User's Manual

UT8805E Benchtop Digital Multimeter

Preface

Thank you for purchasing the new benchtop digital multimeter. In order to use this product safely and correctly, please read this manual thoroughly, especially the *Safety Information* part.

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

Copyright Information

General Safety Precautions

This instrument strictly complies with safety standards of IEC61010-1, EN61010-2-030, pollution level II, over voltage CATI 1000V, CAT II 300V and double insulated during design and manufacturing. It is IP65 waterproof and dustproof. In case the meter is not used properly as instructions, the protection provided may be weakened or lost.

- Please use the dedicated UNI-T power supply wire appointed to the local region or country for this product, and check if there is any metal part exposed or insulating layer damage.
- This product is grounded through the power supply ground wire. To avoid electric shock, grounding conductors must be connected to the ground. Please be sure that the product is properly grounded before connecting to the input or output of the product. The signal ground wire of the rear panel is the same as the ground potential.
- Please check the accessories and wires for any mechanical damage before usage. Please replace the wire before use if it is damaged.
- Please notice rated operating range and product marks. Never input over-range voltage into any terminal or ground point of this product.
- When measuring, do not touch any exposed wires, connectors, unused inputs or the circuits being measured. When measuring the voltage higher than 60V (DC) or 30V (AC), keep your fingers behind the finger guard ring of the test leads to prevent electric shock.
- Do not operate the product if you suspect it is faulty, and please contact UNI-T authorized service personnel for inspection. To avoid injury and damage, only trained personnel can perform the maintenance program.
- Never touch exposed joints and components after connecting the power supply.
- Please do not operate the product when the instrument box opens. Do not change the internal circuit of the meter.
- Only use fuse that appointed to this product.
- Use appropriate overvoltage protection to ensure that there is no overvoltage (like caused by lightning), otherwise it may cause electric shock.
- Do not use or store the meter in high temperature, high humidity, flammable, explosive and strong magnetic field environments.
- Before measuring resistance, continuity, diode and capacitors, please disconnect the power and fully discharge all high-voltage capacitors.

Input Terminal Protection Limits

1) Main input terminal (HI and LO)

The input terminals HI and LO apply to voltage, resistance, capacitance, continuity, frequency and diode measurements.

a. HI-LO limit protection: the HI-LO limit is maximum 1000V DC or 750V AC voltage, which can also be expressed as maximum 1000Vpk.
b. LO-GND limit protection: the limit of input terminal LO-GND can safely float to 500Vpk. The limit of the terminal HI-GND is maximum 1000Vpk. Therefore, the sum of floating voltage and measured voltage shall less than 1000Vpk.

2) Sampling terminals (HI and LO Sense)

Terminal Sense HI and LO sense are used for 4-wire resistance measurement.

a. The limit protection of Sense HI-LO sense is 200Vpk.
b. The limit protection of LO sense-LO is 2Vpk.

3) Current input terminals mA and A

a. The terminal mA and terminal LO are used for current measurement below 200mA. The fuse on rear panel provides a maximum current limit protection 250mA for mA terminal.
b. The terminal A and terminal LO are used for current measurement from 200mA to 10A. The fuse on rear panel provides a maximum current limit protection 10A for terminal A.

Note: the voltage of the current input terminal is similar to that of terminal LO. To maintain good protection, only the specified type and class fuses can be replaced.

IEC Measurement Category II Overvoltage Protection

To avoid shock hazards, UT8805E provides overvoltage protection for mains connections that meet both conditions below.

1. The input terminals HI and LO are connected to the mains under the measurement class II condition (described below).
2. The maximum voltage of the mains is 300V AC.

WARNING: IEC measurement category II includes electrical devices connected to mains by a socket on a branch circuit, such as most small appliances and measuring instruments. UT8805E can apply to make following measurements: input terminals HI and LO are connected to the mains of IEC measurement category II devices (maximum 300V AC) or are connected to branch outlets. However, the input terminals HI and LO cannot be connected to the mains of permanently installed electrical device, such as the distributor of main circuit breaker, the cut-out box of sub-distributor, or the permanently connected motor, because these devices and circuits are prone to be overvoltage.

CAUTION: voltages above 300V AC can only be measured in circuits that disconnected from the mains. However, transient overvoltage also exists in this kind of circuits. UT8805E can safely withstand accidental transient overvoltage up to 2500Vpk. Do not use the device to measure circuits if the transient overvoltage may exceed this range.

Safety Terms and Symbols

Terms in the manual --- Following terms may appear in this manual:

Warning: a Warning specifies conditions and actions that may pose hazards to the user.

Caution: a Caution identifies conditions and actions that may cause damage to the product or other properties.

The CAT I (1000V)

IEC measurement category I. The maximum measurable voltage at terminal HI-LO is 1000Vpk

The CAT II (300V)

IEC measurement category II. In the case of class II overvoltage, the input may be connected to the mains (up to 300V AC)

Terms on the product --- Following terms may show on the product:

DANGER indicates any injury hazard immediately accessible as you read the marking.

WARNING indicates any injury hazard not immediately accessible as you read the marking.

CAUTION indicates any damage may happen to the product or other properties

Symbols on the product --- Following symbols may show on the product:

 Caution, possibility of electric shock

 Warning or Caution

 Protective conductor terminal

 Ground terminal for chassis

 Earth (ground) terminal

Overview

UT8805E is a 200000 count benchtop digital multimeter with high precision, multi-function and full-automatic functions of mathematical operations, capacitance, temperature and other basic measurements.

UT8805E comes with 4.3-inch 480*272 TFT display, supports LAN, USB, RS-232C operations, which makes it a great laboratory instrument and a precise measurement tool for automated test systems.

Features：

- 200000 count resolution
- Measuring speed: 2.5/10/5k readings/second
- Dual display
- 200mV~1000V DC voltage range
- 200μA~10A DC current range
- True-RMS，200mV~750V AC voltage range
- True-RMS，2mA~10A AC current range
- 200Ω~100MΩ resistance range 2-line and 4-line resistance measurement
- 2nF~2000μF capacitance range
- 20Hz~1MHz frequency range
- Continuity and diode test
- Temperature measurement with built-in thermocouple cold junction compensation
- Various mathematic operations: maximum, minimum, average value, standard deviation, pass/fail, dBm, dB, relative measurement, histogram, trend chart, bar chart
- USB drive store data and configuration
- Supports interface of USB, GPIB, RS-232C and LAN, USB-TMC, IEEE 488.2 standard, VXI11 and SCPI language
- The latest mainstream multimeter SCPI command set compatible
- History data record and storage
- 1GB NAND FLASH storage, mass storage system and test data
- Chinese & English menu and online help system
- PC control software of upper computer
- Supports global mains voltage

Table of Contents

Chapter 1 Quick start

This chapter is a simple guide of preparation before using, the front/real panel and interfaces of UT8805E digital multimeter.

1.1 General Inspection

1) Checking for any damage in transit
   Keep the package if the packing carton or foamed plastic cushion is seriously damaged, until the multimeter and accessories pass the electric and mechanical inspections. Contact distributor or local representative office immediately if any abnormality is found.
2) Accessories checking
   The accessories list is provided in appendix A of chapter 6. User can check refer to this list. Contact distributor or local representative office immediately if any accessory is missing or damaged.
3) Complete instrument checking
   Contact distributor or local representative office immediately if any abnormal operation or appearance damage is found.

1.2 Handle Adjustment

To adjust the handle of multimeter, please hold the handle by both sides, pull outward, and rotate it as needed, see Figure 1-1 and 1-2.

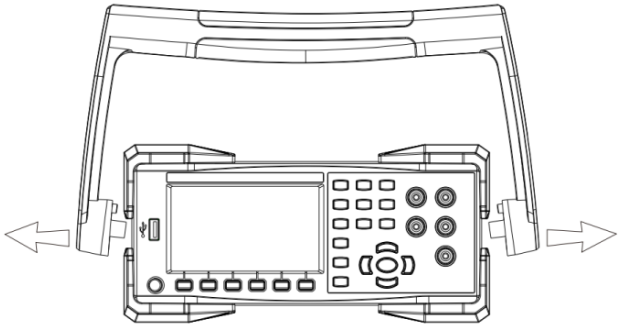


Figure 1-1 Handle adjustment

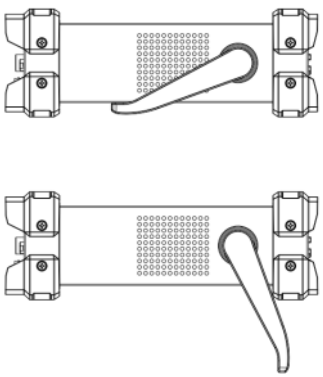


Figure 1-2 Lying position

Figure 1-3 Moving position

1.3 The Front Panel

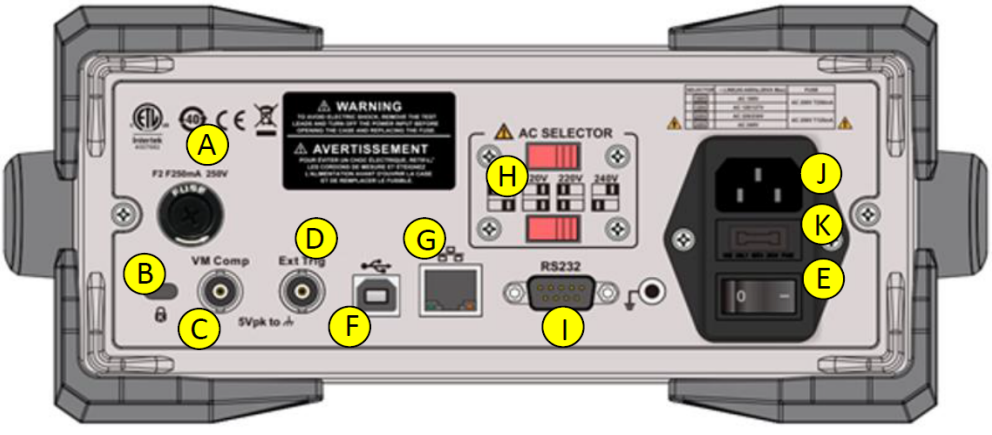
UT8805E comes with a simple clear front panel, its controlling buttons are designed by logic and can be easily found to make basic operation. See Figure1-4.

Figure 1-4 Front panel

[A] LCD display
[B] USB Host interface
[C] Power switch
[D] Menu operating buttons
[E] Measure and auxiliary function buttons
[F] Range selector and direction buttons
[G] Input interfaces

1.4 The Rear Panel

Various interface are provided by UT8805E, includes USB Device, RS-232C, LAN and so on, as shown in figure:



[A] Current measurement fuse
[B] Lockhole
[C] VMC output
[D] External trigger input
[E] Power switch
[F] USB Device interface
[G] LAN interface
[H] AC voltage selector
[I] RS-232C interface
[J] Power supply interface
[K] Power supply fuse

1.5 Power On

Please follow these steps to power on the multimeter:

1) According to local power supply standard, adjust the AC voltage selector to be 100(100~110V, 45~440Hz, AC), 120(110~132V, 45~440Hz, AC), 220(200~240V, 45~66Hz, AC), or 240(216~264V, 45~66Hz, AC).
2) Connect the multimeter with AC current by random power line.
3) Observe the power indicator on front panel turns red.
4) Long press the power button for a few second till the multimeter displays picture.

Note: the items in [ ] are F1-F6 soft key menu items.

