

RIGOL

Quick Guide

English

中文

MSO5000-E Series

Digital Oscilloscope

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RIGOL TECHNOLOGIES CO., LTD.

Guaranty and Declaration

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E-mail: service@rigol.com

Website: www.rigol.com

General Safety Summary

1. Only the exclusive power cord designed for the instrument and authorized for use within the local country could be used.
2. Ensure that the instrument is safely grounded.
3. Observe all terminal ratings.
4. Use proper overvoltage protection.
5. Do not operate without covers.
6. Do not insert objects into the air outlet.
7. Use the proper fuse.
8. Avoid circuit or wire exposure.
9. Do not operate the instrument with suspected failures.
10. Provide adequate ventilation.
11. Do not operate in wet conditions.
12. Do not operate in an explosive atmosphere.
13. Keep instrument surfaces clean and dry.
14. Prevent electrostatic impact.
15. Handle with caution.

Safety Notices and Symbols

Safety Notices in this Manual:



WARNING

Indicates a potentially hazardous situation or practice which, if not avoided, will result in serious injury or death.



CAUTION

Indicates a potentially hazardous situation or practice which, if not avoided, could result in damage to the product or loss of important data.

Safety Terms on the Product:

DANGER

It calls attention to an operation, if not correctly performed, could result in injury or hazard immediately.

WARNING

It calls attention to an operation, if not correctly performed, could result in potential injury or hazard.

CAUTION

It calls attention to an operation, if not correctly performed, could result in damage to the product or other devices connected to the product.

Safety Symbols on the Product:Hazardous
VoltageSafety
WarningProtective Earth
Terminal

Chassis Ground



Test Ground

Care and Cleaning

Care

Do not store or leave the instrument where it may be exposed to direct sunlight for long periods of time.

Cleaning

Clean the instrument regularly according to its operating conditions.

1. Disconnect the instrument from all power sources.
2. Clean the external surfaces of the instrument with a soft cloth dampened with mild detergent or water. Avoid having any water or other objects into the chassis via the heat dissipation hole. When cleaning the LCD, take care to avoid scarifying it.

**CAUTION**

To avoid damage to the instrument, do not expose it to caustic liquids.

**WARNING**

To avoid short-circuit resulting from moisture or personal injuries, ensure that the instrument is completely dry before connecting it to the power supply.

Document Overview

This manual gives you a quick review about the front and rear panel of MSO5000-E series, the user interface, and the basic operation method.

Tip

For the latest version of this manual, download it from the official website of **RIGOL** (www.rigol.com).

Format Conventions in this Manual

1. Key

The key on the front panel is denoted by the format of "Key Name (Bold) + Text Box" in the manual. For example, **Utility** denotes the "Utility" key.







2. Menu

The menu items are denoted by the format of "Menu Word (Bold) + Character Shading". For example, **System** denotes the "System" menu item under **Utility**.

3. Operation Procedures

→ denotes the next step of operation. For example, **Utility** → **System** denotes that first press **Utility**, and then press the **System** softkey.

4. Knob

Label	Knob	Label	Knob
Horizontal SCALE 	Horizontal Time Base Knob	Vertical SCALE 	Vertical Scale Knob
Horizontal POSITION 	Horizontal Position Knob	Vertical OFFSET 	Vertical Offset Knob
Trigger LEVEL 	Trigger Level Knob		Multifunction Knob

Content Conventions in this Manual

MSO5000-E series includes the following models. Unless otherwise specified, this manual takes MSO5152-E as an example to illustrate the functions and operation methods of MSO5000-E series digital oscilloscope.

Model	Max. Analog Bandwidth	No. of Analog Channels	No. of Function/Arbitrary Waveform Generator Channels	No. of Digital Channels
MSO5152-E	150 MHz	2	1, Opt.	16 (Required to purchase the probe)

General Inspection

1. Inspect the packaging

If the packaging has been damaged, do not dispose the damaged packaging or cushioning materials until the shipment has been checked for completeness and has passed both electrical and mechanical tests.

The consigner or carrier shall be liable for the damage to the instrument resulting from shipment. **RIGOL** would not be responsible for free maintenance/rework or replacement of the instrument.

2. Inspect the instrument

In case of any mechanical damage, missing parts, or failure in passing the electrical and mechanical tests, contact your **RIGOL** sales representative.

