

RIGOL

Quick Guide

**DG5000 Series Function/Arbitrary
Waveform Generator**

**Oct. 2010
RIGOL Technologies, Inc.**

Guaranty and Declaration

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RIGOL guarantees this product conforms to the national and industrial standards in China. International standard conformance certification is in progress, e.g. ISO.

Contact Us

If you have any problem or requirement when using our products, please contact **RIGOL** or your local distributors, or visit: www.rigol.com

Safety Requirement

General Safety Summary

Please review the following safety precautions carefully before putting the instrument into operation so as to avoid any personal injuries or damages to the instrument and any product connected to it. To prevent potential hazards, please use the instrument only specified by this manual.

Use Proper Power Cord.

Only the power cord designed for the instrument and authorized by local country could be used.

Ground The Instrument.

The instrument is grounded through the Protective Earth lead of the power cord. To avoid electric shock, it is essential to connect the earth terminal of power cord to the Protective Earth terminal before any inputs or outputs.

Observe All Terminal Ratings.

To avoid fire or shock hazard, observe all ratings and markers on the instrument and check your manual for more information about ratings before connecting.

Use Proper Overvoltage Protection.

Make sure that no overvoltage (such as that caused by a thunderstorm) can reach the product, or else the operator might expose to danger of electrical shock.

Change The Power Fuse.

If the power fuse needs to be changed, please return the instrument back to our factory and the **RIGOL** authorized operator will change it for you.

Do Not Operate Without Covers.

Do not operate the instrument with covers or panels removed.

Avoid Circuit or Wire Exposure.

Do not touch exposed junctions and components when the unit is powered.

Do Not Operate With Suspected Failures.

If you suspect damage occurs to the instrument, have it inspected by qualified service personnel before further operations. Any maintenance, adjustment or replacement especially to circuits or accessories must be performed by **RIGOL** authorized personnel.

Keep Well Ventilation.

Inadequate ventilation may cause increasing of temperature or damages to the device. So please keep well ventilated and inspect the intake and fan regularly.

Do Not Operate In Wet Conditions.

In order to avoid short circuiting to the interior of the device or electric shock, please do not operate in a humid environment.

Do Not Operate in an Explosive Atmosphere.

In order to avoid damages to the device or personal injuries, it is important to operate the device away from an explosive atmosphere.

Keep Product Surfaces Clean and Dry.

To avoid the influence of dust and/or moisture in air, please keep the surface of device clean and dry.

Electrostatic Prevention.

Operate in an electrostatic discharge protective area environment to avoid damages induced by static discharges. Always ground both the internal and external conductors of the cable to release static before connecting.

Handling Safety

Please handle with care during transportation to avoid damages to buttons, knob interfaces and other parts on the panels.

Safety Terms and Symbols

Terms in this Manual. These terms may appear in this manual:



WARNING

Warning statements indicate the conditions or practices that could result in injuries or loss of life.



CAUTION

Caution statements indicate the conditions or practices that could result in damage to this product or other property.

Terms on the Product. These terms may appear on the product:

DANGER indicates an injury or hazard may immediately happen.

WARNING indicates an injury or hazard may be accessible potentially.

CAUTION indicates a potential damage to the instrument or other property might occur.

Symbols on the Product. These symbols may appear on the product:



**Hazardous
Voltage**



**Refer to
Instructions**



**Protective
Earth
Terminal**



**Chassis
Ground**



**Test
Ground**

General Care and Cleaning

General Care

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

Cleaning

Clean the instrument regularly according to its operating conditions. To clean the exterior surface, perform the following steps:

1. Disconnect the instrument from all power sources.
2. Clean the loose dust on the outside of the instrument with a lint- free cloth (with a mild detergent and water). When clean the LCD, take care to avoid scarifying it.



CAUTION

To avoid damages to the instrument, do not expose them to liquids which have causticity.



WARNING

To avoid injury resulting from short circuit, make sure the instrument is completely dry before reconnecting into a power source.

Environmental Considerations

The following symbol indicates that this product complies with the applicable European Union requirements according to Directives 2002/96/EC on waste electrical and electronic equipment (WEEE) and batteries.



Product End-of-Life Handling

The equipment may contain substances that could be harmful to the environment or human health. In order to avoid release of such substances into the environment and harmful to human health, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately. Please contact your local authorities for disposal or recycling information.

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Quick Start

General Inspection

1. Inspect the shipping container for damage.

If there are damages in the container or foam, keep them until the whole machine and the accessories passing the electrical and mechanical tests.

If your instrument has damaged during shipping, please contact your shipper and carrier for compensation. **RIGOL** will provide no free repair or replacement.

2. Inspect the instrument.

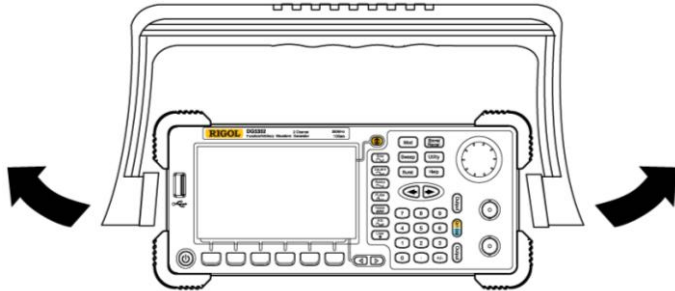
In case of any mechanical damage or defect, or if the instrument does not operate properly or pass the electrical and mechanical tests, please contact your **RIGOL** sales representative.

3. Check the accessories

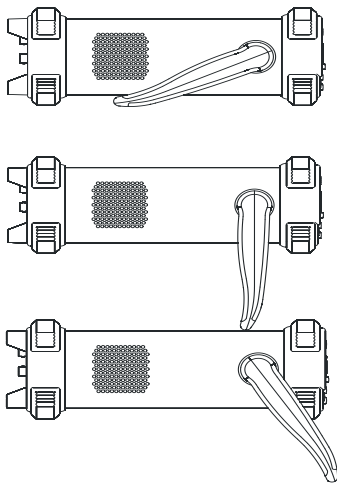
Please check the accessories according to the packing lists. If the accessories are incomplete or damaged, please contact your **RIGOL** sales representative.