1.6 User Interface

Single screen:

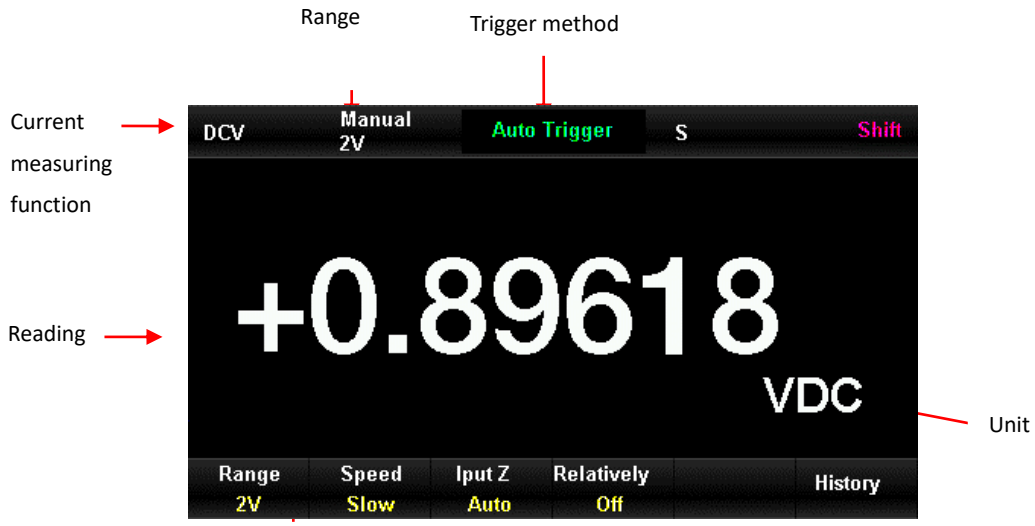


Figure 1-6 Interface of single screen mode

Dual screen:

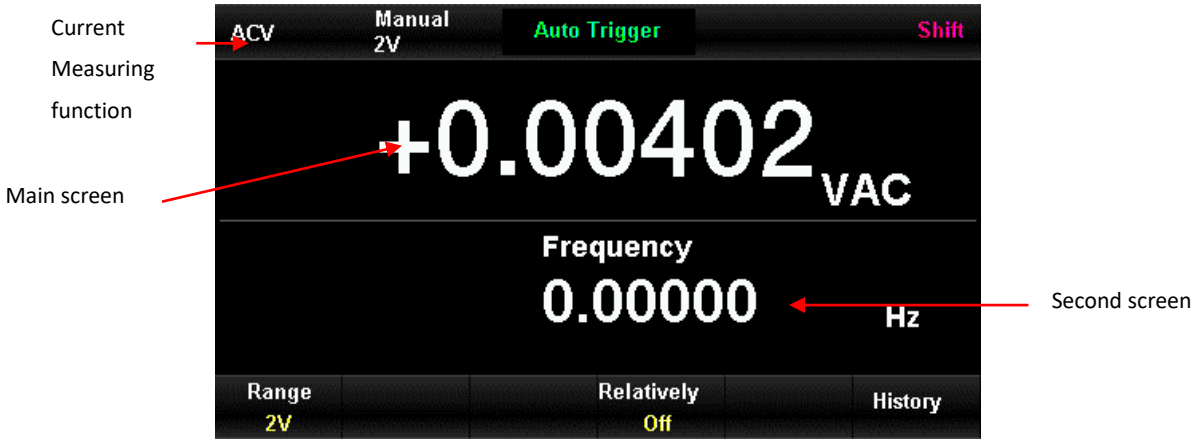


Figure 1-7 Interface of dual screen mode

Chapter 2 Front Panel Operation

- DC voltage/current measurement 

- AC voltage/current measurement 

- 2/4-wire resistance measurement 

- Capacitance/temperature measurement 

- Continuity/diodes measurement 
- Frequency/period measurement 

- Dual display or auxiliary system utility 

- Acquire setting or help system 

- Mathematical operation or save 

- Run/stop/exit function 

- Manual trigger or hold function 

- Shift function switch 

- Auto/manual range selector 

- Range selector and direction buttons 

- Menu operating buttons 

- Power switch 

2.1 Range Selection

Both auto range and manual range can be selected. The multimeter can automatically select proper range according to the input signal, so that the input value is just between 10% and 110% of the range

conveniently. Users can also choose ranges manually for faster readings and results. The range selector is located on the right side of the front panel as Figure 2-1.

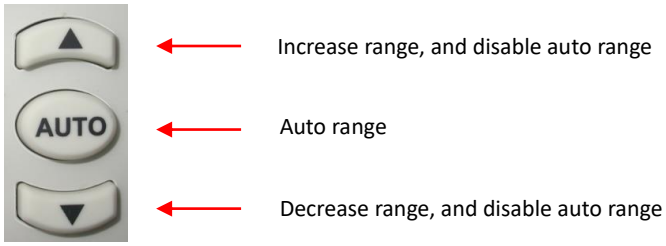


Figure 2-1 Front panel range select button

Method 1: select ranges by range selector on front panel.

Auto range: press AUTO button to switch between auto/manual ranges

Manual range: press ▲ button to increase the range, and press ▼ button to decrease.

Method 2: select ranges by soft key menu in main interface, as Figure 2-2.

Auto range: press [auto] to select auto range and disable the manual range

Manual range: press [200mV], [2V], [20V], [200V] or [1000V]. Take DC voltage measurement as an example, set proper range manually, and auto range is disabled.

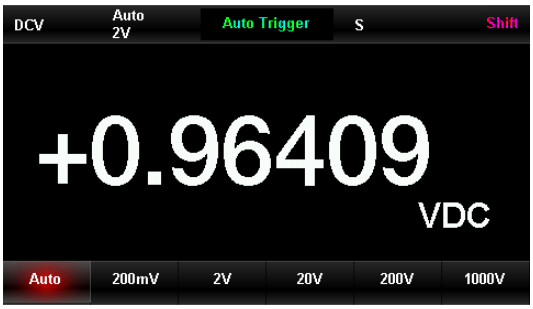


Figure 2-2 Range selecting menu

Note:

1) The overload symbol – OL will be shown if the input signal is over range.
2) All scales except DCV 1000V and ACV 750V are allowed to exceed the range by 20%.
3) When the instrument is powered on, remotely reset and started with the factory settings, auto range is selected by default.
4) It is suggested that users should choose auto range in case of unpredictable measuring range to protect the instrument and obtain accurate data.
5) For the dual display function, the ranges of both screens are similar and cannot be changed separately.
6) The ranges are fixed in continuity/diode measurement, which is 2kΩ for continuity measurement, and 4V for diode.
7) Particularly, the maximum range of the input terminal mA is 200mA (including DCI and ACI, the same as following ranges). The input terminal A is used for ranges of 2A and 10A. Therefore, current over 200mA shall be input by terminal A, and current below 200mA shall be input by terminal mA. There is no automatic switching between two different current input terminals.
8) In current measurement, overcurrent protection is provided by two fuses.
9) Voltage measurement shall not be overloaded for a long period to avoid circuit damage.

2.2 Reading Speed Selection

There are 3 reading speeds can be selected by soft key menu: [Slow] 2.5 reading/s, [Medium] 10 reading/s and [Fast] 5k reading/s. The display refreshing rate is 10 times/s. Press [Speed] button, and then select [Slow], [Medium] or [Fast] to select measuring speed.

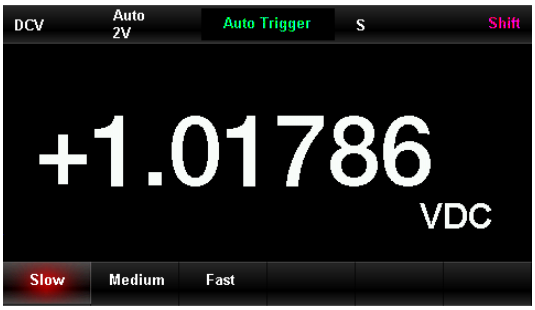


Figure 2-3 Interface of measuring speed selecting

Note:

1) There are 3 reading speeds (slow, medium and fast) can be set in DCV, DCI and 2W/4W resistance functions.
2) In slow speed measurement, the zero reading function of DCV, DCI and 2W/4W resistance is on, which can restrain thermo-electromotive force and offset voltage/current caused by temperature variation and component aging.
3) 2.5 reading/s and 10 reading/s are corresponding to 5.5 bits reading resolution.
4) 5k reading/s is corresponding to 5.5 bits reading resolution.
5) Temperature measurement is corresponding to 5.5 bits reading resolution (slow speed).
6) Diode/continuity measurement is corresponding to 4.5 bits reading resolution (medium speed).
7) Frequency measurement is corresponding to 5.5 bits reading resolution, and the reading speed depends on the input signal frequency.
8) Capacitance measurement is corresponding to 3.5 bits reading resolution, and the reading speed depends on the charge-discharge time of capacitor.

2.3 Basic Measurements

The basic measurement functions of UT8805E include measurements of DC/AC voltage, DC/AC current, 2/4-wire resistance, capacitance, continuity, diode, frequency/cycle and temperature.

2.3.1 DC Voltage Measurement

The maximum DC voltage range of UT8805E is 1000V, and DC voltage measurement is selected by default. The connecting methods and operation are introduced below.

Steps:

1) Press  button to enter interface of DC voltage measurement as Figure 2-4.

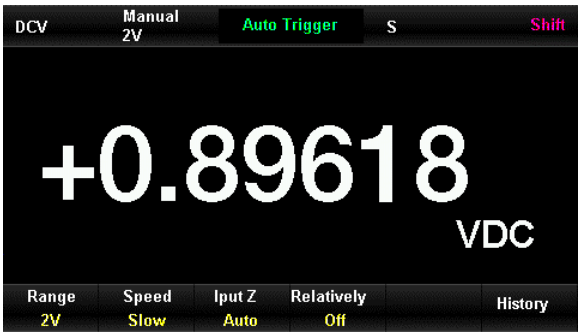


Figure 2-4 Interface of DC voltage measurement

2) Connect test leads to the measured voltage as Figure 2-5, red test lead should be connected to terminal HI, and the black one to terminal LO.

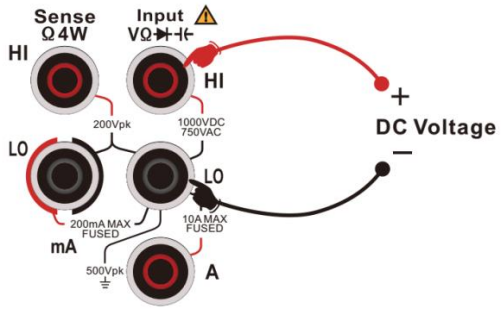


Figure 2-5 Connection of DC voltage measurement

3) Select proper range according to input DC voltage.

Range	200mV, 2V, 20V, 200V, 1000V
Input protection	DC 1000V or AC 750Vrms (terminal HI) for all ranges
Configurable parameters	Range, input impedance, reading speed, relative operation set value

Note:

- Except for 1000V, all ranges are allowed to exceed range by 20%.
- In 1000V range, OL will show if input voltage exceeds 1050V.
- 1000V input protection is provided in arbitrary ranges.

4) DC input impedance setting (only for scales of 20V and below)

There are two options of input impedance: [Auto] and [10M]. For scales of 20V and below, [Auto] means the input impedance is over 10GΩ, otherwise the input impedance is 10MΩ.

5) Relative value setting

Turn the relative operation on, the displayed value is actual measured value minus the set relative value. About relative value setting, please refer to 2.10 Mathematical Functions.

6) Reading speed

Press [Speed] to select proper reading speed during measurement.

7) History data review

User can check the history data by number, bar chart, trend chart, and histogram.

Note: when the input terminal is in dangling state (no voltage input), random reading between ±20V will

show.

