RIGOL

DG900 Pro 系列

函数/任意波形发生器

用户手册

2023.09

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contact us

If you have any questions or needs while using this product or this manual, please contact RIGOL:

Email: service@rigol.com

URL: *http://www.rigol.com*

chapter theme page number

Illustrated catalog

table directory

1 security requirements

1.1 General safety summary

Understand the following safety precautions to avoid injury and prevent damage to this product or any product connected to this product. To avoid possible hazards, be sure to use this product as specified.

- **Proper use of BNC output connectors**

  The BNC output connector on the front panel of this product only allows signal output and does not support signal input.

- **Use the correct power cord.**

  Only use the power cord approved for this product in your country.

- **View all terminal ratings.**

  To avoid fire and excessive current shock, please check all ratings and markings on the product. Please consult the product manual for detailed rating information before connecting the product.

- **Use appropriate overvoltage protection.**

  Make sure that no overvoltages (such as those caused by lightning) reach the product. Otherwise the operator may be in danger of electric shock.

- **Do not open the cover.**

  Do not operate this product with the instrument case open.

- **Do not insert foreign objects into the fan's exhaust vents.**

  Do not insert foreign objects into the exhaust vent of the fan to avoid damaging the instrument.

- **Avoid exposing circuits.**

  When power is on, do not touch exposed connectors and components.

- **Do not operate the product if you suspect it is malfunctioning.**

  If you suspect that this product is malfunctioning, please contact RIGOL authorized maintenance personnel for inspection. Any maintenance, adjustment or parts replacement must be performed by RIGOL authorized service personnel.

- **Maintain adequate ventilation.**

  Poor ventilation will cause the temperature of the instrument to rise, causing damage to the instrument. Good ventilation should be maintained during use, and vents and fans should be checked regularly.

- **Do not operate in wet conditions.**

  To avoid short circuiting the internal circuit of the instrument or the risk of electric shock, do not operate the instrument in a humid environment.

- **Do not operate in flammable and explosive environments.**

  To avoid instrument damage or personal injury, do not operate the instrument in flammable and explosive environments.

- **Please keep the product surface clean and dry.**

  To prevent dust or moisture in the air from affecting instrument performance, please keep the product surface clean and dry.

- **Anti-static protection.**

  Static electricity can cause damage to the instrument, so testing should be conducted in an anti-static area as much as possible. Before connecting the cable to the instrument, briefly ground its inner and outer conductors to discharge static electricity.

- **Use batteries correctly.**

  If batteries are provided with the instrument, do not expose the batteries to high temperatures or fire. Keep batteries away from children. Improper battery replacement may cause explosion (WARNING: Lithium-ion batteries). Batteries specified by RIGOL must be used.

- **Pay attention to handling safety.**

  To prevent the instrument from slipping during transportation and causing damage to the keys, knobs, interfaces and other components on the instrument panel, please pay attention to transportation safety.

warn

Equipment complying with Class A requirements may not provide adequate protection for broadcasting services in residential environments.

1.2 Safety terms and symbols

Safety terms in this manual:

warn

Warning statements identify situations or practices that may cause personal injury or endanger life.

Notice

Caution statements identify conditions or actions that could cause damage to the product or loss of data.

Safety terminology on the product:

- **DANGER**

  Indicates that failure to do so may cause immediate harm to you.

- **WARNING**

  Indicates that failure to do so may cause potential harm to you.

- **CAUTION**

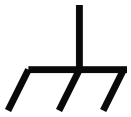
  Indicates that failure to do so may cause damage to this product or other devices connected to this product.

Safety symbols on the product:

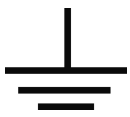
high voltage

safety warning

Protective ground terminal



Shell ground terminal



Measurement ground terminal

1.3 Measurement category

Measurement category

This instrument can perform measurements under measurement category I.

warn

This instrument may only be used within specified measurement categories.

