TELEDYNE TEST TOOLS
Everywhereyoulook™

User Manual

T3DMM5-5 Digital Multimeter

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General Safety Summary

Read the following safety precautions carefully to avoid any personal injuries or damage to the instrument and any products connected to it. Use the instrument only as specified.

Use only the power cord supplied with the instrument.

Ground the instrument.

The instrument is grounded through the ground conductor of the power cord. To avoid electric shock, always connect to grounded outlets. Make sure the instrument is grounded correctly before connecting its input or output terminals.

Connect the signal wires correctly.

To avoid damage, observe input polarity and maximum voltage/current ratings at all times.

Observe all terminal ratings and signs on the instrument to avoid fire or electric shock. Before connecting to the instrument, read the manual to understand the input/output ratings.

Do not operate with suspected failures. If you suspect that the product is damaged, contact the Teledyne LeCroy service department immediately.

Do not operate in wet/damp conditions.

Do not operate in an explosive atmosphere.

Keep the surface of the instrument clean and dry.

Avoid circuit or wire exposure. Do not touch exposed contacts or components when the power is on.

Do not operate without covers.

Do not operate the instrument with covers or panels removed.

Use only the fuse specified for the instrument.

Use proper over-voltage protection.

Use anti-static protection. Operate in an anti-static protected area. Ground measurement cable conductors before connecting to the instrument to discharge any static electricity before connecting the cables to the instrument.

Observe ventilation requirements. Ensure good ventilation. Check the vent and fan regularly to prevent overheating.

Safety Terms and Symbols

The following terms may appear on the instrument:

DANGER: Direct injury or hazard may occur.

WARNING: Potential injury or hazard may occur.

CAUTION: Potential damage to instrument/property may occur.

CAT I (1): IEC Measurement Category I, applicable for making measurements on ‘other’ circuits that are not directly connected to mains. See p. 6.

CAT II: IEC Measurement Category II, applicable for making measurements on circuits connected directly to utilization points (socket outlets and similar points) of the low voltage mains installation.

See page 6

(1) CAT I as defined in IEC/EN 61010-031:2008. Note that Measurement Category I was removed in IEC/EN 61010-031:2015 and replaced by ‘O’, indicating "other circuits that are not directly connected to mains."

The following symbols may appear on the instrument:

CAUTION Risk of injury or damage; refer to manual

WARNING Risk of electric shock or burn

Earth Ground Terminal

Protective Conductor Terminal

Frame or Chassis Terminal

ON/ Standby Power

Alternating Current

Operating Environment

Temperature: 0 °C to 40 °C

Humidity: 5% to 90% relative humidity (non-condensing) up to +30 °C. Upper limit derates to 50% relative humidity (noncondensing) at +40 °C.

Altitude: ≤ 2000 m

Use indoors only.

Pollution Degree 2. Use in an operating environment where normally only dry, non-conductive pollution occurs. Temporary conductivity caused by condensation should be expected.

AC Power

Input Voltage & Frequency: 100-120 V at 50/60 Hz or
200-240 V at 50/60 Hz

Manual AC selection with a slide switch.

Power Consumption: 20 W maximum

Mains Supply Connector: CAT II per IEC/EN 61010-1:2010, instrument intended to be supplied from the building wiring at utilization points (socket outlets and similar).

Fuse Type

Current Input Terminal: 250 VAC F 10 A, 3 AG

AC Mains: 250 VAC F 300 mA, 5x20 mm

Input terminal protection limitation.

Protection limitation is defined for the input terminals:

1. **Main input (HI and LO) terminal**

   HI and LO terminals are used for Voltage, Resistance, Capacitance, Continuity, Frequency, Diode and Temperature measurements. Two protection limitations are defined:

   - **HI-LO protection limit:** 1000VDC or 750AVC. This is the maximum measurable voltage. The limitation can be expressed as 1000Vpk.
   - **LO-ground protection limit:** LO terminal can safely "float" 500Vpk relative to ground. The maximum protection limitation of the HI terminal relative to ground is 1000Vpk. Therefore, the sum of the "float" voltage and the measured voltage cannot exceed 1000Vpk.

2. **Sampling (HI Sense and LO Sense) terminals**

   HI Sense and LO Sense are used for 4-wire Resistance measurements. Two protection limits are defined:

   - **HI Sense-LO Sense protection limitation:** 2000Vpk.
   - **LO Sense-LO Sense protection limitation:** 2Vpk.

3. **Current input (I) terminal**

I and LO terminals are used for current measurement. The maximum current which go through the **I** terminal is limited to 10A by the fuse on the back panel.

NOTE:

Voltage on the current input terminal corresponds to voltage on LO terminal. To keep protected, only use the fuse of specified type and value to replace this fuse.

IEC Measurement Category II Overvoltage Protection

To avoid the danger of electric shock, the Digital Multimeter provides overvoltage protection for line-voltage mains connections that meet both of the following conditions:

1. The HI and LO input terminals are connected to the mains under Measurement Category II conditions described in the warning below.
2. The maximum line voltage of the mains does not exceed:

300 VAC for T3DMM4-5

600 VAC for T3DMM5-5 and T3DMM6-5

WARNING:

IEC Measurement Category II includes electrical devices connected to mains at an outlet on a branch circuit, such as most small appliances, test equipment, and other devices that plug into a branch outlet or socket.

The multimeter can make measurements with the **HI** and **LO** inputs connected to mains in such devices (≤ 300 VAC for T3DMM4-5 and ≤ 600 VAC for T3DMM5-5/T3DMM6-5) or to the branch outlet itself.

However, the **HI** and **LO** terminals of the multimeter can't be connected to mains in permanently installed electrical devices such as the main circuit-breaker panels, sub-panel disconnected boxes and permanently wired motors. Such devices and circuits are prone to exceed the protection limits of the multimeter.

Limits for Measurements on Other Circuits Not Directly Connected to Mains

Max. rated input voltage: 1000 Vrms

Transient overvoltage: 4000 Vpk

WARNING:

Voltages above 300 VAC (for T3DMM4-5) or 600 VAC (T3DMM5-5 / T3DMM6-5) can only be measured in circuits that are isolated from mains. However, there may be transient over voltage in circuits that are isolated from mains. The multimeter is able to withstand occasional transient overvoltage up to 4000 Vpk. Please don't use this instrument to measure circuits where transient overvoltage may exceed this level.

Introduction to the T3DMM5-5

T3DMM5-5 is a 5½ digit reading resolution, dual-display instrument, especially fitting to the needs of high-precision, multifunction, and automation measurements. It contains a combination of basic measurement functions, multiple math functions, and display functions, etc.

T3DMM5-5 has a 4.3 inch colour TFT-LCD display screen. Its clear keyboard layout and operation hints make it easier and quick to use. It also supports multi-interfaces such as USB Device, USB Host, and LAN.

Main Features:

- 4.3 inch colour TFT-LCD display screen with 480*272 resolution
- Real 5½ digits readings resolution
- Up to 150rdgs/S measurement speed
- True-RMS AC Voltage and AC Current measurements
- 1 Gb Nand Flash size, mass storage configuration files and data files
- Built-in cold terminal compensation for thermocouples
- Support standard SCPI and control software on a PC, compatible With commands of mainstream multimeters
- Supports dual-display function, Chinese and English menu
- Built-in help system, for immediate help and further information
- Support USB Device, USB Host and LAN interfaces
- Configuration and measured data can be imported or exported via VXI 11, USBTMC and USB flash drive, which is convenient for users to modify, view and backup

Abstract

The manual covers information for the effective operation of the T3DMM5-5 Digital Multimeter. It contains these chapters:

Chapter 1 Quick Start

General introduction to the T3DMM5-5 Digital Multimeter, the Front/Back panel and user interface.

Chapter 2 Function and Operation

Introduce the functions and operations of T3DMM5-5 in detail.

Chapter 3 Application Examples

Introduce the measurement functions and capabilities of this instrument through examples.

Chapter 4 Measurement Tutorial

How to avoid and eliminate possible errors that could appear during your measurement, and obtain accurate results.

Chapter 5 General Troubleshooting

Provide general troubleshooting hints and tips.

Chapter 6 Appendix

Provide information about accessories, warranties, troubleshooting, services and support.

Content

Chapter 1 Quick Start

- General Inspection
- Handle Adjustment
- The Front Panel
- The Back Panel
- To Connect Power Line
- User Interface
- To Use Safety Lock

General Inspection

1. **Inspect the shipping container.**

   Please keep the damaged container and cushioning material until the contents of the shipment have been checked completely and the instrument has passed the electrical and mechanical test.

   Damage of the instrument caused by the shipment will be compensated by the shipper or carrier. Teledyne Test Tools will not be responsible for free repair or replacement.

2. **Inspect the instrument.**

   If there is any mechanical damage or damaged accessories, or the instrument fails the electrical and mechanical test, please contact your Teledyne Test Tools sales.

3. **Check the accessories.**

   Check the accessories according to the packing list carefully. If there are any accessories damaged or missing, please contact your Teledyne Test Tools sales.

How to adjust the Handle

Adjust the handle position of T3DMM5-5 properly to place the instrument in a stable position, so that users can manipulate and observe the display better. Please grip the handle by the two sides and pull it outward. Then rotate the handle to the appropriate position. Please operate as shown in the following diagrams.

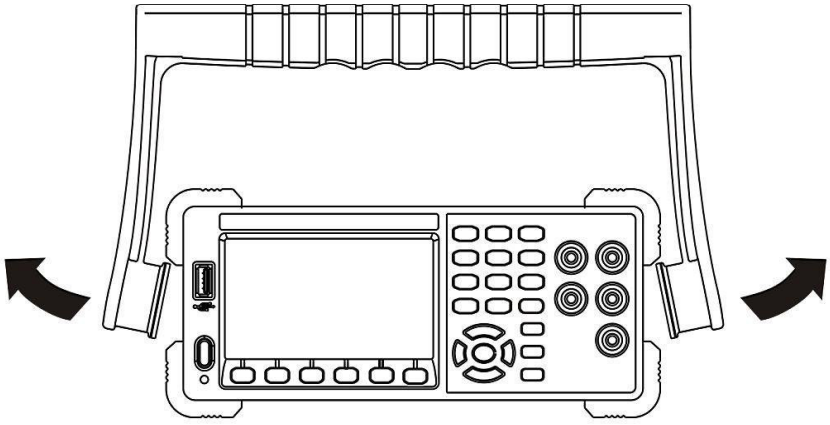


Diagram 1- 1 Handle adjustment

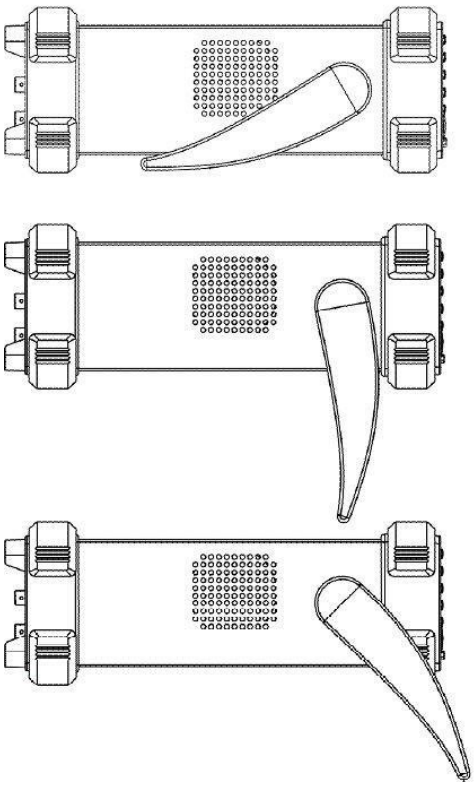


Diagram 1- 2 Horizontal Position

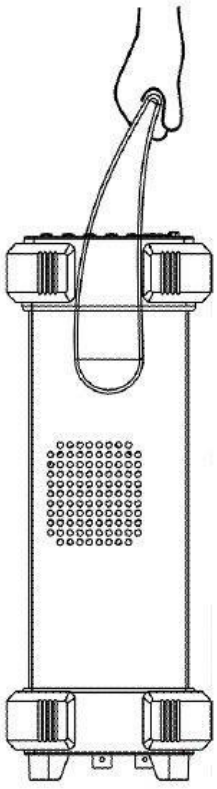


Diagram 1- 3 Carrying Position

Front Panel

T3DMM5-5 Digital Multimeter provides users with a brief and clear front panel. These control buttons are logically group and users only need to choose the corresponding buttons to carry out the basic operations, as shown in Diagram 1- 4.

Diagram 1- 4 Front Panel Overview

A LCD Display

B USB Host

C Power Key

D Menu Keys

E Basic Measurement Function Keys

F Auxiliary Measurement Function Keys

G Enable Trig Keys

H Direction Keys

I Signal Input Port

Back Panel

T3DMM5-5 Digital Multimeter's Back Panel provides users with abundant interfaces as shown in the following diagram.

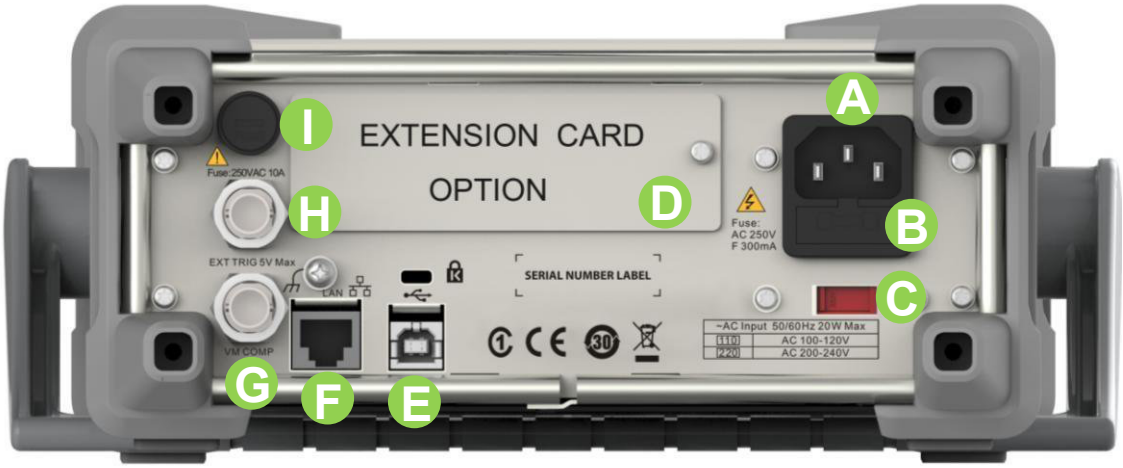


Diagram 1- 5 Back Panel Overview

A Power Socket

B Power Fuse

C AC Voltage Selector

D Extension card interface (not used)

E USB Device

F LAN

G VMC Output

H Ext Trig

I Current Input Fuse

Power On

Please power on the instrument with the following steps:

1. Adjust the AC Voltage Selector to 110 (100~120V, 45~440Hz, AC) or 220 (200~240V, 50/60Hz, AC) in accordance with the power standards of your country.
2. Connect the instrument to an AC supply via a power cord supplied by **Teledyne Test Tools**.
3. Press the power key on the front panel, the instrument will be started a few seconds later.

User Interface

Single Display:

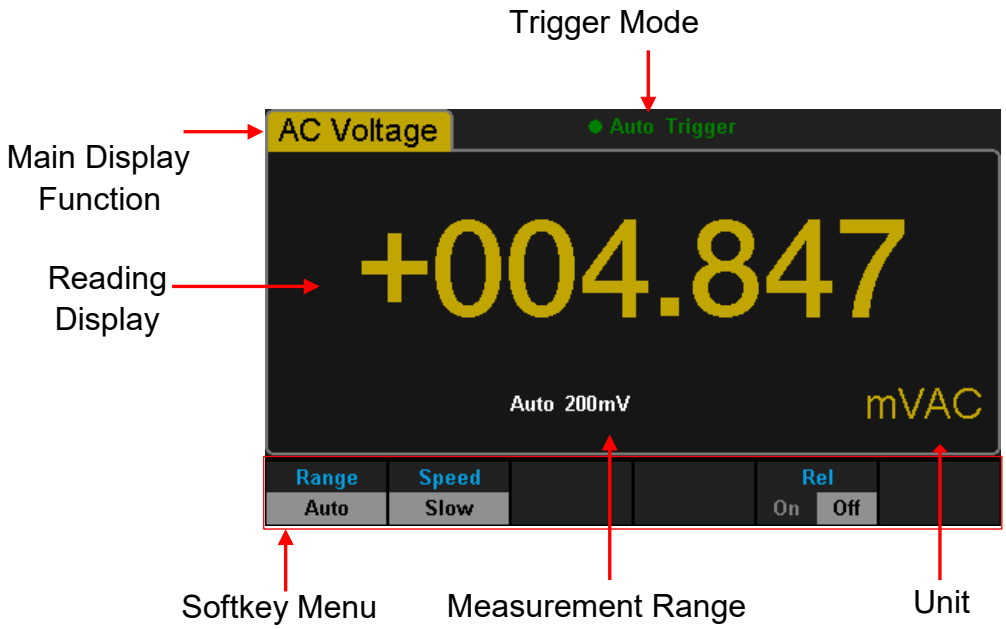


Diagram 1- 6 Single Display Interface

Dual-Display:

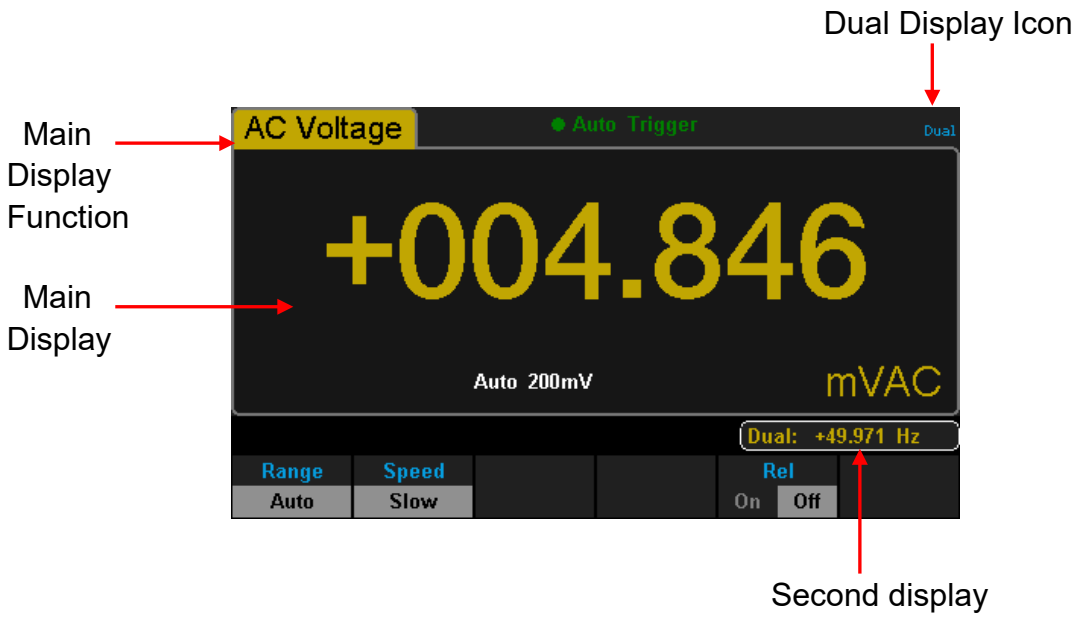


Diagram 1-7 User Interface

Chapter 2 Function and Operation

- To Measure DC Voltage/Current 

- To Measure AC Voltage/Current 

- To Measure 2-Wire/4-Wire Resistance 

- To Measure Frequency/Capacitance 

- To Test Continuity/Diode 

- To Measure Temperature 

- To use Dual-display Function or Set Up the Utility 

- Acquire Function or Help System 

- Math Function or Display Function 

- Run/Stop 

- Single Trigger / Hold Measurement Function 

- To Switch Functions or Return to Local Menu 

- To Select Measurement Range 

To Select Measurement Range

The Multimeter has two kinds of modes of selecting a measurement range: “Auto” and “Manual”. It can select the appropriate range according to the signals input in Auto mode, which is very convenient for users. While in Manual mode, you can obtain a higher reading precision. Range selection keys are on the right side of the front panel as shown in diagram 2- 1.