2.3.2 DC Current Measurement

The maximum DC current range of UT8805E is 10A. The connecting and measurement methods are shown below:

Steps:

1) Press Shift button, then press mV button again to enter DC current measuring interface, as figure shown:

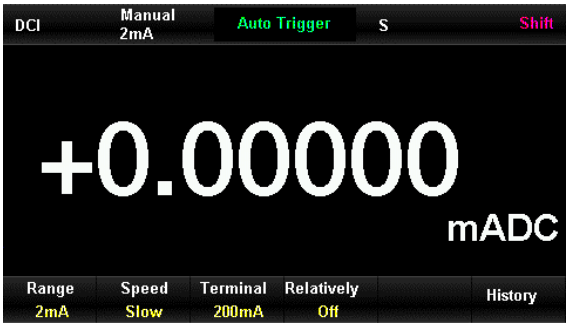


Figure 2-6 Interface of DC current measuring

2) Connect the multimeter to the circuit as Figure 2-7. When the current is <200mA, connect the red test lead to terminal mA and connect the black one to terminal Input-LO; When the current is 200mA-10A, connect the red test lead to the terminal A and connect the black one to terminal Input-LO.

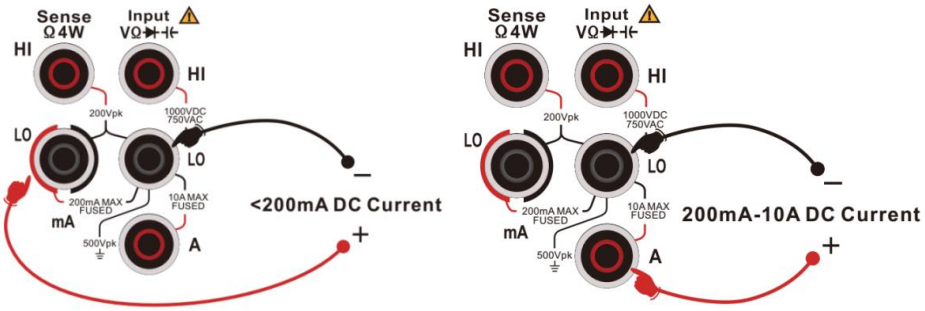


Figure 2-7 Connection of DC voltage measurement

3) Select proper range according to input current.

Range	200μA, 2mA, 20mA, 200mA, 2A, 10A
Input protection	250mA overcurrent protection for ≤ 200mA range (rear panel); 10A built-in overcurrent protection for the ranges of 2A and 10A.
Configurable parameters	Range, reading speed, relative operation set value

Note: Except for 10A, all ranges are allowed to exceed range by 20%.

4) Relative value setting

Turn the relative operation on, displayed value is actual measured value minus the set relative value. About relative value setting, please refer to 2.10 Mathematical Functions.

5) Measured value reading

Press [Speed] to select proper reading speed during measurement.

6) History data review

User can check the history data by number, bar chart, trend chart, and histogram.

2.3.3 AC Voltage Measurement

The maximum AC voltage range of UT8805E is 750V. The connecting and measurement methods are shown below:

Steps:

1) Press ~V button to enter the interface of AC voltage measurement as Figure 2-8:

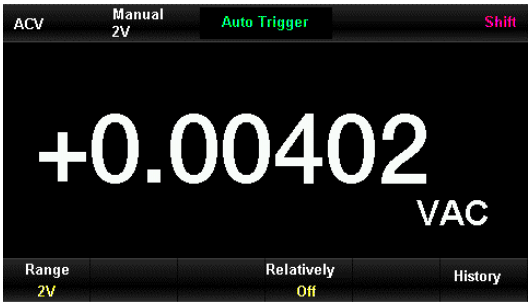


Figure 2-8 Interface of AC voltage measurement

2) Connect the test leads to the measured voltage as Figure 2-9, connect the red test lead to terminal HI, and connect the black one to terminal LO.

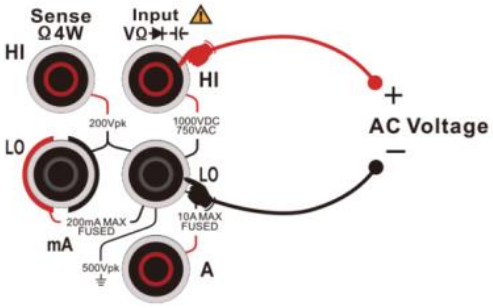


Figure 2-9 Connection of AC voltage measurement

3) Select proper range according to the input AC voltage.

Range	200mV, 2V, 20V, 200V, 750V
Input protection	DC 1000V or AC 750Vrms (terminal HI) for all ranges
Configurable parameters	Range, reading speed, relative operation set value

Note:

- Except for 750V, all ranges are allowed to exceed range by 20%.
- In 750V range, OL shows when input exceeds 787V.
- 750Vrms input protection is provided in arbitrary ranges.

4) Relative value setting

Turn relative operation on, the displayed value is actual measured value minus the set relative value. About relative value setting, please refer to 2.10 Mathematical Functions.

5) Measured value reading

Press Dual button to obtain the frequency value of measured signal as Figure 2-10.

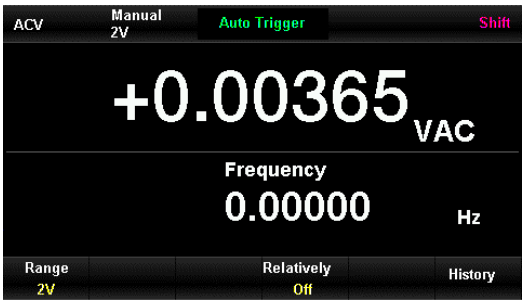


Figure 2-10 Interface of AC voltage and frequency measurement

6) History data review

User can check the history data by number, bar chart, trend chart, and histogram.

2.3.4 AC Current Measurement

The maximum AC current range of UT8805E is 10A. The connecting and measurement methods are shown below:

Steps:

1) Press Shift button and press ~V button to enter interface of AC current measurement as Figure 2-11.

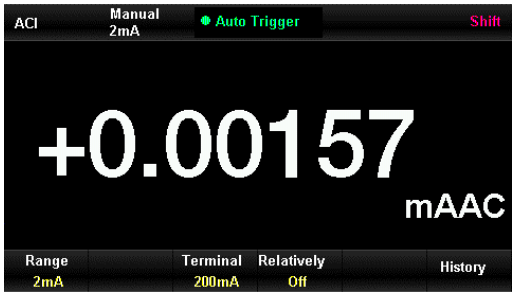


Figure 2-11 Interface of AC voltage measuring

2) Connect the multimeter to the measured circuit as Figure 2-12. When the current is <200mA, the red test lead should be connected to terminal mA while the black one should be connected to terminal Input-LO. When the current is 200mA-10A, connect the red test lead to terminal A, and connect the black one to terminal Input-LO.

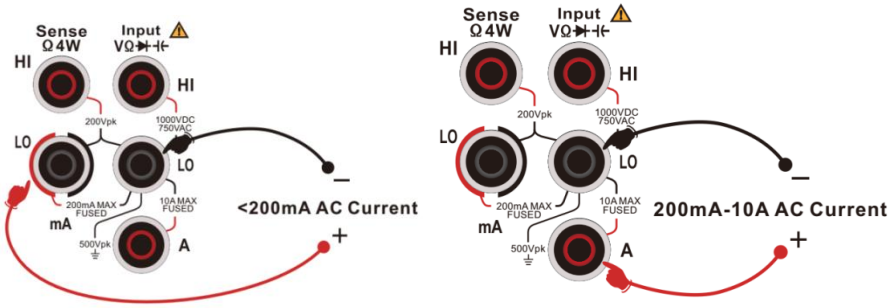


Figure 2-12 Connection of AC current measurement

3) Select proper range according to the input current.

Range	20mA, 200mA, 2A, 10A
Input protection	250mA overcurrent protection for the ranges of 200mA and below (rear panel); 10A built-in overcurrent protection for the ranges of 2A and 10A.
Configurable	Range, reading speed, relative operation set value

parameters	

Note: Except for 10A, all ranges are allowed to exceed range by 20%.

4) Relative value setting

Turn the relative operation on, the displayed value is actual measured value minus the set relative value. About relative value setting, please refer to 2.10 Mathematical Functions.

5) Measured value reading

If the current value is big enough, press Dual button to obtain the frequency value of measured signal.

6) History data review

User can check the history data by number, bar chart, trend chart, and histogram.

2.3.5 2-wire/4-wire Resistance Measurement

Both the 2-wire/4-wire resistance measurement modes are provided by UT8805E. The connecting and measurement methods are shown below:

A. 2-wire Resistance Measurement

Steps:

1) Press Shift button to enter interface of 2-wire resistance measurement as Figure 2-13.

Figure 2-13 Interface 2-wire resistance measurement

2) Connect the test leads to the measured resistance as Figure 2-14, connect the red test lead to terminal HI, and the black one to terminal LO.

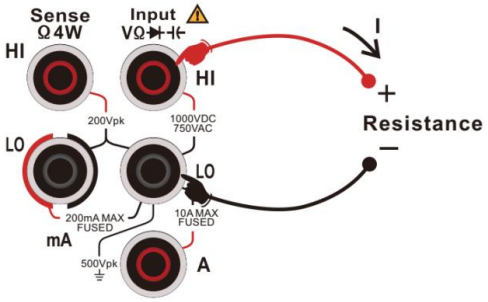


Figure 2-14 Connection of 2-wire resistance measurement

3) Select proper current range according to the input resistance.

Range	200Ω, 2kΩ, 20kΩ, 200kΩ, 2MΩ, 10MΩ,100MΩ
Open circuit voltage	<8V
Input protection	DC 1000V or AC 750Vrms (terminal HI) for all ranges
Configurable parameters	Range, reading speed, relative operation set value

Note: all ranges are allowed to exceed range by 20%.

4) Relative value setting

Turn the relative operation on, the displayed value is the actual measured value minus the setting relative value. About relative value setting, please refer to 2.10 Mathematical Functions.

5) Measured value reading

Press [Speed] to select proper reading speed and read the measured value.

6) History data review

User can check the history data by number, bar chart, trend chart, and histogram.

Note: Relative operation is recommended in low resistance measurement, which can eliminate test lead impedance error.

B. 4-wire Resistance Measurement

When the measured resistance is low, error will be caused by test lead resistance and contact resistance in circuit. Therefore, 4-wire measuring mode is necessary for a precise measurement.

Steps:

1) Press Shift button, and then press Ω2W button to enter interface of 4-wire resistance measurement, as Figure 2-15.

Figure 2-15 Interface of 4-wire resistance measurement

2) Connect the test leads to the measured resistance as Figure 2-16, connect the red test lead to terminal HI, and the black one to terminal LO. The test leads above are constant current source output circuits. Connect the red test leads to terminal Sense HI, and the black one to terminal Sense LO, and these 2 test leads are voltage gauging circuits.

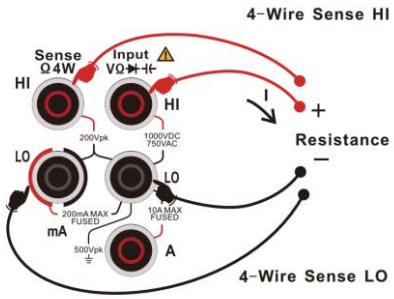


Figure 2-16 Connection of 4-wire resistance measurement

3) Select proper current range according to the input resistance.

Range	200Ω, 2kΩ, 20kΩ, 200kΩ, 2MΩ, 10MΩ,100MΩ

Open circuit voltage	<8V
Input protection	a)DC 1000V or AC 750Vrms for all ranges (terminal HI) b)DC 200V for all ranges (terminal Sense HI and terminal Sense LO)
Configurable parameters	Range, reading speed, relative operation set value

Note: all ranges are allowed to exceed range by 20%.

4) Relative value setting

Turn the relative operation on, the displayed value is actual measured value minus the set relative value. About relative value setting, please refer to 2.10 Mathematical Functions.

5) Measured value reading

Press [Speed] to select proper reading rate and read the measured value.

6) History data review

User can check the history data by number, bar chart, trend chart, and histogram.