Handle Adjustment

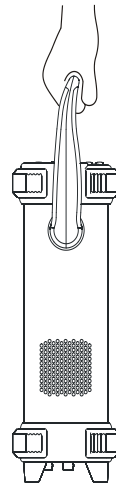
To adjust the handle position of the instrument, please grip the handle by sides and pull it outward. Then, rotate the handle to the desired position. The operating method is shown below.



Adjusting the handle

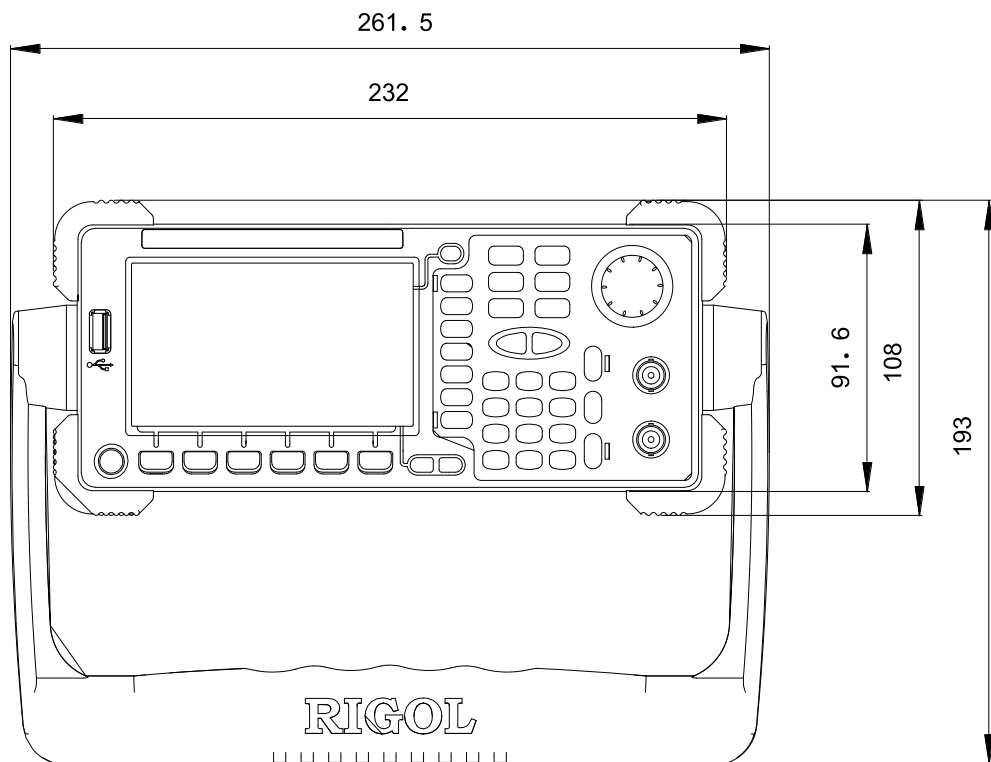


Viewing Positions



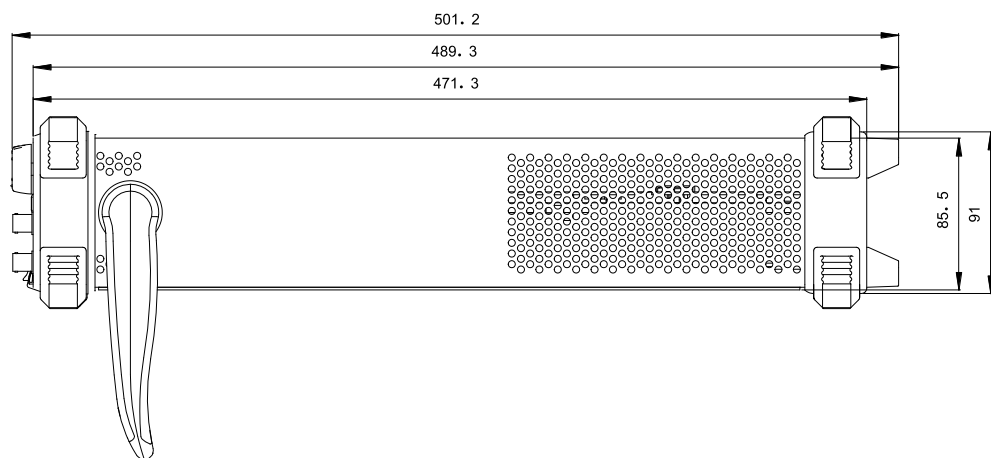
Carrying Position

Appearance and Dimensions



Front Elevation

Unit: mm



Side Elevation

Unit: mm

Front Panel

The manual illustrates the front panel of the instrument taking the dual-channel model for example.