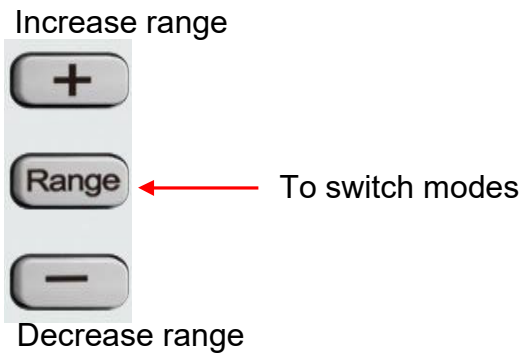


Diagram 2- 1 Range Selection Keys

Method 1: By Function keys on the Front Panel

Auto Range: Press Range to switch between Auto Range and Manual Range. **Manual Range:** Press + to increase the range and press − to decrease the range.

Method 2: By soft keys on the measurement main interface as Diagram 2-2. Auto Range: Press **[**Auto**]** to choose Auto Range, meanwhile the Manual Range is disabled.

Manual Range: Press [200mV**], [**2V**], [**20V**], [**200V**]** or **[**1000V**]** to choose a required range manually. Auto Range is disabled.

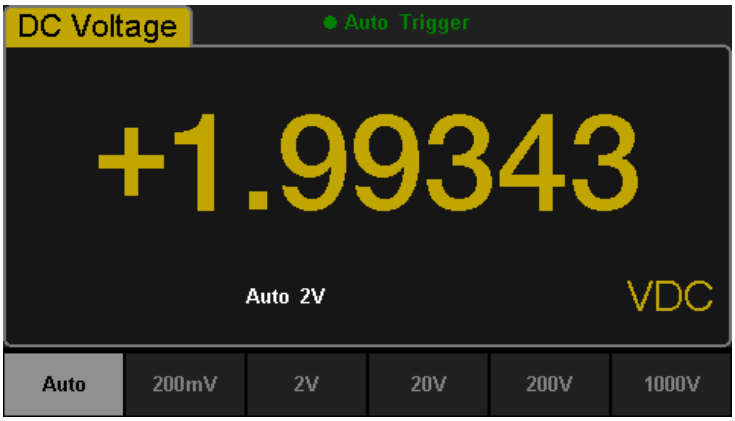


Diagram 2- 2 Range selection menus

Explanation:

1. When the input signal is beyond the current scope of the measurement range, the Multimeter will show “overload”.
2. The Range option will turn back to default setting “Auto” after restarting and remote reset.
3. Users are advised to select the “Auto” range so as to protect the instrument against damage and extract as much data as possible when it is hard to predict the measurement range.
4. For the Dual-display Function, the measurement range of the second display is auto.
5. The range is fixed during Continuity testing. The range for continuity is selected as 2kΩ, while the Diode is 2V.
6. Auto Range is not suitable for measuring current up to 10A. If the signal is used to **I** Terminal, users need to choose range manually.

Selecting Measurement Speed

The instrument provides three types of measurement rates: 5 reading/s, 50 reading/s and 150 reading/s. 5 reading/s is the “Slow” rate; 50 reading/s is the “Middle” rate and 150 reading/s is the “Fast” rate.

Measurement speed can be controlled by the soft key menu. Press **[**Speed**]** and then press **[**Slow**]**, **[**Middle**]** or **[**Fast**]** to choose the measurement speed.

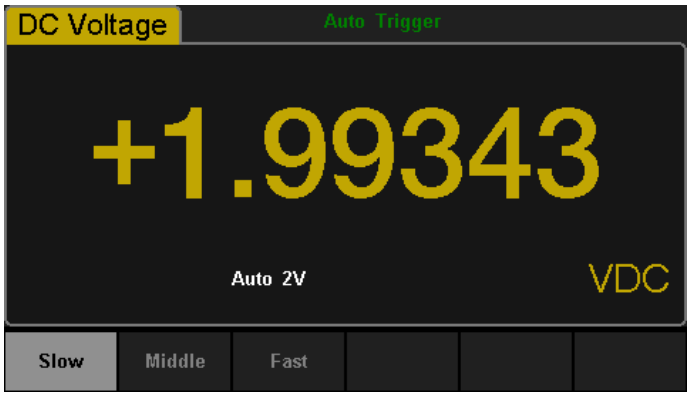


Diagram 2- 3 Range selection menu

Explanation:

1. Three reading rates are available for DCV, ACV, DCI, ACI and 2-Wire/4- Wire Resistance: “Slow”, “Middle” and “Fast”.
2. There is a linkage for both reading resolution and reading (measurement) rate.
3. 5 reading/s gives 5.5 digit resolution.
4. 50 reading/s and 150 reading/s gives 4.5 digit resolution.
5. The reading resolution of Temperature is fixed at 5.5 digit and “Slow” respectively.
6. The reading resolutions and measurement rates of both Diode and Continuity are fixed at 5.5 digit and “Fast” respectively.
7. The reading resolution and measurement rate of the Frequency function are fixed 5.5 digit and “Slow” respectively.
8. The reading resolution and measurement rate of the Capacitance function are fixed at 5.5 digit and “Slow” respectively.

Basic Measurement Functions

T3DMM5-5 Digital Multimeters have the following basic functions:

- **To Measure DC Voltage**
- **To Measure AC Voltage**
- **To Measure DC Current**
- **To Measure AC Current**
- **To Measure 2/4-Wire Resistance**
- **To Measure Capacitance**
- **To Test Continuity**
- **To Test Diode**
- **To Measure Frequency or Period**
- **To Measure Temperature**

To Measure DC Voltage

The Multimeter enables a user to measure DC Voltage up to 1000V. The process steps to connect and measure DC Voltage will be introduced as follows.

Operating Steps:

1. Press DCV on the front panel to enter the DC Voltage measurement interface, as shown in Diagram 2- 4.

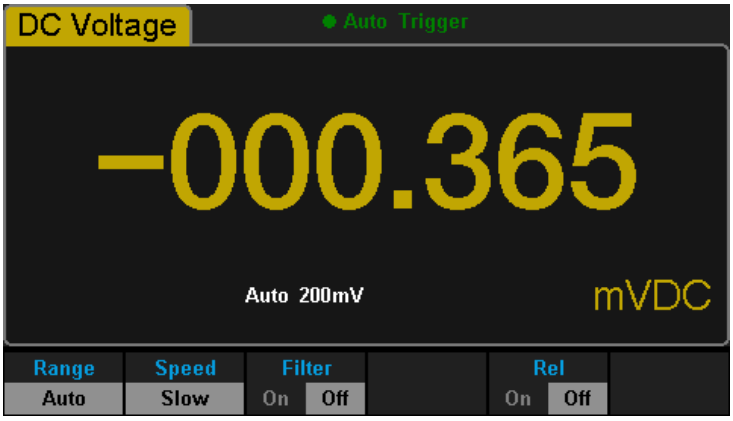


Diagram 2- 4 DC Voltage Measurement Interface

2. Connect the red lead to the terminal Input-HI and the black lead to terminal Input-LO as displayed in diagram 2- 5.

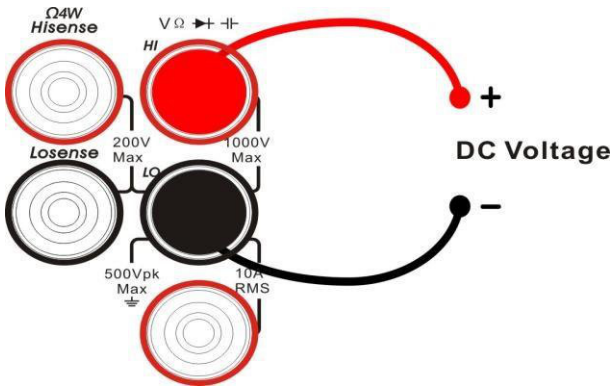


Diagram 2- 5 Sketch Map for Measuring DC Voltage

3. Choose a voltage range in accordance with the measured circuit.

Table 2- 1 Measurement Characteristics of DC Voltage

Ranges*	200mV, 2V, 20V, 200V, 1000V
Input Protection	1000V on all ranges (HI terminal)
Configurable	Range, Speed DC input impedance, Rel

NOTE*:

- All the ranges enable a user to obtain a 20% value higher than the original except 1000V. Both the Manual and Auto are available for setting every range.
- When inputting a range that is higher than 1000V at the 1000V Level, “overload” will be displayed on the screen.
- 1000V input protection exists in every range.

4. Set the DC input impedance (Only for Manual 200mV and 2V range).

   Press **[**Input Z**]** to set the DC resistance to “10M” (default value) or “>10G”. Users can execute DC voltage measurement directly without modifying this parameter which has been setup before leaving the factory.

5. Set AC Filter function.

   Press **[**Filter**]** toturn the AC Filter on or off. (**NOTE: Only DC Voltage and DC Current have this function**.)

6. Set the relative value (Optional operation).

   Press **[**Rel**]** to turn on or off the Relative math function. When it is on, the reading displayed is a relative value which comes from the result of actual measurement value minus the value that has been set. The default relative value is the measurement value when the function is turned on. For details, please refer to “Maths Functions” in Chapter 2.

7. Read the measurement result.

   Select the required measurement rate (reading rate) by pressing **[**Speed**]** and read the measurement result.

8. View historical data.

   There are four methods to view historical data: “Number”, “Bar Meter” “Trend Chart” and “Histogram”.

Measure DC Current

The Multimeter can measure the DC Current up to 10A. The method to connect and measure the DC Current will be introduced in detail in the following steps.

Operating Steps:

1. Press Shift and DCV on the front panel to enter the DC Current measurement interface, as shown in diagram 2- 6.

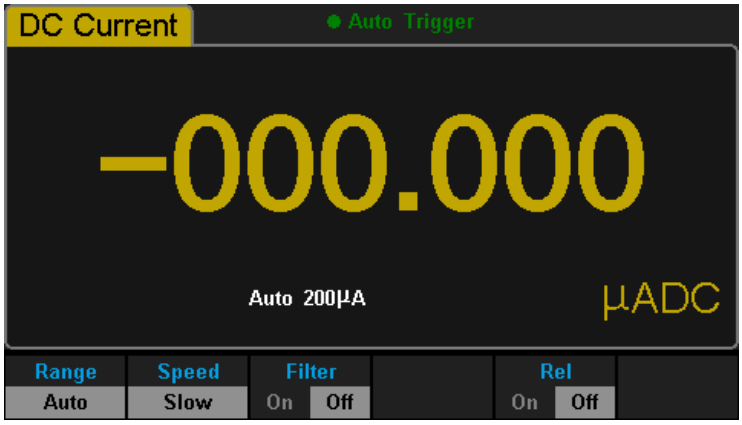


Diagram 2- 6 DC Voltage Measurement Interface

2. Connect the red lead to the terminal Input-I and the black lead to terminal Input-LO as displayed in diagram 2- 7.

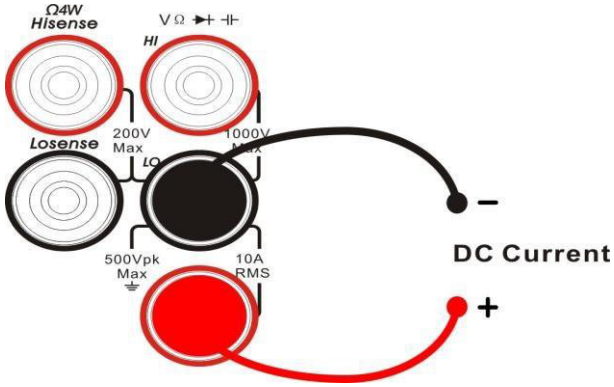


Diagram 2- 7 Connections for Measuring DC Current

3. Choose a current range in accordance to the measured circuit.

Table 2- 2 Measurement Characteristics of DC Current

Ranges*	200μA, 2mA, 20mA, 200mA, 2A, 10A
Input Protection	10A (back panel), 12A (inside the instrument)
Configurable	Range, Speed, Rel, Auto

NOTE*:

All the ranges enable a user to obtain a 10% value higher than the original except 10A. Manual and Auto are available for setting every range.

4. Set the relative value (Optional operation).

   Press **[**Rel**]** to turn on or off, the Relative math function. When it is on, the reading displayed is a relative value which comes from the result of actual measurement value minus the relative value that has been set. The default relative value is the measurement value when the function is on. For details, please refer to “Maths Functions” in Chapter 2.

5. Read the measurement result.

   Select the required measurement rate (reading rate) by pressing **[**Speed**]** and read the measurement result.

6. View historical data

   There are four methods to view historical data: “Number”, “Bar Meter” “Trend Chart” and “Histogram”.

7. Set AC Filter function.

   Press **[**Filter**]** to open or close the AC Filter.

To Measure AC Voltage

The Multimeter can measure the AC Voltage up to 750V. The method to connect and measure the AC Voltage will be introduced in detail in the following steps.

Operating Steps:

1. Press ACV on the front panel to enter the AC Voltage measurement interface, as shown in Diagram 2- 8.

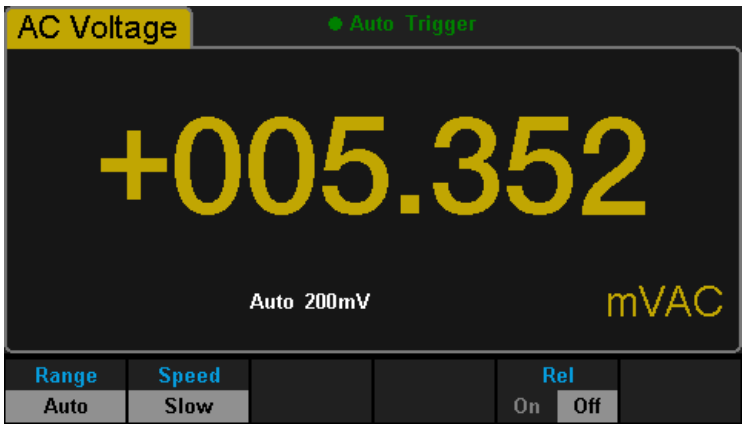


Diagram 2- 8 AC Voltage Measurement Interface

2. Connect the red lead to the terminal Input-HI and the black lead to terminal Input-LO as the displayed in diagram 2- 9.

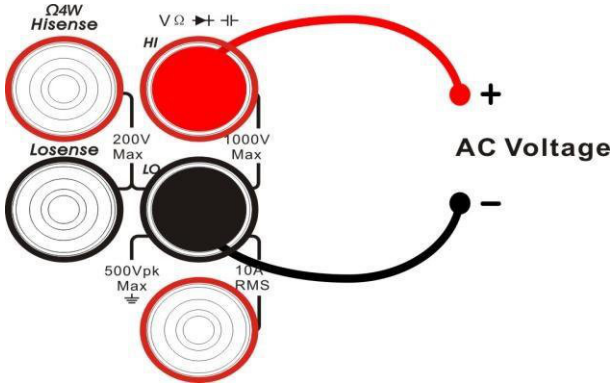


Diagram 2- 9 Connections for Measuring AC Voltage

3. Choose a voltage range in accordance to the measured circuit.

Table 2- 3 Measurement Characteristics of AC Voltage

Ranges*	200mV, 2V, 20V, 200V, 750V
Input Protection	750Vrms on all ranges (HI terminal)
Configurable	Range, Speed, Rel, Auto

NOTE*:

- All the ranges can withstand a 20% value higher than the range maximum except 750V. Manual and Auto are available on every range.
- When inputting a value that is higher than 750V at the 750V Level, “overload” will be displayed on the screen.
- 750V input protection exists on every range.

4. Set the relative value (Optional operation).

   Press **[**Rel**]** to turn on or off the Relative math function. When it is on, the reading displayed is a relative value which comes from the result of actual measurement value minus the relative value that has been set. The default relative value is the measurement value when the function is Turned on. For details, please refer to “Maths Functions” in Chapter 2.

5. Read the measurement result.

   Select required measurement rate (reading rate) by pressing [Speed] and read the measurement result. Press Dual and then press Shift and ⊣⊢ to get the frequency value measured from the input AC signal.

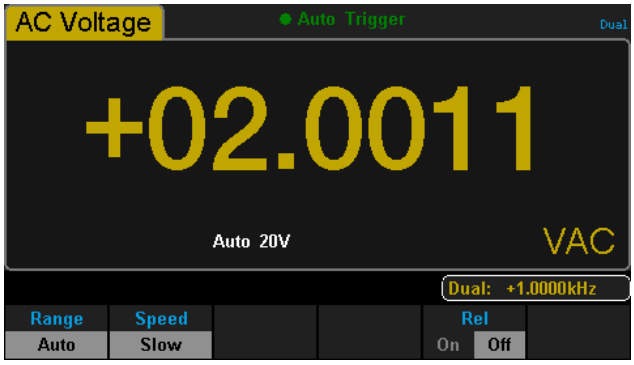


Diagram 2- 10 Dual-display

6. View historical data

   There are four methods to view historical data: “Number”, “Bar Meter” “Trend Chart” and “Histogram”.

To Measure AC Current

The Multimeter can measure the AC Current up to 10A. The method to connect and measure AC Current will be introduced in detail in the following steps.

Operating Steps:

1. Press Shift and ACV on the front panel to enter the AC Current measurement interface, as displayed in diagram 2- 11.

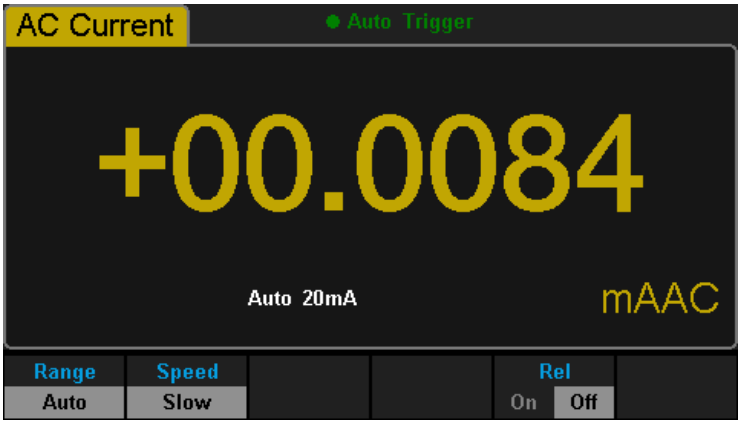


Diagram 2- 11 AC Voltage Measurement Interface

2. Connect the red lead to the terminal Input-I and the black lead to terminal Input-LO as displayed in diagram 2- 12.

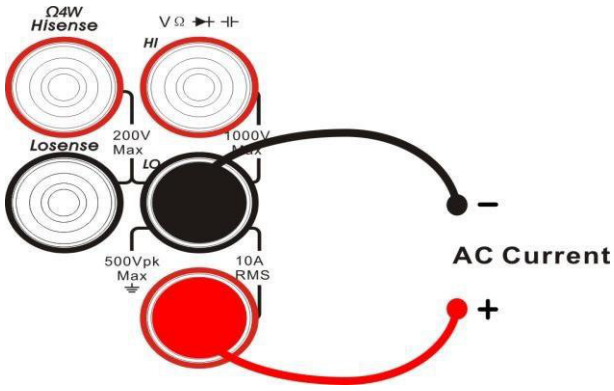


Diagram 2- 12 Connections for Measuring AC Current

3. Choose a current range in accordance to the measured circuit.

Table 2- 4 Measurement Characteristics of AC Current

Ranges*	200uA, 2mA, 20mA, 200mA, 2A, 10A
Input Protection	10A (back panel), 250V(fuse), 12A (inside the instrument)
Configurable	Range, Speed, Rel, Auto

NOTE*:

All the ranges can measure a Value 20% higher than original except 10A.

Both Manual and Auto modes are available for setting every range.

4. Set the relative value (Optional operation).

   Press **[**Rel**]** to turn on or off the Relative math function. When it is on, the reading displayed is a relative value which comes from the result of actual measurement value minus the relative value that has been set. The default relative value is the measurement value when the function is Turned on. For details, please refer to “Maths Functions” in Chapter 2.