Note:

- During resistance measurement, please avoid short circuit caused by antistatic rubber, copper foil and other conductors, and keep away from strong electromagnetic radiation.
- When the input terminal is in dangling state in 4-wire resistance measurement, random reading will show.

2.3.6 Frequency Measurement

Frequency value can be read by turning on the dual display function in AC voltage measurement. Besides that, the same frequency value can be read in frequency measurement. The connecting and measurement methods are shown below:

1) Press Hz button to enter interface of signal frequency measurement as Figure 2-19.

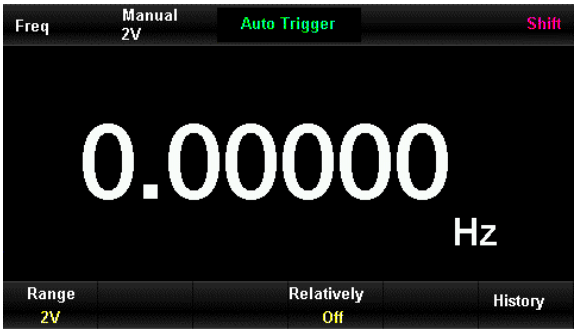


Figure 2-19 Interface of signal frequency measurement

2) Connect the test leads to measured signal as Figure 2-20, connect the red test lead to terminal Input-HI, and the black one to terminal Input-LO.

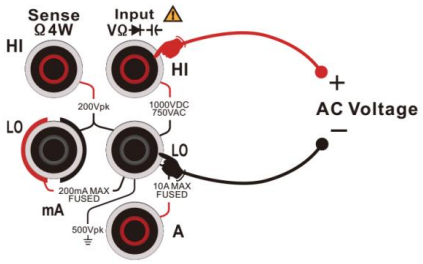


Figure 2-20 Connection of signal frequency measurement

3) Select proper range according to the input AC voltage.

Range	200mV, 2V, 20V, 200V, 750V
Input protection	DC 1000V or AC 750Vrms for all ranges (terminal HI)
Configurable parameters	Voltage range, relative operation set value

4) Relative value setting

Turn the relative operation on, the displayed value is actual measured value minus the set relative value. About relative value setting, please refer to 2.10 Mathematical Functions.

5) Measured value reading

The reading speed of frequency measurement depends on the frequency of measured signal.

6) History data review

User can check the history data by number, bar chart, trend chart, and histogram.

2.3.7 Signal Cycle Measurement

Frequency value can be read by turning on the dual display function in AC voltage measurement. Besides that, the same frequency value can be read in frequency measurement. The connecting and measurement methods are shown below:

1) Press Shift button and then press Hz button to enter interface of signal cycle measurement as Figure 2-21.

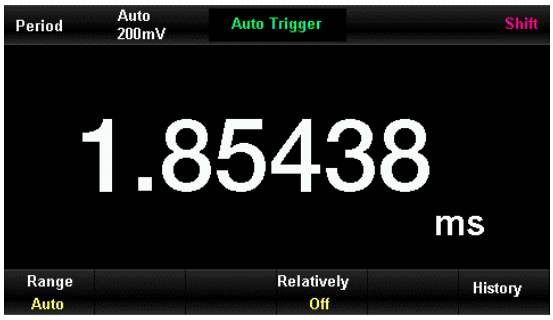


Figure 2-21 Interface of signal cycle measurement

2) Connect the test leads to the measured signal as figure 2-22, connect the red test lead to the terminal Input-HI, and the black one to terminal Input-LO.

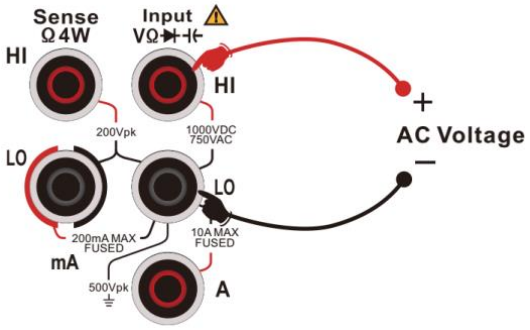


Figure 2-22 Connection of signal cycle measurement

3) Select proper range according to the input AC voltage.

Range	200mV, 2V, 20V, 200V, 750V
Input protection	750Vrms for all ranges (terminal HI)
Configurable parameters	Voltage range, relative operation set value

4) Relative value setting

Turn the relative operation on, the displayed value is actual measured value minus the set relative value. About relative value setting, please refer to 2.10 Mathematical Functions.

5) Measured value reading

The reading speed of signal cycle measurement depends on the frequency of measured signal.

6) History data review

User can check the history data by number, bar chart, trend chart, and histogram.

2.3.8 Continuity Test

Continuity test uses 2-wire mode to measure the resistance of circuit at a current of 1mA in order to check the integrity of the circuit.

When the measured resistance value in the short-circuit circuit is lower than the set short-circuit resistance, the circuit is connected, and the beeper continuously beeps. The connecting and measurement methods are shown below:

1) Press  button to enter interface of continuity test as Figure 2-23.

Figure 2-23 interface of continuity test

Connect the test leads to the measured circuit as Figure 2-24, connect the red test lead to terminal Input-HI, and the black one to terminal Input-LO.

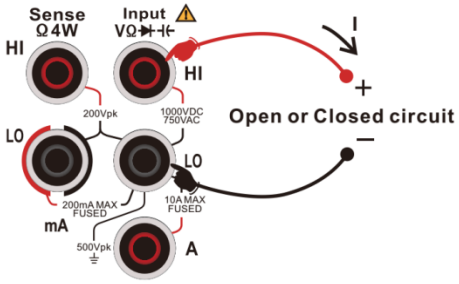


Figure 2-24 Connection of continuity testing

2) Short-circuit resistance setting (threshold value)

The short circuit defaulted value is 30Ω, and can be set by direction buttons. Users can carry continuity test directly if this parameter is no need to be modified.

The characteristics of continuity test:

Test current	1mA
Range	2kΩ fixed
Open circuit voltage	<8V
Input protection	DC 1000V OR AC 750Vrms (terminal HI)
Beeper condition	0 ≤ R ≤ set value

3) Beeper setting

Press [Beeper] to turn the beeper function on or off. If the circuit is connected, the beeper will continuously beep.

4) Test the testing point and read the displayed value.

2.3.9 Diode Measurement

Diode measurement uses 2-wire mode to measure the break-over voltage of circuit at a current of 1mA. The connecting and measurement methods are shown below:

1) Press Shift button and then press button to enter interface of diode measurement as Figure 2-25.

Figure 2-25 Interface of diode measurement

2) Connect the test leads to the measured circuit by connecting the red test lead to terminal Input-HI, and the black one to terminal Input-LO as Figure 2-24.

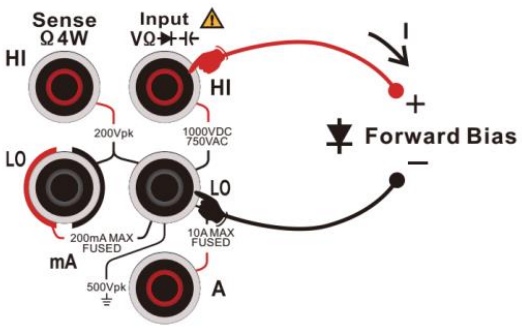


Figure 2-26 Connection of diode measurement

3) The characteristics of diode measurement:

Test current	1mA
Range	0~4V. > 4V, Open will be shown
Open circuit voltage	<8V
Input protection	DC 1000V OR AC 750Vrms (terminal HI)

4) Test the testing point and read the displayed value.

2.3.10 Temperature Measurement

Both thermocouple and thermal resistance types of temperature sensor are supported by UT8805E. The connecting and measurement methods are shown below:

Steps:

1) Press Shift button and then press button to enter interface of temperature measurement as Figure 2-27.

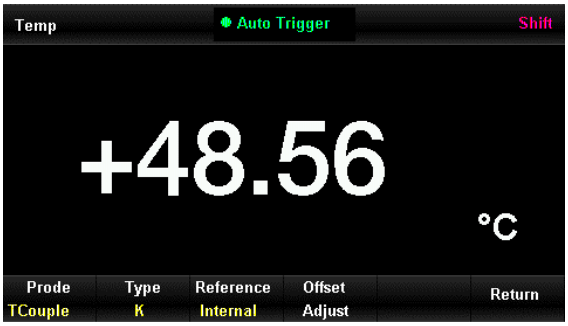


Figure 2-27 Interface of temperature measurement

2) Connect the test leads to the sensor as Figure 2-28. Please be aware of the polarity of thermocouple probe and don't reverse connect.

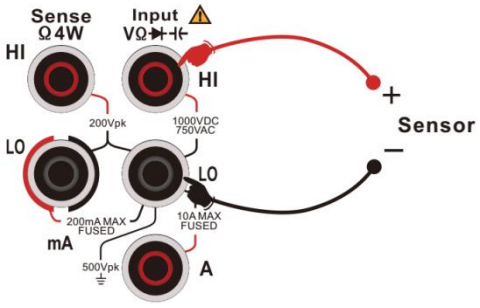


Figure 2-28 Connection of temperature measurement

3) Select temperature probe

Press [Probe] to select the probe type: [RTD 2W], [RTD 4W], [Thermis2W], [Thermis4W] and [Tcouple]. The RO value of RTD is 100Ω by default which can be selected and manual modified in menu. The relevant Steps of UT8805E thermocouple are: press [Tcouple] to enter the menu, select thermocouple type in [Type], set offset value in [Offset Adjust] by direction buttons, and select proper temperature reference in [Reference] (internal NTC sensor by default).

4) Relative value setting

Turn the relative operation on, the displayed value is actual measured value minus the set relative value. About relative value setting, please refer to 2.10 Mathematical Functions.

5) Unit setting

3 units of temperature, °C, °F, K, are selectable in UT8805E.

6) Test the testing point and read the displayed value.

Note: When the input terminal is in dangling state in thermocouple temperature measurement, random reading will show.

2.3.11 Capacitance Measurement

The maximum capacitance range is 2mF. The connecting and measurement methods are shown below:

Steps:

1) Press button to enter capacitance measuring interface as Figure 2-17.

Figure 2-17 capacitance measuring interface

2) Connect the test leads to the measured capacitance as Figure 2-18, the red test lead to the terminal Input-HI and the capacitance anode, and the black one to terminal Input-LO and cathode.

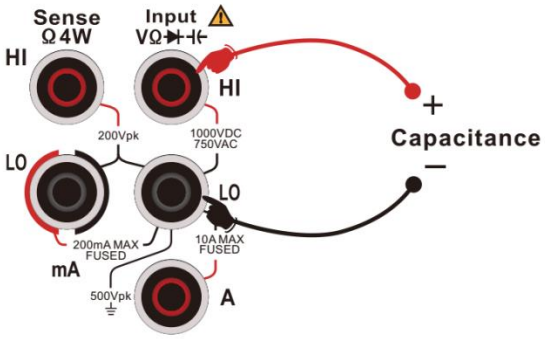


Figure 2-16 Connection of 4-wire resistance measurement

3) Select proper range according to the measured capacitance.

Range	2nF, 20nF, 200nF, 2μF, 20μF, 200μF, 2mF
Input protection	DC 1000V or AC 750Vrms for all ranges (terminal HI)
Configurable parameters	Range, relative operation set value

Note: all ranges are allowed to exceed range by 20%.

4) Relative value setting

Turn the relative operation on, the displayed value is actual measured value minus the set relative value. About relative value setting, please refer to 2.10 Mathematical Functions.

5) Measured value reading

The refreshing rate of measured value depends on the measured capacitance value.

6) History data review

User can check the history data by number, bar chart, trend chart, and histogram.

Note: please discharge the capacitor before high-capacity electrolytic capacitor measurement.

2.4 Relative Measurement Parameters

Relative measurement parameters of multimeter are configured at factory, so users can operate measurements directly or modify parameters as needed.