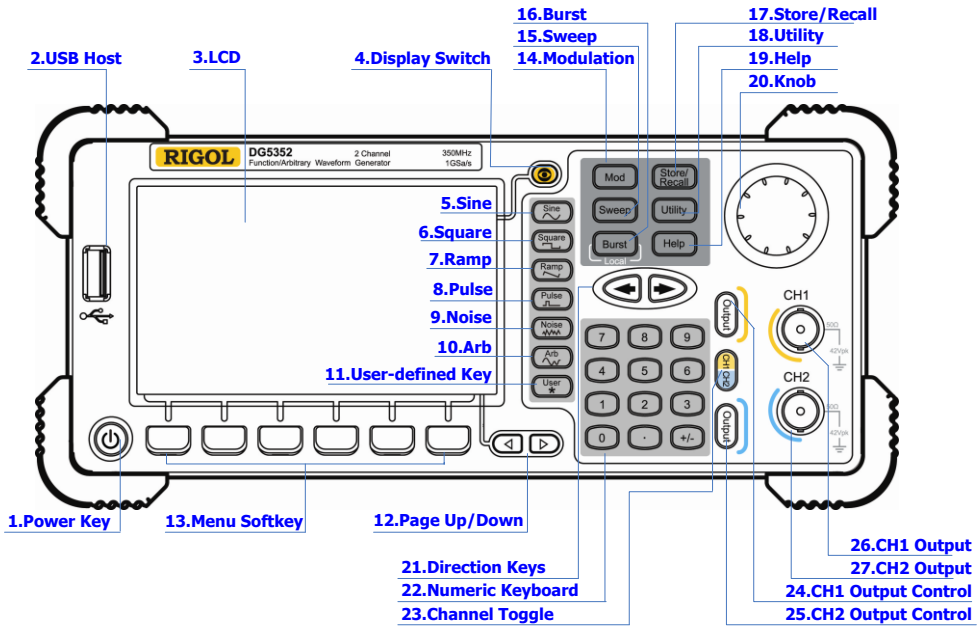


Figure 7 Dual-Channel Model Front Panel Overview

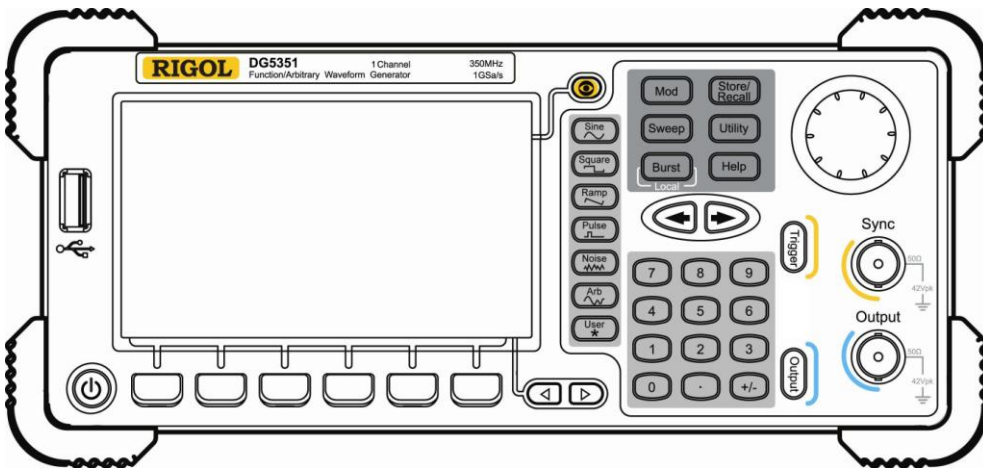


Figure 8 Single-Channel Model Front Panel Overview

1. Power Key

The power soft key is used to turn the generator on or off.

2. USB Host

Support FAT file format USB flash device, **RIGOL** TMC digital oscilloscope (DS) and power amplifier (PA).

- USB flash device: Read the waveform or state files from the USB flash device, or store the current instrument state and edited waveform data into the USB flash device.
- TMC DS: Seamlessly interconnect with the **RIGOL** DS that fits the TMC standard, read and store the waveform data sampled by the DS and display it nondestructively.
- PA (optional): Support the **RIGOL** power amplifier, for example, PA1011. Enable to be configured online and amplify the signal power before output.

3. LCD

480 × 272 TFT color LCD is used to display the current function menu and parameters setting, system state and prompt messages.

4. Display Switch

For dual-channel model: Switch between Parameter/Graph display mode.
For single-channel model: not available.

5. Sine

Generate a Sine waveform with frequency from 1 μ Hz to 350 MHz.

- When the function is enabled, the backlight of the button turns on.
- Enable to change Frequency/Period, Amplitude/High Level, Offset/Low Level and Start Phase of the Sine waveform.

6. Square

Generate a Square waveform with frequency from 1 μ Hz to 120 MHz and variable duty cycle.

- When the function is enabled, the backlight of the button turns on.
- Enable to change Frequency/Period, Amplitude/High Level, Offset/Low Level, Duty Cycle and Start Phase of the Square waveform.

7. Ramp

Generate a Ramp waveform with frequency from 1 μ Hz to 5 MHz and variable symmetry.

- When the function is enabled, the backlight of the button turns on.

- Enable to change Frequency/Period, Amplitude/High Level, Offset/Low Level, Symmetry and Start Phase of the Ramp waveform.

8. Pulse

Generate a Pulse waveform with frequency from 1 μ Hz to 50 MHz and variable pulse width and edge time.

- When the function is enabled, the backlight of the button turns on.
- Enable to change Frequency/Period, Amplitude/High Level, Offset/Low Level, Pulse Width/Duty Cycle, Leading Edge Time, Trailing Edge Time and Delay of the Pulse waveform.

9. Noise

Generate a Gauss Noise with bandwidth up to 250 MHz.

- When the function is enabled, the backlight of the button turns on.
- Enable to change Amplitude/High Level and Offset/Low Level of the Noise waveform.

10. Arb

Generate an arbitrary waveform with frequency from 1 μ Hz to 50 MHz.

- Provide two output modes: "Normal" and "Play".
- Generate 10 built-in waveforms: DC, Sinc, Exponential Rise, Exponential Fall, ECG, Gauss, Haversine, Lorentz, Pulse and Dual-Tone; generate arbitrary waveforms from USB flash device; generate arbitrary waveforms edited online (512 kpts) or through PC software and then downloaded to the instrument by the users; support wavetable points up to 128 Mpts.
- When the function is enabled, the backlight of the button turns on.
- Enable to change Frequency/Period, Amplitude/High Level, Offset/Low Level and Start Phase of the arbitrary waveform.

11. User-defined Key

For some frequently used menus with "deep" location, users can define them as shortcuts (under the function key **Utility**). And then, in any operation interface, press the **User-defined Key** to quickly open and set your desired menu or function.

12. Page Up/Down

Open the previous or next page of the current function menu.

13. Menu Softkey

Press any softkey to activate the corresponding menu.

14. Modulation

Generate modulated waveforms. Provide versatile common modulations and user defined IQ modulation.

