



RIGOL

# DG70000 Series

Arbitrary Waveform Generator

Quick Guide

Feb. 2023

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RIGOL guarantees that this product conforms to the national and industrial standards in China as well as the ISO9001:2015 standard and the ISO14001:2015 standard. Other international standard conformance certifications are in progress.

### **Contact Us**

If you have any problem or requirement when using our products or this manual, please contact RIGOL.

E-mail: [service@rigol.com](mailto:service@rigol.com)

Website: <http://www.rigol.com>

# 1 Safety Requirement

## 1.1 General Safety Summary

Please review the following safety precautions carefully before putting the instrument into operation so as to avoid any personal injury or damage to the instrument and any product connected to it. To prevent potential hazards, please follow the instructions specified in this manual to use the instrument properly.

- |   |  |    |   |
|---|--|----|---|
| 1 | Only the exclusive power cord designed for the instrument and authorized for use within the destination country could be used. | 9  | Do not operate the instrument with suspected failures.                                    |
| 2 | Ensure that the instrument is safely grounded.   | 10 | Provide adequate ventilation.   |
| 3 | Observe all terminal ratings.  | 11 | Do not operate in wet conditions.   |
| 4 | Use proper overvoltage protection.   | 12 | Do not operate in an explosive atmosphere.  |
| 5 | Do not operate without covers.   | 13 | Keep instrument surfaces clean and dry.   |
| 6 | Do not insert objects into the air outlet.   | 14 | Prevent electrostatic impact.   |
| 7 | Use the proper fuse.   | 15 | Handle with caution.  |
| 8 | Avoid circuit or wire exposure.  | 16 | Please use the front-panel SMA output connectors properly. They only allow signal output. |



### **WARNING**

Equipment meeting Class A requirements may not offer adequate protection to broadcast services within residential environment.

## 1.2 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 Notices 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:**

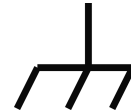
**Hazardous  
Voltage**



**Safety Warning**



**Protective Earth  
Terminal**



**Chassis Ground**



**Test Ground**

## 1.3 Measurement Category

**Measurement Category**

This instrument can make measurements in Measurement Category I.

**WARNING**

**This instrument can only be used for measurements within its specified measurement categories.**

**Measurement Category Definitions**

- **Measurement category I** is for measurements performed on circuits not directly connected to MAINS. Examples are measurements on circuits not derived from MAINS, and specially protected (internal) MAINS derived circuits. In the latter case, transient stresses are variable. Thus, you must know the transient withstand capability of the equipment.
- **Measurement category II** is for measurements performed on circuits directly connected to low voltage installation. Examples are measurements on household appliances, portable tools and similar equipment.
- **Measurement category III** is for measurements performed in the building installation. Examples are measurements on distribution boards, circuit-breakers, wiring (including cables, bus-bars, junction boxes, switches and socket-outlets) in the fixed installation, and equipment for industrial use and some other

equipment. For example, stationary motors with permanent connection to a fixed installation.

- **Measurement category IV** is for measurements performed at the source of a low-voltage installation. Examples are electricity meters and measurements on primary overcurrent protection devices and ripple control units.

## 1.4 Ventilation Requirement

This instrument uses a fan to force cooling. Please make sure that the air inlet and outlet areas are free from obstructions and have free air. When using the instrument in a bench-top or rack setting, provide at least 10 cm clearance beside, above and behind the instrument for adequate ventilation.



### CAUTION

Inadequate ventilation may cause an increase of temperature in the instrument, which would cause damage to the instrument. So please keep the instrument well ventilated and inspect the air outlet and the fan regularly.

## 1.5 Working Environment

### Temperature

Operating: 0°C to +50°C

Non-operating: -30°C to +70°C

### Humidity

- **Operating:**
  - Below +30°C: ≤90%RH (without condensation)
  - +30°C to +40°C: ≤75% RH (without condensation)
  - +40°C to +50°C: ≤45%RH (without condensation)
- **Non-operating:**
  - Below +65°C: ≤90%RH (without condensation)



### WARNING

To avoid short circuit inside the instrument or electric shock, never operate the instrument in a humid environment.