5. Read measurement result.

   Select the required measurement rate (reading rate) by pressing **[**Speed**]** and read the measurement result.

6. View historical data

   There are four methods to view historical data: “Number”, “Bar Meter” “Trend Chart” and “Histogram”.

Measure 2-Wire/4-Wire Resistance

The Multimeter can measure a 2-Wire Resistance and 4-Wire Resistance. The method to connect and measure a 2-Wire/4-Wire Resistance will be introduced in detail separately.

2-Wire Resistance

Operating Steps:

1. Press Ω2W on the front panel to enter the 2-Wire Resistance measurement interface, as displayed in diagram 2- 13.

Diagram 2- 13 2-Wire Resistance Measurement Interface

2. Connect the red lead to the terminal Input-HI and the black lead to terminal Input-LO as displayed in diagram 2- 14.

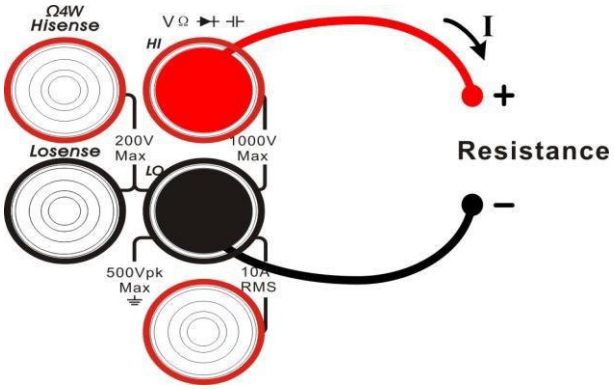


Diagram 2- 14 Connections for Measuring 2-Wire Resistance

3. Choose a resistance range in accordance to the scope.

Table 2- 5 Measurement Characteristics of 2-Wire Resistance

Ranges*	200Ω, 2kΩ, 20kΩ, 200kΩ, 2MΩ, 10MΩ,100MΩ
Open-circuit Voltage	<8V
Input Protection	1000V on every range (HI terminal)
Configurable	Range, Speed, Rel, Auto

NOTE*:

All the ranges can measure a value 20% higher than the selected range. Both Manual and Auto are available for every range.

4. Set the relative value (Optional operation).

   Press **[**Rel**]** to turn on or off the Relative math function. When it is on, the reading displayed is a value which comes from the result of actual measurement value minus the relative value that has been set. The default relative value is the measurement value when the function is turned on. For details, please refer to “Maths Functions” in Chapter 2.

5. Read the measurement result.

   Select the required measurement rate (reading rate) by pressing **[**Speed**]** and read the measurement result.

6. View historical data

   There are four methods to view historical data: “Number”, “Bar Meter” “Trend Chart” and “Histogram”.

NOTE:

You are recommended to make use of the Relative function when measuring a small resistance to reduce the likelihood of impedance error from the Test Leads

4-Wire Resistance

Operating Steps:

1. Press Shift and Ω2W on the front panel to enter the 4-Wire Resistance measurement interface, as displayed in diagram 2- 14.

Diagram 2- 15 4-Wire Resistance Measurement Interface

2. Connect the red lead to the terminal Input-HI and the black lead to terminal Input-LO as displayed in diagram 2- 16.

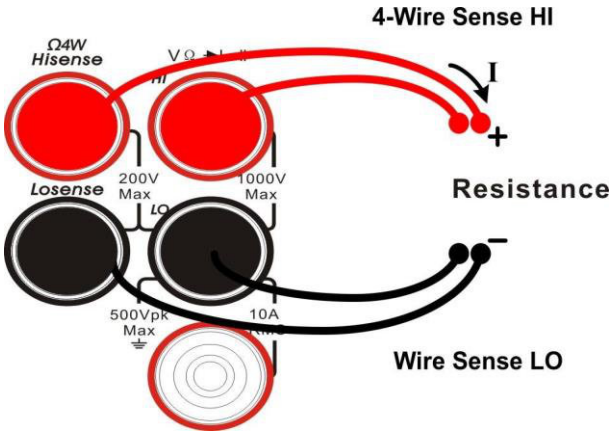


Diagram 2- 16 Connections for Measuring 4-Wire Resistance

3. Manually choose a resistance range or set to Auto.

Table 2- 6 Measurement Characteristics of 4-Wire Resistance

Ranges*	200Ω, 2kΩ, 20kΩ, 200kΩ, 2MΩ, 10MΩ, 100MΩ
Open-circuit Voltage	<8V
Input Protection	1000V on each range (HI terminal) 200V on each range (HI Sense, LO Sense)
Configurable Parameters	Range, Speed, Rel, Auto

NOTE*:

All the ranges can measure a Value that is 20% higher than the range. Both Manual and Auto are available for setting every range.

4. Set the relative value (Optional operation).

   Press **[**Rel**]** to open or close the Relative math function. When it is open, the reading displayed is a value which comes from the result of actual measurement value subtracts the relative value that has been set. The default relative value is the measurement value when the function is opened. For details, please refer to “Maths Functions” in Chapter 2.

5. Read the measurement result.

   Select the required measurement rate (reading rate) by pressing **[**Speed**]** and read the measurement result.

6. View historical data

   There are four methods to view historical data: “Number”, “Bar Meter” “Trend Chart” and “Histogram”.

NOTE:

Please do not put the resistance measuring lead tips on a conductive surface or in your hand to avoid measurement error. The bigger the measured resistance, the more effect there will be if you touch the measuring tips.

To Measure Capacitance

The Multimeter can measure Capacitance up to 10000μF. The method to connect and measure Capacitance will be introduced in detail in the following steps.

Operating Steps:

1. Press ⊣⊢ on the front panel to enter the Capacitance measurement interface, as shown in diagram 2- 17.

Diagram 2- 17 Capacitance Measurement Interface

2. Connect the red lead to the terminal Input-HI and the black lead to terminal Input-LO as the following diagram.

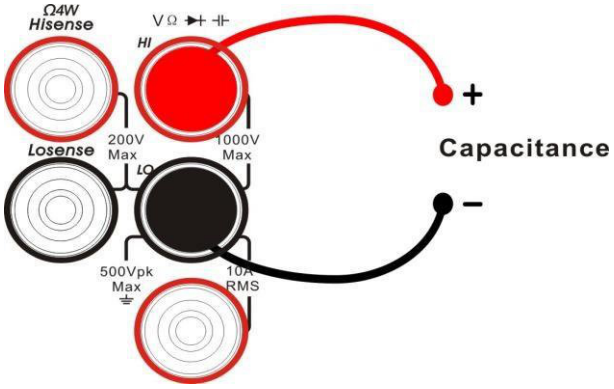


Diagram 2- 18 Sketch Map for Measuring Capacitance

3. Choose a capacitance range in accordance to the measured circuit.

Table 2- 7 Measurement Characteristics of Capacitance

Ranges*	2nF, 20nF, 200nF, 2μF, 200μF, 200μF, 10000μF
Input Protection	1000V on all ranges (HI terminal)
Configurable Parameters	Range, Rel

NOTE*:

All the ranges can obtain a 20% value higher than the original. Both Manual and Auto are available for setting every range.

4. Set the relative value (Optional operation).

   Press **[**Rel**]** to open or close the Relative math function. When it is opened, the reading displayed is a value which comes from the result of actual measurement value subtracts the relative value that has been set. The default relative value is the measurement value when the function is opened. For details, please refer to “Maths Functions” in Chapter 2.

5. Read the measurement result.

   Capacitance measurement is fixed at “Slow” rate. Therefore, you cannot adjust the reading rate when reading the result.

6. View historical data

   There are four methods to view historical data: “Number”, “Bar Meter” “Trend Chart” and “Histogram”.

NOTE:

Before measuring the electrolytic capacitance, you should short circuit the two legs of the electrolytic capacitor and let it discharge.

To Measure Frequency or Period

The Frequency or Period of a signal could be obtained by the Dual-display Function whilst measuring its voltage or current; or by the function button on the front panel. The method to connect and measure the Frequency or Period will be introduced in detail in the following steps.

To Measure Frequency

Operating Steps:

1. Press Shift and ⊣⊢ on the front panel to enter the Frequency measurement interface. The lower right corner of the screen shows the unit of Frequency, as displayed in Diagram 2- 19.

Diagram 2- 19 Frequency Measurement Interface

2. Connect the red lead to the terminal Input-HI and the black lead to terminal Input-LO as displayed in diagram 2- 20.

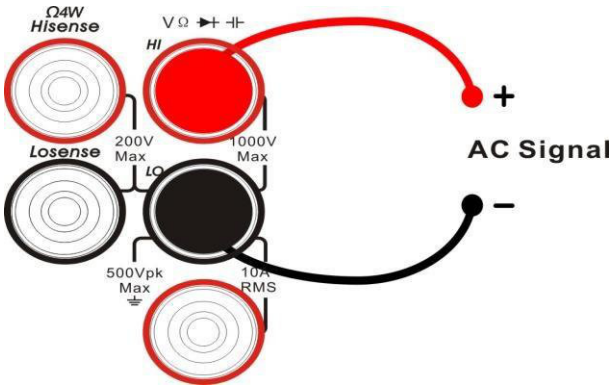


Diagram 2- 20 Sketch Map for Measuring Frequency

3. Choose a voltage range in accordance to the measured circuit.

Table 2- 8 Measurement Characteristics of Frequency

Ranges	200mV, 2V, 20V, 200V, 750V
Measurement Range	20Hz ~ 1MHz
Input Protection	750Vrms on all ranges (HI terminal)
Configurable	Range, Rel

4. Set the relative value (Optional operation).

   Press **[**Rel**]** to open or close the Relative math function. When it is opened, the reading displayed is a value which comes from the result of actual measurement value subtracts the relative value that has been set. The default relative value is the measurement value when the function is opened. For details, please refer to “Maths Functions” in Chapter 2.

5. Read the measurement result.

   Frequency measurement is fixed at “Slow” rate. Therefore, you cannot adjust the reading rate while reading the result.

6. View historical data

   There are four methods to view historical data: “Number”, “Bar Meter” “Trend Chart” and “Histogram”.

To Measure Period

Operating Steps:

1. Press Shift and ⊣⊢ on the front panel and select **[**Period**]** to enter the Period measurement interface. The lower right corner of the screen shows the unit of Period, as displayed in diagram 2- 21.

Diagram 2- 21 Period Measurement Interface

2. Connect the red lead to the terminal Input-HI and the black lead to terminal Input-LO as the displayed in diagram 2- 22.

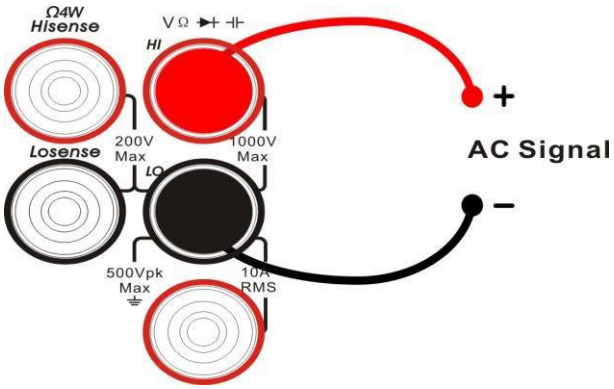


Diagram 2- 22 Sketch Map for Measuring Period

3. Choose a voltage range in accordance to the measured circuit.

Table 2- 9 Measurement Characteristics of Period

Ranges	200mV, 2V, 20V, 200V, 750V
Measurement Range	1μs – 50ms
Input Protection	750Vrms on all ranges (HI terminal)
Configurable	Range, Rel

4. Set the relative value (Optional operation).

   Press **[**Rel**]** to open or close the Relative math function. When it is open, the reading displayed is a value which comes from the result of actual measurement value subtracts the relative value that has been set. The default relative value is the measurement value when the function is opened. For details, please refer to “Maths Functions” in Chapter 2.

5. Read the measurement result.

   Period measurement is fixed at “Slow” rate. Therefore, you cannot adjust the reading rate while reading the result.

6. View historical data

   There are four methods to view historical data: “Number”, “Bar Meter” “Trend Chart” and “Histogram”.

To Test Continuity

Continuity test uses the double leads method to measure the resistance of the measured circuit via the 0.5mA current. When the measured resistance in circuit is lower than the selected value, it is considered to be connected to the instrument. The method to test Continuity will be introduced in detail in the following steps.

Operating Steps:

1. Press Cont on the front panel to enter the Continuity test interface, as displayed in diagram 2- 23.

Diagram 2- 23 Continuity Measurement Interface

2. Connect the red lead to the terminal Input-HI and the black lead to terminal Input-LO as displayed in diagram 2- 24.

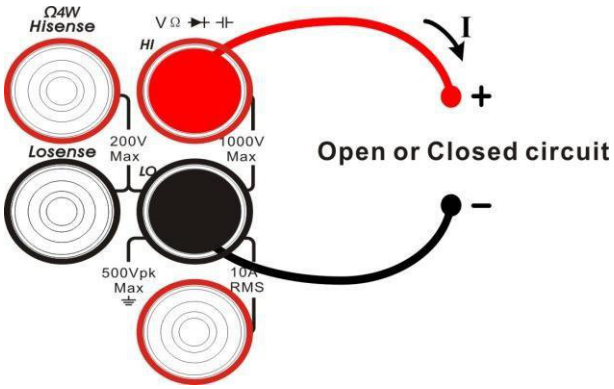


Diagram 2- 24 Sketch Map for Testing Continuity

3. Set the Short-circuit resistance.

   The default value is set as 50Ω before leaving the factory. The value can be changed by using the direction keys. You also can execute the Continuity measurement directly without modification.

Table 2- 10 Measurement Characteristics of Continuity

Test Current	1mA
Ranges*	Fixed at 2kΩ
Open-circuit Voltage	<8V
Input Protection	1000V on all ranges (HI terminal)
Beep Condition	$0 \leq R_{testing} \leq$ Short-circuit impedance 1Ω≤Short-circuit impedance≤2kΩ

4. Set the Beeper function.

   Press **[**Beeper**]** to turn the Beeper on or off. If the circuit is continuous, the instrument will beep once when the Beeper is turned on.

5. Search for the test point and read the measurement result.

NOTE:

Before testing continuity, please turn off the DUT power and discharge all the capacitors to avoid damage to the Multimeter.

To Test Diode

If input voltage is under +0.7V (about 1.4kΩ), the Beeper will beep one time. If input voltage is under 50mV (about 100Ω) the Beeper will beep persistently. The method to test Diode will be introduced in details as the following steps.

Operating Steps:

1. Press Shift and Cont on the front panel to enter the Diode test interface, as displayed in Diagram 2- 25.

Diagram 2- 25 Diode Test Interface

2. Connect the red lead to both terminal Input-HI and anode of the Diode. Connect the black lead to both terminal Input-LO and cathode of the Diode as the displayed in diagram 2-26.

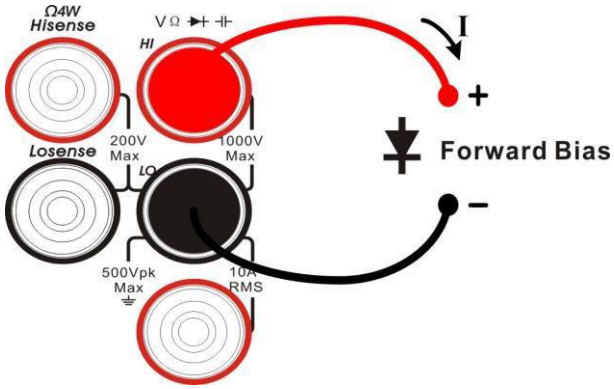


Diagram 2- 26 Sketch Map for testing Diode

Table 2- 11 Characteristics of Checking Diodes

Test Current	1mA
Ranges*	Fixed at 2V
Open-circuit Voltage	<8V
Input Protection	1000V (HI terminal)
Beep Condition	0.1V ≤ V measured ≤ 2.0V

3. Set the Beeper function.

   Press **[**Beeper**]** to turn the Beeper on or off. If the circuit is continuous, the instrument will beep once when the Beeper is turned on.
4. Read the measurement result.
5. Reverse the probes and measure the voltage in the diode once more.

   Evaluate the diode according to the following rules:

   - If the Multimeter shows “overload” when in reverse bias model, it indicates that the diode is normal.
   - If the Multimeter shows voltage about 0V and the instrument beeps persistently when in forward and reverse bias model, it indicates that the diode is short.
   - If the Multimeter shows “overload” when in forward and reverse model, it indicates that the diode is open.

Note:

Before testing diodes, please turn off the power and discharge all the capacitors to avoid damage to the Multimeter.

To Measure Temperature

The Multimeter supports two types of temperature sensor: TC and RTD. The method to connect and measure Temperature will be introduced in detail in the following steps.

Operating Steps:

1. Press Temp on the front panel to enter the Temperature measurement interface, as displayed in diagram 2- 27.

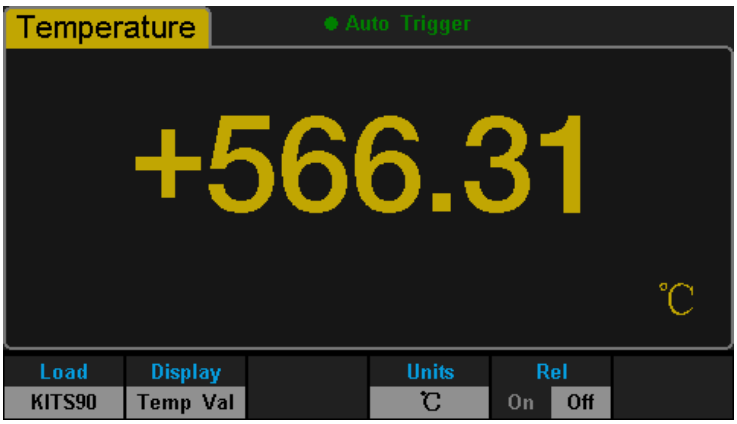


Diagram 2- 27 Temperature Measurement Interface

2. Connect the red lead to terminal Input-HI and the black lead to terminal Input-LO as displayed in diagram 2-28.

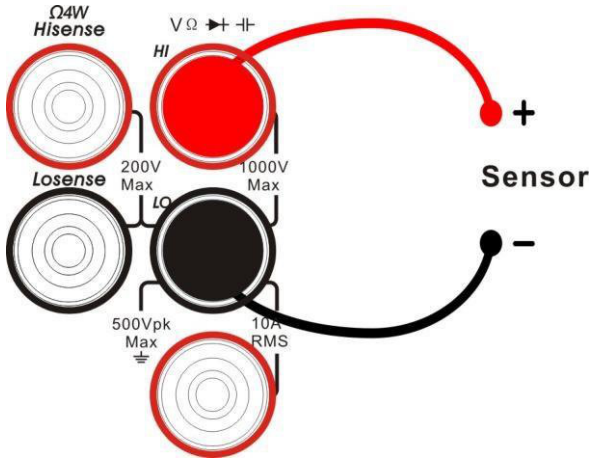


Diagram 2- 28 Sketch Map for Measuring Temperature

3. Press **[**Load**]** and use the direction keys to select the required file.
   Press **[**Read**]** to recall an existing configuration file.