3. Check the accessories

Please check the accessories according to the packing lists. If the accessories are damaged or incomplete, please contact your **RIGOL** sales representative.

Product Overview

The MSO5000-E series is a high-performance digital oscilloscope designed on the basis of the **RIGOL** UltraVision II technology. It has a 9-inch capacitive touch screen, and integrates 7 instruments into one. With a compact and portable design, it delivers excellent specifications, such as super high sample bandwidth ratio and high memory depth. All the MSO5000-E series support multiple channels, bandwidths, and the upgrade of the analysis software. They integrate the functions of multiple instruments. Different user groups can have more choices in selecting their desired product based on their needs, helping them save their budget to a large extent while enjoying the superior test support and user experience.

For descriptions of the front panel, refer to Figure 1 and Table 1; for descriptions of the rear panel, refer to Figure 2 and Table 2; and for descriptions of the main interface (display screen), refer to Figure 3 and Table 3.

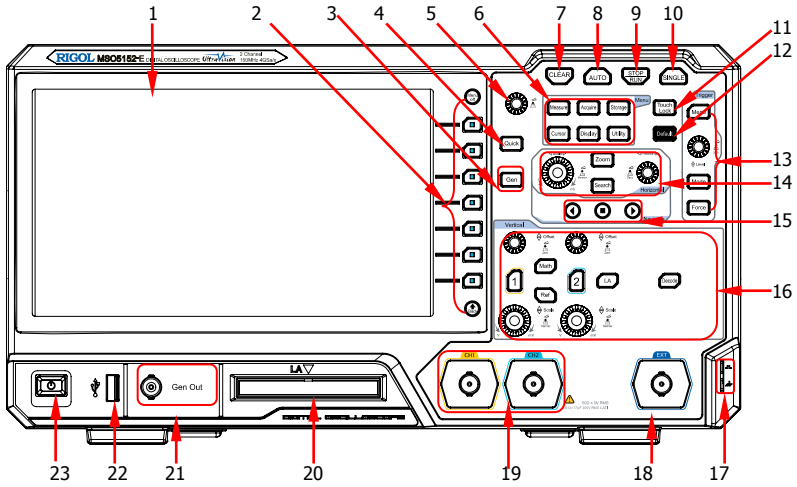


Figure 1 Front Panel

Table 1 Front Panel Description

No.	Description	No.	Description
1	Capacitive Touch Screen	13	Trigger Control System
2	Function Menu Operation Keys	14	Horizontal Control System
3	Function/Arbitrary Waveform Generator Setting Key ^[1]	15	Navigation Control key
4	Quick Key (Shortcut Key)	16	Vertical Control System
5	Multifunction Knob	17	Probe Compensation Signal Output Terminal/Ground Terminal
6	Common Operation Keys	18	External Trigger Input
7	CLEAR Key	19	Analog Channel Input
8	Auto Waveform Display Key	20	Digital Channel Input ^[2]
9	RUN/STOP Key	21	Function/Arbitrary Waveform Generator Output Terminal ^[1]
10	Single Trigger Control Key	22	USB HOST Interface
11	Touch Lock Key	23	Power Key
12	Default Setting Key	--	--

Note:^[1] This function is only available for the model installed with the MSO5000-E-AWG option.

Note:^[2] PLA2216 active logic probe option is required to be ordered.

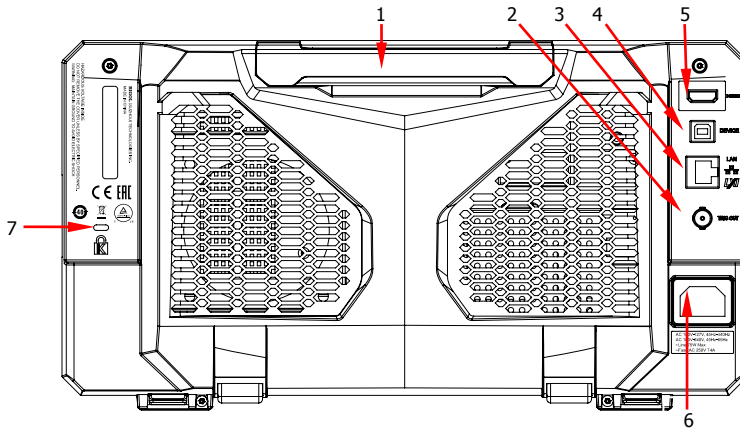


Figure 2 Rear Panel

Table 2 Rear Panel Description

No.	Description
1	Handle
2	Trigger Output Interface
3	LAN Interface
4	USB DEVICE Interface
5	HDMI Video Output
6	AC Power Cord Connector
7	Kensington Security Lock Hole

