# RIGOL

## Quick Guide

# DS4000E Series Digital Oscilloscope

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**RIGOL** TECHNOLOGIES, INC.

English | # Guaranty and Declaration

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E-mail: service@rigol.com
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# Contents

# 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. Connect the probe correctly.
4. Observe all terminal ratings.
5. Use proper overvoltage protection.
6. Do not operate without covers.
7. Do not insert objects into the air outlet.
8. Use the proper fuse.
9. Avoid circuit or wire exposure.
10. Do not operate the instrument with suspected failures.
11. Provide adequate ventilation.
12. Do not operate in wet conditions.
13. Do not operate in an explosive atmosphere.
14. Keep instrument surfaces clean and dry.
15. Prevent electrostatic impact.
16. 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 Voltage | Safety Warning | Protective 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. 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 introduces some basic information that you should know when you use the DS4000E series digital oscilloscope for the first time. For more information about this instrument, log in to the **RIGOL** official website (www.rigol.com) to download the latest version of the relevant manuals.

## 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 softkey
   The menu softkey is denoted by the format of "Menu Name (Bold) + Character Shading" in the manual. For example, System denotes the "System" softkey under Utility.

3. Operation Procedures:
   The next step of the operation is denoted by an arrow "➔" in the manual. For example, Utility ➔ System denotes that first press Utility, and then press System.

4. Knob

| Icon | Knob |
|------|------|
| HORIZONTAL 🔘 SCALE | Horizontal time base knob |
| HORIZONTAL 🔘 POSITION | Horizontal position knob |
| VERTICAL 🔘 SCALE | Channel vertical scale knob |
| VERTICAL 🔘 POSITION | Channel vertical position knob |
| TRIGGER 🔘 LEVEL | Trigger level knob |

## Content Conventions in this Manual

DS4000E series includes the following models. Unless otherwise specified, this manual takes DS4024E as an example to illustrate the basic information of DS4000E series.

| Model | Analog Bandwidth | No. of Analog Channels |
|-------|------------------|------------------------|
| DS4024E | 200 MHz | 4 |
| DS4014E | 100 MHz | 4 |

# 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

Based on the UltraVision technology, DS4000E is a multi-functional digital oscilloscope with high performance. It is easy to use, and its superb technical specifications and multiple functions are perfectly integrated, enabling you to quickly accomplish the tasks, such as test measurement, remote control, etc.

For a brief introduction about the front panel, refer to Figure 1; for the rear panel, refer to Figure 2; and for the user interface, refer to Figure 3. For details about them, refer to the User's Guide of this instrument.
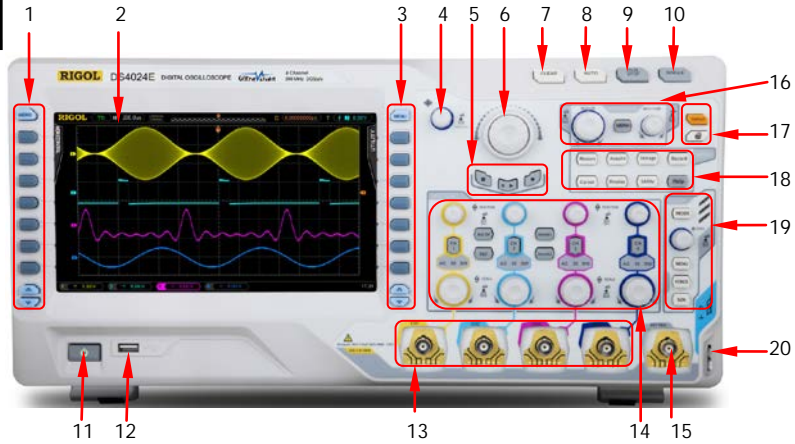
Figure 1 Front Panel

Table 1 Front Panel Description

| No. | Description | No. | Description |
|-----|-------------|-----|-------------|
| 1 | Parameter Measurement Menu Softkeys | 11 | Power Key |
| 2 | LCD | 12 | USB HOST Interface |
| 3 | Function Setting Menu Softkeys | 13 | Analog Channel Input Terminals |
| 4 | Multi-function Knob | 14 | Vertical Control Area |
| 5 | Waveform Record Keys | 15 | External Trigger Input Terminal |
| 6 | Navigation Knob | 16 | Horizontal Control Area |
| 7 | CLEAR Key | 17 | Default Key and Print Key |
| 8 | AUTO Key | 18 | Function Keys |
| 9 | RUN/STOP Key | 19 | Trigger Control Area |
| 10 | SINGLE Key | 20 | Probe Compensation Signal Output Terminal and Ground Terminal |