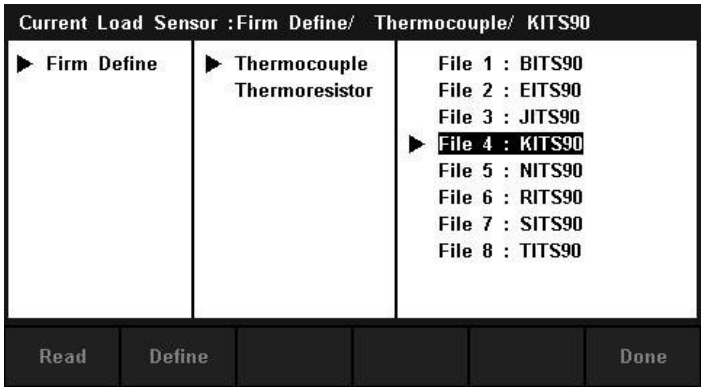


Diagram 2- 29 Load a Configuration File

4. Press **[**Define**]** to view the configuration, as displayed diagram 2- 30.

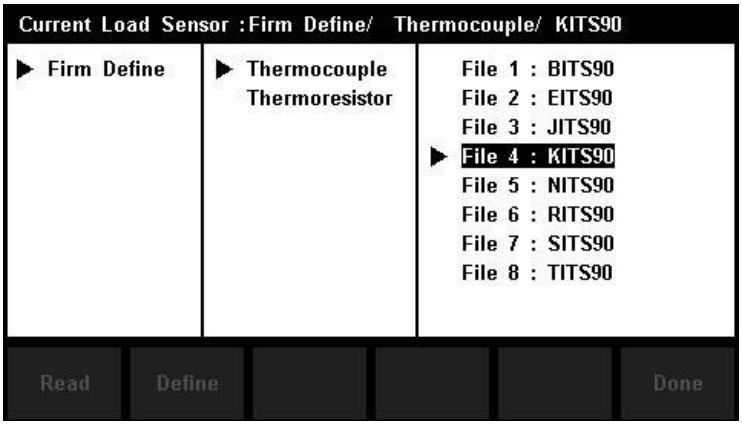


Diagram 2- 30 Configuration of the Sensor

5. Press **[**Display**]** to choose a display mode. The Multimeter supports three display modes: Temperature Value, Measured Value and All.

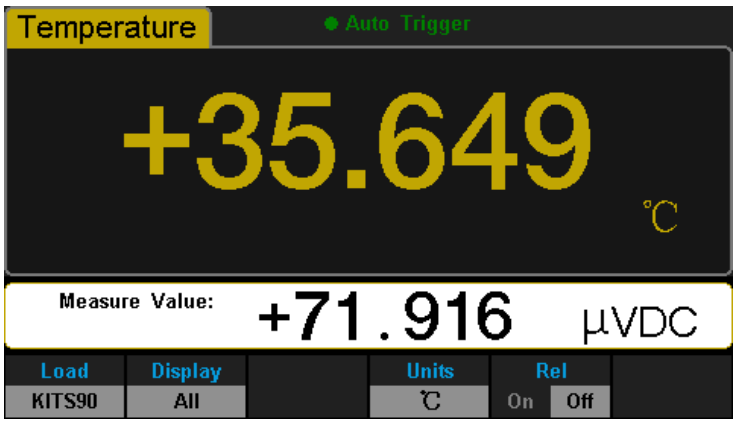


Diagram 2- 31 Choose Display Mode of Temperature Measurement

6. Press **[**All**]**, the measured value will be shown on the secondary display and the corresponding value will be shown on the Main display at the same time, which is convenient for users to observe temperature and voltage values.

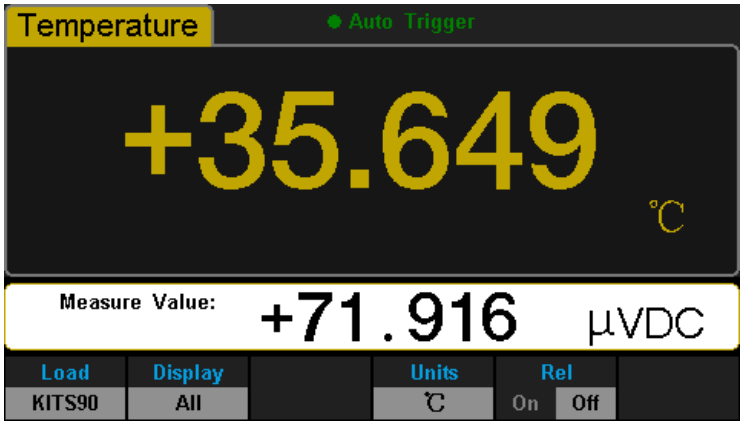


Diagram 2- 32 Show Temperature And Voltage Values

7. Press **[**Units**]** to choose the unit of temperature. The Multimeter supports three units: °C, °F, K.

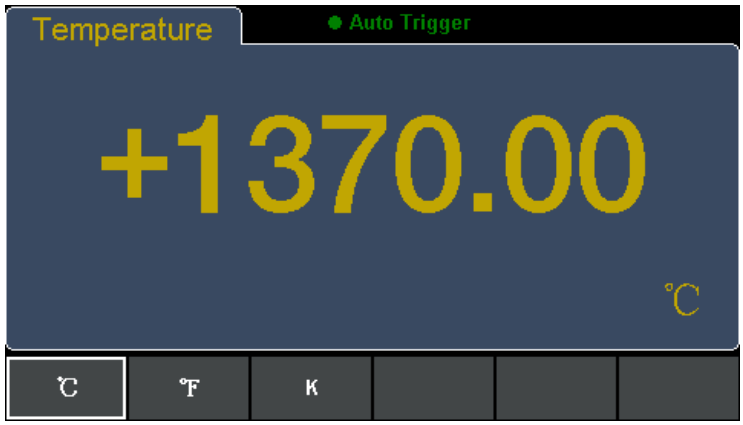


Diagram 2- 33 Unit Selection Interface

8. Set the relative value (Optional operation).

   Press **[**Rel**]** to open or close the Relative math function. When it is opened, the reading is a value which comes from the result of actual measurement value subtracts the relative value that has been set. The default relative value is the measurement value when the function is opened. For details, please refer to “Maths Functions” in Chapter 2.

9. Read the measurement result.

   The Temperature measurement is fixed at “Fast” rate. Therefore, you cannot adjust the reading rate when reading the result.

10. View historical data.

    There are four methods to view historical data: “Number”, “Bar Meter” “Trend Chart” and “Histogram”.

Measurement Parameters

The parameters have been configured before the Multimeter leaves the factory. Users can either measure or modify the parameters to meet your own requirements.

AC Filter

AC Filter is applicable for DC Voltage and DC Current measurement. When DC Voltage or DC Current function is selected, press 【Filter】to open the filter, as shown in the following diagram. If AC component existing in inputted DC signal, it can be filtered by AC Filter so as to make the data more exactly.

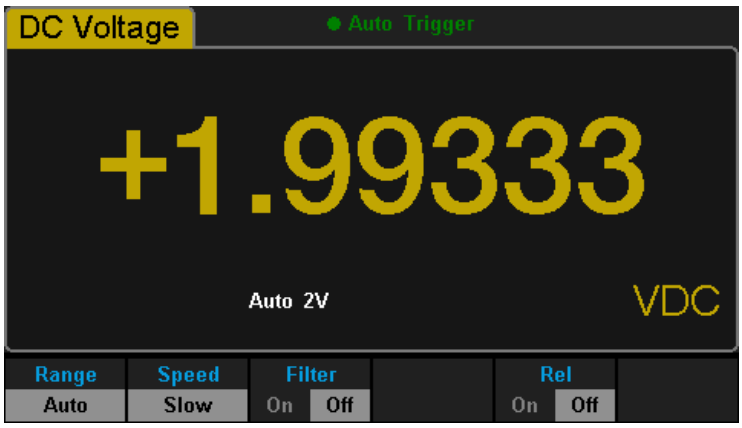


Diagram 2-34 Turn the AC Filter on or off

DC Input Impedance

DC input impedance is only applicable for a DC voltage measurement. When the DC Voltage function is selected, press **[**Range**]** and select **[**600mV**]** to show the menu **[**Input Z**]**, as displayed in diagram 2- 35.

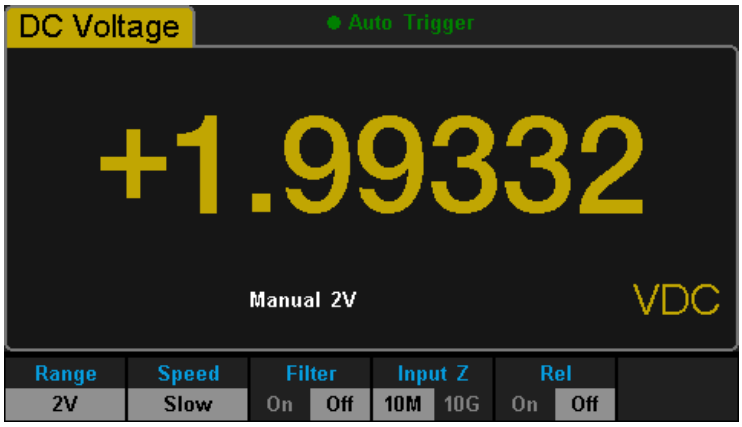


Diagram 2- 34 Choose DC Input Impedance

The options of input impedance for the DC voltage measurements are 10MΩ and 10GΩ. 10MΩ impedance is general for the Multimeter, but for 200mV and 2V manual range. The 10GΩ should be chosen for better a result. The current selection will be saved in non-volatile memory.

DC input impedance selection:

- While the DC input impedance is selected as 10MΩ, the input impedance of all measurement range is 10MΩ.
- While the DC input impedance is selected to 10GΩ, the input impedance for 200mV and 2V ranges is 10GΩ; for 20V, 200V and 1000V measurement range is kept at 10MΩ.
- The default value of DC input impedance is 10MΩ. Settings of the DC input impedance are stored in the non-volatile memory.

Short-circuit Resistance

Set up the short-circuit resistance value in the short-circuit test menu. When the measured resistance is lower than the short-circuit resistance, the circuit is considered as connected, and the beeper sounds (if sound is turned on). The short-circuit resistance is only applicable to the continuity test.

Operating Steps:

1. When the Continuity function is selected, press **[**Threshold**]** to enter the interface as displayed in diagram 2- 35.

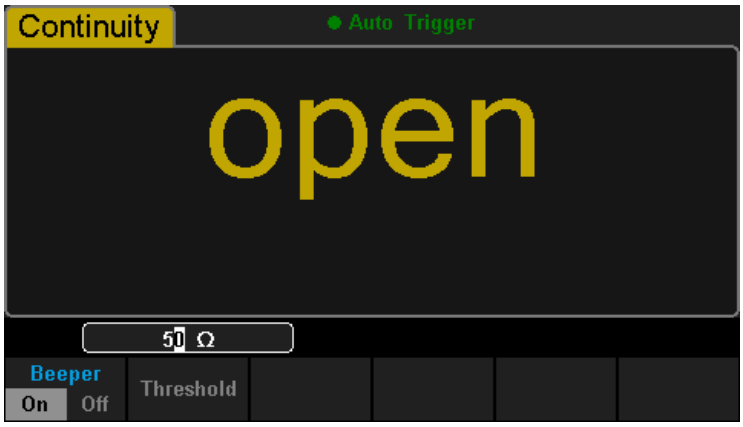


Diagram 2- 35 Set Up the Short-circuit Resistance

2. Use the direction keys to change the parameter values.

   Press the left and right directional keys to choose different digits. Each press of the Left key, the former number will be selected and vice versa. Press the up and down keys to change the current digit value. Each press for the up key, the value will be increased 1 and vice versa.

Short-circuit Resistance:

- The range of short-circuit resistance is 0Ω~2000Ω. The default value is 50Ω.
- The value of short-circuit resistance is stored in the non-volatile memory and the resistance remains unchanged after the power is turned off.

Dual-display Function

Dual-display function is used to improve the test and measurement functions.

Press Dual to open the Dual-display function and the upper right corner will show “Dual”. Now press a function key if this function can be used as the secondary display, the result will be displayed in the secondary Display. The Main Display will display the function that is selected before the Dual-display function is turned on. All the available combinations are listed in table 2-12.

Table 2- 12 Available Main/Secondary Function Combinations (shade is available)

		Main Display Function								
		DCV	DCI	ACV	ACI	FREQ	PERIOD	2WR	4WR	Cap
Secondary Display Function	DCV	■	■	■	■					
	DCI	■	■	■	■					
	ACV	■	■	■	■	■	■			
	ACI	■	■	■	■	■	■			
	FREQ			■		■				
	PERIOD			■			■			
	2WR							■		
	4WR								■	
	Cap									■

Explanations:

1. If the same measurement function is used in both Main and second Display.
   - The readings in both displays will update at the same time.
   - If the math function (dBm, dB) is used in Main Display, when opening thesecond Display, the math operation will be closed automatically. The secondary Display will show the same measurement result as the Main Display.
   - If the math function (Statistics, Limits, Relative) is used in the Main Display; when opening the second Display the result will still be shown in Main Display. The second Display will show the same measurement result as the Main Display.

2. If different measurement functions are used in both Main and second Display.

   - The readings in both displays will update alternately.
   - If the math function (dBm, dB) is used in the Main Display, when opening the second Display, the math operation will be closed automatically, and second Display will show the second selected function normally.
   - If the math function (Statistics, Limits, Relative) is used in the Main Display; when opening the second Display the result will still be shown in the Main Display. The second Display will show the second selected function normally.

3. If the Temperature function is used in the Main Display, set the display mode (Temp →**[**Display**]** →**[**All**]**). The result (corresponding value) will be shown in the Main Display and the current measurement value is shown in the secondary Display.

4. Auto Range is adopted by the secondary Display. If the same measurement functionis used in both displays, so does the range.

5. Measured data in the secondary Display cannot be saved into “History”.

Utility Function

The Utility function enables users to set up system parameters, interface parameters of the multimeters. Press Shift and Dual to enter the operating menu of the Utility function, as displayed in diagram 2- 36.

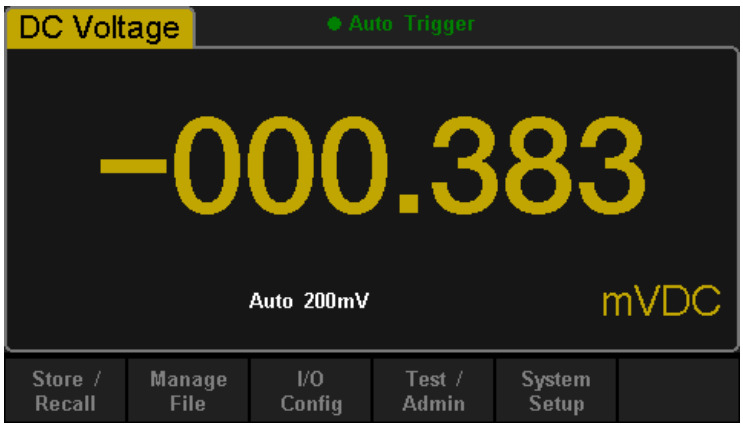


Diagram 2- 36 Utility Function Configuration Interface

Table 2- 13 Utility Function Menu Description

Function Menu	Description
Store/Recall	Store or recall setting files.
Manage File	Create a new file, copy, rename or delete a file.
I/O Config	Set up LAN parameters.
Test/Admin	Provide board test and firmware update function.
System Setup	Set up system information configuration.

Store and Recall

The Store/Recall function enables users to store and recall the instrument parameters and data files in the local storage as well as in the USB storage.

Operating Steps:

1. After entering the Utility function menu, press **[**Store/Recall**]** to enter the interface as displayed in diagram 2-37.

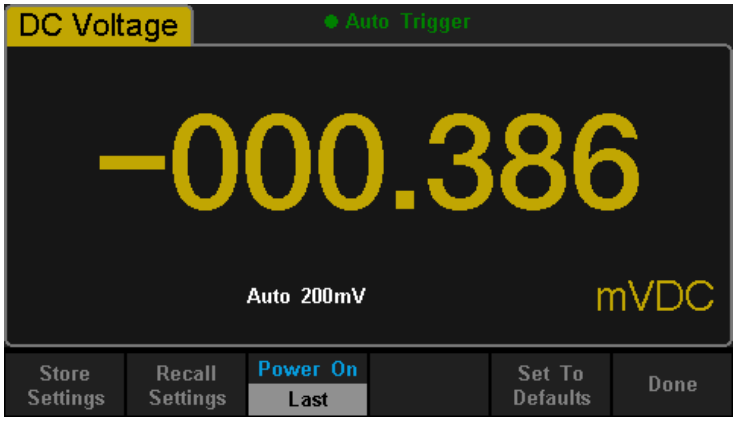


Diagram 2- 37 Store and Recall Interface

2. Press **[**Store Settings**]** to enter the following interface.

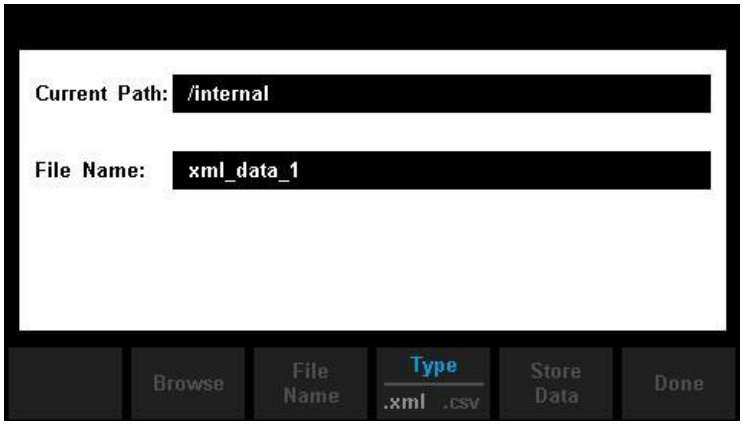


Diagram 2- 38 Store Settings Interface

Table 2- 14 Storage Function Menu Description

Function Menu	Settings	Description
Browse		Choose the location that file will be saved.
File Name		Input a file name.
Type	.xml/ .csv	Choose the type that the file is saved.
Store MS Data		Save the file as input file name to the current selected location.
Done		Save all changes and return to the higher-level menu.

3. Press **[**Recall Settings**]** to enter the following interface. Use the direction keys to choose a storage path and location, and press **[**Select**]** to recall the corresponding file.

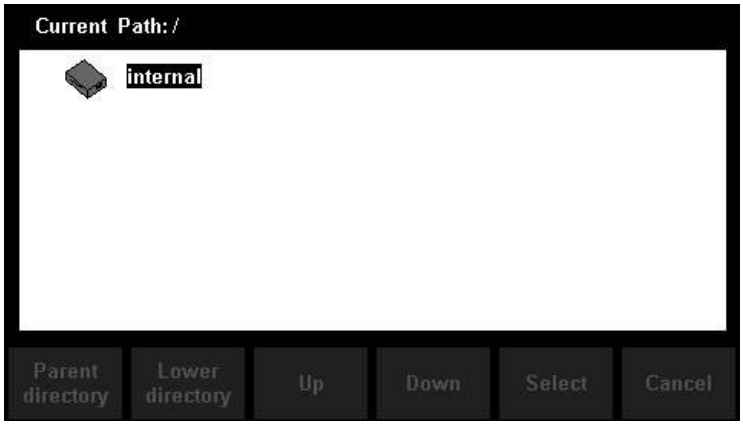


Diagram 2- 39 Recall Function Interface

4. Press **[**Power on**]** to set the Power On state of the instrument.
   - You can choose **[**Last**]** or **[**Factory Default**]** as the initial state when the instrument is turned on.
   - The configuration is effective when you restart the Multimeter.
   - DC Voltage is always the selected function when the instrument is turned on even if you have selected **[**Last**]** or **[**Factory Default**]** as the Power On state.
5. Press **[**Set to Defaults**]** to select “Factory Default” as the Power On state.

Manage File

The Manage File function enables users to create a new folder and save, copy, rename or delete files in the local storage as well as in USB storage.

Operating Steps:

1. After entering into the Utility function menu, press **[**Manage File**]** to enter the interface as displayed in diagram 2-40.

Diagram 2- 40 Manage File Interface

2. Choose the file location.

   Press **[**Browse**]** and use the direction keys to select the corresponding file.