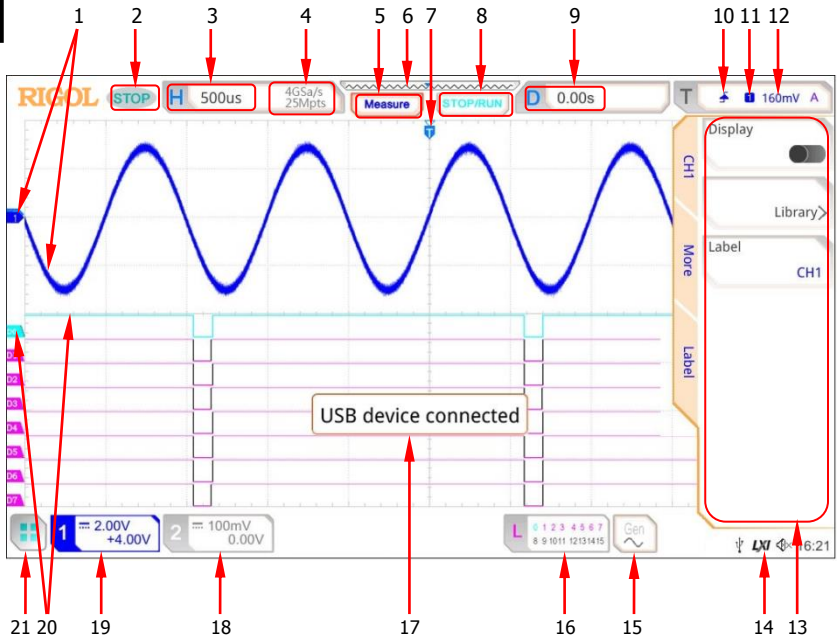


Figure 3 User Interface

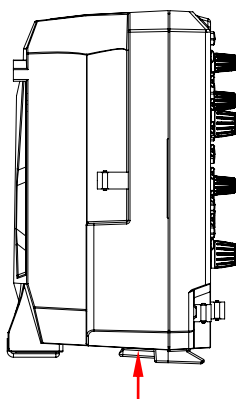
Table 3 User Interface Icons

No.	Description	No.	Description
1	Analog Channel Label and Waveform	12	Trigger Level/Threshold Level
2	Operating Status	13	Operation Menu
3	Horizontal Time Base	14	Notification Area
4	Sample Rate and Memory Depth	15	Arbitrary Waveform Generator Waveform Label
5	Auto Measurement Label	16	Digital Channel Status Area
6	Waveform Memory	17	Message Box
7	Trigger Position	18	CH2 Status Label
8	RUN/STOP Label	19	CH1 Status Label
9	Horizontal Position	20	Digital Channel Label and Waveform
10	Trigger Type	21	Function Navigation
11	Trigger Source	--	--

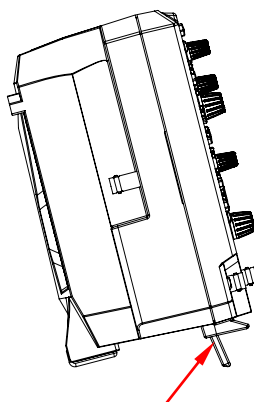
To Prepare for Use

To Adjust the Supporting Legs

You can unfold the supporting legs to use them as stands to tilt the instrument upwards for easier operation and observation, as shown in Figure 4. You can also fold the supporting legs for easier storage or shipment when the instrument is not in use.



To fold the supporting legs



To unfold the supporting legs

Figure 4 To Adjust the Supporting Legs

To Connect to AC Power

The input AC power requirements of the oscilloscope are 100~240 V, 45~440 Hz. Please use the power cord provided in the accessories to connect the oscilloscope to the AC power source via the power cord connector, as shown in Figure 5.