### Altitude

- **Operating:** below 3 km
- **Non-operating:** below 15 km

### Protection Level Against Electric Shock

ESD  $\pm 8\text{kV}$

### Installation (Overvoltage) Category

This product is powered by mains conforming to installation (overvoltage) category II.



#### WARNING

Ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the operator might be exposed to the danger of an electric shock.

### Installation (Overvoltage) Category Definitions

Installation (overvoltage) category I refers to signal level which is applicable to equipment measurement terminals connected to the source circuit. Among these terminals, precautions are done to limit the transient voltage to a low level.

Installation (overvoltage) category II refers to the local power distribution level which is applicable to equipment connected to the AC line (AC power).

### Pollution Degree

Pollution Degree 2

#### Pollution Degree Definition

- **Pollution Degree 1:** No pollution or only dry, nonconductive pollution occurs. The pollution has no effect. For example, a clean room or air-conditioned office environment.
- **Pollution Degree 2:** Normally only nonconductive pollution occurs. Temporary conductivity caused by condensation is to be expected. For example, indoor environment.
- **Pollution Degree 3:** Conductive pollution or dry nonconductive pollution that becomes conductive due to condensation occurs. To be found in industrial environment or construction sites (harsh environments). For example, sheltered outdoor environment.
- **Pollution Degree 4:** The pollution generates persistent conductivity caused by conductive dust, rain, or snow. For example, outdoor areas.

### Safety Class

Class 1 – Grounded Product

## 1.6 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.

## 1.7 Environmental Considerations

The following symbol indicates that this product complies with the WEEE Directive 2002/96/EC.



The equipment may contain substances that could be harmful to the environment or human health. To avoid the release of such substances into the environment and avoid harm to human health, we recommend you to recycle this product appropriately to ensure that most materials are reused or recycled properly. Please contact your local authorities for disposal or recycling information.

You can click on the following link <https://int.rigol.com/services/services/declaration> to download the latest version of the RoHS&WEEE certification file.

## 1.8 Keep Hands Clear



### WARNING

While the main screen is opening or closing, keep hands clear from the inclination angle between the main screen and its instrument body to avoid being pinched.

## 2 Document Overview

This manual gives you a quick overview of the front and rear panel, user interface as well as basic operation methods of DG70000 series.



### TIP

For the newest version of this manual, download it from RIGOL official website ([www.rigol.com](http://www.rigol.com)).

### Publication Number

QGB13101-1110

### Format Conventions in this Manual

#### 1. Key

The front panel key is denoted by the menu key icon. For example, indicates the "Default" key.

Default


#### 2. Menu

The menu item is denoted by the format of "Menu Name (Bold) + Character Shading" in the manual, for example, **Setup**.

#### 3. Operation Procedures

The next step of the operation is denoted by ">" in the manual. For example,



> **Storage** indicates first clicking or tapping the icon  and then clicking or tapping **Storage**.

### Content Conventions in this Manual

DG70000 series Arbitrary Waveform Generator (AWG) includes the following models. Unless otherwise specified, this manual takes DG70004 as an example to illustrate the functions and operation methods of DG70000 series.

Model	Number of Channels	Max. Output Frequency
DG70002	2	5 GHz
DG70004	4	5 GHz



## 3 General Inspection

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### 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.