Measurement category definition

- **Measurement Category I**This refers to measurements being made on a circuit that is not directly connected to the mains power supply. For example, measurements are made on circuits that are not derived from the mains supply, especially protected (internal) mains-derived circuits. In the latter case, instantaneous stress changes. Therefore, users should understand the momentary endurance of the device.
- **Measurement Category II**Refers to measurements taken on a circuit directly connected to low voltage equipment. For example, measurements are made on household appliances, portable tools and similar equipment.
- **Measurement Category III**Refers to measurements taken in construction equipment. For example, in fixed installations, switchboards, circuit breakers, wiring (including cables, busbars, junction boxes, switches, sockets) as well as equipment for industrial use and certain other equipment (e.g. stationary motors permanently connected to the fixture) Take measurements on.
- **Measurement Category IV**Refers to measurements taken at the source of a low voltage device. For example, electricity meters, measurements on main overcurrent protection devices and measurements on pulse control units.

1.4 Ventilation requirements

This instrument is forced cooled by a fan. Make sure the air intake and exhaust areas are clear of obstructions and have free flow of air. To ensure adequate ventilation, when using the instrument in a workbench or rack, ensure that there is at least 10 cm of clearance on the sides, above, and behind it.

Notice

Poor ventilation will cause the temperature of the instrument to rise, causing damage to the instrument. Good ventilation should be maintained during use, and vents and fans should be checked regularly.

1.5 working environment

temperature

During operation: 0°C to +40°C

Non-operating time: -20°C to +60°C

humidity

- **During operation:**

  0°C to +40°C: ⩽80% relative humidity (no condensation)

- **When not operating:**

  - 20°C to +40°C: ⩽90% relative humidity (no condensation)

  + Below 60°C: ⩽80% relative humidity (no condensation)

warn

To avoid short circuiting the internal circuit of the instrument or the risk of electric shock, do not operate the instrument in a humid environment.

Altitude

- **During operation:**Below 3000 meters
- **When not operating:**Below 12,000 meters

Electricity protection level

ESD ±8kV

Installation (overvoltage) category

This product is powered by a mains supply complying with installation (overvoltage) category II.

warn

Make sure that no overvoltages (such as those caused by lightning) reach the product. Otherwise the operator may be in danger of electric shock.

Installation (Overvoltage) Category Definition

Installation (overvoltage) category I refers to signal levels applicable to the measuring terminals of equipment connected to a source circuit where measures have been taken to limit transient voltages to correspondingly low levels.

Installation (overvoltage) Category II refers to the local distribution level, which applies to equipment connected to the mains (AC mains).

pollution level

Category 2

Definition of pollution level

- **Pollution degree 1:**No contamination, or only dry non-conductive contamination occurs. This level of contamination has no impact. For example: a clean room or an air-conditioned office environment.
- **Pollution degree 2:**Generally only dry non-conductive pollution occurs. Temporary conduction due to condensation may sometimes occur. For example: general indoor environment.
- **Pollution degree 3:**Conductive contamination occurs, or dry non-conductive contamination becomes conductive due to condensation. For example: a covered outdoor environment.
- **Pollution degree 4:**Permanent conductive contamination through conductive dust, rain or snow. For example: outdoor places.

Security Level

level 2

1.6 Maintenance and cleaning

maintainance

Do not place the instrument where it will be exposed to sunlight for long periods of time.

clean

Please clean the instrument regularly according to usage. Methods as below:

1. Disconnect the power.
2. Wipe the outside of the instrument with a soft cloth soaked in mild detergent or water. Please be careful not to let water or other foreign matter enter the chassis through the heat dissipation holes. When cleaning an instrument with an LCD screen, be careful not to scratch the LCD screen.

Notice

Do not let any corrosive liquid get on the instrument to avoid damage to the instrument.

warn

Before re-energizing, please make sure the instrument is completely dry to avoid electrical short circuit or even personal injury caused by moisture.

1.7 Environmental considerations

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

Some substances contained in this product may be harmful to the environment or human health. To avoid releasing harmful substances into the environment or harming human health, it is recommended to use appropriate methods to recycle this product to ensure that most materials can be reused correctly. or recycling. For information on disposal or recycling, please contact your local authorities.

You can click*https://www.rigol.com/services/services/declaration*Download the latest version of the RoHS&WEEE certification document.