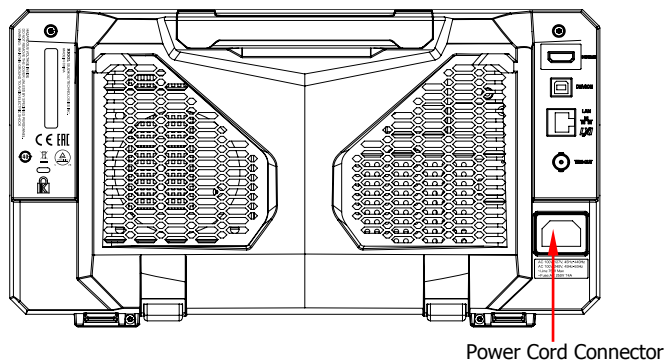



Figure 5 To Connect to AC Power

Turn-on Checkout

When the oscilloscope is connected to power, press the Power key  at the lower-left corner of the front panel to start the oscilloscope. During the start-up process, the oscilloscope performs a series of self-tests. After the self-test, the welcome screen is displayed.

To Set the System Language

MSO5000-E series oscilloscope supports multiple system languages. You can press **Utility** → **Language** to set the system language. You can also enable the touch screen to perform the above menu operation.

To Connect the Probe

RIGOL provides the passive probe and the logic probe for MSO5000-E series. For specific probe models, please refer to *MSO5000-E Datasheet*. For detailed technical information of the probes, please refer to the specified Probe User Guide.

Connect the passive probe:

1. Connect the BNC terminal of the probe to an analog channel input terminal of the oscilloscope on the front panel, as shown in Figure 6.

2. Connect the ground alligator clip or spring of the probe to the circuit ground terminal, and then connect the probe tip to the circuit point to be tested.

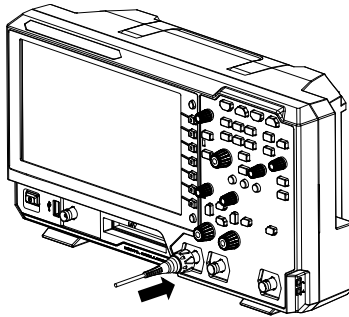


Figure 6 To Connect the Passive Probe

After you connect the passive probe, check the probe function and probe compensation adjustment before making measurements. For detailed procedures, refer to "**Function Inspection**" in this manual and the "**Probe Compensation**" section introduced in *MSO5000-E User Guide*.

Connect the logic probe:

1. Disconnect the device under test (DUT) from the power source.
2. Connect the output terminal of the logic probe to the digital channel input terminal on the front panel of the oscilloscope in the correct direction, as shown in Figure 7.
3. Connect the other terminal of the logic probe to the signal terminal under test. **RIGOL's** MSO5000-E series supplies PLA2216 active logic probe option. To apply to different application scenarios, PLA2216 provides two connection methods to connect the signal under test. For details, refer to *PLA2216 Active Logic Probe User's Guide*.

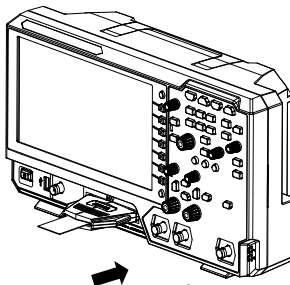


Figure 7 To Connect the Logic Probe

Note: The digital channel input terminal does not support hot plugging. Please do not insert or pull out the logic probe when the instrument is in power-on state.

Function Inspection

1. Press **Default** on the front panel, and then a prompt message "Restore default settings?" is displayed. Press **OK** to restore the oscilloscope to its factory default settings.
2. Connect the ground alligator clip of the probe to the "Ground Terminal" as shown in Figure 8 below.
3. Use the probe to connect the input terminal of CH1 of the oscilloscope and the "Compensation Signal Output Terminal" of the probe, as shown in Figure 8.

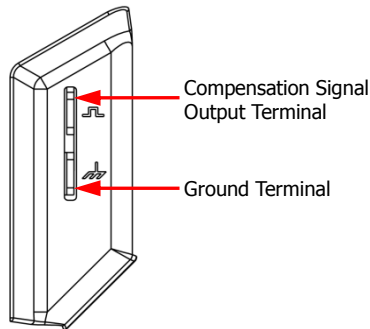


Figure 8 To Use the Compensation Signal

4. Set the probe attenuation to 10X, and then press **AUTO**.
5. Observe the waveform on the display. In normal condition, the square waveform as shown in Figure 9 should be displayed.