### Recommended Calibration Interval

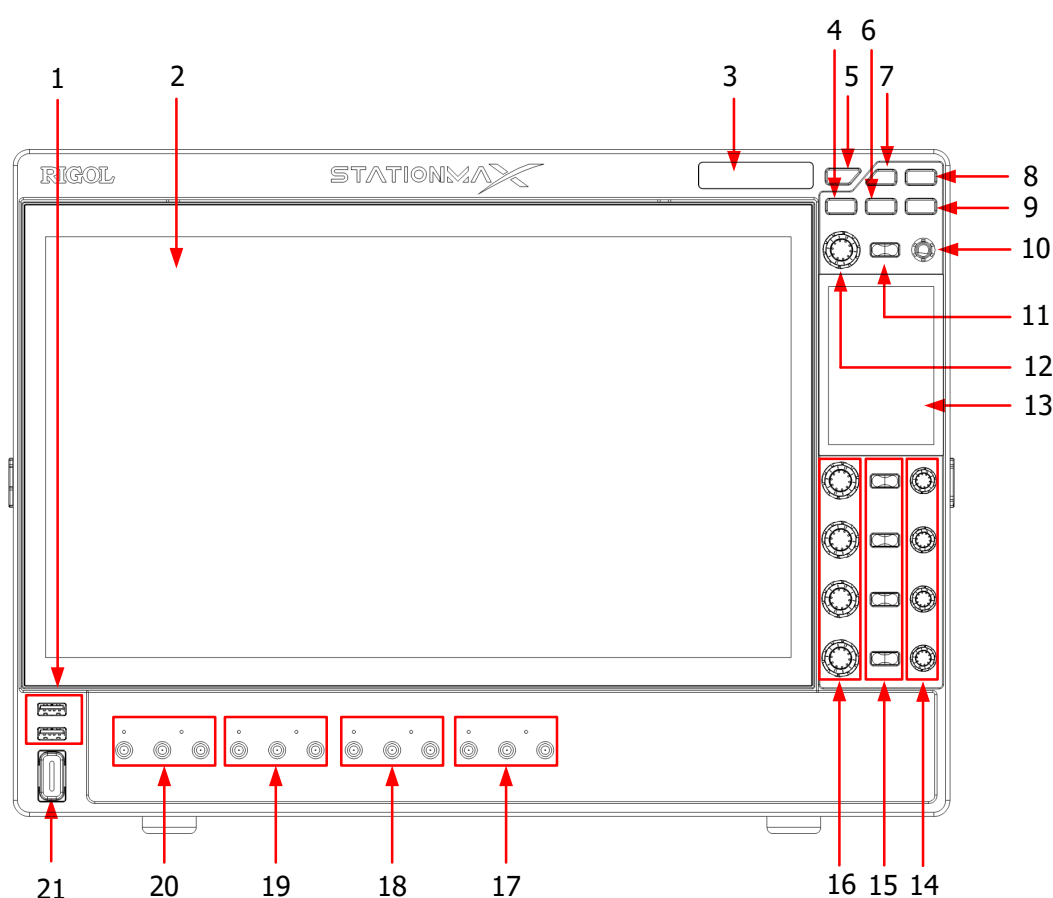
RIGOL suggests that the instrument should be calibrated every 12 months.

## 4 Product Overview

DG70000 series is an industry-leading Arbitrary Waveform Generator (AWG), delivering excellent performance with up to 12 GSa/s sample rate, 5 GHz analog bandwidth, 16-bit vertical resolution, and 1.5 Gpts waveform memory depth. With -70 dBc Spurious Free Dynamic Range (SFDR), it can provide clearer and purer signals.

Unless otherwise specified, this chapter takes DG70004 as an example to introduce the front panel, rear panel, and user interface (display) of the DG70000 series.