2 Features

Features

- Maximum sampling rate 1.25 GSa/s
- Maximum output frequency 200 MHz
- Vertical resolution 16 bit
- Arbitrary wave editing function, the maximum arbitrary wave length is up to 16 Mpts/CH (optional 32 Mpts/CH)
- Built-in harmonic generator up to 20th order
- Independent signal frequency measurement channel, maximum measurement frequency 1 GHz
- USB and LAN interfaces provide remote connectivity capabilities
- Type-C power interface supports mobile power supply and can meet on-site testing needs
- Standard Web Control web control function makes remote collaboration more convenient

DG900 Pro series function/arbitrary waveform generator has a maximum sampling rate of 1.25 GSa/s, a standard maximum storage depth of 16 Mpts/CH, and integrates function generators, arbitrary waveform generators, noise generators, pulse generators, and harmonic generators , analog/digital modulator, frequency meter and other functions in one, it is a multi-functional, cost-effective dual-channel function/arbitrary waveform generator.

3 Document overview

This document is used to guide users to quickly understand the front and rear panels, user interface and basic operation methods of the DG900 Pro series function/arbitrary waveform generator.

hint

The latest version of this manual can be found on the RIGOL website (*www.rigol.com*) to download.

Document number

UGB15000-1110

Document format conventions

1. Button

Use icons to represent front panel buttons, such as Default Represents the "Default" button.

2. Menu

Use "menu text (bold) + character shading" to represent a menu option, such as **basic settings** .

3. Operation steps

with arrow ">" indicates the next operation, such as  > **Auxiliary** Indicates click  and then click **Auxiliary** Function keys.

Agreement on document content

The DG900 Pro series of function/arbitrary waveform generators includes the following models. Unless otherwise specified, this manual uses DG922 Pro as an example to illustrate the basic operations of the DG900 Pro series.

model	Number of channels	Sampling Rate	Maximum output frequency
DG902Pro	2	1.25GSa/s	70MHz
DG912Pro	2	1.25GSa/s	150MHz
DG922Pro	2	1.25GSa/s	200MHz

4 Quick Start

4.1 General inspection

1. Check the shipping packaging

If the shipping packaging is damaged, please keep the damaged packaging or shock-proof materials until the goods have been completely inspected and the instrument has passed electrical and mechanical tests.

If the instrument is damaged due to transportation, the shipper and carrier will contact each other for compensation. RIGOL will not perform free repair or replacement.

2. Check the whole machine

If there is mechanical damage or missing, or the instrument fails the electrical and mechanical tests, please contact your RIGOL dealer.

3. Check the accompanying accessories

Please check the random accessories according to the packing list. If any are damaged or missing, please contact your RIGOL dealer.

Recommended calibration intervals

RIGOL recommends that the calibration cycle of the instrument is 12 months.

4.2 physical dimension

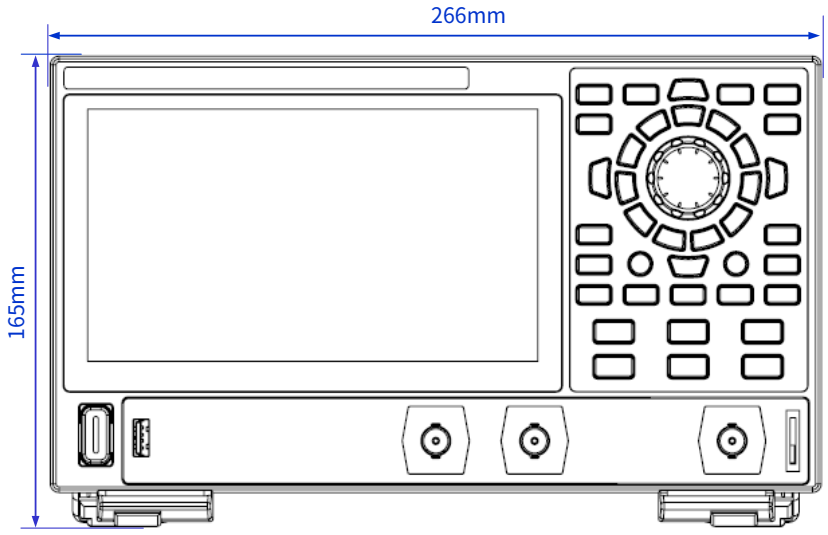


Figure 4.1 Front view

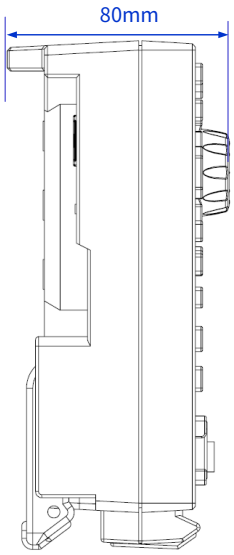


Figure 4.2 Side view

4.3 Preparation before use

4.3.1 Connect the power supply

The input power specifications of this signal source are: USB PD 15 V, 3 A. Please use the power adapter provided in the accessory to connect the instrument to the AC power supply (100~240 V, 50~60 Hz), as shown in the figure below. In addition to the standard power adapter of the instrument, this instrument also supports power supply using the standard PD (Power Delivery) protocol power adapter, but the adapter needs to support 15 V 3 A 45 W output.