- Common Modulations: Support internal and external modulations, generate AM, FM, PM, ASK, FSK, PSK and PWM modulated signal.
- User Defined IQ Modulation: Support internal and external modulation, generate IQ modulated signal.

15. Sweep

Generate the frequency sweeping signal of Sine, Square, Ramp and Arbitrary Waveforms (except DC).

- Support three sweep types: Linear, Log and Step.
- Set Start Hold, End Hold and Return Time.
- Provide the "Mark" function.
- When the function is enabled, the backlight of the button turns on.

16. Burst

Generate burst waveforms of Sine, Square, Ramp, Pulse and Arbitrary waveform (except DC).

- Support three burst types: N Cycle, Infinite and Gated.
- Noise can also be used to generate Gated burst.
- When the function is enabled, the backlight of the button turns on.
- In remote mode, press this button to switch to local mode.

17. Store/Recall

Store/recall the instrument state or user-defined arbitrary waveform data.

- Support file management system to execute normal file operations.
- Provide 1 GBytes built-in non-volatile memory (C Disk) and two external USB flash devices (D Disk and E Disk). In addition, files stored in a USB flash device can be copied to C Disk for long-term preservation.
- When the function is enabled, the backlight of the button turns on.

18. Utility

Provide some advanced operations, including system parameters setting, waveform saving and printing, functions expanding and the remote control interfaces configuration.

When the function is enabled, the backlight of the button turns on.

19. Help

To get context help information about any front-panel key or menu softkey, press

this key until it is illuminated and then press the desired key.

20. Knob

Be used to increase (clockwise) or decrease (anticlockwise) the current highlighted number. Also can be used to select file location or switch the character of the soft keyboard when entering file name.

21. Direction Keys

Be used to switch the digits of the number, the data page and the file locations.

22. Numeric Keyboard

Consists of numbers (0~9), decimal point (.) and operators (+/-). Notice that, if a negative required, please input an operator "-" before the numbers. In addition, the decimal point "." also can be used to switch units quickly.

23. Channel Toggle

For dual-channel model: switch and toggle a channel.

For single-channel model: not available.

24. CH1 Output Control

For dual-channel model: control the output of CH1. When the output function enables, the backlight of the button goes on.

For single-channel model: trigger "Sweep" and "Burst" manually.

25. CH2 Output Control

For dual-channel model: control the output of CH2. When the output function enables, the backlight of the button turns on.

For single-channel model: control the output of the main channel. When the output function enables, the backlight of the button turns on.

26. CH1 Output

This BNC connector is used as an output terminal.

For dual-channel model: enable or disable waveform signals generated from [Output] connector corresponding to CH1. The nominal output impedance is 50 Ω .

For single-channel model: output a TTL-compatible pulse synchronized with the main output. The nominal source impedance is 50 Ω .

27. CH2 Output

This BNC connector is used as an output terminal. The nominal output

impedance is 50 Ω .

For dual-channel model: enable or disable waveform signals generated from [Output] connector corresponding to CH2.

For single-channel model: output signals of the main channel.



CAUTION

Overvoltage protection of the output channel will take effect once any of the following conditions is met.

- Amplitude setting in the generator is greater than 2 Vpp; the input voltage is greater than ± 12.1 V (± 0.1 V) and frequency is lower than 10 kHz.
- Amplitude setting in the generator is lower than or equal to 2 Vpp; the input voltage is greater than ± 4.8 V (± 0.1 V) and frequency is lower than 10 kHz.

The message "OverLoad protect, The output is off!" will appear on the screen when overvoltage protection takes effect.

Rear Panel

The manual illustrates the rear panel of the instrument taking the dual-channel model for example.