Figure 2 Rear Panel

Table 2 Front Panel Description

| No. | Description |
|-----|-------------|
| 1 | Trig Out/Calibration |
| 2 | 10 MHz In/Out |
| 3 | Video Output |
| 4 | LAN Interface |
| 5 | USB DEVICE Interface |
| 6 | USB HOST Interface |
| 7 | Lock Hole |
| 8 | AC Power Supply Connector and Power Switch |
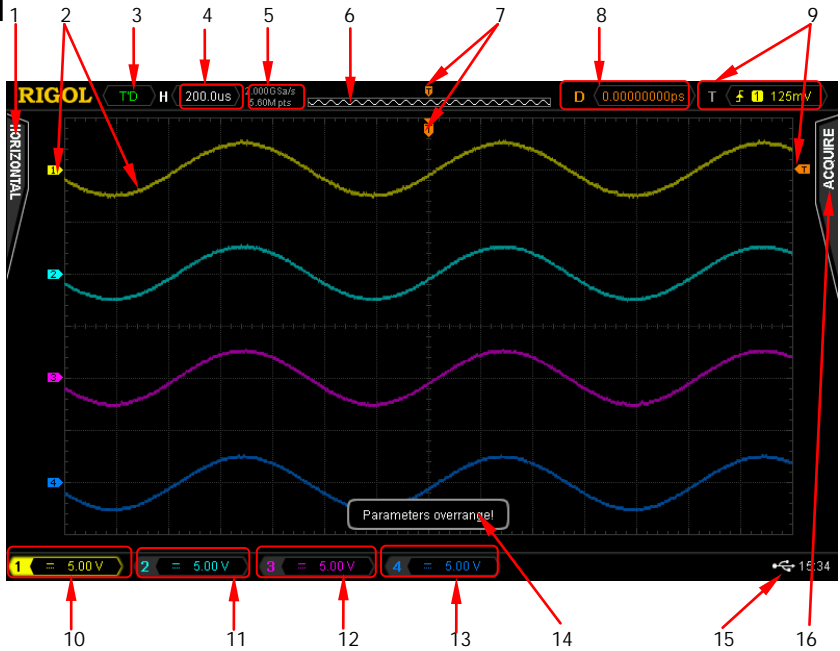
Figure 3 User Interface

Table 3 User Interface Description

| No. | Description | No. | Description |
|-----|-------------|-----|-------------|
| 1 | Auto Measurement Option | 9 | Trigger Setting |
| 2 | Analog Channel Label and Waveform | 10 | CH1 Status Label |
| 3 | Operating Status | 11 | CH2 Status Label |
| 4 | Horizontal Time Base | 12 | CH3 Status Label |
| 5 | Sample Rate and Memory Depth | 13 | CH4 Status Label |
| 6 | Waveform Memory | 14 | Message Box |
| 7 | Trigger Position | 15 | Notification Area |
| 8 | Horizontal Position | 16 | Function Setting Menu |

# To Prepare the Oscilloscope for Use

## To Remove the Front Panel Cover

Before using the oscilloscope, remove the front panel cover. Grasp the transverse tabs on each side and pull them outward to remove the cover.



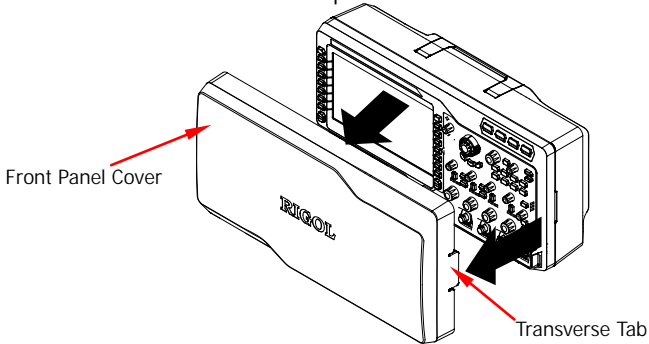Front Panel Cover

Transverse Tab

Figure 4 To Remove the Front Panel Cover

## To Connect to Power Supply

This oscilloscope supports two kinds of AC input power supplies: 100 V-127 V, 45 Hz-440 Hz; 100 V-240 V, 45 Hz-65 Hz. Please use the power cord supplied with the accessories to connect the oscilloscope to the AC power source, as shown in the figure below. After you turn on the power switch, the oscilloscope is connected to power, and the Power key 🔘 located at the lower left corner of the front panel is blinking.
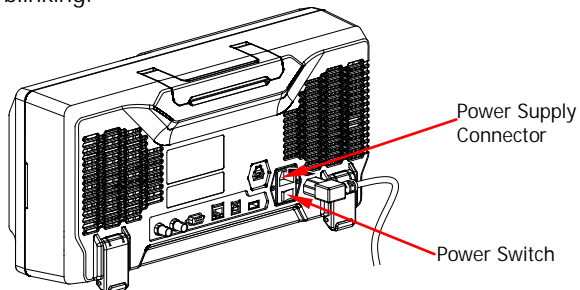


Power Supply Connector

Power Switch

Figure 5 To Connect to Power Supply

# Power-on Inspection

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. You can hear the switching sound of the relay. After the self-test, the welcome screen is displayed. The "Current Options" dialog box will be displayed if your instrument currently has installed the trial versions of the options. From this dialog box, you can view the name, version, and the remaining trial time of the option currently installed. The instrument will be installed with the trial versions of the options before leaving factory. Its remaining trial time is about 2,000 minutes. You can press Utility → System → SelfTestInfo to view the self-test results.