After connecting to the power supply, the backlight of the power switch button on the front panel may have the following three states:

- **Red gradient:**It means that the instrument is connected to a power adapter that meets the requirements and is in standby mode. At this time, you can press the power button to turn it on.
- **Solid yellow:**It means that the instrument does not detect a power adapter that meets the requirements and cannot be turned on at this time.
- **Steady green:**Indicates that the instrument is in normal power-on state.

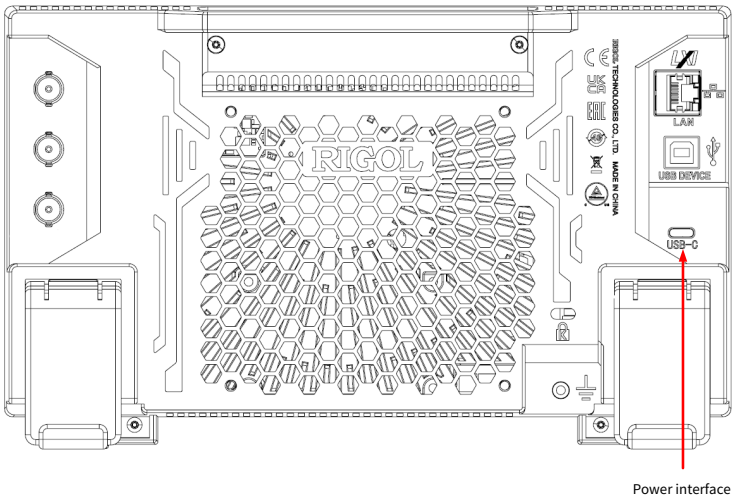


Figure 4.3 Connecting the power supply

Table 4.1 Power adapter specifications

parameter	illustrate
enter	100V~240V, 50Hz~60Hz, 1.6A Max
output	USB PD 15V, 3A, 45W

Notice

The power adapter provided in the accessory can only be used to power RIGOL instruments and should not be used for other devices such as mobile phones.

warn

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

4.3.2 Power on check

After connecting the power supply correctly, press the power button in the lower left corner of the front panel. The instrument can now be started. The instrument performs initialization during the boot process. process and self-test process, and the startup screen will appear after the self-test is completed. You can also click the "Source Settings" > Auxiliary > basic settings > select "Electricity after power is supplied. If it cannot be turned on normally, please refer to *Troubleshooting* Processed in one section.

hint

To shut down the instrument, do the following:

- Click > Shut down , or press the power key , click in the pop-up "Do you need to shut down?" prompt box Shut down ,closure instrument.

- Press the power button twice Turn off the instrument.
- Long press the power button Turn off the instrument in three seconds.

4.3.3 Set system language

This product supports Chinese and English system languages. You can click > Auxiliary > basic settings Enter the basic settings menu and click language In the drop-down menu on the right, select the desired system language as "Chinese" or "English".

4.4 Product introduction

This section takes DG922 Pro as an example to introduce the appearance dimensions, front panel, rear panel and user interface (display) of DG900 Pro.