### 4.1 Front Panel Overview



**Figure 4.1 Front Panel (4-channel Model)**

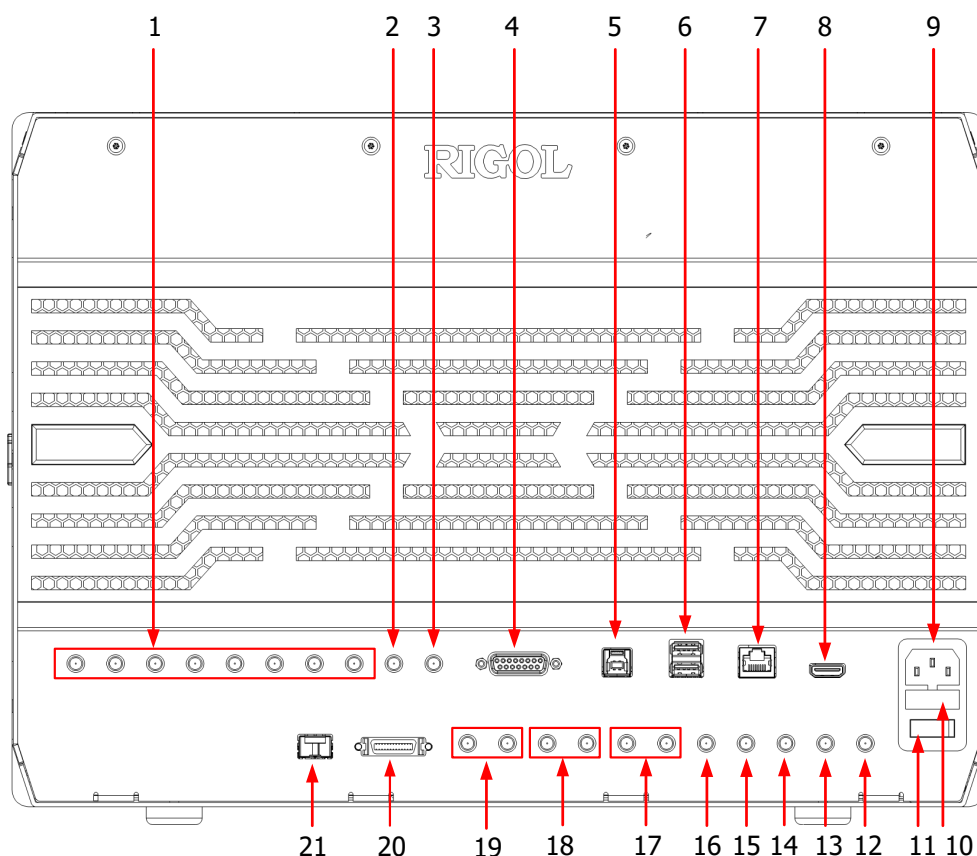
1	USB HOST Interface	12	Sample Rate Knob
2	High-Definition Touch Screen with One Button Electronic Tilt	13	High-Definition Smart and Quick Responsive Keyboard
3	Electronic Label	14	Channel Offset Knobs
4	Screen Tilt Adjustment Lock Key	15	Channel ON/OFF Keys
5	RUN/STOP Key	16	Channel Amplitude Knobs
6	Default Key	17	CH4 Output Connectors

7	Import/Export Function Key	18	CH3 Output Connectors
8	Screen Capture Key	19	CH2 Output Connectors
9	Local Key	20	CH1 Output Connectors
10	Trigger Interval/Screen Tilt Adjustment Knob	21	Power Key
11	Touch Lock Key		

**NOTE**

DG70002 is a two-channel model. Therefore, it only provides output connectors for two channels (CH1 and CH2) as well as their channel on/off keys, amplitude knobs, and offset knobs.