3. Press **[**File Name**]** to enter the following interface.

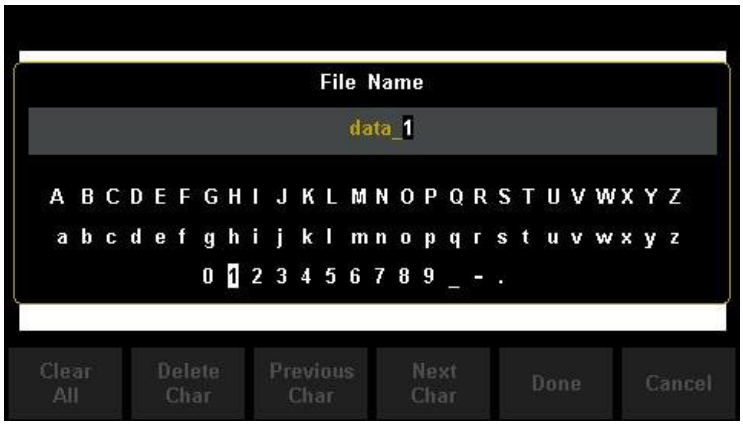


Diagram 2- 41 Input File Name

The method of inputting a file name:

- Press the direction keys to select a desired char in the input area.
- Press “OK” key on the front panel to input selected char in the input area.
- Press **[**Clear All**]** to clear all input chars.
- Press **[**Delete Char**]** to delete the letter on which the cursor is positioned.
- Press **[**Previous Char**]** to move the cursor in the file name area to the previous char.
- Press **[**Next Char**]** to move the cursor in the file name area to the next char.
- Press **[**Done**]** to save the current file and return to the higher-level menu.
- Press **[**Cancel**]** to cancel the current operation and return to the higher-level menu.

4. Press **[**Action**]** and select **[**Folder**]**, **[**Capture Display**]**, **[**Copy**]**, **[**Rename**]** or **[**Delete**]** to perform the corresponding operation.

Table 2- 15 Action Settings

Function Menu	Description
Folder	Press **[**Create Folder**]** to create a new folder.
Capture Display	Press **[**Save Screen**]** to save the current captured screen picture as a standard BMP format.
Copy	Press **[**Perform Copy**]** to copy the selected file.
Rename	Press **[**Perform Rename**]** to rename the selected file.
Delete	Press **[**Perform Delete**]** to delete the selected file.
Done	Save all changes and return to the higher-level menu.

I/O Configuration

Press [I/O Config] to enter the following interface and set up the parameters.

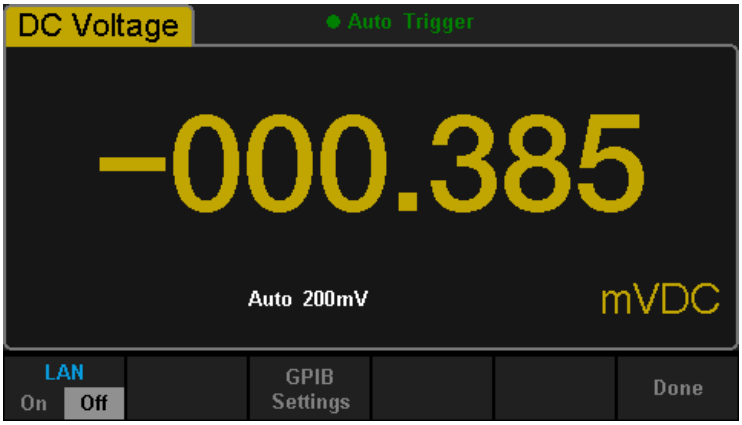


Diagram 2- 42 I/O Configuration Interface

LAN Settings

The Multimeter enables users to operate the instrument remotely by LAN interface and store or recall internet settings. You can review the current LAN settings and set up the IP address and subnet mask.

After entering the Utility function menu, press **[**I/O Config**]**. Select **[**On**]** → **[**LAN Settings**]** → **[**Modify Settings**]** to enter the following interface.

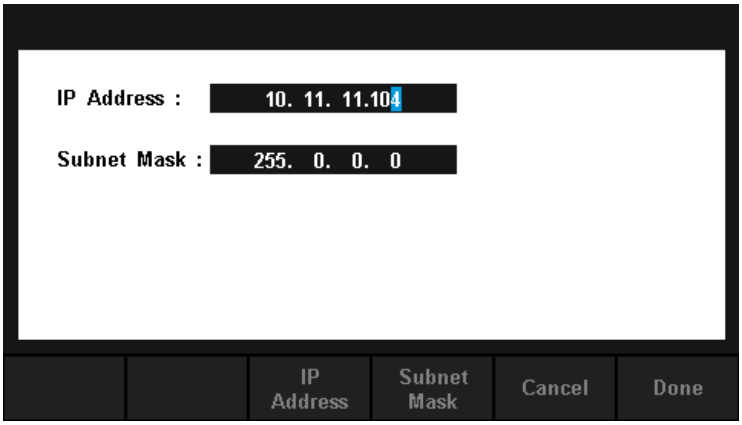


Diagram 2- 43 LAN Settings Interface

Table 2- 16 LAN Settings

Function Menu	Description
IP Address	Set up IP address and the default setting is 10.11.11.104.
Subnet Mask	Set up subnet mask and the default setting is 255.0.0.0.
Cancel	Cancel current operation and return to the higher-level menu.
Done	Save all changes and return to the higher-level menu.

Board Test

T3DMM5-5 provides self-test functions, including Key Test, LCD Test, Beeper Test and Chip Test.

Operating Steps:

1. Press Shift and Dual, then choose **[**Test/Admin**]** → **[**Board Test**]** to enter the following interface.

Diagram 2- 45 Board Test Interface

Table 2- 17 Board Test Function Description

Function Menu	Description
Key	Test the instrument's keys.
LCD	Test the instrument's LCD screen.
Beeper	Test the instrument's beeper.
Chip	Test the instrument's chips.
Done	Return the higher level menu.

2. Test the keys.

Select **[**Key**]** to enter the key test interface, as displayed in diagram 2-46. The on-screen lathy rectangle shapes represent the keys on the front panel. Test all keys and knobs and you should also verify that all the backlit buttons illuminate correctly.

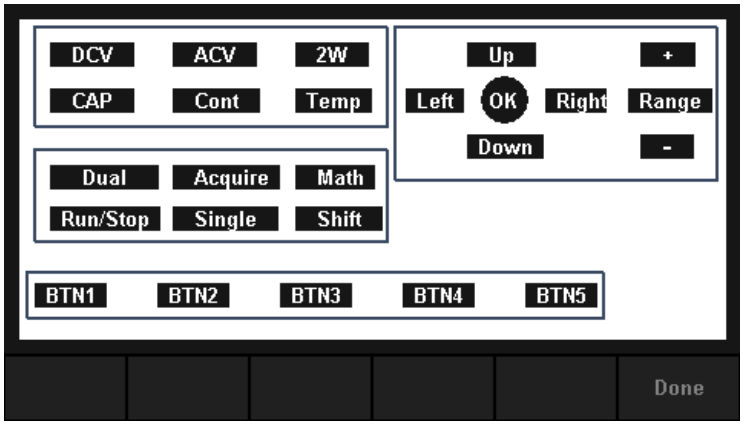


Diagram 2- 46 Key Test Interface

NOTE:

- Before you operate, the shapes on the screen display in a blue colour.
- The corresponding area of tested buttons or knobs would display in a green colour.
- Press **[**Done**]** to exit the test.

3. Test the LCD screen.

   Select **[**LCD**]** to enter the screen test interface. The screen displays the message “Press ‘Change’ to change; Press ‘Done’ to exit”. Press **[**Change**]** to start the test and observe if the screen has changed colour or displayed an error message, as shown in diagram 2-47.

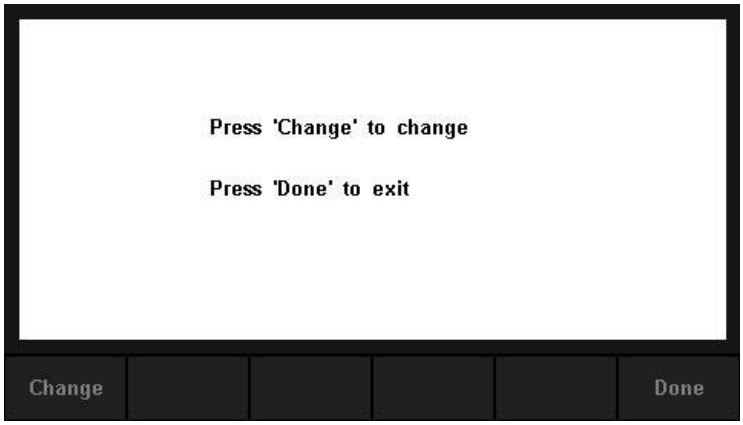


Diagram 2- 47 LCD Test Interface

NOTE:

- Press [Change] to change the colour of the screen.
- There are three colours: red, blue and green.
- Press **[**Done**]** to exit the test.

4. Test the beeper.

   Press **[**Beeper**]** to test the beeper. Under regular circumstance, press **[**Beeper**]** one time and the instrument will beep one time.

5. Test the chips.

   Press **[**Chip**]** → **[**Start**]** to enter chip test interface, as Diagram 2-48 shows.

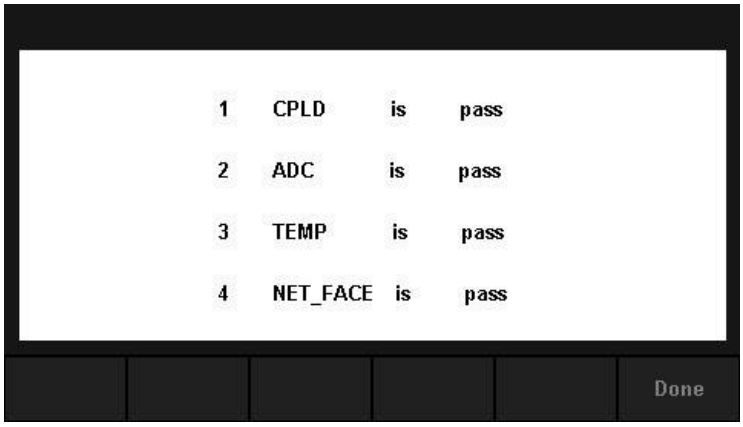


Diagram 2- 48 Chip Test Interface

NOTE:

- If the test has passed, the corresponding result shows “pass”.
- If the test has failed, the corresponding result shows “fail”.

6. Press **[**Done**]** to exit the board test.

System Setup

Press Shift and Dual, then select **[**System Setup**]** to enter the following interface.

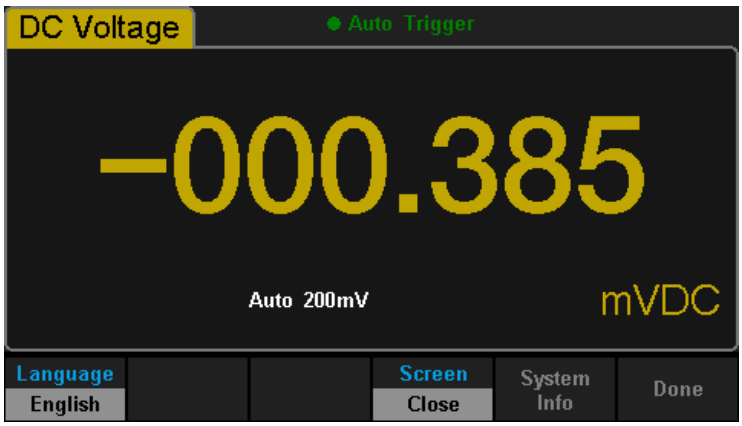


Diagram 2- 49 System Setup Interface

Table 2- 18 System Settings Menu Description

Function Menu	Description
Language	Select the display interface language.
Screen	Set up the screen protection function.
System Info	View system information.
Done	Return to the higher level menu.

1. Select language.

The Multimeter supports two languages, English and Chinese. Press **[**Language**]** to enter the following interface.

Diagram 2- 50 Choose Language

2. Set up the time of the screen saver.

Press **[**Screen**]** to set up the screen saver as 1 Min, 5 Mins, 15 Mins, 30 Mins, 1 Hour, 2 Hours or 5 Hours according to different demands. Activate the screen saver program and the screen saver will be on if no action is taken within the time that you have selected. Press any button to resume.

3. View system information.

Press **[**System Info**]** to view system information, including start-up times, software version, hardware version, production ID and serial number, as shown in the diagram 2- 51.

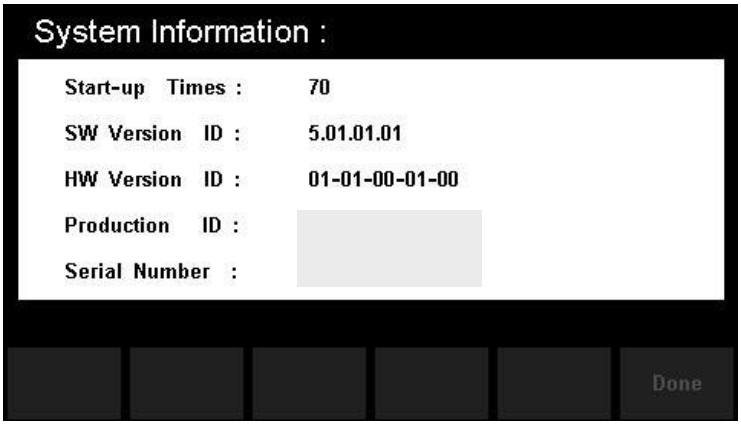


Diagram 2- 51 System Information

Firmware Update

The software of the Multimeter can be updated directly via a USB flash drive, to update the current software version to a desired software version.

Operating Steps:

1. Copy the update file to the USB flash drive.
2. Insert the USB flash drive to the USB host interface on the front panel of the Multimeter.
3. Press Shift → Dual → **[**Test/Admin**]** → **[**Firmware Update**]**, then press **[**Browse**]** and select the update file. Next, press **[**Update**]** → **[**Yes**]** to start updating the system software.
4. On completion of the firmware update, the screen will display the message: “Firmware Update Done!”. You can now remove the USB flash drive.
5. Restart the Multimeter and check the version information.

   Press Shift → Dual → **[**System Setup**]** → **[**System Info**]** to check if the software and hardware version after updating is in accordance with the desired version. If not, the updating has failed, and you will need to update once more using the above steps.
6. After checking, press **[**Done**]** to exit the system information interface.

NOTE:

Do not turn off or disconnect the power whilst the instrument is updating.

Acquire

Sampling is a process of acquiring and digitising a signal. The optional Trigger methods of the Multimeter include Auto Trigger, Single Trigger and the External Trigger.

Press Acquire to enter the interface shown as the following diagram:

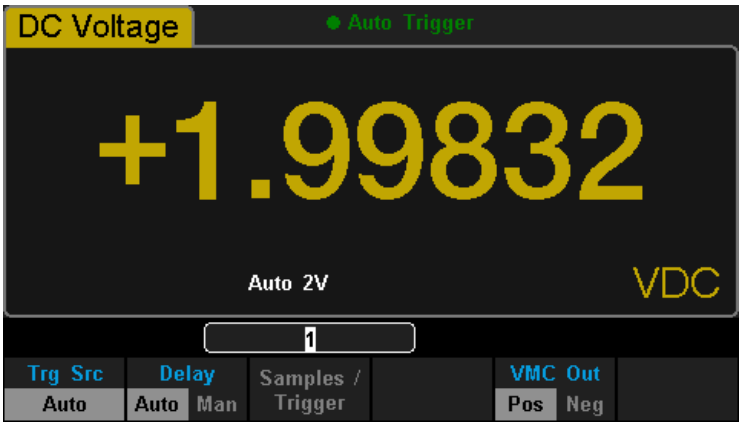


Diagram 2- 52 Acquire Interface

Table 2- 19 Function Menu of triggering parameter

Function Menu	Description
Trg Src	Set the source of the trigger.
Slope	Set the polarity slope of the external trigger.
Delay	Set the delay.
Samples/Trigger	Set the number of samples or trigger.
VMC Out	Set the polarity output pulse signal when the sampling signal has finished.

Auto Trigger

Auto Trigger parameters that need to be set up include delay, samples/trigger and VMC out.

Operating Steps:

1. Press 

, then select **[**Trg Src**]** → **[**Auto**]** or press 

on the front panel directly to enable the Auto Trigger.
2. Set the delay.

   Delay is the waiting time after the trigger signal is sent out and before the acquiring starts. Press **[**Delay**]** to select Auto or Manual mode. When choosing Manual mode, the Left and Right keys are used to switch the number of a numerical value. The Up and Down keys are used to change the selected value.
3. Set the number of samples or trigger.

   Press **[**Samples/Trigger**]** to set the sample count. The Left and Right keys are used to switch the number of a numerical value. The Up and Down keys are used to change the selected value.

Sample Count

- Sample Count indicates the count of point sampled while the Multimeter receives a signal from the Single Trigger.
- The range of sampling point should be between 1 and 599999999.
- The default value of Sample Count is 1.

4. Set the VMC Out.

   The Multimeter outputs a pulse signal through the VM COMP interface on the rear panel after the sampling signal has finished.

   Press **[**VMC Out**]** to choose a Positive or Negative polarity.

Single Trigger

Single Trigger parameters that need to be set up include delay, samples/trigger and VMC out.

Operating Steps:

1. Press Acquire, then select **[**Trg Src**]** → **[**Single**]**; or press Single on the front panel directly to enable the Single Trigger. See diagram 2- 53.

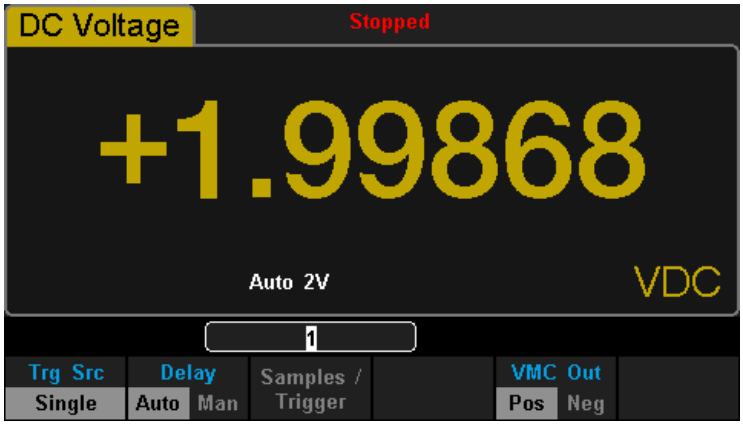


Diagram 2- 53 Setting interface of Auto Trigger

2. Set the delay.

   Press **[**Delay**]** to select Auto or Manual mode.

3. Set the number of samples or trigger.

   Press **[**Samples/Trigger**]** to set the sample count.

4. Set the VMC Out.

   The Multimeter outputs a pulse signal through the VM COMP interface on the rear panel after the sampling signal has finished.

   Press **[**VMC Out**]** to choose a Positive or Negative polarity.

External Trigger

The external trigger signal will be input via the EXT TRIG interface on the rear panel. The External trigger parameters that need to be set up include delay, samples /trigger, slope and VMC out.

Operating Steps:

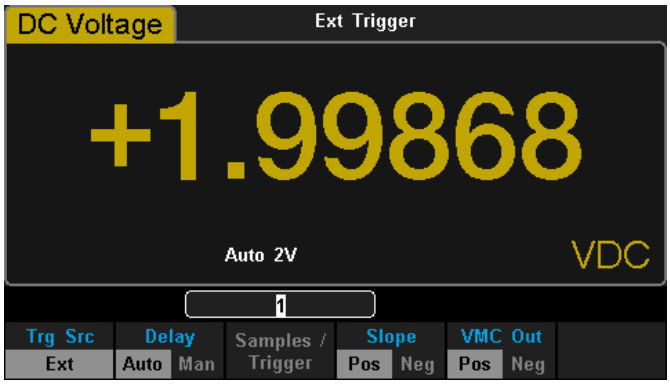
1. Press Acquire, then select **[**Trg Src**]** → **[**Ext**]** or press Single on the front panel directly to enable the External Trigger.
2. Set the polarity of slope.

   Press **[**Slope**]** to choose a Positive or Negative polarity.
3. Set the delay.

   Press **[**Delay**]** to choose Auto or Manual mode.
4. Set the number of samples or trigger.

   Press **[**Samples/Trigger**]** to set the sample count.
5. Set the VMC Out.

   In External Trigger mode, the Multimeter could output a pulse signal through the VM COMP interface on the rear panel after the sampling signal has finished.



Help System

T3DMM5-5 provides a powerful built-in help system. You can recall help information at any time whilst using the instrument. You also can get functionality help for every button on the front panel or menu soft key by using the built-in help system. You can also get help on familiar operations with the help list.

Press Shift and Acquire to enter the help list, as diagram 2- 55 shows.