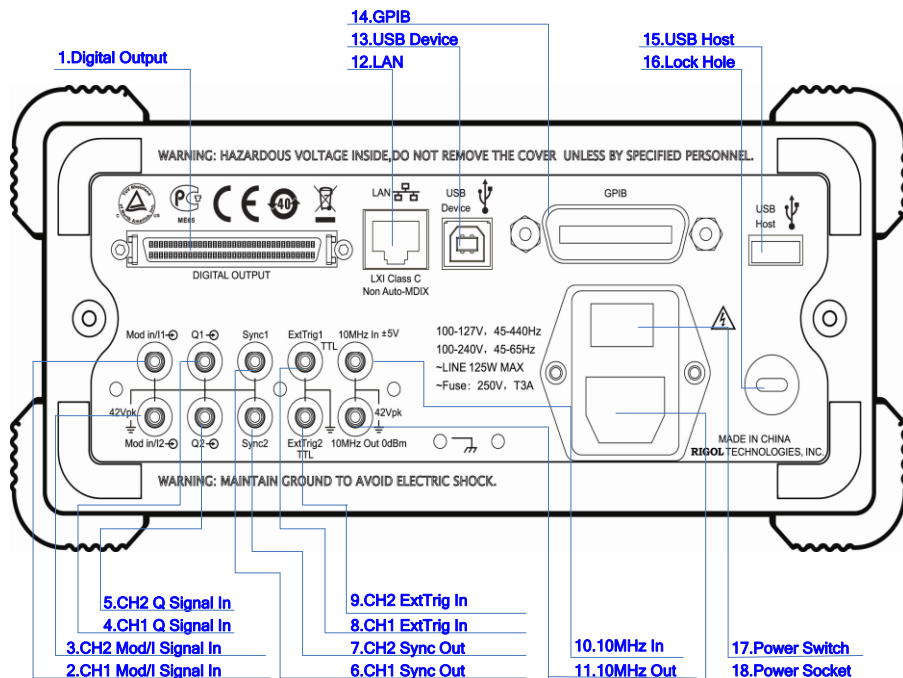


Figure 9 Dual-Channel Model Rear Panel Overview

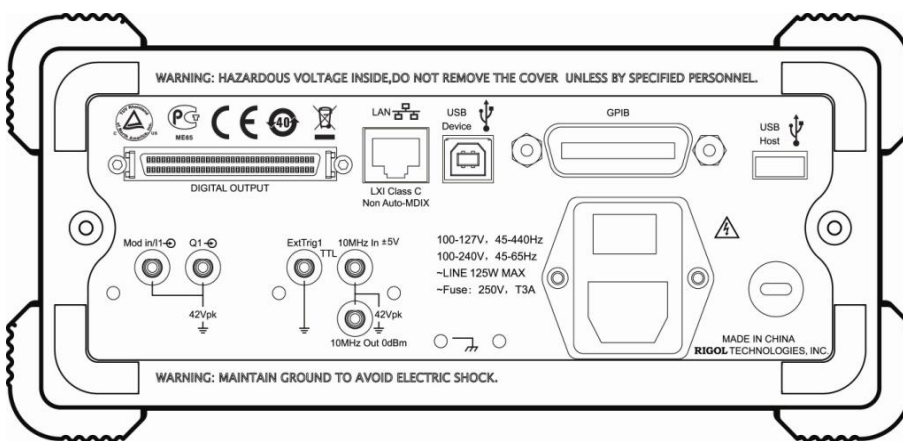


Figure 10 Single-Channel Model Rear Panel Overview

1. DIGITAL OUTPUT

Connect the generator with the “logic signal output module” DG-POD-A (optional). Then, configure specific sequence digital signal in the generator and output the signal through the digital module.

2. CH1 Mod/I Signal In (Mod/I1)

This SMB connector accepts an external Analog modulation signal or In-Phase (I) baseband signal to be used in CH1’s modulation. The nominal input impedance is 10 k Ω .

3. CH2 Mod/I Signal In (Mod/I2)

This SMB connector accepts an external Analog modulation signal or In-Phase (I) baseband signal to be used in CH2’s modulation. The nominal input impedance is 10 k Ω .

4. CH1 Q Signal In (Q1)

This SMB connector accepts an external Analog/ Quadrature Phase (Q) modulation signal to be used in CH1’s modulation. The nominal input impedance is 10 k Ω .

5. CH2 Q Signal In (Q2)

This SMB connector accepts an external Analog/ Quadrature Phase (Q) modulation signal to be used in CH2’s modulation. The nominal input impedance is 10 k Ω .

6. CH1 Sync Out (Sync1)

This SMB connector outputs a TTL-compatible pulse synchronized with the output of CH1. The nominal source impedance is 50 Ω .

7. CH2 Sync Out (Sync2)

This SMB connector outputs a TTL-compatible pulse synchronized with the output of CH2. The nominal source impedance is 50 Ω .

8. CH1 ExtTrig In (ExtTrig1)

This SMB connector accepts an external TTL-compatible pulse as the trigger input of CH1. Besides, it can also be used as the trigger out in Sweep and Burst mode.

9. CH2 ExtTrig In (ExtTrig2)

This SMB connector accepts an external TTL-compatible pulse as the trigger input of CH2. Besides, it can also be used as the trigger out in Sweep and Burst mode.

10. (11.)10MHz In/10MHz Out

These two connectors are used to synchronize generators. The connector [10MHz In] accepts an external 10 MHz clock signal, and the connector [10MHz Out] can output a 10 MHz clock signal generated by the crystal inside the generator.

19. LAN

Through this interface, the generator can be connected to your local network for remote control. An integrated testing system may be built, as the generator conforms to the LXI-C class standard of LAN-based instrument control.

20. USB Device

Through this interface, the generator can be connected to a PictBridge printer to print its screen, or be connected to a PC and controlled via PC software.

21. GPIB

Meet IEEE-488.2 specification.

22. USB Host

Reference to "USB Host" page 5.

23. Lock Hole

Use the security lock (please buy it yourself) to lock the generator in fixed location.

24. Power Switch

Connect or cut off the power supply.

25. Power Socket

The generator can accept two types of AC power supply.

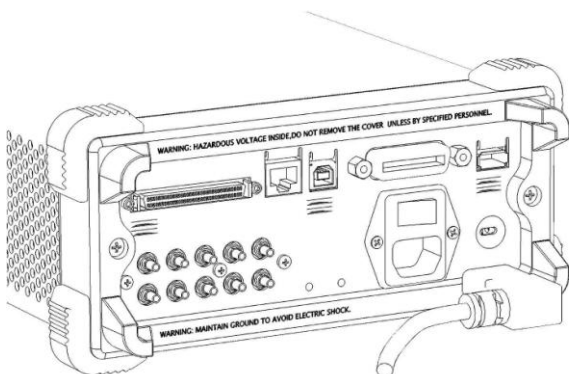
AC Power Supply: 45-440 Hz, 100-127 V, or 45-60 Hz, 100-240 V.

Power Fuse: 250 V, T3A.

Power Consumption: less than 125 W.

Power on the Generator

Connect the generator to the AC supply by using the supplied power cord, and then perform the following steps.



1. Turn on the power of the instrument

Turn on the power switch at the rear panel of the instrument.



WARNING

To avoid electric shock, make sure the instrument has been properly grounded.

2. Start-up the instrument

Press down the power key at the front panel. The instrument starts and executes self-test and then enters the user interface.

User Interface

The user interface is usually shown in two modes which are "Parameter" and "Graphic". The illustration given here will take the "Graphic" mode of the Dual-Channel Model for example.

Parameter Mode

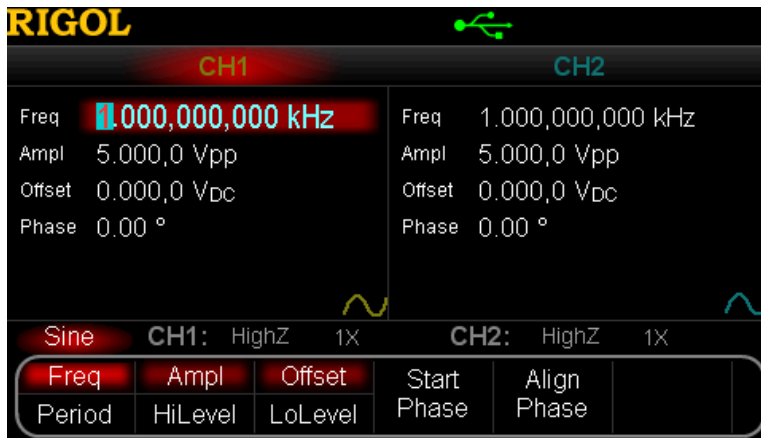


Figure 11 User Interface (Parameter Mode)

Graph Mode

In parameter mode, toggle the "Display Switch"  at the upper right of the screen to switch to the Graphic Mode.