2.4.1 DC Input Impedance

Select the particular input impedance value for DC voltage measurement. Press [Input Z] in DC voltage function to enter the following interface:

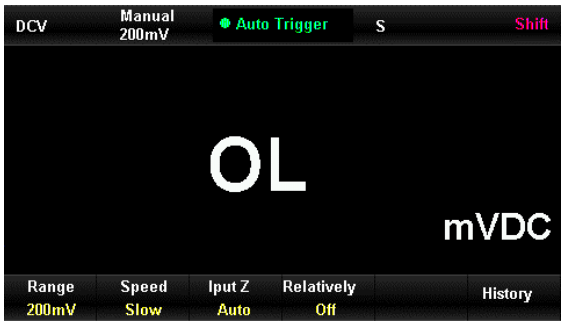


Figure 2-29 Interface of input impedance selecting

10MΩ or 10GΩ parameters are selectable. Generally, 10MΩ is regular used, but higher impedance value 10GΩ is recommended to improve the measuring precision for 200mV, 2V and 20V ranges. Current selection is saved in non-volatile memory.

- The default input impedance is 10GΩ for DC voltage 200mV, 2V and 20V ranges, and 10MΩ for 200V and 1000V ranges.
- 10GQ input impedance is only supported in 200mV, 2V and 20V ranges.
- The DC input impedance setting is saved in non-volatile memory.

2.4.2 Short- circuit Resistance

Short-circuit resistance value is only used in continuity test and can be modified. The beeper beeps when the measured resistance is lower than set value.

Steps:

1) Turn the continuity test function on, and enter following interface as Figure 2-30.

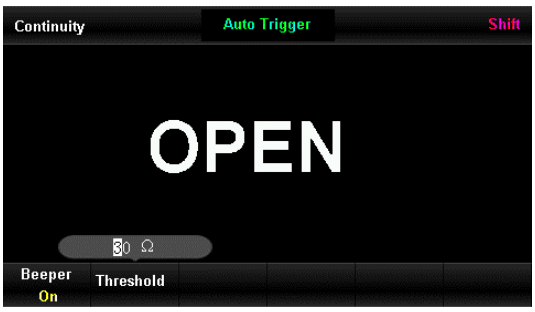


Figure 2-30 Interface of threshold value setting in continuity test

2) Short-circuit resistance modification (threshold value)

Use the left and right direction button to switch to different digit position, and use up and down button to increase/decrease the value in selected digit position.

- The short-circuit impedance range is 0-2kΩ, and the default short-circuit impedance is 30Ω.
- The short-circuit impedance value will be saved in volatile memory and remains after power failed.
-

2.4.3 Dual Display Function

The dual display function can display primary measurement value and additional measurement value simultaneously.

Press Dual button to turn on the dual display function. UT8805E supports the following dual display combination:

		Additional measurement
Primary measurement	ACV	FREQ
	ACI	FREQ
	FREQ	Period, ACV
	Period	FREQ, ACV
	Temp (thermocouple)	Input voltage, reference temperature
	Temp (thermal resistance)	Resistance

- Both primary and additional measurement will display measurement data separately.
- If the primary measurement uses mathematical operations such as statistics, limits, and relativity, primary measurement will remain the results of mathematical operations after additional measurement is turned on.
- If primary measurement uses dB, dBm and other mathematical operations, it will automatically exit mathematical operations after additional measurement is turned on.
- Additional measurement uses automatic range by default, and its data cannot be saved.

2.5 Auxiliary System Functions

Press Shift button and then press Dual button to enter operation menu of auxiliary system function setting, where users can set relevant system parameters of multimeter.

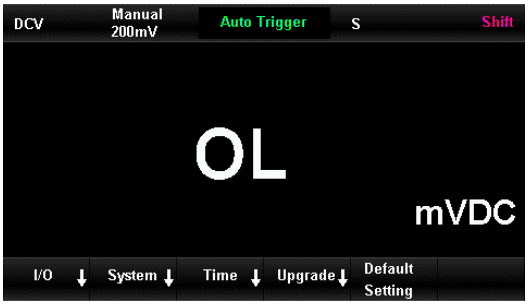


Figure 2-31 Interface of auxiliary system function setting

Menu	Description
I/O	The interfaces setting
System	System information and setting
Time	System time setting
Upgrade	Firmware upgrade
Default Setting	Default settings restorable for all of the configurable items, such as function, reading rate, input impedance, relative value, threshold, beeper, probe type, temperature unit, display mode, etc., see the menu for details

2.5.1 I/O Configuration

Press [I/O] to set the interfaces parameters as Figure 2-32.

Figure 2-32 Interface I/O setting

- **LAN Setting**

Remote operation is allowed through LAN interface. Users can check or set the current IP address, subnet mask and gateway in network setting.

After opening the operation menu of auxiliary system function setting, press [I/O] to open the network and select [LAN] to enter the following interface as Figure 2-33, and change the setting by direction buttons.

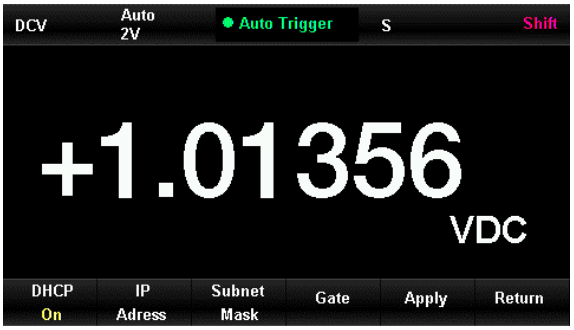


Figure 2-33 Interface of LAN setting

LAN parameters setting

Functions menu	Description
DHCP	Dynamic host configuration protocol, which can be turned on/off
IP address	IP address setting
Subnet mask	Subnet mask setting
Gate	Gateway setting
Apply	Apply current setting and return to previous menu
Return	Do not save modification and return to previous menu

- **RS-232C Setting**

By setting RS-232C Uart, make sure the settings of baud rate, parity and stop bit are match with the computer setting. The setting of Uart is saved in non-volatile memory.

Steps:

1) Press [Uart] button after opening the interfaces setting menu:

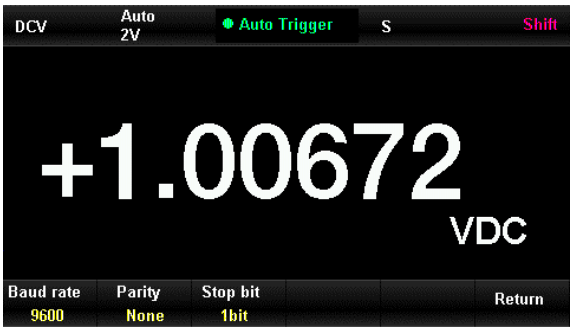


Figure 2-34 RS-232C

2) Value can be modified by direction buttons. The current settings are saved in non-volatile memory.

Function menu	Options	Description
Baud rate	9600 (default), 14400, 19200, 38400, 56000, 57600, 115200, 128000, 256000	Set baud rate of RS-232C operation
Parity	None (default), Odd, Even	Set parity of RS-232C operation
Stop bit	1bit, 1.5bit, 2bit	Set stop bit of RS-232C operation
Return		Save current setting and return to previous menu

When the parity is:

None: the bit of upper computer should be 8 bits

Odd/even parity: the bit of upper computer should be 7 bits

2.5.2 System Settings

press Shift button, then press Dual button，select [System] to enter the interface as Figure2-35.

Figure 2-35 Interface of system setting

Description of System setting menu

Function menu	Description
Lang	Language of menu setting
Beeper	Turn the beeper on/off
Light	Adjust backlight between 10%, 30%, 50%, 70%, 90% and 100%
Format	The digits format in menu
About	Check the system version
Done	Return to previous menu

1) Language

8805E supports both Chinese and English menu, and the operation menu and help options will be displayed in the selected language.

2) Beeper

Press [Beeper] to turn the beeper on or off. By each click, the beeper will beep, and it also beeps during the continuity measurement.

3) Backlight

Adjust the backlight of the display.

4) Format

There are three formats of input value -- none, comma and space. Take 2V in three formats as an example: 2.00000V, 2.000, 00V and 2.000 00V.

5) About

Check the system information, includes machine model, software version, hardware version, serial number and other information as Figure 2-36.

Figure 2-36 system information

2.5.3 Time Setting

Press [Time] to set the time from year to minute by direction buttons. Press [Done] to save and exit, the timing circuit is powered by internal battery.

2.5.4 Firmware Upgrade

U-disk firmware upgrade is allowed.

Steps:

1) Copy the upgrade files by U-disk.
2) Insert the U-disk into the USB Host interface on front panel.
3) Press [Shift] → [Dual] → [Upgrade], and press [Locate], and then press direction buttons to select the upgrade files, then press [Select] → [OK] to start upgrading.

4) U-disk can be pulled out only after the upgrade is completed and the instrument is restarted.
5) Restart the instrument and check the updated version information. Press [Shift] → [Dual], and then select [System] → [About] to check whether upgraded version of software/hardware is right or not. Follow above steps to upgrade again if the upgrade is not successful.
6) After checking, press [Done] to exit the system information interface.
7) Besides, users can press [Auto] button to upgrade software by U-disk files directly.

Caution: Do not pull out the U-disk, shutdown the instrument or disconnect the power during upgrading.

2.6 Samples Acquirement Setting

Sample acquirement is the process of collecting signal in certain time lag and digitizing it. The optional trigger methods include auto trigger, single trigger and external trigger.

Press Acquire button to enter the interface as Figure 2-37.

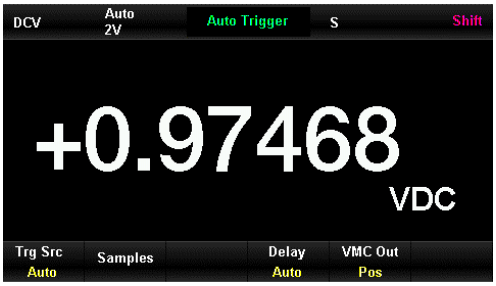


Figure 2-37 Samples acquirement setting

Sampling menu description:

Function menu	Options	Description
Trg Src	Auto/Single/Ext	Set trigger source of sample acquirement
Slope		Set the polarity of external trigger slope
Delay	Auto/Manual	Set delay
Samples		Set the samples number
VMC Out	Pos/Neg	Set the polarity of output pulse signal after sampling

2.6.1 Auto Trigger

The parameters to be set in auto trigger function are samples/trigger and VMC out.

Steps:

1) Press Acquire button and then select [Trg Src] → [Auto], or press Run/Stop button to turn the auto trigger function on.
2) Delay, the waiting time after trigger signal and before sampling. Set delay to be auto or manual by [Delay]. Select Manual mode and use direction buttons to modify.
3) Select [Samples] to set sampling number by direction buttons.
4) Select [VMC Out] to set positive or negative polarity of output pulse signal.

2.6.2 Single Trigger

The parameters to be set in single trigger function are samples/trigger and VMC out.

Steps:

1) Press Acquire button and then select [Trg Src] → [Single], or press Single button to turn single trigger function on directly as Figure 2-38.

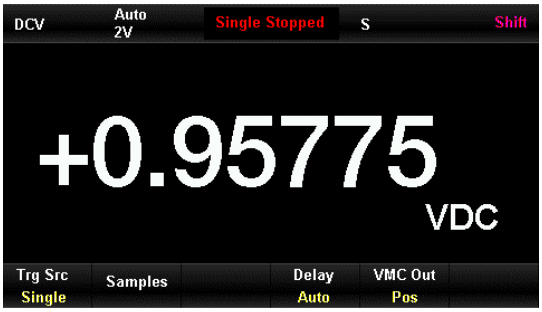


Figure 2-38 Setting interface of single trigger

2) Select [Delay] to set the delay to be auto or manual mode.
3) Select [Samples] to set sampling number by direction buttons.
4) Select [VMC out] to set positive or negative polarity of output pulse signal.