## 4.2 Rear Panel Overview



**Figure 4.2 Rear Panel (4-channel Model)**

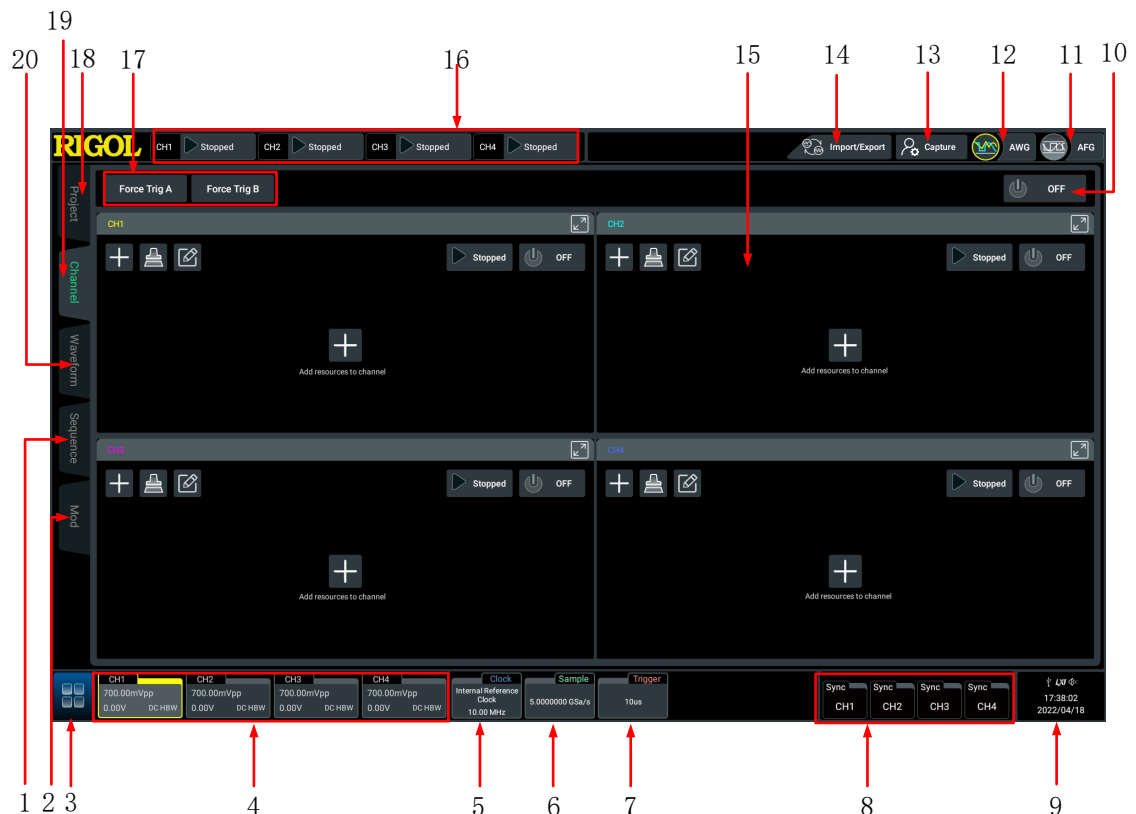
1	Output Interfaces of Marker1 and Marker2 for CH1~CH4	12	Sample Clock Input Interface
2	10 MHz Reference Clock Output Interface	13	Sample Clock Output Interface
3	External Reference Clock Input Interface	14	Sync Clock Output Interface

4	Pattern Jump Input Interface	15	Calibration Input Interface
5	USB DEVICE Interface	16	Calibration Output Interface
6	USB HOST Interface	17	Modulation Input 2 (Input Interfaces of I Signal and Q Signal)
7	LAN Interface	18	Modulation Input 1 (Input Interfaces of I Signal and Q Signal)
8	HDMI Interface	19	Trigger A/B Input Interface
9	AC Power Socket	20	Sync Input and Output Control Interface
10	Fuse	21	SFP+ Interface (not used)
11	Power Switch		