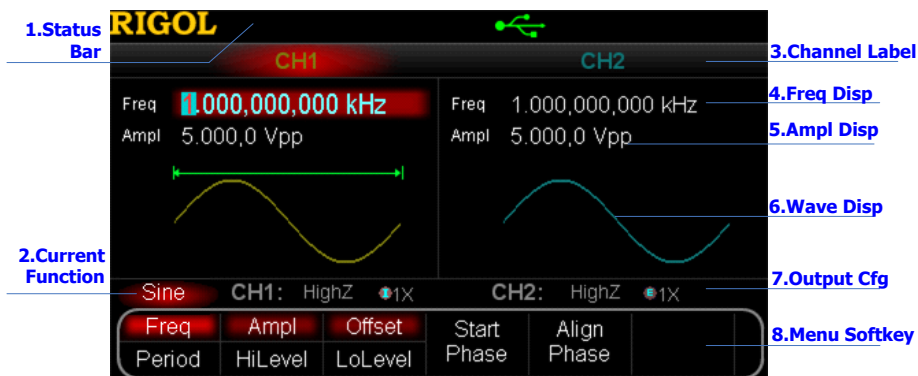



Figure 12 User Interface (Graphic Mode)

1. Status Bar

Indicate system status. For example, an icon  denotes that a USB flash device has been detected.

2. Current Function

Show the current active function. For example, "Sine" denotes that sine wave has been selected at present.

3. Channel Label Bar

Be divided into two parts which marks the display areas of CH1 and CH2 respectively. The currently selected channel label will be highlighted.

4. Frequency Display

Display the current waveform frequency in each channel. Press corresponding softkey **Freq** and use the numeric keyboard or knob to modify this parameter. The parameter that can be modified currently will be highlighted.

5. Amplitude Display

Display the current waveform amplitude in each channel. Press corresponding softkey **Ampl** and use the numeric keyboard or knob to modify this parameter. The value that can be modified currently will be highlighted.

6. Waveform Display

Display the currently selected waveform shape in each channel. The waveform of the currently selected channel will be highlighted.

7. Output Configuration

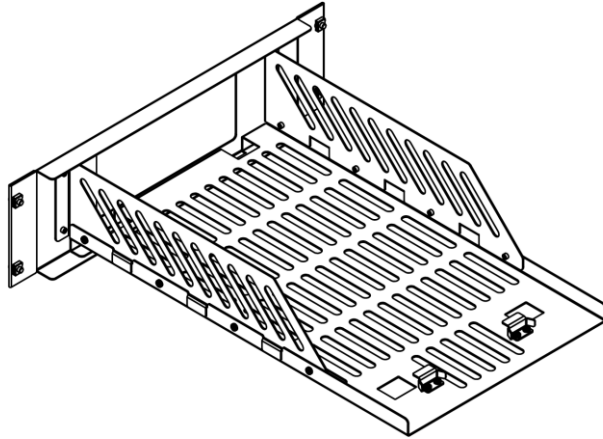
Display the current output configuration in each channel, including "Output resistance" and "Attenuation setting".

8. Menu Softkey

Press any softkey to activate the corresponding function.

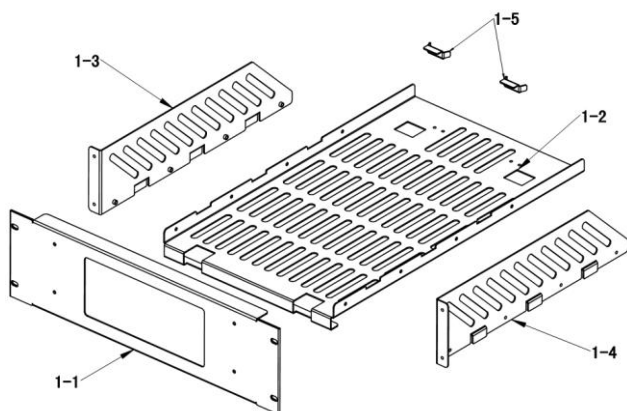
To Rack Mount the Instrument

This generator can be mounted in a standard 19-inch rack cabinet. Please disassemble the cushioning material and handle before the installation.



Kit Parts List

NO.	Name	Qty.	Part Number	Description
1-1	Front Panel	1	RM-DG-5-01	
1-2	Support Board	1	RM-DG-5-02	
1-3	Left Plate	1	RM-DG-5-03	
1-4	Right Plate	1	RM-DG-5-04	
1-5	Fixed Figure	2	RM-DG-5-05	
2-1	M4 Screw	19	RM-SCREW-01	M4*6 Phil-Slot Pan Head Machine Screw Nail
2-2	M6 Screw	4	RM-SCREW-02	M6*20 Phil-Slot Pan Head Machine Screw Nail
2-3	M6 Nut	4	RM-SCREW-03	M6*4 Square Machine Female Screw Contain Lock Blade