4.4.1 Front panel introduction

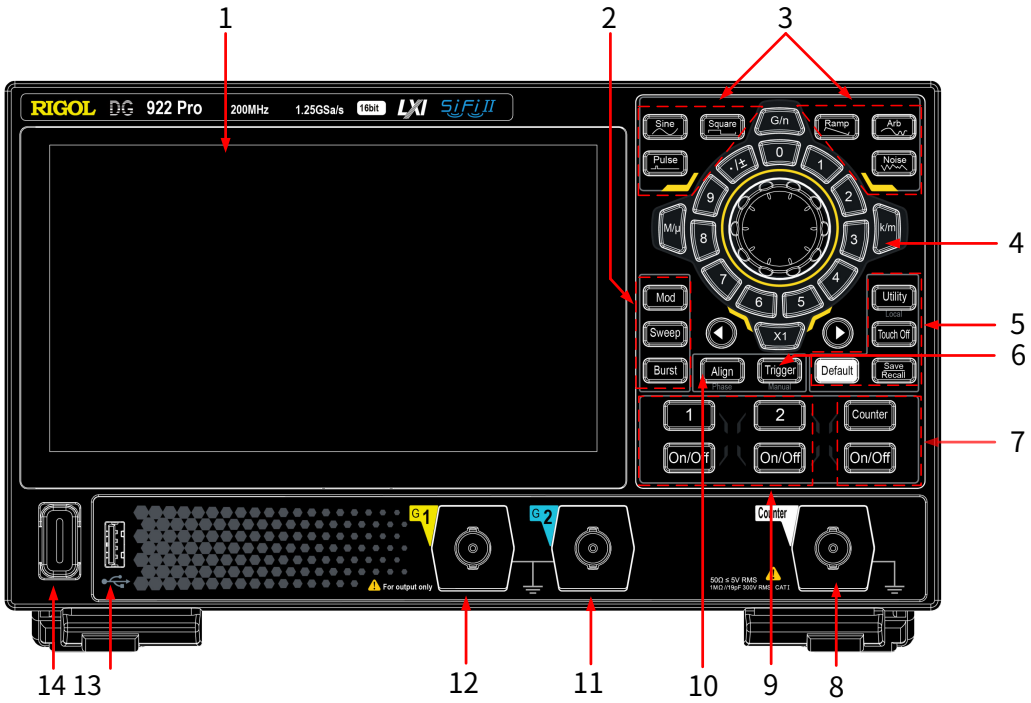


Figure 4.4 Front panel

1. 7-inch touch screen

Display menu labels, parameter settings, system status, prompt messages, etc.

2. Output mode selection area

- Mod: Modulation button. Press this key to set the output mode of the current channel to modulation output, which can generate AM, FM, PM, SUM, ASK, FSK, PSK and PWM modulation signals. For a detailed description of the modulation mode, see *modulation*.

- Sweep:Sweep button. Press this key to set the output mode of the current channel to sweep output. For detailed description of sweep mode, please refer to *Sweep*.
- Burst: Burst button. Press this key to set the output mode of the current channel to burst output. For detailed description of burst mode, please refer to *burst*.

3. Basic waveform selection area

- Sine: Sine wave button. Press this key to set the basic waveform of the current channel to sine wave. For detailed description of sine wave, please refer to *Output sine wave*.
- Square: Square wave button. Press this key to set the basic waveform of the current channel to square wave. For detailed description of square wave, please refer to *Output square wave*.
- Pulse: Pulse wave button. Press this key to set the basic waveform of the current channel to pulse wave. For detailed description of pulse wave, please refer to *Output pulse wave*.
- Ramp: Sawtooth wave button. Press this key to set the basic waveform of the current channel to a sawtooth wave. For a detailed description of the sawtooth wave, see *Output sawtooth wave*.
- Arb: Arbitrary wave button. Press this key to set the basic waveform of the current channel to arbitrary waveform. For detailed description of arbitrary waveform, please refer to *Output arbitrary wave*.
- Noise: Noisy keys. Press this key to set the basic waveform of the current channel to the noise waveform. For a detailed description of the noise waveform, see *Output noise*.

4. Parameter input area

The parameter input area includes knobs, numeric keyboard, unit keys and direction keys. For detailed introduction to parameter input methods, please refer to *Parameter setting method*.

5. Shortcut keys

Utility: Auxiliary/local mode button. Press this key to enter the system auxiliary function setting interface, where you can set remote interface parameters, system functions, and view instrument information. When the instrument is in remote control mode, press this key to switch the instrument from remote mode to local mode.

Touch Off:Touch screen lock button. Press this key to disable or enable touch screen functionality.

Save Recall: Store menu button. Press this key to open or close the memory menu.

Default:Default setting key. Press this key and click in the prompt box **confirm** to restore the instrument to the factory default configuration.

6. Manual trigger button

When the instrument is in sweep mode or manual trigger source in burst mode, the sweep/burst output is pressed once each time. Trigger Buttons will be triggered manually

7. Frequency meter control area

Counter: Frequency meter menu key. Press this button to open the frequency meter setup menu.