Figure 9 Square Waveform Signal

6. Use the same method to test the other channels. If the square waveforms actually shown do not match that in the figure above, please perform relevant procedures specified in "**Probe Compensation**".

**WARNING**

To avoid electric shock when using the probe, please make sure that the insulated wire of the probe is in good condition. Do not touch the metallic part of the probe when the probe is connected to high voltage source.

Tip

The probe compensation signal can only be used for probe compensation adjustment and cannot be used for calibration.

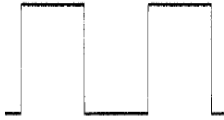
Probe Compensation

When the probes are used for the first time, you should compensate the probes to make them match the input channels of the oscilloscope. Non-compensated or poorly compensated probes may cause measurement inaccuracy or errors. The probe compensation procedures are as follows:

1. Perform Step 1, 2, 3 and 4 specified in "**Function Inspection**".
2. Check the displayed waveforms and compare them with waveforms in Figure 10.



Over compensated



Perfectly compensated



Under compensated

Figure 10 Probe Compensation

3. Use the adjustment tool to adjust the low-frequency compensation adjustment hole on the probe until the waveform is displayed as "Perfectly compensated" in the figure above.

Touch Screen Operation


MSO5000-E series provides a 9-inch super large capacitive touch screen, which supports multi-touch and gesture operation. It has strong waveform display capability and excellent user experience. It features great convenience, high flexibility, and great sensitivity. The actions supported by the touch screen controls include tapping, pinching&stretching, dragging as well as rectangle drawing.

Tip

The touch screen function is available for all the menus displayed on the screen and the buttons enabled.

Tap

Use one finger to touch the symbol or characters on the screen slightly, as shown in Figure 11. The actions supported by the tap action include:

- Tap and operate the menus on the screen.
- Tap the function navigation icon  at the lower-left corner of the touch screen to enable the function navigation.
- Tap the displayed numeric keypad to set the parameters.
- Tap the virtual keypad to set the label name and the filename.

- Tap close button at the upper-right corner of the message box to close it.
- Tap and operate the windows on the screen.



Figure 11 Tap Gesture

Pinch&Stretch

Pinch or stretch two points on the screen with two fingers to zoom in or out the waveform. To zoom in the waveform, first pinch the two fingers and then stretch the fingers; to zoom out the waveform, first stretch the two fingers, and then pinch the fingers together, as shown in Figure 12. The actions supported by the pinching&stretching action include:

- Pinching&stretching in the horizontal direction can adjust the horizontal time base of the waveform.
- Pinching&stretching in the vertical direction can adjust the vertical scale of the waveform.

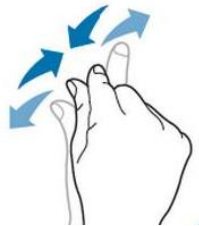


Figure 12 Pinch&Stretch Gesture

Drag

Use one finger to select the object, and then drag the object to a destination place, as shown in Figure 13. The actions supported by the drag action include:

- Drag the waveform to change its position or offset.
- Drag the window controls to change the positions of the controls (e.g. numeric keypad).
- Drag the marker to change the position of the marker.

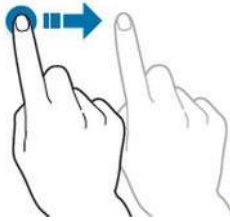


Figure 13 Drag Gesture

Rectangle Drawing

Enable the function navigation, and then tap the "Draw rect" icon to switch to the rectangle drawing mode. Drag a finger from upper left to lower right across the screen to draw a rectangle on the screen, as shown in Figure 14 (a). Move your finger away from the screen, and then a menu is displayed on the screen. At this time, you can tap to select "Trigger zone A", "Trigger zone B", "Histogram", "Horizontal zoom in", "Vertical zoom in", or "Waveform zoom in". Drag a finger from lower right to upper left across the screen to draw a rectangle on the screen, as shown in Figure 14 (b). Move your finger away from the screen, and then a menu is displayed on the screen. At this time, you can tap to select "Trigger zone A", "Trigger zone B", "Histogram", "Horizontal zoom out", "Vertical zoom out", or "Waveform zoom out".