# To Connect the Probe

**RIGOL** provides passive and active probes for DS4000E. For detailed information of the probes, please refer to the User's Guide of the corresponding probe. The following table lists the recommended probes for this oscilloscope.

| Model | Description |
|---------|-------------|
| RP3300A | 350 MHz, passive probe, standard, auto detection |
| RP7150 | 1.5 GHz, active probe, optional, auto detection |

Besides, DS4000E supports Tektronix probes with TekProbe II BNC Interface (required to be used with the option - **RIGOL** T2R1000 interface adapter).
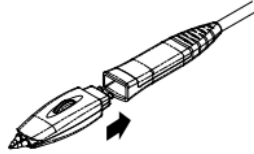
## To Connect the Passive Probe

1. Connect the BNC terminal of the probe to an analog channel input terminal or the external trigger input connector on the front panel of the oscilloscope.

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

After connecting the passive probe, you need to perform probe function inspection and probe compensation adjustment before making measurements. For detailed procedures, refer to "Function Inspection for the Passive Probe" and "Probe Compensation".

## To Connect the Active Probe

Take RP7150 (using the differential probe front) as an example.

1.  Connect the probe head to the active probe amplifier.



2.  Connect the other end of the active probe amplifier to the analog channel input terminal or the external trigger input connector on the front panel of the oscilloscope. Note that you need to push the probe straight on until it latches into place.
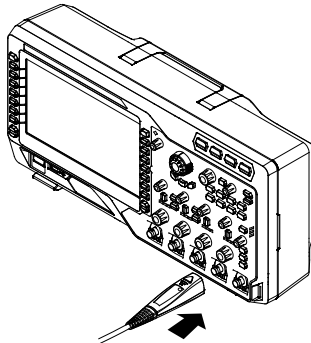


Figure 6 To Connect the Active Probe

3.  Use the probing aids to connect the probe head to the circuit under test.

After connecting the active probe, you can perform probe calibration and offset voltage adjustment if necessary. For detailed procedures, refer to the User's Guide of this instrument.

## To Connect the Tektronix Probe

1.   Connect the Tektronix probe to one end of T2R1000 adapter properly.

2.   Connect the other end of T2R1000 adapter to the analog channel input terminal or the external trigger input connector on the front panel of the oscilloscope.



T2R1000

Tektronix Probe

3.   Connect the ground terminal of the probe to the circuit ground terminal, and connect the probe tip to the test point of the circuit.

For the specified model of the Tektronix probe, after connecting the probe, you can perform probe calibration and offset voltage adjustment if necessary. For detailed procedures, refer to the User's Guide of this instrument.


## Function Inspection for the Passive Probe

You need to perform probe function inspection according to the steps below before making measurements with the passive probe.

1.   Press Default ➔ OK to restore the oscilloscope to factory settings.

2.   Connect the ground alligator clip of the probe to the "Ground Terminal" as shown in Figure 7 below.

3.   Connect one end of the probe to CH1 input terminal of the oscilloscope, and connect the other end to the "Probe Compensation Signal Output Terminal" as shown in Figure 7.
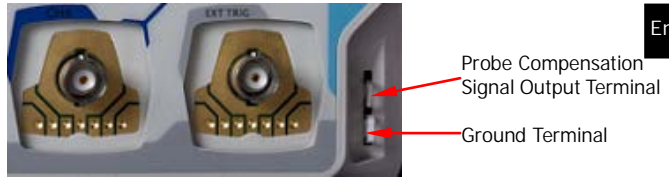
Probe Compensation
Signal Output Terminal

Ground Terminal

Figure 7 To Use the Compensation Signal

4.    Press AUTO.

5.    Observe the waveform on the screen. In normal conditions, the square
      waveform is displayed, as shown in the figure below. If the square
      waveform actually shown does not match that in the figure below, please
      follow the procedures for "Probe Compensation" in the next section.
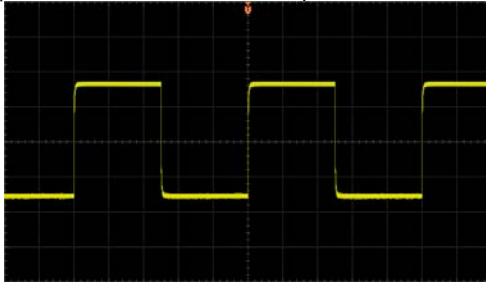


Figure 8 Probe Compensation Signal (Square Waveform)

6.    Use the same method to inspect other analog channels.

⚠  WARNING
   To avoid electric shock, please ensure that the insulated wire of
   the probe is in good condition, and 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 probe is used for the first time or when the probe compensation signal does not match that shown in Figure 8, you should compensate the probe to match the input channel of the oscilloscope. The non-compensated or poorly compensated probe may cause measurement errors.

