 count	0.03%±3 count	1A	<3V
3	300mΩ	300.000mΩ	1mΩ	0.05%± 5 count	0.03%±3 count	100mA	<3V
4	3Ω	3.00000Ω	10mΩ	0.05%± 5 count	0.03%±3 count	100mA	<3V
5	30Ω	30.0000Ω	100mΩ	0.05%±5 count	0.03%±3 count	10mA	<3V
6	300Ω	300.000Ω	1mΩ	0.05%± 5 count	0.03%±3 count	1mA	<3V

Temperature measurement indicators:

Range	-10°C ~ 80°C	80°C ~ 125°C
Resolution	0.1°C	
Accuracy	0.5°C	1°C

A General Specification

Screen	TFT, 480x272 screen resolution,24- color,4.3”
Display parameters	Direct reading, the percentage of error and compare the results.
Display range	0.1mW ~ 300W minimum resolution: 0.01mW.
Maximum readings	300000
Test Signal	Pulse Test
Trigger	Internal, external, remote trigger.
Range	Automatic and manual.
Interface	RS232/RS485(Communication) interface
	Processor (Handler) interface
	Optional: GPIB (IEEE488) interface
Zero-adjustment	Short-circuit clear.
Programming languages	SCPI / MODEBUS(RTU)
Environment	Indicators: temperature 15 °C ~35 °C, Humidity <80% RH
	Operation: Temperature 10 °C ~ 40 °C, Humidity 10 ~ 90% RH
	Storage: Temperature 0 °C ~ 50 °C, Humidity 10 ~ 90% RH
Power supply	100V ~ 240VAC 50Hz ~ 60Hz

Weight	3.5kg approx.
Accessories	Manual, CHT9340B Kelvin four-terminal cable, CHT9702 temperature probe, AC power cord, test report, warranty certificate.

Dimensions

All dimensions is in millimeters (mm)
Dimension: 249mm*102mm*358mm