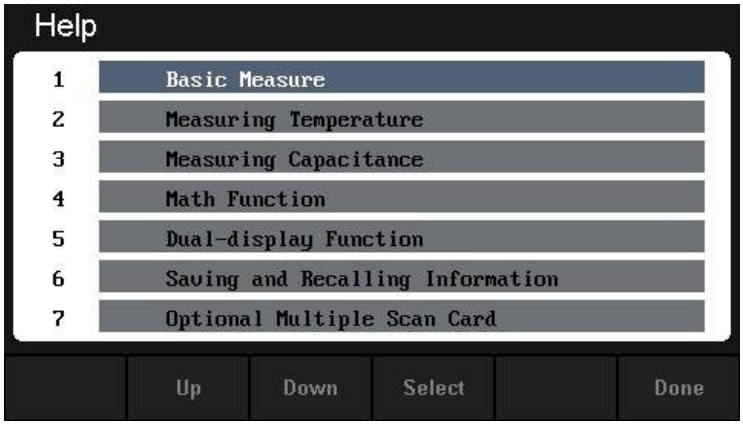


Diagram 2- 55 Help Menu

Table 2- 20 Help System Operating Menu

Function Menu	Description
Up	Move up the cursor and select the help menu.
Down	Move down the cursor and select the help menu.
Select	Select the help information you want to read.
Done	Return to the higher menu.

1. **Basic Measure.**

   Get basic measurement types and methods to connect the leads in different measurements.

2. **Measuring Temperature.**

   Get the method to measure temperature.

3. **Measuring Capacitance.**

   Get the method to measure temperature.

4. **Math Function.**

   Introduce how to use the math function while you are measuring.

5. **Dual-display Function.**

   Get the method to use the dual-display function while you are measuring.

6. **Saving and Recalling Information.**

   Introduce how to store and recall the data/parameter/sensors files.

7. **Optional Multiple Scan Card.**

   Get help about operating optional multiple scan cards.

8. **The convention and Tips of Softkeys.**

   Get help about the convention and tips of softkeys.

9. **Technical Support.**

   Get the method to obtain technical support.

Explanation:

- In the help menu interface, you can move the cursor and select the corresponding menu by using the up and down direction keys and press" OK" to read the help information.
- While reading the help information, you also can look up and down the information by using up and down direction keys.

Math Function

The Multimeter provides five math functions: Statistics, Limits, dBm, dB and Relative. Choose different math functions to meet different measurement demands. Math functions can only be used in DC Voltage, AC Voltage, DC Current, AC Current, Resistance, Frequency, Period and Temperature measurement. Among these functions, dBm and dB are only used in DC Voltage and AC Voltage measurement.

Press Math to show the operating menu of math functions on the screen, as shown in the following diagrams.

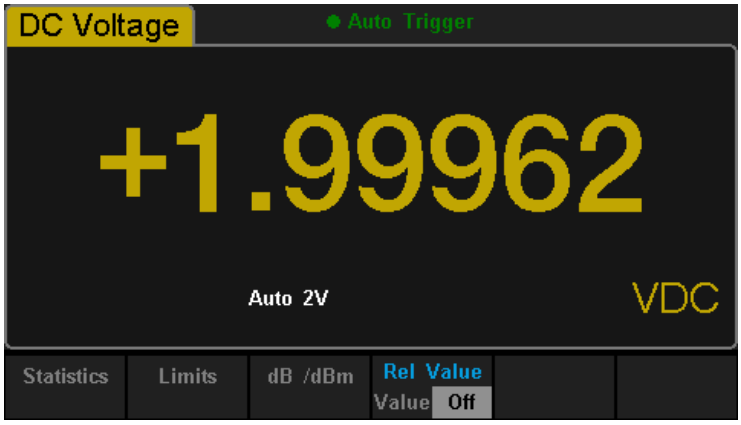


Diagram 2- 56 Math Function Menu of DC Voltage

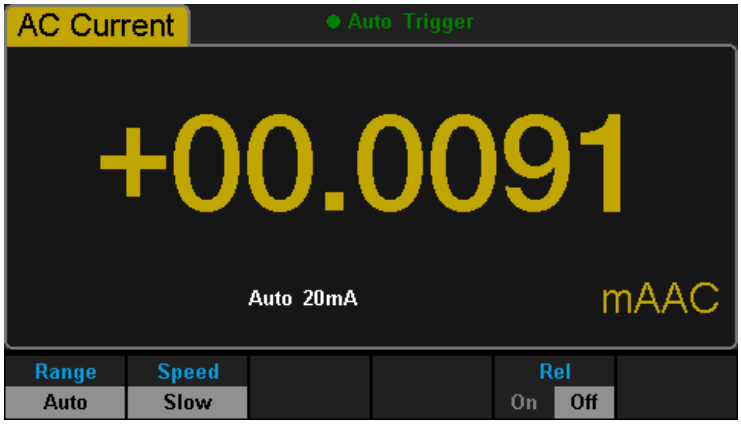


Diagram 2- 57 Math Function Menu of AC Current

Table 2- 21 Math Function Menu Description

Function Menu	Settings	Description
Statistics		Reading statistic functions, including: max, min, average, span, std dev and samples.
Limits		The Limits function performs Pass/Fail testing according to the specified upper and lower limits.
dBm		The dBm is based on a calculation of power delivered to a reference resistance, 0dBm = 1mW.
dB		The dB measurement is the difference between the input signal and a stored relative value.
Rel Value	Value/Off	Turn on the relative value function and set up the value. Or turn off the function.

Explanations:

- Math function can only be applicable to the main display.
- If the measurement function has changed, all math functions will be closed except Statistics.

Statistics

There are many kinds of reading statistic functions, including: Max, Min, Average and Standard deviation. The Statistic function is available for DC Voltage, AC Voltage, DC Current, AC Current, Resistance, Frequency, Period, Capacitance and Temperature measurement.

Press Math → **[**Statistics**]** → **[**Show**]** to enter the interface shown in the following diagram.

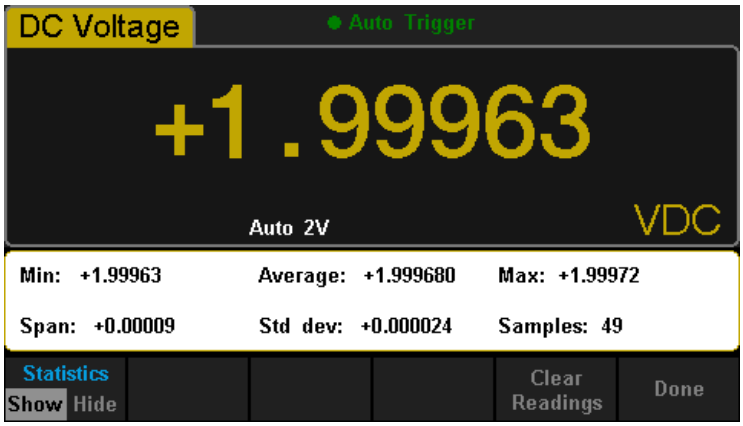


Diagram 2- 58 Statistics

Table 2- 22 Statistic Measurement Menu Function Description

Function Menu	Settings	Description
Statistics	Show/Hide	Show or hide the statistics function interface.
Min		Show the minimum statistics value of current measurement.
Average		Show the average statistics value of current measurement.
Max		Show the maximum statistics value of current measurement.
Span		Show the span of current measurement.
Std dev		Show the std dev statistics value of current measurement.
Samples		Show the maximum statistics value of current measurement.
Clear Readings		Clear all current readings and restart statistics.
Done		Return to the higher level menu.

Statistics Function:

- In statistic function, the first reading is usually set to the maximum or minimum value. When performing more readings, the current displaying value is always the maximum/minimum reading among all the measured values.
- The maximum, minimum, average and reading quantities are stored in volatile memory.

Limits

Limits function is available to prompt signals beyond ranges according to the upper and lower parameters. The Statistic function is available for DC Voltage, AC Voltage, DC Current, AC Current, Resistance, Frequency, Period, Capacitance and Temperature measurement.

Press Math → **[**Limits**]** → **[**On**]** to enter the interface shown in the diagram 2- 59.

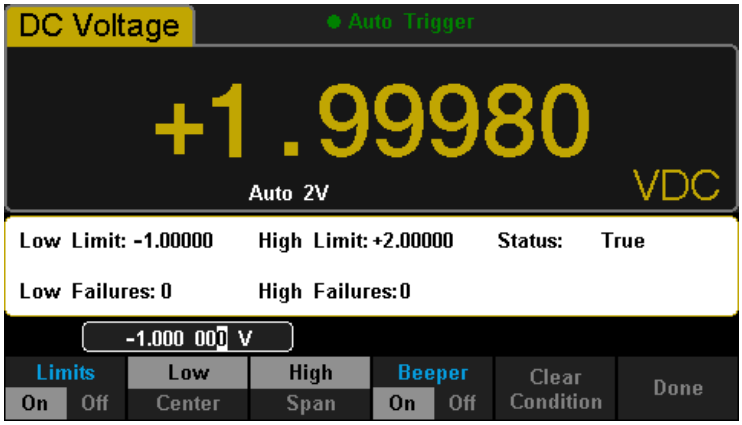


Diagram 2- 59 Limits

Table 2- 23 Limits Measurement Menu Function Description

Function Menu	Settings	Description
Limits	On/Off	Turn on or turn off the Limits function.
Low		Set the desired lower limit.
Centre		Set the desired centre value
High		Set the desired upper limit.
Status		Show the status of the limit test.
Low Failures		Show the times when the reading is lower than the limit.
High Failures		Show the times when the reading is higher than the limit.
Span		Set the desired span.
Beeper	On/Off	When the beeper is on, if the reading is lower or higher than limits, the instrument will beep once.
Clear Condition		Clear all current readings and restart the test.
Done		Save all changes and return to the higher level menu.

1. **How to Set Limits**

   Select **[**High**]**, **[**Low**]**, **[**Centre**]** or **[**Span**]** and then switch to the required digit by using the Left or Right Direction keys and input the numerical value by using the Up and Down Direction keys.

2. **Unit**

   The unit of Limits is decided by the current measurement function.

3. **Over hint**

   - When the reading is lower than the set lower limit, the colour of the main display will switch from blue to red.
   - When the reading is higher than the set higher limit, the colour of the main display will switch from blue to red.
   - When the reading is lower or higher than the set limits, the Beeper will beep once. (The beeper is turned on.)

The range of Limits function:

- The upper limit value should always be bigger than the lower limit value.
- The upper and lower values are stored in volatile memory. They will be set to default values when the power is on.

The Limits range is -120% ~ +120% of the current measurement range.

dBm

The dBm function is logarithmic and based on a calculation of power delivered to a reference resistance, relative to 1 mill watt. This function only applies to AC voltage and DC voltage measurements.

Press Math → **[**dB/dBm**]** → **[**On**]** and select **[**Function dBm**]** to enter the interface displayed in diagram 2- 60.

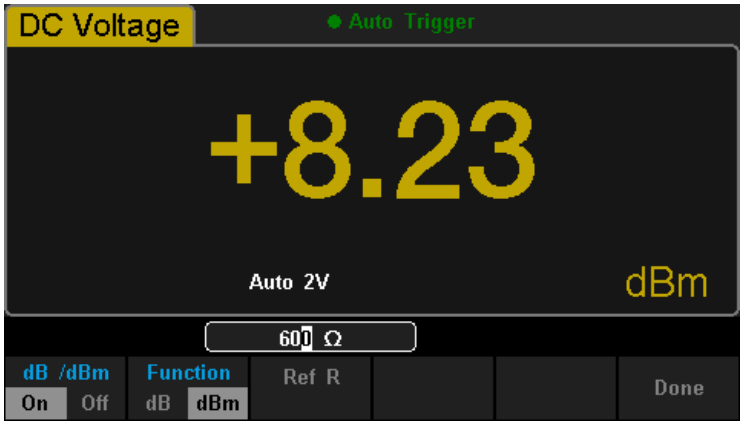


Diagram 2- 60 dBm Function Interface

Table 2- 24 dB Measurement Function Menu Function Description

Function Menu	Settings	Description
dB/dBm	On/Off	Turn on or turn off dB or dBm function.
Function dBm		Open the dBm function and the lower right corner of the main display will display “dBm”.
Ref R		Set the parameter via direction keys: 50Ω ~ 8000Ω.
Done		Save all changes and return to the higher level menu.

The computation method of dBm:

When the dBm function is turned on, the measured value of voltage is transformed into dBm according to the following formula.

$$\mathbf{dBm = 10 \times Log_{10}\,[(Reading^2 / R_{REF})/0.001W]}$$

dB

Each dB measurement is different between the input signal and a stored relative value, with both values converted to dBm. The dB function applies to AC voltage and DC voltage measurements only.

Press Math → **[**dB/dBm**]** → **[**On**]** and select **[**Function dB**]** to enter the interface displayed in diagram 2- 61.

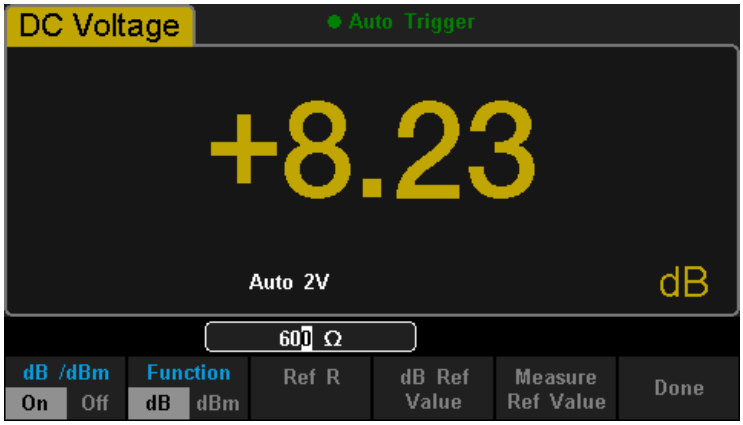


Diagram 2- 61 dB Function Interface

Table 2- 25 dB Measurement Function Menu Function Description

Function Menu	Settings	Description
dB/dBm	On/Off	Turn on or turn off the dB or dBm function.
Function dB		Open the dB function and the lower right corner of the main display will show “dB”.
Ref R		Set the parameter via the direction keys: 50Ω ~ 8000Ω.
dB Ref Value		Set the reference value of dB.
Measure Ref Value		Set the reference value of measurement.
Done		Save all changes and return to the higher level menu.

The computation method of the dB:

dB = 10 x Log_{10} [(Reading^2/R_{REF})/0.001W] – (dB Ref value)

R_{REF} is the resistance value measurement of the actual electric circuit.

Range of the dB Ref value: -200 dBm ~ +200 dBm. The default is 0 dBm

dB Ref value

- Input a value in the dB setting interface via the direction buttons; and then store it as a dB setting value.
- Settings of dB value are stored in volatile memory

Relative Value

Relative value is used for relative measurement. The actual measurement reading is the depression between the measurement value and preset value.

The Multimeter allows operating for the following parameters: DC Voltage, AC Voltage, DC Current, AC Current, Resistance, Frequency, Period, Capacitance and Temperature.

Press Math → **[**Rel Value**]** to enter the interface shown in diagram 2- 62.

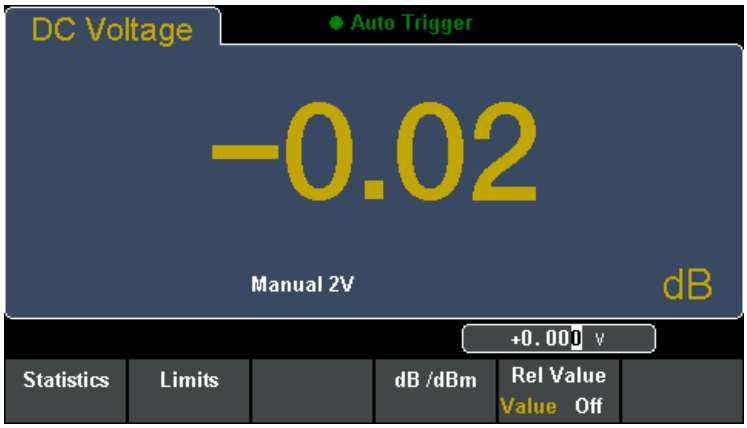


Diagram 2- 62 Relative Operation

Table 2- 26 Rel Value Operation Function Menu

Function Menu	Description
Value	Select current measurement value as the pre-set value.
Off	Turn off the relative operation function.

When the dBm function is turned on, the result of the relative measurement will display on the screen.

Main display = Measurement value – Pre-set value

Display Mode

The Multimeter supports four methods to view measured data: “Number”, “Bar Meter”, “Trend Chart” and “Histogram”.

Number

Press Shift and Math to open the menu in display mode and press **[**Display**]** to enter the following interface. “Number” is always the selected mode when the Multimeter is turned on.

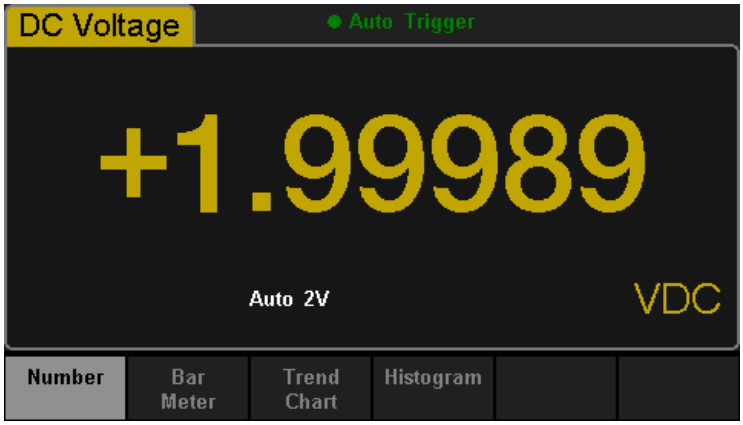


Diagram 2- 63 Number Display Mode

Bar Meter

Operating Steps:

1. Press **[**Bar Meter**]** to enter Bar Meter display mode.

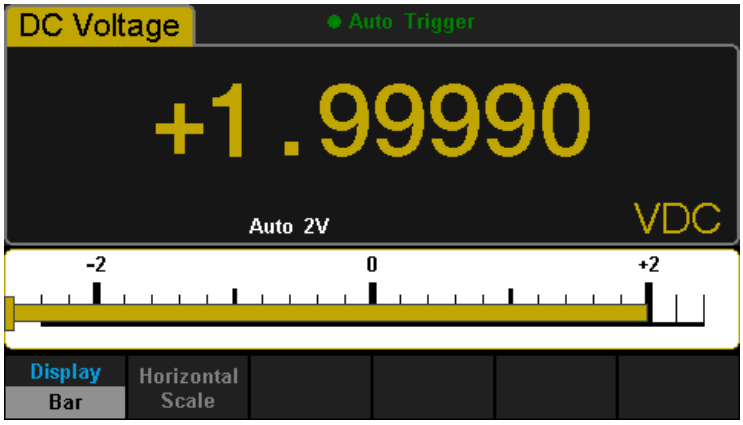


Diagram 2- 64 Bar Meter Display Mode

2. Press **[**Horizontal Scale**]** to set the vertical scale as a Default or Manual mode or Limits (limit function is on).

Table 2- 27 To Set the Vertical Scale of Bar Meter manually

Function Menu	Description
Low	Set the low value of the horizontal scale.
High	Set the high value of the horizontal scale.
Centre	Set the centre value of the horizontal scale.
Span	Set the span of the horizontal scale.
Done	Save all changes and return to the higher level menu.

Trend Chart

Operating Steps:

1. Press **[**Trend Chart**]** to enter the Trend Chart display mode. The default vertical scale is -2V to 2V when DC Voltage measurement is selected.