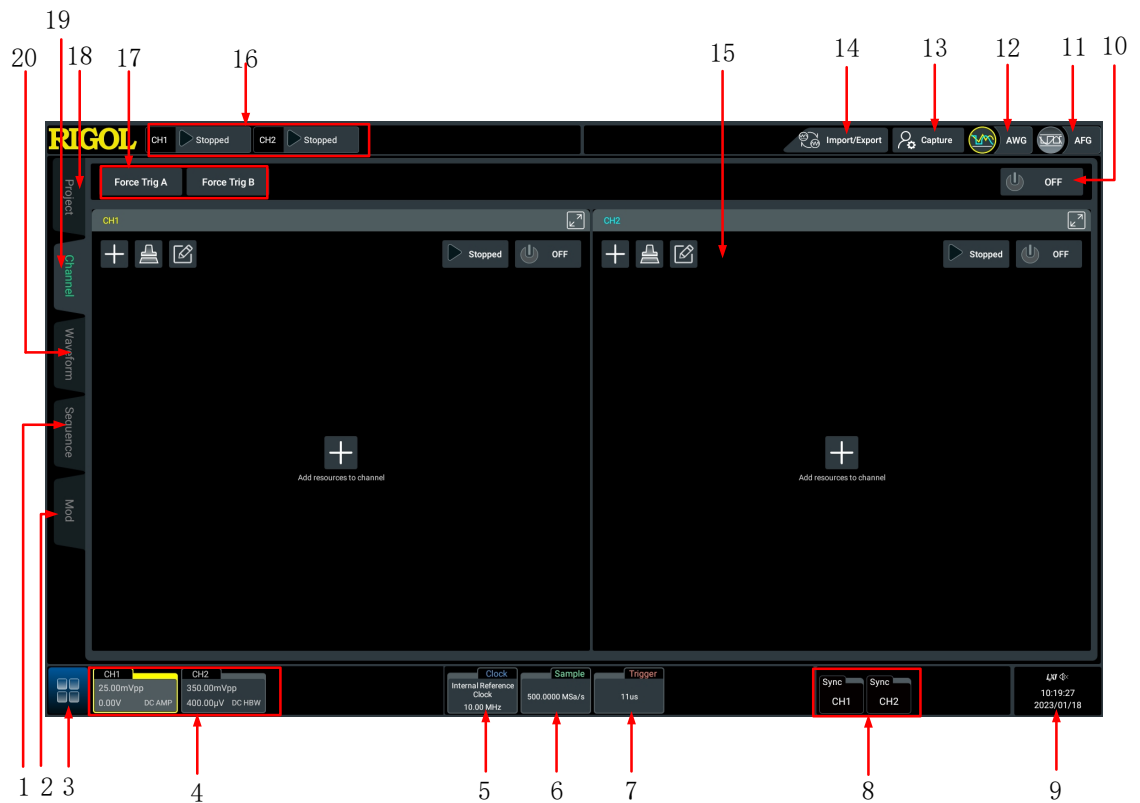
**NOTE**

As DG70002 is a two-channel model, it only supports output interfaces of Marker1 and Marker2 for CH1 and CH2.

## 4.3 User Interface Overview



**Figure 4.3 User Interface (4-channel Model)**



**Figure 4.4 User Interface (2-channel Model)**

1	Sequence Setup Function Label	11	AFG Mode Key
2	Modulation Setup Function Label	12	AWG Mode Key
3	Function Navigation Icon	13	Capture Function Key
4	Channel Labels	14	Import/Export Function Key
5	Clock Label	15	Channel Operation Area
6	Sample Label	16	Channel Operating State Labels
7	Trigger Label	17	Force Trigger Function Keys
8	Sync Labels	18	Project Management Function Label
9	Notification Area	19	Channel Management Function Label
10	Channel All On/Off	20	Waveform Setup Function Label

## 5 To Prepare for Use

### 5.1 To Connect to Power

Please use the power cord provided in the accessories to connect the generator to the AC power source, as shown in *Figure 5.1*. The power requirements of the generator are 100 V to 240 V, 45 Hz to 440 Hz. The maximum input power is no more than 500 W. When the generator is connected to AC power through the power cord, it will be automatically adjusted to the correct voltage range without the need for manual selection.

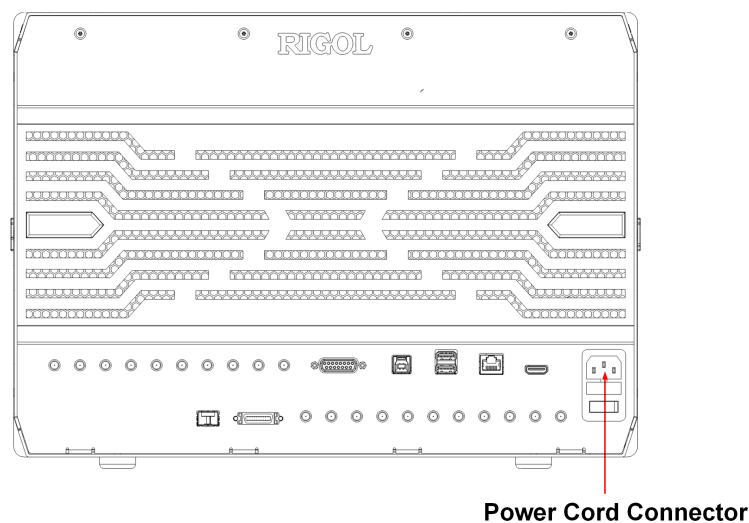



Figure 5.1 Connecting to Power





#### WARNING

To avoid electric shock, please ensure that the instrument is correctly grounded.