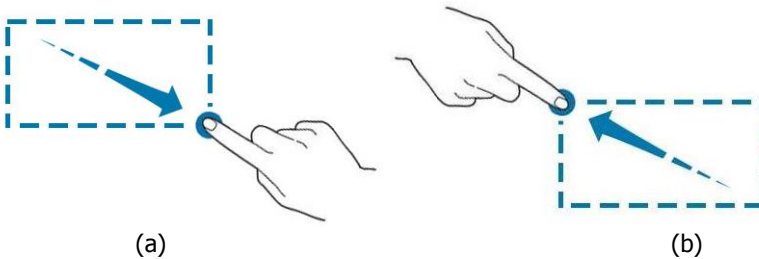




Figure 14 Rectangle Drawing Gesture

- Select "Trigger zone A":
 - Draw the region for Trigger zone A;
 - Open Trigger zone A;
 - Open the "Zone Trigger" menu.
- Select "Trigger zone B":
 - Draw the region for Trigger zone B;
 - Open Trigger zone B;

- Open the "Zone Trigger" menu.
- Select "Histogram":
 - Draw the region for the histogram;
 - Open the "Histogram" menu.
- Select "Horizontal zoom in": expands the waveforms in the horizontal direction. Select "Horizontal zoom out": compresses the waveforms in the horizontal direction.
- Select "Vertical zoom in": expands the waveforms in the vertical direction. Select "Vertical zoom out": compresses the waveforms in the vertical direction.
- Select "Waveform zoom in": expands the waveforms both in the horizontal and vertical direction. Select "Waveform zoom out": compresses the waveforms both in the horizontal and vertical direction.


Tip

Tap the "Draw rect" icon to switch between the rectangle drawing and waveform operation modes.

Tap the "Draw rect" icon, if  is displayed, it indicates that the rectangle drawing mode is enabled. Tap the "Draw rect" icon, if  is displayed, it indicates that the waveform operation mode is enabled. By default, the waveform operation mode is enabled.

To Use the Built-in Help System

The help system of this oscilloscope provides instructions for all the function keys on the front panel and their corresponding menu keys. The steps for opening the built-in help system are as follows:

1. Press **Utility** → **System** → **Help**, and then the "Help" menu is displayed on the screen. You can also use the touch screen function, tap the function navigation icon  at the lower-left corner of the touch screen to enable the function navigation. Tap the "Help" icon, and then the "Help" menu is displayed on the screen.
2. Press **Content** on the front panel or tap the "Content" menu item, and then the help information is displayed on the screen, as shown in Figure 15. The help interface mainly consists of two sections. The left section lists "Help Options", and the right section is the "Help Display Area".

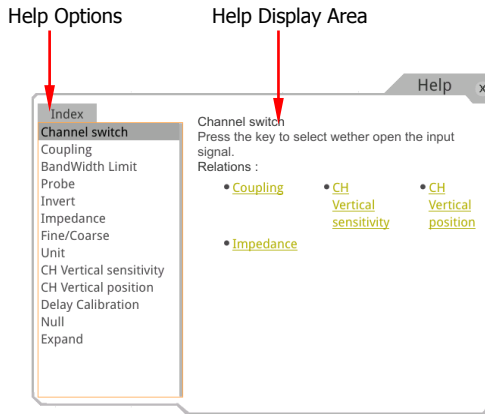




Figure 15 Help Information


After opening the help interface, you can get its help information in the "Help Display Area" through the following three methods:

Method 1:

For the keys, you can directly press the front-panel keys (except the Power key , the **Menu off** key and **Back** key) to obtain the corresponding help information.

For the buttons, you can rotate the knob or press down the knob to get the corresponding help information (except the multifunction knob ). As the function of rotating the knob is different from that of pressing down the knob, these two operations will give you different help information.



Method 2:

In the "Help Options", rotate the multifunction knob  to switch among the help options to get the corresponding help information.

Method 3:

Enable the touch screen and tap the desired help option to get the corresponding help information.

Tip

- Help information for other keys and buttons:
 - Power key : powers on/off the instrument.
 - **Menu off** key: displays or hides menus. By default, menus are displayed. If menus are hidden, pressing this key can display the menus again.
 - **Back** key: returns to the previous menu or the last set function menu.
 - Multifunction knob : In non-menu-operation mode, rotate this knob to adjust the brightness of waveform display. In menu-operation mode, for the menu item that has multiple parameters under it, when you press the menu softkey, rotate the knob to select the parameter item, then press down the knob to select it (sometimes, the specified parameter item can be selected by rotating the knob).
It can also be used to modify parameters, input a filename, etc.
- If the menu item is grayed out, you cannot press the corresponding front-panel menu key to obtain the help information. What you can do is only to follow the above Method 2 or 3 to get the help information.