2.6.3 External Trigger

The external signal is accessed by the EXT TRIG pin on rear panel. The parameters to be set in external trigger function are samples, VMC out and slope.

Steps:

1) Press Acquire button and then select [Trg Src] → [Ext] to turn external trigger function on as Figure 2-39.

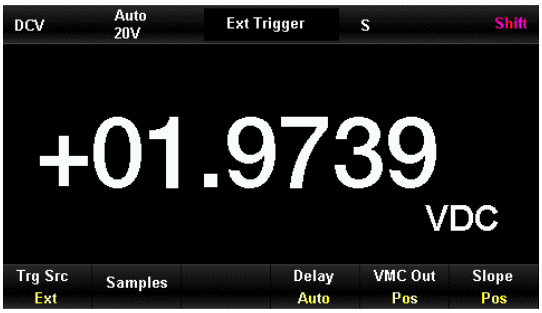


Figure 2-39 Setting interface of external trigger

2) Select [Slope] to select positive/negative, and set external trigger to be rising edge trigger or falling edge trigger.
3) Select [Samples] to set sampling number by direction buttons.
4) Select [VMC out] to set positive or negative polarity of output pulse signal.

2.7 Help Information

UT8805E comes with a help system, which can call out needed help information during measurement. Build-in help message provides relevant instructions for front panel buttons, soft keys and common operation.

Press Shift button, then press Acquire button to enter built-in help menu as Figure 2-40.

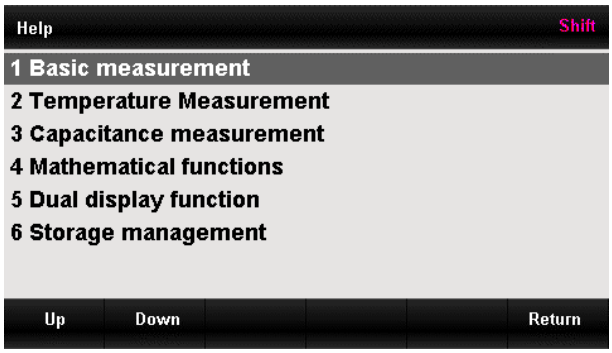


Figure 2-40 Help system

Description of operation menu

Function menu	Description
Up/▲	Move cursor up
Down/▼	Move cursor down
Select	Select and read the information, press AUTO button
Return	Return to previous menu

1) Basic measurement

This is to access the measuring function types and the probe connection in different measurements.

2) Temperature measurement

This is to access the method of temperature measurement.

3) Capacitance measurement

This is to access the method of capacitance measurement.

4) Mathematical functions

This is to access the operation guide of using mathematical function in measurement.

5) Dual display function

This is to access the operation guide of using dual display function in measurement.

6) Storage management

This is to access the method of storing and recalling data/parameters/arbitrary sensor files.

Operating instructions:

In the interface of Help menu, the direction buttons ▲ and ▼ can also be used to select the corresponding items and press AUTO button to read the help information.

2.8 Mathematical Functions

5 main functions are included in mathematical operation: statistics, limits, dB, relative operation and dBm. Different mathematical function satisfies different measuring requirements, which is suitable for voltage, current, resistance, capacitance, frequency/cycle and temperature measurements. The dB and dBm operations are only suitable for voltage measurement.

Press Math button to enter the operating menu of mathematical operation as Figure 2-41.

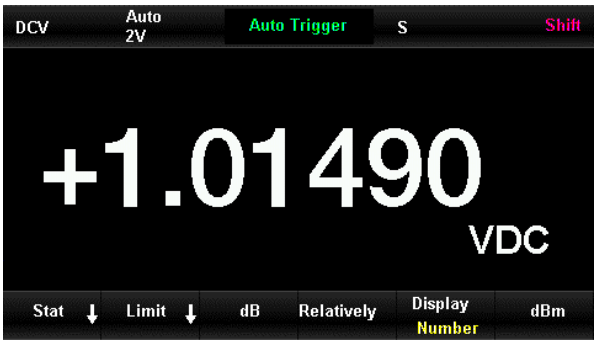


Figure 2-41 Interface of mathematical operating function

Mathematical operating function menu

Function menu	Options	Description
Stat	On/Off	Statistics maximum, minimum, average, Span, standard deviation and samples of current measurement
Limit		Operate the pass/fail test according to the high/low limit
dB		Calculate of measured decibels relative to the reference value
Relatively	On/Off	Turn the relative operation on/off and set the relative value
dBm		Calculate the power of resistance, 0dBm=1mW

Note:

- The mathematical operation can only be processed in primary measurement.
- Except for statistic, all the mathematical operations will turn off automatically if the measurement function is changed.

2.8.1 Statistics Operation

Statistics operation can be applied to measure the minimum, maximum, average, standard deviation of reading during the measurements of DC/AC voltage, DC/AC current, resistance, frequency, cycle, capacitance and temperature.

Press Math → [Stat] → [On] to enter the interface of Figure 2-42.

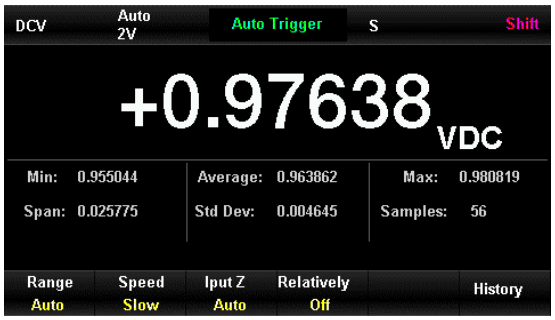


Figure 2-42 Interface of statistics operation

Menu of statistics operation

Function menu	Options	Description
Stat	On/Off	Display or hide the statistics operating interface
Min		The minimum reading during measurements
Average		The average of readings during measurements
Max		The maximum reading during measurements
Span		The span of readings during measurements
Std Dev		The standard deviation of readings during measurements
Samples		The number of samples during measurements
Clear		Clear current data and restart the statistic
Done		Save current settings and return to previous menu

Statistics operating method:

In statistics operation, the beginning reading of multimeter is displayed as maximum/minimum, and then the minimum/maximum value of current readings will be displayed. The minimum, maximum, average and reading numbers are saved in volatile memory and will be auto deleted after power off.

2.8.2 Limit Operation

The limit operation can indicate the over-range signal base on the set high/low limit, which includes the measurements of DC/AC voltage, DC/AC current, resistance, frequency, cycle, capacitance and temperature.

Press Math → [Limit] → [On] to enter the interface of Figure 2-43.

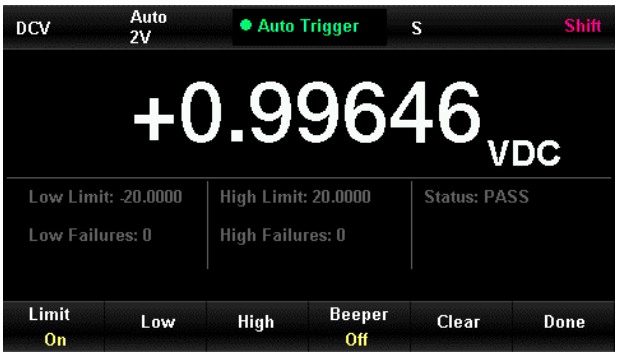


Figure 2-43 Interface of limit operating

Menu of limit operation function

Function menu	Options	Description
Limit	On/Off	Turn the limit operation on/off
Low		Set low limit
High		Set High limit
Beeper	On/Off	When it is on, beeper beeps as the reading exceeds limit.
Clear		Clear current data and restart the statistic
Done		Save current settings and return to previous menu
Low Limit		Current set low limit
High Limit		Current set high limit
Status		Indicate the status of limit operation (Pass/Fail)
Low Failures		The number of low limit exceeding failures
High Failures		The number of high limit exceeding failures

1) Limit setting method

Select [High] or [Low], switch digits by left/right direction buttons, and modify digits by up/down direction buttons.

2) Unit of limit

The unit of limit is decided by current measuring function.

3) Over-range indicator

The font of primary measurement will change to red from black and beeper will beep if the reading is exceeding the high/low limit.

4) Range of limit operation

- The set high limit should always higher than the low limit.
- The high/low limits are saved in volatile memory, and will be auto reset to default value after power off.

2.8.3 The dBm Operation

dBm is an decibel unit represents the absolute value of power, and is relative to 1mW. The dBm operation is to work out the power of reference resistance by measured voltage. The dBm operation is only suitable for AC/DC voltage measurement.

Press Math → [dBm] → [On] to enter the interface of Figure 2-44.

Figure 2-44 Interface of dBm operation

Menu of dBm operation

Function menu	Options	Description
dBm	On/Off	Turn the dBm function on or off
Resist		Can be set by direction buttons in the range of 1Ω~8000Ω
Done		Save current settings and return to previous menu

The operating method of dBm

In dBm operation, the measured voltage can be transferred to dBm value by formula below:

dBm = 10 x Log10 [(Reading2/RREF)/0.001W]

2.8.4 dB Operation

dB represents relative value and is applied to the relative operation of dBm. The dB operation is only suitable for AC/DC voltage measurement.

Press Math → [dB] → [On] to enter the interface of Figure 2-45.

Figure 2-45 Interface of dB operation

Menu of dB operation

Function menu	Options	Description
dB	On/Off	Turn the dB function on or off
Resist		Can be set by direction buttons in the range of 50Ω

		~ 8000Ω
dB Rel		Set the relative value of dB
Done		Save current settings and return to previous menu

The operating method of dB

In dB operation, the instrument will work out the dBm value of next reading, and count the deference between this dBm value and the saved set dB value, as formula shown below:

dB = 10xLog10 [(Reading2/RREF)/0.001W] - dB relative value

The set range of dB is -200 dBm ~ +200 dBm. The default dB value is 0dBm.

The dB relative value

Input a value in operating interface by direction button and save it as dB relative value.

The dB relative value is saved in volatile memory, and will be auto deleted after power off.

2.8.5 The Relative Operation

The relative operation is applied to relative measurement. The reading is the difference between the measuring value and the set value.

Press Math → [Relatively] → [On] to enter the interface of Figure 2-46.

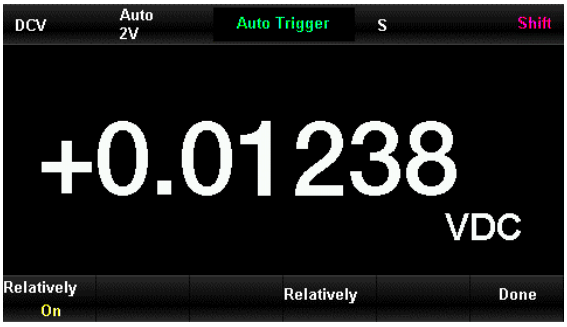


Figure 2-46 Interface of relative operation

Menu of relative operation

Function menu	Options	Description
Relatively	On/Off	Turn the relative function on or off
Relatively		Can be set by direction buttons
Done		Save current settings and return to previous menu

The relative operating method:

The result of relative measurement will be displayed in relative operation.

The primary measurement value = measured value – set value

Relative operation is allowed in the measurements of DC/AC voltage, DC/AC current, resistance, frequency, cycle, capacitance and temperature.

2.9 Display Format

3 kinds of display formats are supported by UT8805E. User can check the measured data by number, bar chart, trend chart, and histogram.

2.9.1 Number

Press Math to enter the display function menu, press [Display] to enter the interface below. The number display format is enabled by default.