### 5.2 Turn-on Checkout

After the instrument is connected to the power source, press the power key  at the lower-left corner of the front panel to power on the instrument. During the start-up process, the instrument performs a series of self-tests. After the self-test, the splash screen is displayed.

- Restart:** Click or tap the function navigation icon  at the lower-left corner of the screen to open the function navigation. Click or tap the **Restart** icon, then a prompt message "Are you sure to reboot?" is displayed. Click or tap **OK** to restart the instrument.


- **Shutdown:** Click or tap the function navigation icon  at the lower-left corner of the screen to open the function navigation. Click or tap the **Shutdown** icon, then a prompt message "Are you sure to shutdown?" is displayed. Click or tap **OK** to shut down the instrument. You can also press the Power key at the lower-left corner of the instrument to turn off the instrument.

## 5.3 To Set the System Language

This instrument supports multiple languages. You can click or tap  > **Utility** > **Setup** > **Language** to set the system language.

## 6 To Use the Built-in Help System

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The help system of this instrument provides instructions for all the function keys on the front panel and their corresponding menu keys. Click or tap  > **Help** to enter the "Help" system.

After entering the "Help" interface, you can get its help information by clicking or tapping the link for the desired item.



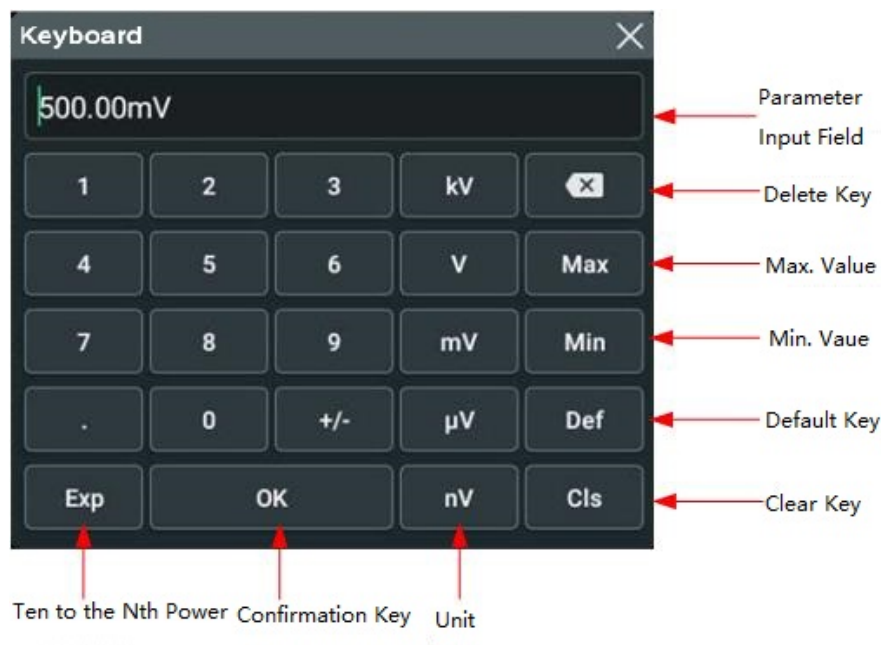
## 7 Parameter Setting Method

For this instrument, you can use the knob and touch screen to set parameters. The common parameter setting methods are as follows:

- **Method 1:** Some parameters can be adjusted by rotating the knob on the front panel.
- **Method 2:** Click or tap the input field of a specified parameter, then a virtual keypad is displayed. Complete the parameter setting with the keypad.

### Input a Value

When setting or modifying a parameter, input an appropriate value with the keypad in *Figure 7.1*.