The procedures for the probe compensation are as follows:

1.  Perform Step 1, 2, 3, and 4 in the above section.

2.  Check the waveform displayed on the screen of the oscilloscope and compare it with the waveforms shown in the figure below.



Overcompensated          Properly Compensated          Undercompensated
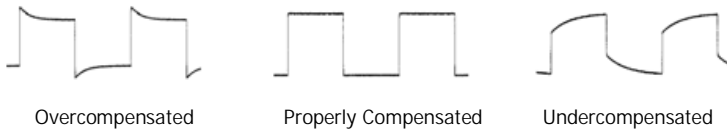
Figure 9 Probe Compensation

3.  Use a nonmetallic screwdriver to adjust the low-frequency compensation adjustment hole on the probe until the waveform is displayed as "Properly Compensated" in the figure above.


# To Use the Built-in Help System

The help system of this oscilloscope provides instructions for all the function keys and menu softkeys on the front panel. Press Help to open the help interface, and press it again to close the interface. The help interface consists of two sections. The left section is "Help Options", and you can select the "Button" or "Index" tab. The right section is "Help Display Area", which displays the help information.
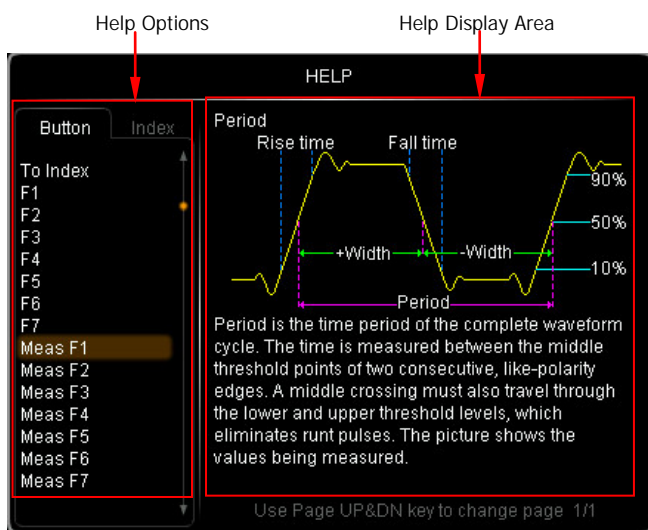
Figure 10 Help Information

Button:
By default, the "Button" tab is selected. Under the tab, you can view the corresponding help information in the "Help Display Area" by pressing the keys or menu softkeys (except the Power key ⏻, multi-function knob ↻, and the Page Up/Down key ▲/▼) on the front panel directly or rotating the multi-function knob ↻ to select the desired key name (the item currently selected is displayed with brown shading) in the "Help Options" area and then pressing down the knob.
Besides, you can acquire the help information of the navigation knob by rotating the multi-function knob ↻ to select "WaveSearch" or directly rotating the navigation knob to quickly select "WaveSearch". To switch to the "Index" tab, use the multi-function knob ↻ to select "To Index" and then press down the knob.

Index:
Under the tab, you can view the corresponding help information in the "Help Display Area" by rotating the multi-function knob ↻ to select the desired key name (the item currently selected is displayed with brown shading) in the "Help Options" area and then pressing down the knob. To switch to the Button tab, use the multi-function knob ↻ to select "To Button" and then press down the knob.

# Remote Control

DS4000E series digital oscilloscope can be connected to the PC via the USB, LAN, or GPIB (option) 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. DS4000E series digital oscilloscope supports two ways of remote control: user-defined programming and PC software (e.g. **RIGOL** Ultra Sigma).

# More Product Information

1.  Obtain the device information
    Press Utility → System → System Info to obtain the information of the instrument, including the manufacturer, model, serial number, as well as software and hardware version number.

2.  Check the option installation status
    Press Utility → Options → Installed to view the installation status of the current option.

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.

| | |
|---|---|
| *DS4000E User's Guide* | introduces the functions of the instrument and the operation methods, remote control methods, possible failures and solutions in using the DS4000E series, specifications, and order information; |
| *DS4000E Programming Guide* | provides detailed descriptions of SCPI commands and programming instances of the instrument. |
| *DS4000E Datasheet* | provides the main features and technical specifications of the instrument. |