2-1

2-2

2-3

Installation Tool

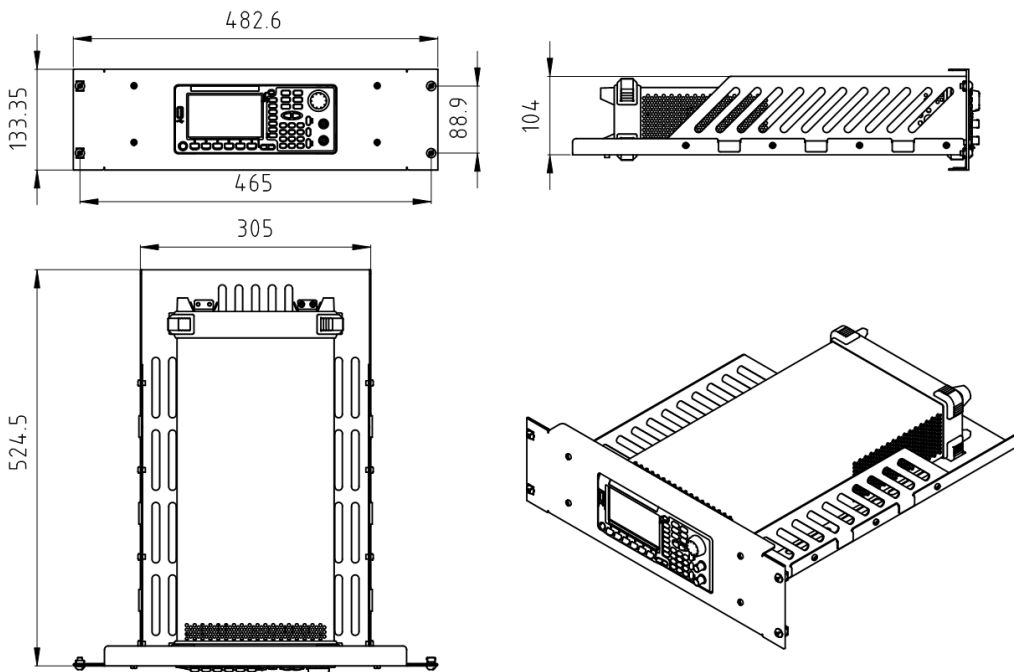
PH2 Phillips Screwdriver (recommended).

Space Requirements for Installation

The following requirements must be fulfilled by the machine cabinet in which the instrument is mounted.

- Dimension of the machine cabinet must be standard 19-inch.
- At least 3U (133.5 mm) space should be provided by the machine cabinet.
- The depth inside the machine cabinet should not be less than 530 mm.

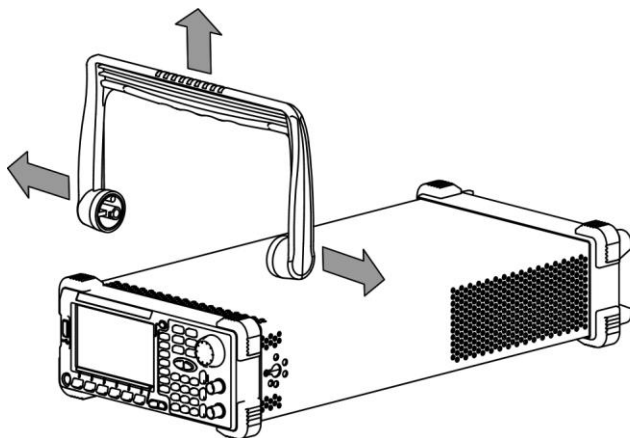
The dimension of the instrument after being mounted is shown below.



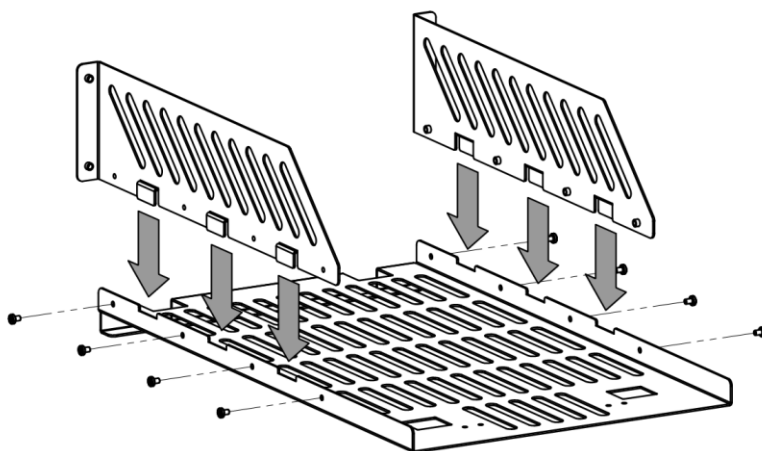
Installation Procedures

Only authorized operators can execute the installation operation. The instrument will be damaged or installed in rack incorrectly if the installation is not proper.

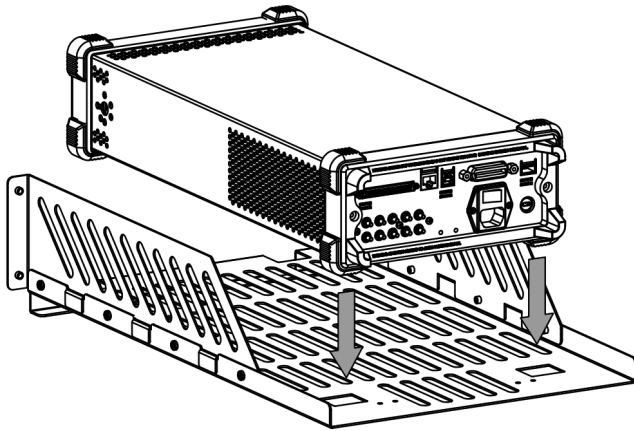
1. Remove the handle: please grip the handle by sides, pull it outward and then upward.



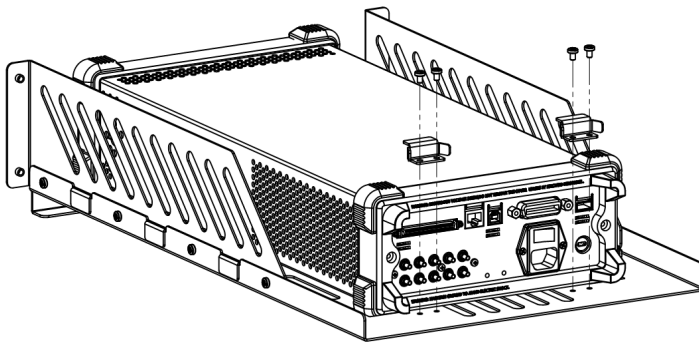
2. Install the right and left plates: align the detents of right and left plates with the openings on the support board and insert them into the support board respectively, then fix them with eight M4 screws.