Parameter Setting Method

For the MSO5000-E series, you can use the multifunction knob or enable the touch screen to set the parameters of MSO5000-E series. The common parameter setting methods are as follows:




Method 1:

For the parameters with the sign , rotate the multifunction knob  on the front panel directly to select the parameter item or modify the parameter value.

Method 2:

For the parameters with the sign , rotate the multifunction knob  on the front panel and press it down to select the parameter item or modify the parameter value.

Method 3:

For the parameters with  displayed on the menu, rotate the multifunction knob  on the front panel directly to set the parameter, or press down the multifunction knob  or the specified menu softkey, and then the numeric

keypad is shown in Figure 16 below.

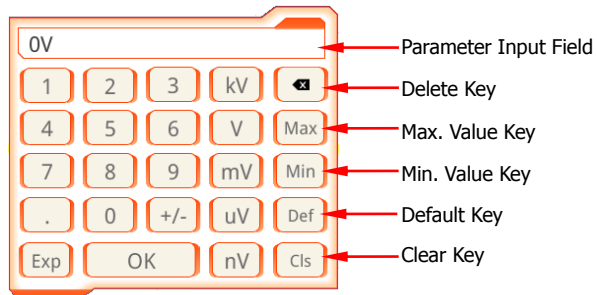



Figure 16 Numeric Keypad

In the numeric keypad, rotate the multifunction knob  to select the parameter, then press down the knob to select it. Then input the value or the unit. You can also enable the touch screen and tap the value or unit in the numeric keypad to input them. After you input all the values and select the desired units, the numeric keypad is turned off automatically. This indicates that you have completed parameter setting. Besides, after you have input the values, you can also press **OK** directly to close the numeric keypad. At this time, the unit of the parameter is the default unit. In the numeric keypad, you can also perform the following operations:

- Delete the parameter value that has been input.
- Set the parameter to a maximum or minimum value (sometimes, the maximum or minimum value are the specified one for the current state).
- Set the parameter to a default value.
- Clear the parameter input field.

Method 4:

For the parameters without the above signs, press the desired menu softkey to switch between the parameter items. This method is applicable to the parameters with only two available options.

Tip

The above method is commonly used for the parameter settings of the oscilloscope. For other methods of parameter settings, refer to details in relevant chapters of *MSO5000-E User Guide*.

Remote Control

MSO5000-E series digital oscilloscope can be connected to the PC via the USB, LAN, or GPIB interface to set up communication and realize remote control through the PC. The remote control can be realized by using SCPI (Standard Commands for Programmable Instruments) commands. MSO5000-E series digital oscilloscope supports three ways of remote control: user-defined programming, PC software (e.g. **RIGOL** Ultra Sigma), and Web Control.

More Product Information

1. Obtain the device information

Press **Utility** → **System** → **About** to obtain the information of the instrument, such as the manufacturer, model, serial number, hardware version number, etc. You can also refer to descriptions in "**To Use the Built-in Help System**" to open the "Help" menu, and then press **About** to obtain the device information. You can also enable the touch screen to perform the above menu operation.

2. View the option information and the option installation

The instrument is installed with the trial versions of the options before leaving factory. When you power on the instrument for the first time, the trial time is about 2,160 minutes. Refer to descriptions in "**To Use the Built-in Help System**" to open the "Help" menu, and then press **Option list** to view the options currently installed on the oscilloscope and their information. Press **Option install** to install the option. For detailed setting methods, refer to descriptions in *MSO5000-E User Guide*. You can also enable the touch screen to perform the above menu operation.

For more information about this instrument, refer to the relevant manuals by logging in to the official website of **RIGOL** (www.rigol.com) to download them.

MSO5000-E User Guide: introduces the functions of the instrument and the operation methods, remote control methods, possible failures and solutions in using the instrument, the technical specifications, and order information.

MSO5000-E Programming Guide: provides detailed descriptions of SCPI commands and programming examples of the instrument.

MSO5000-E Datasheet: provides the main features and technical specifications of the instrument.