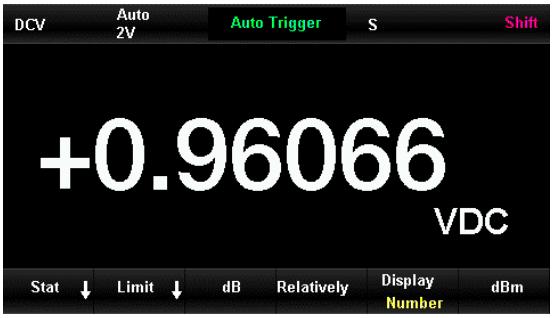


Figure 2-47 Number display format

2.9.2 Bar Chart

Steps:

1) Select [Bar] to enable bar chart display format.

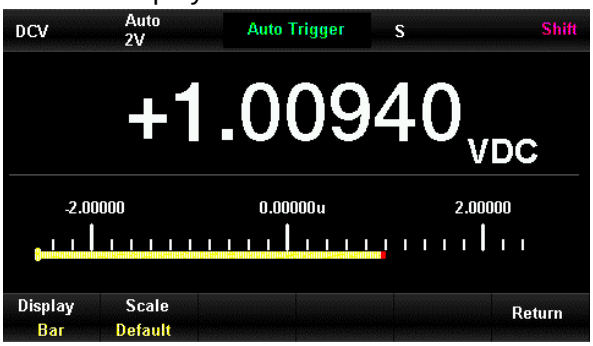


Figure 2-48 Bar chart display format

2) Select [Scale] to set method of horizontal scales to be Default, Manual or Limit setting.

Menu of bar chart manual settings

Function menu	Description
High	Set the high limit of horizontal scale
Low	Set the low limit of horizontal scale
Center	Set the middle value of horizontal scale
Span	Set the span of horizontal scale
Return	Save current settings and return to previous menu

2.9.3 Trend Chart

Steps:

1) Select [Trend] to enable trend chart display format.

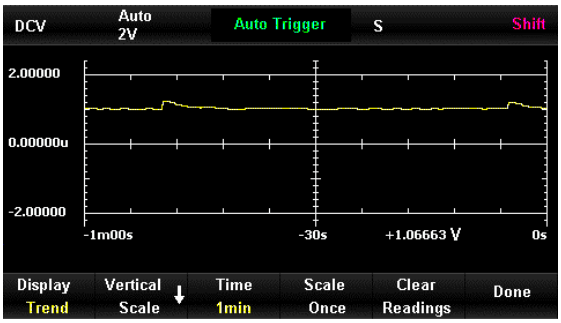


Figure 2-49 Trend chart display format

Menu of trend chart display function

Function menu	Description
Display Trend	The current display format is trend chart
Vertical Scale	Select the setting method of vertical scale
Autoscale Once	Set vertical scale automatically once
Clear Readings	Clear current data and restart the statistics
Done	Save current settings and return to previous menu

2) Press [Vertical Scale] to set method of vertical scales to be Default, Manual or Limit setting.

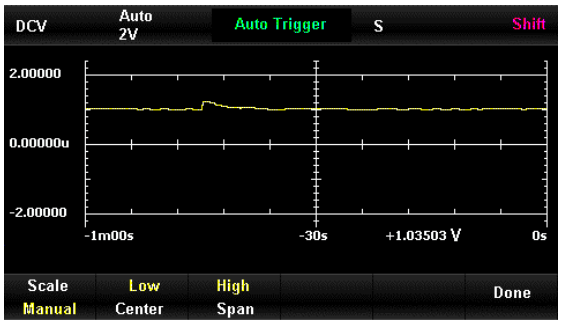


Figure 2-50 Trend chart manual setting

2.9.4 Histogram

The histogram display measured data by frequency distribution.

Steps:

1) Press [HISTO] to enable histogram display format.

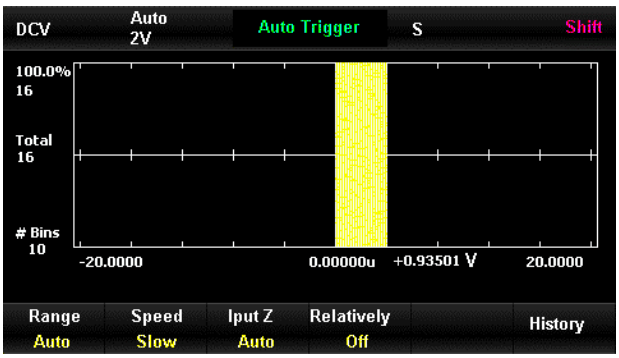


Figure 2-51 Histogram display format

Histogram display function menu

Function menu	Description
Display Histo	The current display format is histogram
Autoscale Once	Set vertical scale automatically once
Setting	Set histogram manually
Clear	Clear current reading and restart the statistics
Cumulate	Display or hide the curve of cumulative distribution function
Return	Save current settings and return to previous menu

2) Press [Setting] to enable manual setting mode as Figure 2-51.

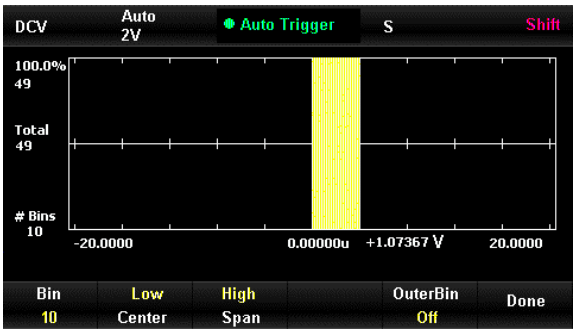


Figure 2-51 Histogram manual setting

Histogram setting menu

Function menu	Options	Description
Bin		Set the number of bins: 10 20 40 100 200 400
High		Set the high limit of horizontal scale
Low		Set the low limit of horizontal scale
Center		Set the middle value of horizontal scale
Span		Set the span of horizontal scale
OuterBin	On/Off	Display or hide the outer bin, which shows the readings out of the bins range
Done		Save current settings and return to previous menu

2.9.5 Enabled trigger

The multimeter comes with trigger function, can be triggered by Run/Stop or Single button. Auto or single trigger modes are selectable. Auto trigger is enabled by default after power on.

2.9.6 Auto Trigger

Press Run/Stop to enable auto trigger to acquire continuous readings automatically. **Auto Trigger** will be displayed above the display. Press Run/Stop button again to stop trigger.

2.9.7 Single Trigger

Press Single button to enable single trigger once. **Single Trigger** will be displayed above the display.

2.9.8 Hold Measurement

In Hold measurement, when a serial of stable readout is measured, beeper will beep once and record the measured value on the display. 8 readings can be remained on the display.

Press Shift → Single to enter Hold measurement, **Probe Hold** will be displayed above the display as Figure2-53.

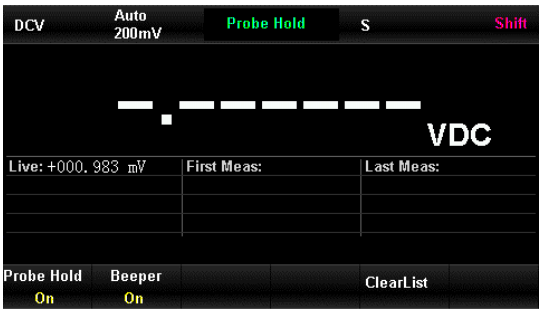


Figure 2-53 Hold measurement

Menu of Hold measurement

Function menu	Options	Description
Probe Hold	On/Off	Turn the probe hold function on or off
Beeper	On/Off	Turn the beeper on or off
Clear List		Clear all the history data on list

2.9.9 Storage Management

UT8805E built-in 1GB Nand Flash memory and external U-disk can be used to save and read the data. The location, name and format of files are configurable in storage management menu.

Press Shift → Math button to open the menu of storage management as Figure 2-54.

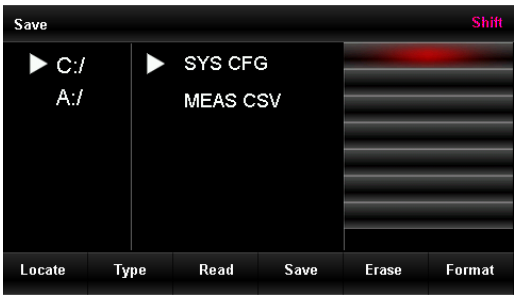


Figure 2-54 Menu of storage management

Menu of storage management

Function menu	Description
Locate	Select the storage location by direction buttons
Type	Select the type of file, .CFG is configuration file, and .CSV is data file
Read	Read .CFG file to configure UT8805E
Save	Save in selected type and input the names of file by direction buttons
Erase	Delete selected file
Format	Formatting built-in Nand Flash memory
Copy to U disk	Copy the selected file to U disk
All copy to U disk	Copy all files to U disk

Chapter 3 Practical Cases

3.1 Readings Statistics

The value of readings statistics is refreshing when multi-readings are continuously measuring as Figure 3-1 and 3-2.

Steps:

1) Press mV button to enable DC voltage measurement and select proper voltage range.
2) Connect the ends of test leads with the multimeter. Connect the red test lead to terminal Input-HI and the black one to terminal Input-LO.
3) Set the parameters of statistics operation. Press Math and select [Stat], which can turn on the statistics operation to analyze the maximum and minimum value in measurement.
4) Connect the test leads with the circuit to measure.

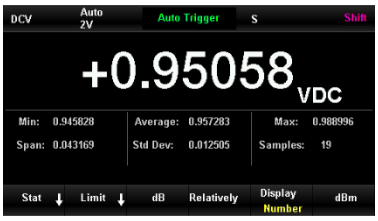


Figure 3-1 DCV readings statistics interface 1

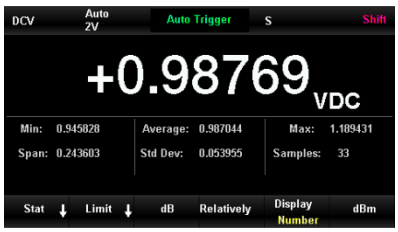


Figure 3-2 DCV readings statistics interface 2

3.2 Elimination of Test Leads Impedance Error

Relative operation is recommended in low resistance measurement, which can eliminate the test lead impedance error.

Steps:

1) Press Ω2W button to choose 2-wire resistance measurement.
2) Connect the ends of test lead with the multimeter. Connect the red test lead to terminal Input-HI and the black one to terminal Input-LO.
3) Select proper range of resistance according to measuring resistance. Auto range is selected by default.
4) Short circuit the test leads and the resistance impedance will be displayed as Figure 3-3.
5) Press Math → [Relatively] to set the reference value by direction buttons.
6) Users can also open the relative value in measurement to obtain the test lead impedance after relative operation.

Figure 3-3 Reading of short-circuit test leads

Figure 3-4 Reading after relative operation

3.3 DBm Measurement

dBm measurement is commonly used in audio signal measurement.

Steps:

1) Press ~V to enable AC voltage measurement and select proper voltage range.
7) Connect a test lead with the multimeter. Connect the red test lead to terminal Input-HI and the black one to terminal Input-LO. See Figure 3-5.
2) Set parameters of dBm operation. Press Math → [dBm] to enable dBm function. Set the dBm operation set value 50Ω as the reference value of hypothetical circuit. The power value of reference resistance will be displayed.

Figure 3-5 dBm measurement

3.4 dB Measurement

The dB value is a common measurement unit in the areas of electronic, wireless, mechanics, impact vibration, mechanics power and acoustic. The power difference between circuits (dB value) can be measured by following steps:

Method 1

Measure dBm1 & dBm2 of two circuits as **3.3 dBm Measurement** shown, dB=dBm1-dBm2

Method 2

1) Press ~V button to enable AC voltage measurement and select proper voltage range.
2) Connect a test lead with the multimeter. Connect the red test lead to terminal Input-HI and the black one to terminal Input-LO. See Figure 3-6.
3) dBm value can be measured as 3.3. Press Math → [dB] to enable dB function. Set the relative value of dB (dBm2), and the power difference between 2 circuits will be displayed.