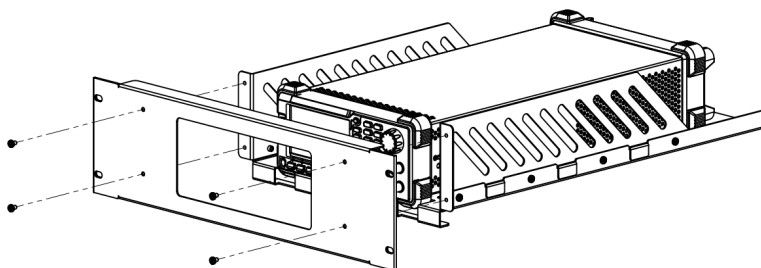
3. Place the instrument: align the protection pads of the instrument with the corresponding holes and then place it on the Support Board.



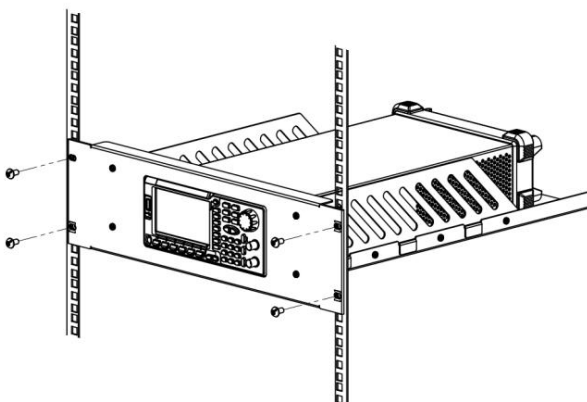
4. Fixed the instrument: Fasten the instrument tightly on the Support Board with two Fixed Figures and fixed it with four M4 screws.



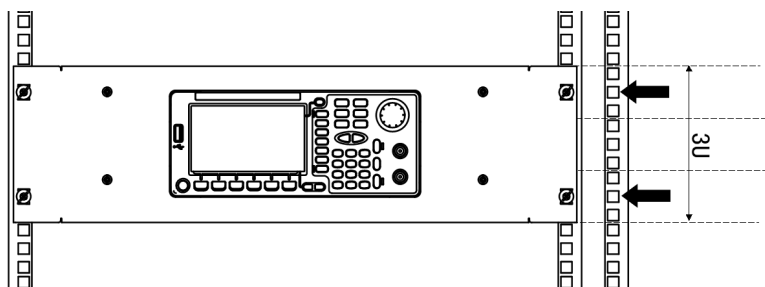
5. Install the Front Panel: aiming the instrument front panel at the opening of the Front Panel of the machine rack and fix them with four M4 screws.



6. Load into the machine cabinet: mount the rack fixed with instrument into a standard 19-inch machine cabinet with four M6 screws and square nuts.

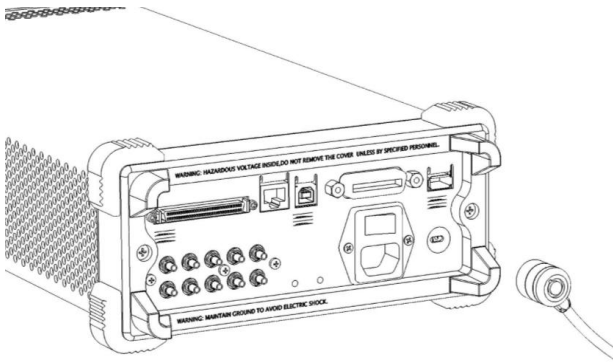


7. Post-installation notice: The rack occupies a height of 3U. The holes pointed out by the arrows are the installation holes. Note that they are aligned while installing.



To Use the Security Lock

Use a security lock to lock your generator in a desired location. As shown in the picture below, align the lock with the lock hole on the generator and insert the lock. Turn the key clockwise to lock the instrument and then pull the key out.



To Use the Built-In Help

To get context help information about any front-panel key or menu softkey, press **Help** to illuminate the key and then press the desired key to get corresponding help. Pressing **Help** twice will get the following common help.

- 1. View the last displayed message.**
- 2. View error queue of the remote commands.**
- 3. Get the help information of a key.**
- 4. Generate a basic waveform.**
- 5. Generate an arbitrary waveform.**
- 6. Generate a modulated waveform.**
- 7. Generate a frequency Sweep.**
- 8. Generate a Burst waveform.**
- 9. IQ (In-Phase/Quadrature) modulation.**
- 10. Frequency hopping output.**
- 11. Storage management.**
- 12. Synchronize multiple Generators.**
- 13. Seamlessly connected with the RIGOL DS.**
- 14. Get technical support from RIGOL.**

Troubleshooting

This chapter lists the commonly encountered failures and their solutions. When you encounter those problems, please solve them following the corresponding steps. If the problem persists, please contact **RIGOL** and provide your device information (**Utility** → **System** → **Sys Info**).

1. The screen is still dark (no display) after power on:

- (1) Check if the power is correctly connected.
- (2) Check if the power switch is really on.
- (3) Restart the instrument after finishing the above inspections.
- (4) If it does not work correctly, contact **RIGOL** for our service.

2. The settings are correct but no waveform is generated:

- (1) Check if the Signal Line is correctly connected to the Output terminal.
- (2) Check if the BNC can work correctly.
- (3) Check the **Output** button, if it is turned on.
- (4) Set **Power On** as "Last" and then restart the instrument after finishing the above inspections.
- (5) If it does not work correctly, contact **RIGOL** for our service.

3. The U-disk cannot be recognized:

- (1) Check if the U-disk can work normally.
- (2) Make sure the U-disk is USB flash disk. The generator doesn't support hard drive-based U-disk.
- (3) Restart the instrument, reinsert the USB device and check it.
- (4) If the U-disk still does not work normally, please contact **RIGOL**.