**Figure 7.1 Numeric Keypad**

Click or tap the value or unit in the numeric keypad to complete the input. 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 perform the following operations:

- Delete the parameter value that has been input;
- Set the parameter value to a maximum or minimum value;
- Set the parameter to a default value;

- Clear the parameter input field.

## 8 Fuse Replacement

If you need to replace the fuse, use only the specified fuse (AC 250V, T3.15A; 5.2 mm×20 mm) and perform the following operations (as shown in *Figure 8.1*):

1. Turn off the instrument, cut off the power, and remove the power cord.
2. Use a small straight slotted screwdriver to pry out the fuse holder.
3. Take out the fuse holder.
4. Replace the old fuse with a specified fuse.
5. Install the fuse holder.

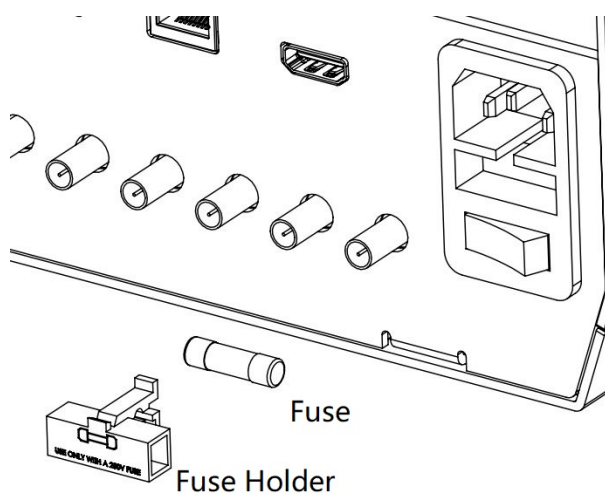


Figure 8.1 Fuse Replacement



### WARNING

To avoid electric shock, please ensure that the instrument has been turned off, the power source has been cut off, and the fuse to be used conforms to the fuse rating.

## 9 Remote Control

The following ways of remote control are supported:

- **User-defined Programming**

Users can program and control the instrument by using the SCPI (Standard Commands for Programmable Instruments) commands. For details about the SCPI commands and programming, refer to *Programming Guide* of this product series.

- **PC Software**

Users can use the PC software to send commands to control the instrument remotely. RIGOL Ultra Sigma is recommended. You can download the software from RIGOL official website (<http://www.rigol.com>).

**Operation Procedures:**

- Set up communication between the instrument and PC.
- Run Ultra Sigma and search for the instrument resource.
- Open the remote command control panel to send commands.

- **Web Control**

This instrument supports Web Control. Connect the instrument to the network, then input the IP address of the instrument into the address bar of the browser of your computer. The web control interface is displayed. Click Web Control to enter the web control page. Then you can view the display of the real-time interface of the instrument. Through the Web Control method, you can migrate the device control to the control terminals (e.g. PC, Mobile, iPad, and other smart terminals) to realize remote control of the instrument. When you first log in to the Web Control, the user name is "admin" and password is "rigol".

This instrument 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.




**CAUTION**

**Before connecting the communication cable, please turn off the instrument to avoid causing damage to the communication interfaces.**

## 10 More Product Information

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### 1. Obtain the Device Information

Click or tap  > **Utility** > **About** to obtain the information of the instrument, such as the model, serial number, firmware version number, and hardware version number.

You can also click or tap the notification area at the lower-right corner of the screen and obtain the information by clicking or tapping **About** in the pop-up **Utility** menu.

### 2. View the Option Information and Install the Option

In the **Utility** menu, click or tap **Option** to view the installation status of all options.

For more information about this instrument, please refer to the relevant manuals by logging in to the official website of RIGOL (<http://www.rigol.com>) to download them.

- *DG70000 User Guide*: introduces the functions of the instrument and the operation methods, remote control methods, possible failures and solutions in using the instrument, specifications, and order information.
- *DG70000 Programming Guide*: provides detailed descriptions of SCPI commands and programming examples of the instrument.
- *DG70000 Datasheet*: provides the main features and technical specifications of the instrument.

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