Figure 3-6 dB measurement

Method 3

1) Connect to circuit 1, Measure dBm2 values as 3.3 **dBm Measurement** shown**.**
2) Press Math → [dB] to enable dB function and set dBm1, the current measured value will be set as the dB relative value. By this time, the reading is 0.
3) Connect to circuit 2, and the power difference between 2 circuits will be displayed.

3.5 Limit Test

In the limit test, indication will be enabled and beeper will beep for over range signal according to the set high/low limit.

Steps:

1) Press ~V button to enable AC voltage measurement and select proper voltage range.
2) Connect a test lead with the multimeter. Connect the red test lead to terminal Input-HI and the black one to terminal Input-LO.
3) Press Math → [Limit] → [High]/[Low] to set the high/low limits.
4) Enable the limit test function and beeper. The state of limit test is PASS when the measured value is within the limits.
5) If the high limit is 2V and the measured value exceeds the limit, the state of limit test is FAIL, beeper beeps once and the interface turns red. The fail number will be also recorded.

Figure 3-7 ACV low limit setting

Figure 3-8 ACV High limit setting

Figure 3-9 Interface of limit test

3.6 Hold Measurement

With Hold measurement, a stable reading can be remained on the display, even if the test leads are removed.

Steps:

1) Press mV button to enable DC voltage measurement and select proper voltage range.
2) Connect a test lead with the multimeter. Connect the red test lead to terminal Input-HI and the black one to terminal Input-LO.
3) Press Shift → Single to enter the interface of Hold measurement. The DC voltage will be recorded as Figure 3-10.
4) Press ~V button to enable AC voltage measurement and select proper voltage range.
5) Connect a test lead with the multimeter. Connect the red test lead to terminal Input-HI and the black one to terminal Input-LO. The AC voltage will be recorded as Figure 3-11.

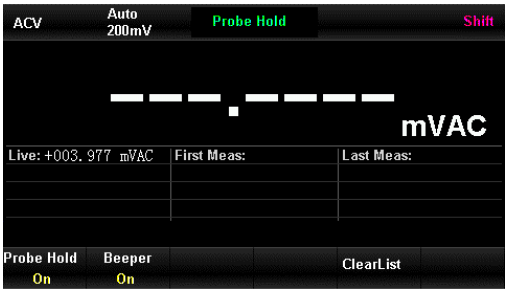


Figure 3-10 DCV Hold measurement

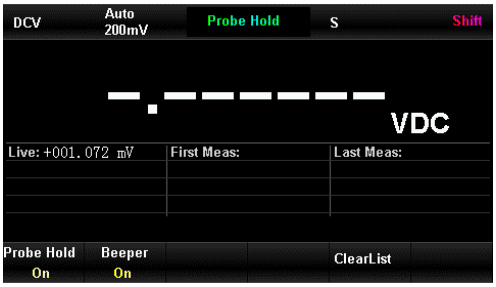


Figure 3-11 ACV Hold measurement

3.7 Thermocouple Setting and Measurement

Thermocouple is common temperature sensor. The type, voltage and the cold junction temperature of thermocouple is required in thermocouple measurement. With a built-in temperature sensor, UT8805E is able to measure the temperature (cold junction temperature) near the terminal HI and terminal LO.

In thermocouple temperature measurement, the multimeter will automatically measure the cold junction temperature and calculates the absolute temperature of the hot junction according to the cold junction temperature.

In the setting of thermocouple sensor, according to the thermocouple type, users only need to input the corresponding relationship between the thermocouple voltage and the temperature difference between cold and hot junctions.

Steps:

1) Connect the sensor as **Chapter 2**. See Figure 3-12.
2) Ensure the type of thermocouple sensor.
   Press Shift button, and then press ⊣⊢ button to enable temperature measurement. Press [Probe

Setting] → [Probe] → [TCouple], and then select [K type] in [Type]. The interface is shown below.

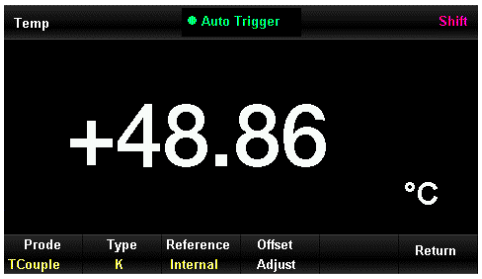


Figure 3-12 K-type thermocouple temperature measurement

3) Return to the previous menu, select [Probe] → [Unit] to set the unit to be °C, then the measured value will be displayed.
4) Press Dual button and then select [Ref Temp] to display the temperatures of measurement and reference sensor simultaneously.

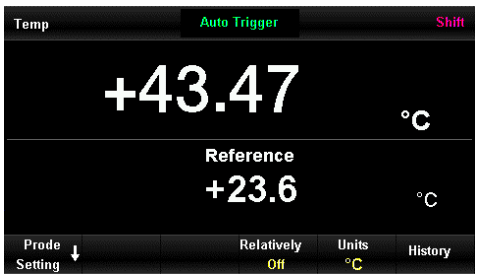


Figure 3-13 Dual display of temperature measurement

Chapter 4 Measurement Guide

4.1 True RMS AC Measurement

With true RMS response of AC measurement, at a period, the average heating power of resistor is proportional to the RMS value square of the voltage on resistor, which has nothing to do with waveform. UT8805E can accurately measure the true RMS value of voltage or current waveform when its energy outside the effective bandwidth of the multimeter can be ignored.

The AC coupling true RMS value that the AC voltage/current functions measured, is the RMS of signal AC component (the DC component is filtered out).

Since the sine wave, triangle wave and square wave do not contain DC offset, their AC RMS is equal to AC+DC RMS. As shown in Table 4-1.

Table 4- 1 The true RMS AC measurement of sine/triangular/square wave

Waveform	Crest Factor C.F.	AC true RMS	AC+DC RMS
Sine wave	$\sqrt{2}$	$\frac{V}{\sqrt{2}}$	$\frac{V}{\sqrt{2}}$
Triangular wave	$\sqrt{3}$	$\frac{V}{\sqrt{3}}$	$\frac{V}{\sqrt{3}}$
Square wave	$\sqrt{\frac{T}{t}}$	$\frac{V}{C.F.} \times \sqrt{1-\left(\frac{1}{C.F.}\right)^2}$	$\frac{1}{C.F.}$

Asymmetrical waveforms contain DC component (such as pulse train), which will be filtered out by AC coupling true RMS measurements.

AC coupling true RMS measurement is ideal for measuring small AC signals with DC offset, such as the AC ripple in the DC power supply output. However, there are cases where AC+DC RMS need to be measured. By this time, the DC and AC component of the signal can be measured by DC/AC voltage functions separately, and then the value of AC+DC RMS can be calculated by following formula. Slow speed mode is necessary for DC voltage measurement to achieve the best AC suppression.

$$RMS_{(AC+DC)} = \sqrt{AC^2 + DC^2}$$

4.2 Crest Factor Error (Non-sinusoidal Input)

The waveform of the input signal will affect the accuracy of the measurement.

Generally, the signal waveform, which is described as crest factor, is the ratio of the crest value to effective value. The greater the crest factor, the greater the energy contained in the high frequency harmonics.

Error related to the crest factor exists in all the multimeters. Particularly, the crest factor error is not suitable for input signals below 100Hz.

The error caused by crest factor can be estimated as follows:

Sum of error = error (sine wave) + error (crest factor) + error (bandwidth).

Error (sine wave): sine wave error
Error (crest factor): outer error of crest factor
Error (bandwidth): the bandwidth error can be estimated according to this **formula:**

Bandwidth Error = $\frac{-C.F. \times F}{4\pi \times BW} \times 100\%$ (% reading)

C.F. The Crest Factor
F Pulse fundamental frequency
BW Effective Bandwidth

Example:
Calculate the approximate measuring error of pulse train input, the crest factor is 2, and the fundamental frequency is 20kHz. Suppose the one-year accuracy of the multimeter is: ± (0.05% of reading + 0.03% of range).

Error sum = (0.05% of reading + 0.03% of range) + (0.05% of range) + (0.8% of reading) = 0.85% of reading + 0.08% of range

4.3 Load Error (AC Voltage)

In AC voltage measurement, the input impedance of UT8805E is 1MΩ, and resistor is in parallel to 100PF capacitors. The multimeter test lead also will introduce some capacitance and load. Table 4-2 shows the approximate input resistance of the multimeter at various frequencies.

Table 4-2 Resistance at various frequencies

Input frequency	Input impedance
100Hz	1MΩ
1kHz	850kΩ
10kHz	160kΩ
100kHz	16kΩ

In low frequency measurement:

Load error (%) = $\frac{-Rs}{Rs+1M\Omega} \times 100\%$

Additional error in high frequency measurement:

Load error (%) = $\left[\frac{1}{\sqrt{1+(2\pi \times F \times Rs \times Cm)}} - 1\right] \times 100\%$

F Input frequency
Rs Internal resistance of signal
Cm Input capacitance (100pF) + capacitance of test leads

Chapter 5 Trouble Shooting

- **If the power switch is pressed without any display**

1) Check whether the power plug is connected properly.
2) Check whether the main power switch on back panel is turned on.
3) Check whether the input power supply fuse on back panel is fused. If it has been fused, please replace it as required.
4) Restart the instrument after the above inspections.
5) If you still cannot use this product normally, please contact UNI-T and let us help you.

- **Reading remains with current signal Inserted**

1) Check whether the test leads are inserted into the terminals correctly.
2) Check whether the current scale fuse on back panel is fused.
3) Check whether the scale is correct (DCI or ACI).
4) Check whether the input is ACI and the scale is in DCI.

- **Abnormal reading with DC power signal connected**

1) Check whether the test lead is inserted into the current terminal and terminal LO correctly.
2) Check whether the current scale fuse on back panel is fused.
3) Check whether the measurement scale has been correctly switched to DCI or DCV scale.
4) Check whether the input is DCI and the scale is in ACI.

- **USB flash drive device cannot be identified**

1) Check whether the U-disk device can work normally.
2) Confirm that it is Flash USB drive device. Hard disk type U-disk device is not supported.
3) Confirm whether the capacity of the U-disk is too large. It is recommended to use U-disk below 4GB.
4) Insert U-disk for inspection after restarting the instrument.
5) Please contact UNI-T if the trouble is unsolved.

Chapter 6 Appendix

Appendix A: Accessories of UT8805E

- A power supply wire appointed to local country
- A pair of test leads
- An USB data cable
- A DB9 cable
- A backup fuse

Note: The length of the USB data cable and network cable of product shall be less than 3m, or the performance may be affected. Please order accessories from local UNI-T office.

Appendix B: Warranty

Uni-Trend guarantees that the product is free from any defect in material and workmanship within 3 years from the purchase date. This warranty does not apply to damages caused by accident, negligence, misuse, modification, contamination or improper handling. The dealer shall not be entitled to give any other warranty on behalf of Uni-Trend. If you need warranty service within the warranty period, please contact your seller directly.

Uni-Trend will not be responsible for any special, indirect, incidental or subsequent damage or loss caused by using this device.

Appendix C: Maintenance and Cleaning

General Maintenance: do not expose the instrument to sunlight for long period or corrosive liquid.

Notice: never stain this product with corrosive liquid, otherwise damage may cause.

Cleaning: disconnect the power. Clean the meter casing with a soft cloth and mild detergent. Do not use abrasives or solvents! Be careful not to scratch the LCD screen when cleaning.

Warning: before restart the instrument, please make sure it is completely dry to avoid electric shock or injury.

Appendix D: Contacts

UNI-T
UNI-TREND TECHNOLOGY (CHINA) CO., LTD.
No. 6, Gong Ye Bei 1st Road,
Songshan Lake National High-Tech Industrial
Development Zone, Dongguan City,
Guangdong Province, China
Tel: (86-769) 8572 3888
www.uni-trend.com