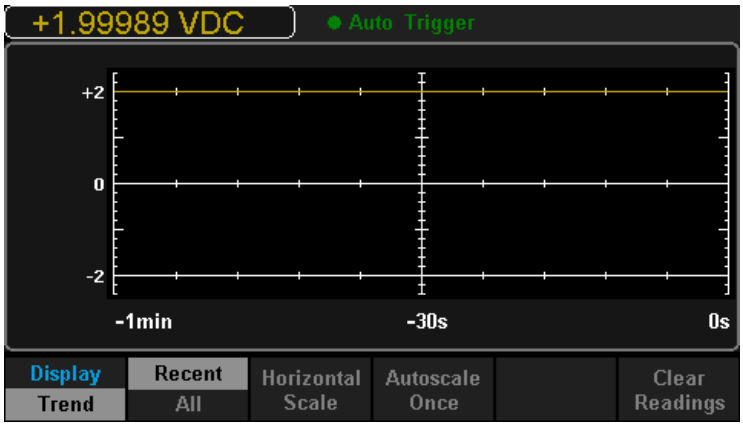


Diagram 2- 65 Trend Chart Display Mode

Table 2- 28 Trend Chart Display Mode

Function Menu	Description
Display Trend	The current selected display mode is Trend Chart.
Recent All	Displays the recent or all readings.
Horizontal Scale	Choose the mode of the Horizontal Scale.
Autoscale Once	Automatically set the horizontal scale once.
Clear Readings	Clear all current readings and restart statistics.

2. Press **[**Horizontal Scale**]** to set the horizontal scale as Default, Auto or Manual or Limits (Limit function is on) mode.
3. Press **[**Auto**]** and the Multimeter will set the vertical scale automatically.

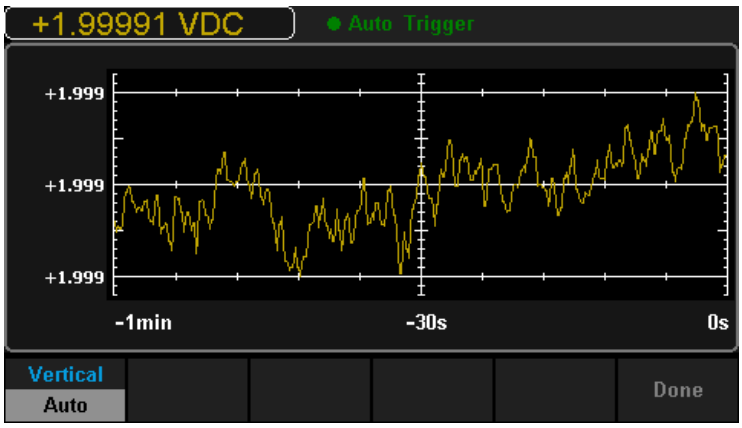


Diagram 2- 66 Auto Vertical Scale

4. Press **[**Manual**]** to set the vertical scale manually, as displayed in diagram 2- 67.

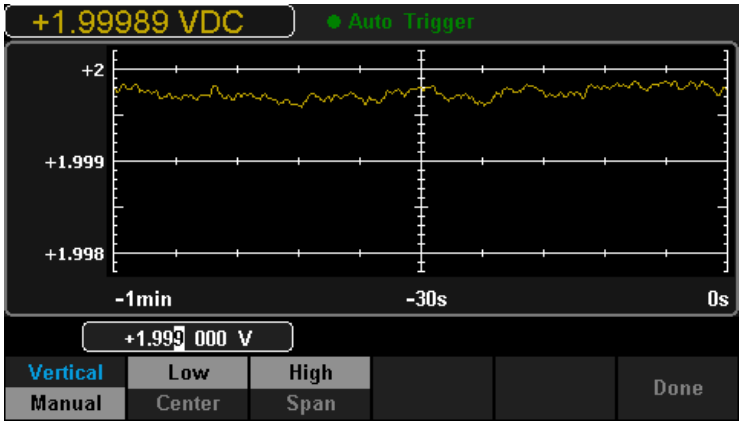


Diagram 2- 67 Manual Vertical Scale

Histogram

Operating Steps:

1. Press **[**Histogram**]** to enter the Histogram display mode.

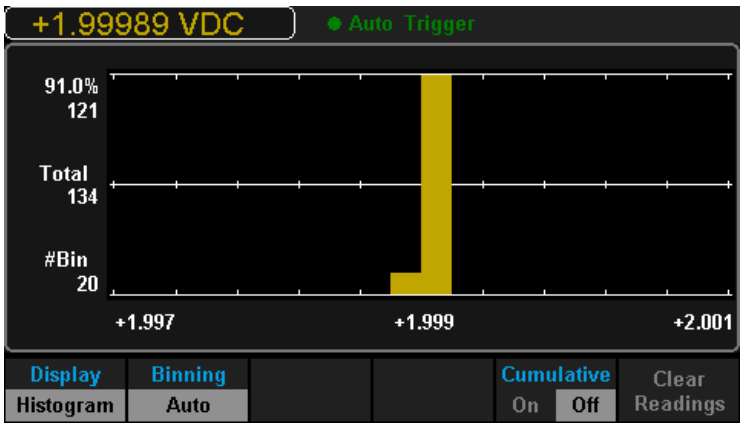


Diagram 2- 68 Histogram Display Mode

Table 2- 29 Histogram Display Mode

Function Menu	Settings	Description
Display Histogram		The current selected display mode is Histogram.
Binning		Set Binning as Auto or Manual mode.
Bin Set		Set the Bin parameters.
Cumulative	On/Off	Turn on or off the Cumulative function.
Clear Readings		Clear all current readings and restart statistics.

2. Press **[**Binning**]** to set Binning to Auto or Manual mode. When in the Manual mode, press **[**Bin Settings**]** to enter the following interface.

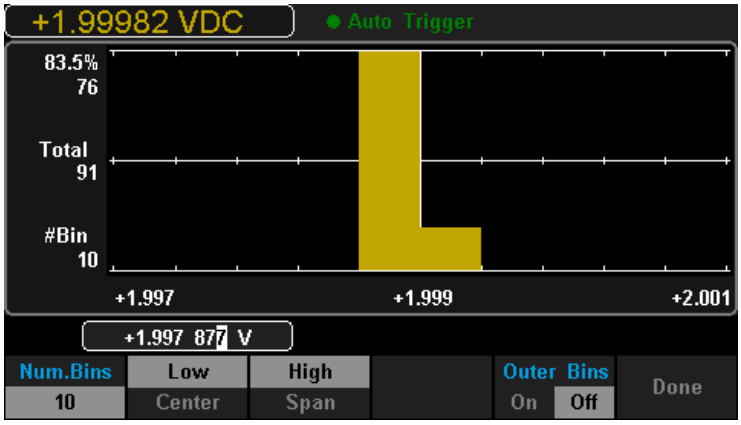


Diagram 2- 69 Bin Set Interface

Table 2- 30 Bin Set

Function Menu	Settings	Description
Num.Bins		Set the number of Bins, 10, 20, 40, 100, 200 or 400.
Low		Set the low value of the horizontal scale.
High		Set the high value of the horizontal scale.
Centre		Set the centre value of the horizontal scale.
Span		Set the span of the horizontal scale.
Outer Bins	On/Off	Show the bins beyond the scope or not.
Done		Save all changes and return to the higher level menu.

Trigger

The Multimeter supports Trigger function. Press 

or 

on the front panel to trigger the Multimeter by Auto or Single mode. Auto trigger is considered as a default when the power is on.

Auto Trigger

Press 

on the front panel one time and the Auto Trigger will be started to capture continuous readings automatically. The trigger field on the screen will display the “Auto Trigger”. Press 

again and the trigger is stopped.

Single Trigger

Press 

on the front panel and the Single Trigger will be started one time and generate a reading. The trigger field of the screen will display the “Single Trigger”.

Explanation:

In Remote Mode, the trigger field just above the screen will display the “Immediate Trigger”. Press 

to switch back to the local mode and the Multimeter will choose Auto Trigger automatically.

Hold Measurement Function

The Hold Measurement function provides users with a stable reading on the screen of the front panel. When the test leads are put away, the reading is still held on the screen, which enables users to view the measured history data.

Press Shift and Single to open the Hold measurement function interface. The black field just above the screen will display the “Probe Hold”, as shown in diagram 2- 70.

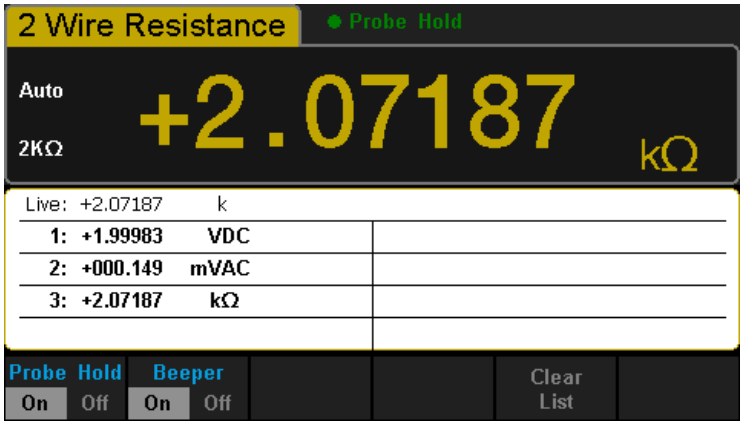


Diagram 2- 70 Hold Measurement Function Interface

Table 2- 31 Hold Measurement Function

Function Menu	Settings	Description
Probe Hold	On/Off	Turn on or off the Probe Hold function.
Beeper	On/Off	Turn on or off the Beeper.
Clear List		Clear all current readings and restart to statistics.

Chapter 3 Application Examples

This chapter introduces a few application examples to help users control and manipulate T3DMM5-5 quickly.

- **Example 1: Reading Statistic Functions**
- **Example 2: To Eliminate Leads Impedance**
- **Example 3: dBm Measurement**
- **Example 4: dB Measurement**
- **Example 5: Limits Test**
- **Example 6: Thermocouple Setting and Measurement**
- **Example 7: To Use Hold Measurement Function**

Example 1: Reading Statistic Functions

Introduce how to use the statistic function during measuring. When continually measuring few readings, the Multimeter will update statistic values constantly.

Operating Steps:

1. Press ACV on the front panel to select the AC Voltage measurement function and select a voltage range.
2. Connect the red lead to the terminal Input-HI and the black lead to terminal Input-LO as shown in Diagram 2-9 on page 27.
3. Set the Statistics function parameters.
4. Press Math → **[**Statistics**]** to turn on the statistics function.
5. Plug test leads into the circuit and start to measure. Statistics will update with the acquisition of samples, as the following diagram shows.

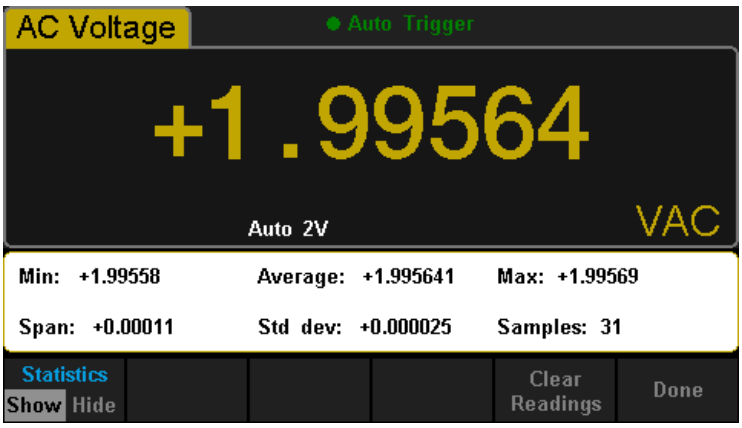


Diagram 3- 1 Statistics 1

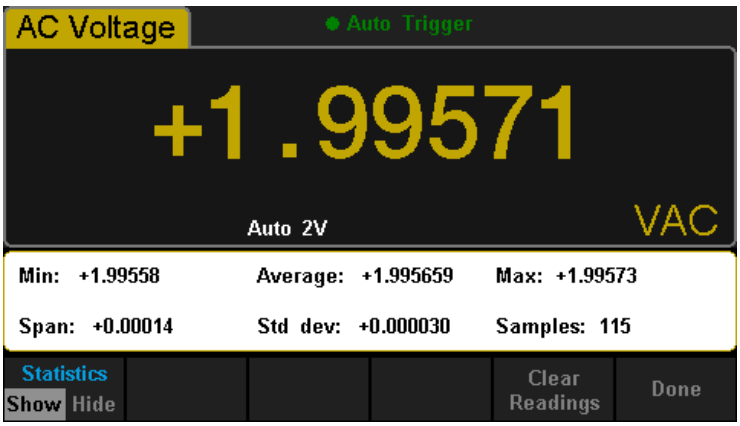


Diagram 3- 2 Statistics 2

Example 2: To Eliminate Leads Impedance

Relative Operation could eliminate impedance errors from leads when measuring smaller resistance.

Operating Steps:

1. Press Ω2W on the front panel to select the 2-Wire Resistance measurement function.
2. Connect the red lead to the terminal Input-HI and the black lead to terminal Input-LO as displayed in diagram 2-14 on page 31.
3. Choose a resistance range according to the scope. The default is Auto Range.
4. Lead impedance will be shown on the screen after connecting with two leads together.

Diagram 3- 3 Test Lead Impedance

5. Set the parameters for Relative operation.

   Press Math → **[**Rel Value**]** to set the relative value as current measured value.

Diagram 3- 4 Set Relative Value

6. Press **[**Rel**]** on the softkey menu to open the Relative operation.

Diagram 3- 5 Lead Impedance after Operation

Example 3: dBm Measurement

dBm is commonly used in the audio signal measurement. The following will introduce you how to measure the dBm value.

Operating Steps:

1. Press ACV on the front panel to select the AC Voltage measurement function and choose a voltage range.
2. Connect the red lead to the terminal Input-HI and the black lead to the terminal Input-LO as Diagram 2-9 on page 27.
3. Set the dBm parameters.
4. Press Math → **[**Statistics**]** to turn on the statistics function. Set the selective value of the dBm as a reference value within the circuit by using the direction key: 50Ω.

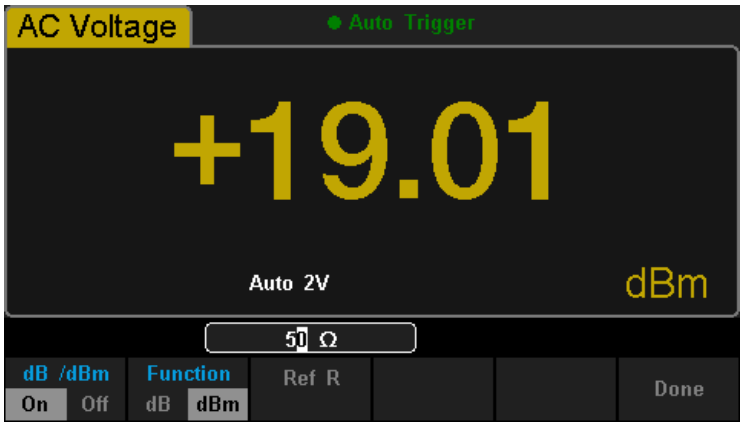


Diagram 3- 6 Select Reference Resistance as Measurement Value

4. Press **[**Done**]** to return to the higher level menu. At this time, the reading shown on the screen is the Power value of reference resistance.

Example 4: dB Measurement

As a common measuring unit, dB has been widely used in electrical engineering, radio science, mechanics, shock and vibration, mechanical power and acoustics areas. The following will introduce you on how to measure dB between two circuits.

Operating Steps:

Method 1:

Measure dBm_1 and dBm_2 existing in two circuits separately according to Example 3, and then dB can be measured.

$dB = dBm_1 – dBm_2$

Method 2:

1. Press ACV on the front panel to select the AC Voltage measurement function and choose a proper voltage range.
2. Connect the red lead to the terminal Input-HI and the black lead to the terminal Input-LO as Diagram 2-9 on page 27.
3. Measure dBm_1 according to Example 3.
4. Press Math → **[**dB/dBm**]** to turn on the dB function and set the parameters for the dB Ref Value (dBm2). At this time, the reading shown on the screen is the power difference between two circuits.

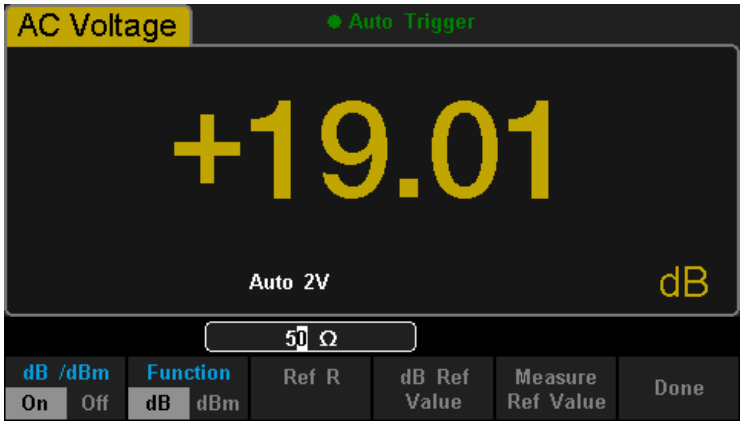


Diagram 3- 7 Set the Parameters of dB

Method 3:

1. Access the first circuit. Measure dBm2 according to Example 3.
2. Press 

→ **[**dB/dBm**]** to turn on the dB function and select **[**Measure Ref Value**]** to set the current dBm measurement value as the preferred value.
3. Access the first circuit. At this time, the reading shown on the screen is the power difference between two circuits.

Example 5: Limits Test

Limits Operation notifies a user if a signal has overstepped its range in accordance to the selected High and Low Limit parameters; meanwhile the beeper will sound an alarm (if sound is on.)

Operating Steps:

1. Press ACV on the front panel to select the AC Voltage measurement function and choose a voltage range.
2. Connect the red lead to the terminal Input-HI and the black lead to the terminal Input-LO as shown in Diagram 2-9 on page 27.
3. Press Math → **[**Limits**]** to set the Limits parameters. Press **[**Low**]** to set the low limit value.

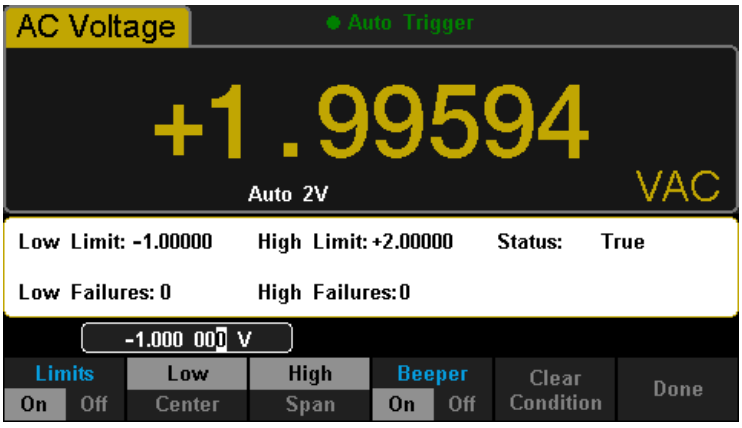


Diagram 3- 8 Set the Low Limit Value

4. Press **[**High**]** to set the high limit value.

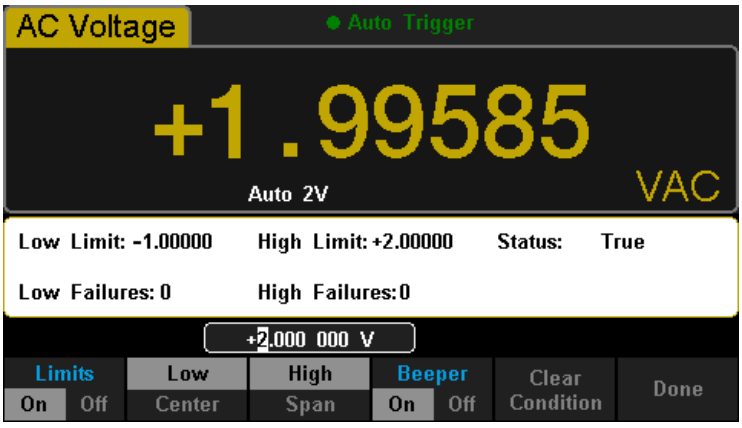


Diagram 3- 9 Set the High Limit Value

5. Turn on the beeper to start the Limits Test. As shown in Diagram 3-10. The measured result is between the Low and High limits, so the test status is “True”.

6. If changing the high limit value to 1V, the measured result for the low and high limits will display. The instrument will beep once (if the beeper is turned on) and the main display will change to a red colour. The test status of “fail” and the high failures value will display.

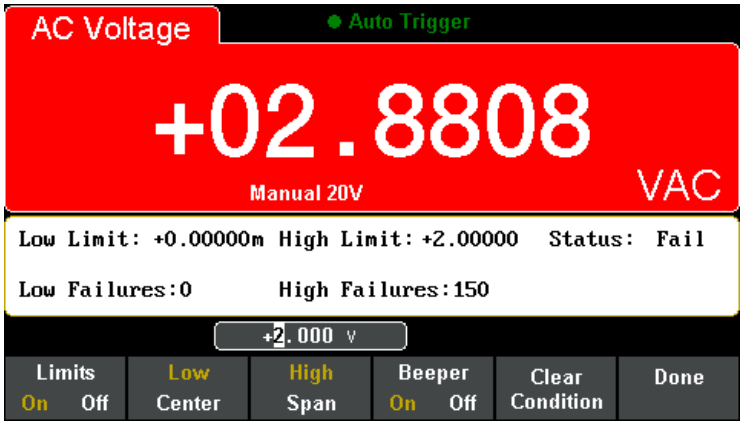


Diagram 3- 10 Limits Test Result

Example 6: Thermocouple setting and measurement

Thermocouple is a common temperature sensor. Type, voltage and cold-side temperature are required for thermocouple measurement.

The instrument can measure temperature of HI and LO terminals (cold-side), and calculate absolute temperature of hot-side. Besides, only the relationship between thermocouple voltage and cold-side temperature is need to be input according thermocouple type when you set the thermocouple sensor.

Operating Steps:

1. Please refer to “To Measure Temperature” in chapter 2 to know about the connection of Sensor.

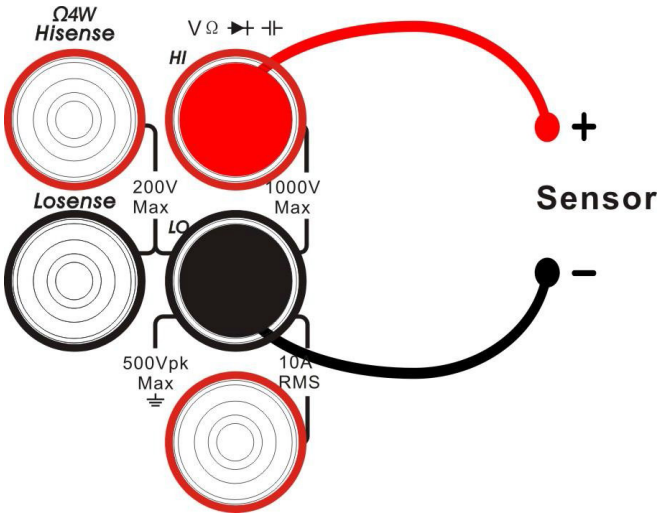


Diagram 3- 13 Sketch map for connecting the sensor

2. Select the type of thermocouple.

   Press【Load】and choose thermocouple measurement. The Multimeter supports 8 kinds of probe type: B、E、J、K、N、R、S and T.

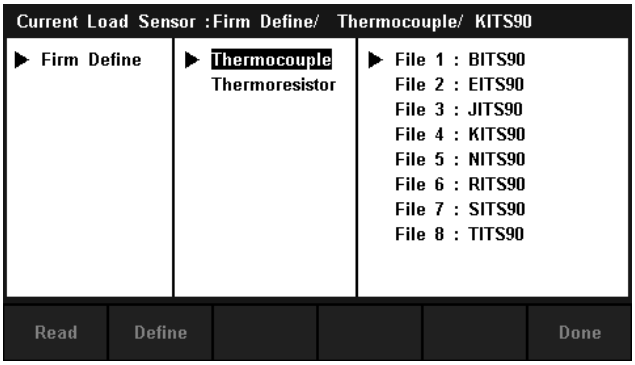


Diagram 3- 14 Select the Type of Thermocouple

3. Use direction keys to select corresponding file and press【Read】to recall the sensor settings file.

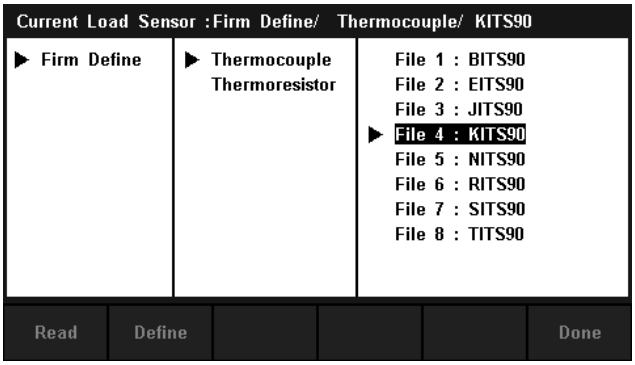


Diagram 3-15 Select Sensor Setting File

4. Press【Units】to choose the unit of temperature.
5. View measured result.

   Press【Display】and select display mode of measurement result as “All” to view measurement value and its corresponding value.

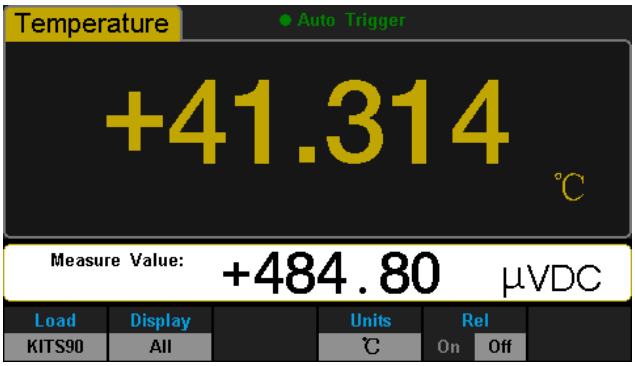


Diagram 3-16 View Measured Results

Example 7: To Use Hold Measurement Function

Reading Hold can help user obtain a stable reading and hold it on the display of Front Panel. The reading would be held all the same although testing pen had been moved away**.** Then we will introduce how to keep the readings displayed on screen.

Operating Steps:

1. Press DCV on the front panel to select the DC Voltage measurement function and choose a voltage range.
2. Connect the red lead to the terminal Input-HI and the black lead to the terminal Input-LO as Diagram 2-4 on page 23.
3. Press Shift and Single to open the Hold measurement function interface. The screen will record the DC voltage measured result, as shown in the following diagram.

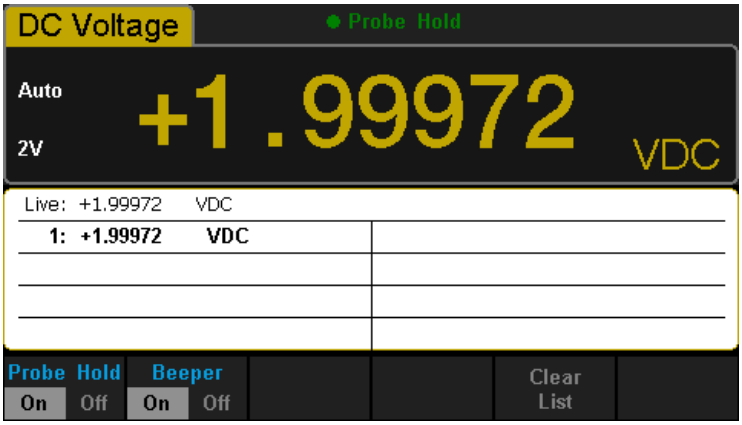


Diagram 3- 11 Result 1

4. Press ACV on the front panel to select the AC Voltage measurement function and choose a voltage range.

5. Connect the red lead to the terminal Input-HI and black lead to the terminal Input-LO as Diagram 2-9 on page 27. The screen will record the AC voltage measured result as shown in the following diagram.

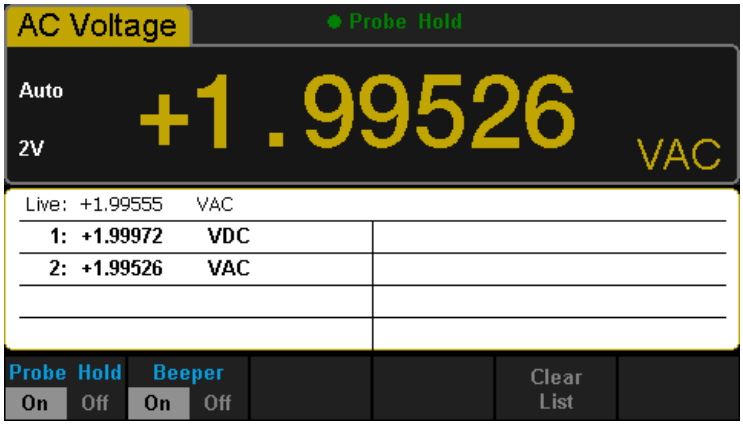


Diagram 3- 12 Result 2

Chapter 4 Measurement Tutorial

True RMS AC Measurement

The AC measurement of the Multimeter has a true RMS response. The power dissipated in the resistor within a time is proportional to the square of the measured true RMS voltage, independent of wave shape. The instrument can accurately measure true RMS voltage or current, if the wave shape contains negligible energy above the effective bandwidth.

The AC voltage and AC current functions measure the “AC coupled” true RMS value, which is to measure the RMS value of the AC component (DC component is rejected) of the input signal. For sine waves, triangle waves, and square waves, the AC and AC+DC values are equal since these waveforms do not contain a DC offset. See the following table 4-1.

Table 4- 1 True RMS AC Measurement of Sine, Triangle and Square waves

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

Non-symmetrical waveforms, such as pulse trains, contain DC voltages which are rejected by AC coupled true RMS measurements.

An AC coupled true RMS measurement is desirable in situations where you are measuring small AC signals in the presence of DC offsets. For instance, measuring the AC ripple present on DC power supplies. There are situations, however, where you might want to know the AC+DC true RMS value. You can determine this value by combining results from DC and AC measurements as the following shows. You should perform the DC measurement using a 5.5-digit mode for best AC rejection.

$$RMS_{(AC+DC)} = \sqrt{AC_2 + DC_2}$$

Crest Factor Errors (non-sinusoidal inputs)

A common misconception is that "since an ac Multimeter is true RMS, its sine wave accuracy specifications apply to all waveforms. “Actually, the shape of the input signal can dramatically affect the measurement accuracy. A common way to describe the signal wave shapes is “crest factor”. Crest factor is the ratio of the peak value to RMS value of a waveform.

The greater the crest factor, the greater the energy contained in the high frequency harmonics. All Multimeters have errors that are crest factor dependent. (The crest factor errors do not apply for input signals below 100Hz.)

You can estimate the measurement error due to signal crest factor as shown below:

Total Error ＝ Error (Sine wave) + Error (Crest factor) + Error (Bandwidth)

Error (Sine wave): error for sine wave.

Error (Crest factor): crest factor additional error.

Error (Bandwidth): estimated bandwidth error as shown below:

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

C.F.: signal crest factor

F*:* fundamental frequency of pulse

BW*:* effective bandwidth of the Multimeter

Example:

Calculate the approximate measurement error for a pulse train input with a crest factor of 2 and a fundamental frequency of 20 kHz. For this example, assume 1- year accuracy specifications of the Multimeter: ± (0.05%× reading + 0.03%×range).

Total Error = (0.05% × reading + 0.03% × range) + (0.05% × range) +

(0.8% × reading)

=0.85% × reading + 0.08% × range

Loading Errors (AC Voltage)

In the AC Voltage function, the input of T3DMM5-5 appears as a 1MΩ resistance in parallel with 100pF of capacitance. The test lead that you use to connect signals to the Multimeter will also add additional capacitance and loading. The approximate input resistances of the Multimeter at different frequencies are listed in the following table.

Table 4- 2 Approximate Input Resistances at Different Frequencies

Input Frequency	Input Resistance
100Hz	1MΩ
1kHz	850kΩ
10kHz	160kΩ
100kHz	16kΩ

For low frequencies:

$$\text{Error（%）} = \frac{-R_S}{R_S+1M\Omega} \times 100\%$$

For high frequencies:

$$\text{Error（%）} = [\frac{1}{\sqrt{1+(2\pi \times F \times R_S \times C_m)}} - 1] \times 100\%$$

F: input frequency

R_s: source resistance

C_m: input capacitance (100pF) plus test lead capacitance

Application of the Analog Filter

The addition of an analog filter can be used to reduce the influence of AC components in DC measurements. Generally, a filter may not be required, but it can improve readings where a large AC component may be problematic such as measuring a DC signal with a substantial AC ripple.

The multimeter does have a user selectable analog filter for DCI and DCV measurements. Enabling the filter is recommended when measuring DCV or DCI signals that have AC components. The filter will notremove the effects of internal noise and it can add additional noise and offset if you are measuring DC signals with little or no AC components.

When measuring signals with little or no AC components, we recommend disabling the analog filter, using a fixed range, and using the REL feature to decrease the offset error of the meter.

Table 5-3 Analogue Filter Error in DCV Measurements

Range	Reading Rate	Additional Analog Filter Error
200mV	Slow	10uV
	Medium	20uV
	Fast	20uV
2V	Slow	15uV
	Medium	20uV
	Fast	20uV
20V	Slow	0.8mV
	Medium	1mV
	Fast	1mV

Table 5-4 Analogue Filter Error in DCI Measurements

Range	Reading Rate	Additional Analog Filter Error
200uA	Slow	0.002% range
	Medium	0.005% range
	Fast	0.005% range
20mA and 2A	Slow	0.04% range
	Medium	0.06% range
	Fast	0.08% range
200mA	Slow	0.004% range
	Medium	0.01% range
	Fast	0.01% range
10A	Slow	0.008% range
	Medium	0.01% range
	Fast	0.01% range

Chapter 5 General Troubleshooting

The following is a list of issues that may arise while using the Multimeter and its solutions. Please use the corresponding steps when troubleshooting. If you are still unable to resolve, please contact Teledyne Test Tools.

➢ **If the screen of the Multimeter is still dark with nothing displayed after pressing the power key:**

1. Check if the power has been connected correctly.
2. Check if the main power switch on the back panel has been turned on.
3. Check if the power fuse has blown. Replace it if it has blown.
4. Restart the Multimeter after all the above steps are complete.
5. If the instrument still cannot start up properly, please contact Teledyne Test Tools.

➢ **The reading does not change when connecting an AC current signal:**

1. Check if the test lead has been connected to the current jack or LO jack correctly.
2. Check if the fuse in the current location on the back panel has blown.
3. Check if the correct measurement type is selected (DCI or ACI).
4. Check if the input is ACI but the measurement setting is DCI.

➢ **The reading does not change when connecting a DC current signal:**

1. Check if the test lead has been connected to the current jack or LO jack correctly.
2. Check if the fuse in the current location on the back panel has blown.
3. Check if the correct measurement type is selected (DCI or ACI).
4. Check if the input is DCI but the measurement setting is ACI.

➢ **USB Disks cannot be recognised by the instrument.**

1. Check if the USB disk works properly.
2. Make sure the used USB disk is of a Flash type. The instrument does not support USB disks of a hard disk type.
3. Check if the capacity of the used USB disk is too large. The Multimeter is recommended not to use USB disks which exceed 8GB.
4. After restarting the instrument, insert the USB disk again.
5. If you still cannot use the USB disk properly, please contact Teledyne Test Tools.

Chapter 6 Appendix

Appendix A: Accessories

Standard Accessories:

- A Power Cord.
- Two test leads (black and red) and two alligator clips.
- An USB Cable.
- A Calibration Certificate.
- A Quick Start.

NOTE:

- We suggest that the length of the USB data wire and LAN cable connected to the instrument should be less than 3m to avoid affecting the product performance.

Appendix B: Warranty summary

Teledyne Test Tools warrants that the products that it manufactures, and sells will be free from defects in materials and workmanship for a period of three years from the date of shipment from an authorised **Teledyne Test Tools** distributor. If a product proves defective within the respective period, **Teledyne Test Tools** will provide repair or replacement as described in the complete warranty statement.

To arrange for service or obtain a copy of the complete warranty statement, please contact your nearest **Teledyne Test Tools** sales and service office. Except as provided in this summary or the applicable warranty statement. **Teledyne Test Tools** makes no warranty of any kind, express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose. In no event shall **Teledyne Test Tools** be liable for indirect, special or consequential damages.

Appendix C: Daily Maintenance and Cleaning

Maintenance

When storing or using the instrument, please avoid long periods of direct sunlight on the instrument display.

NOTE:

To avoid damage to the instrument or probe, please do not place them in mist, liquid or solvent.

Cleaning

Please often clean the instrument and probes according to their use.

- Wipe the external dust off the instrument and probes with a soft rag. Be careful not to scratch the transparent plastic protective screen when cleaning the liquid crystal display.

- After disconnecting the power use a soft, water dampened rag, to clean the instrument. Or use a 75% isopropyl alcohol and water solvent to get a more thorough clean.

NOTE:

- To prevent the surface of the instrument or probe from damage, please do not use any corrosive or chemical cleaning agents.

- Please make sure the instrument is dry before reconnecting it to power and restarting it, to avoid short circuit or personal injuries caused by water.

- Do not allow water or any other liquid to enter or penetrate the instrument.

Appendix D: Contact Teledyne Test Tools

Teledyne LeCroy (US Headquarters)

700 Chestnut Ridge Road
Chestnut Ridge, NY. USA
10977-6499
Phone: 800-553-2769 or 845-425-2000
Fax Sales: 845-578-5985
Email Sales: contact.corp@teledynelecroy.com
Email Support: support@teledynelecroy.com
(Oscilloscopes, Waveform Generators, Signal Integrity)
Web Site: http://teledynelecroy.com/
Phone Support: 1-800-553-2769

Teledyne LeCroy (European Headquarters)

Teledyne LeCroy GmbH
Im Breitspiel 11c
D-69126 Heidelberg, Germany
Phone: + 49 6221 82700
Fax: +49 6221 834655
Fax Sales: +49 6221 834655
Fax Service: +41 22 719 22 99
Email Sales: contact.gmbh@teledynelecroy.com
Email Service: service.gmbh@teledynelecroy.com
Email Support: applications.de@teledynelecroy.com
Web Site: http://teledynelecroy.com
Phone Service: +49 6221 8270 85
Phone Support: +49 6221 8270 28

World wide support contacts can be found at:
https://teledynelecroy.com/support/contact/#

ABOUT TELEDYNE TEST TOOLS

TELEDYNE TEST TOOLS
Everywhereyoulook™

Company Profile

Teledyne LeCroy is a leading provider of oscilloscopes, protocol analyzers and related test and measurement solutions that enable companies across a wide range of industries to design and test electronic devices of all types. Since our founding in 1964, we have focused on creating products that improve productivity by helping engineers resolve design issues faster and more effectively. Oscilloscopes are tools used by designers and engineers to measure and analyze complex electronic signals in order to develop high-performance systems and to validate electronic designs in order to improve time to market.

The Teledyne Test Tools brand extends the Teledyne LeCroy product portfolio with a comprehensive range of test equipment solutions. This new range of products delivers a broad range of quality test solutions that enable engineers to rapidly validate product and design and reduce time-to-market. Designers, engineers and educators rely on Teledyne Test Tools solutions to meet their most challenging needs for testing, education and electronics validation.

Location and Facilities

Headquartered in Chestnut Ridge, New York, Teledyne Test Tools and Teledyne LeCroy has sales, service and development subsidiaries in the US and throughout Europe and Asia. Teledyne Test Tools and Teledyne LeCroy products are employed across a wide variety of industries, including semiconductor, computer, consumer electronics, education, military/aerospace, automotive/industrial, and telecommunications.

Distributed by:

Teledyne LeCroy (US Headquarters)

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Chestnut Ridge, NY. USA 10977-6499

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World wide support contacts can be found at:
https://teledynelecroy.com/support/contact

World wide instrument service can be found at:
https://teledynelecroy.com/support/service.aspx

RoHS and WEEE information can be found at:
https://teledynelecroy.com/support/rohs.aspx

T3 stands for Teledyne Test Tools.

931350 RevA