On/Off: Frequency meter switch key. Press this key to turn on or off the frequency counter function. When the frequency meter function is turned on, the backlight of this key lights up; when the frequency meter function is turned off, the backlight goes out.

8. Frequency meter measurement signal input connector

BNC connector, used to receive the measured signal measured by the frequency meter.

9. Channel output control area

1: Channel 1 selection key. Press this key to select channel 1 as the current channel. The user can set the waveform, parameters and configuration of channel 1 through the front panel buttons and knobs. When channel 1 is selected, the backlight of this key lights up.

2: Channel 2 selection key. Press this key to select channel 2 as the current channel. The user can set the waveform, parameters and configuration of channel 2 through the front panel buttons and knobs. When channel 2 is selected, the backlight of this key lights up.

On/Off: Channel switch key. Press the channel switch key below the channel selection key to turn on or off the corresponding channel output. When the channel output is turned on, the corresponding button backlight lights up.

10. In-phase keys

press Align Perform in-phase operation, see*In phase*one period.

11. CH2 output connector

BNC connector, nominal output impedance is 50 Ω. When the CH2 output is turned on, the CH2 output connector outputs the waveform with the current configuration of CH2.

12. CH1 output connector

BNC connector, nominal output impedance is 50 Ω. When the CH1 output is turned on, the CH1 output connector outputs the waveform with the current configuration of CH1.

13. USB HOST interface

Read the waveform or status file in the USB flash drive, or store the current instrument status or edited waveform data to the USB flash drive. You can also store the current screen display content in the form of pictures to the USB flash drive. Supports FAT32, NTFS or exFAT format USB flash drives.

14. Power button

Used to turn the signal generator on or off.

4.4.2 Rear panel introduction

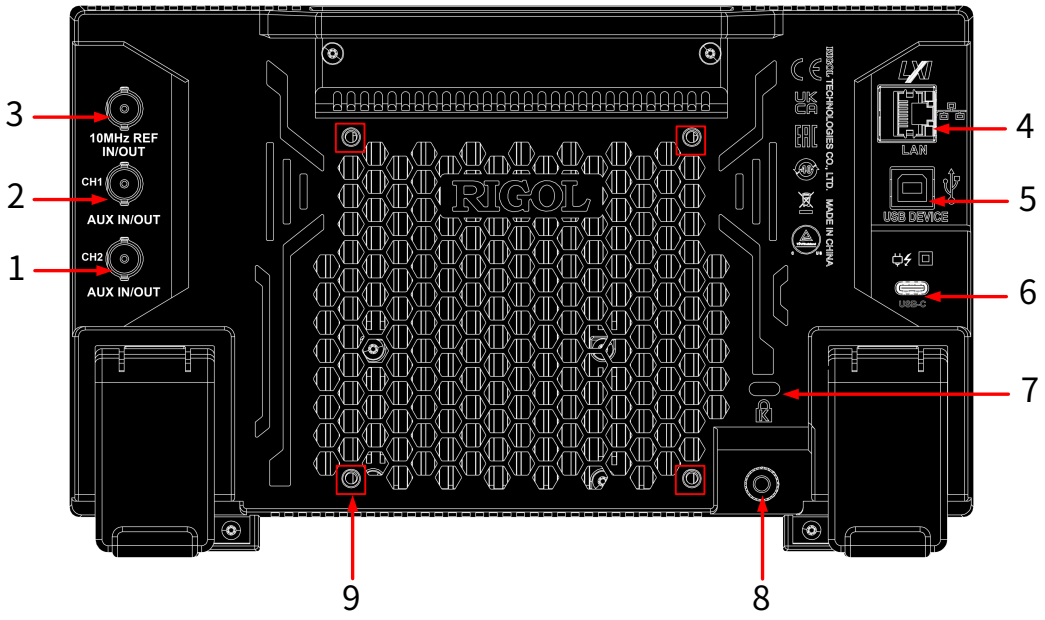


Figure 4.5 Rear panel

1. CH2 auxiliary input/output connector ([CH2 AUX IN/OUT])

BNC female connector, its function is determined by the current working mode of CH2.

- **Synchronous output:**When the synchronization output of CH2 is turned on, this connector outputs a synchronization signal that matches the current configuration of CH2. For the synchronization signal characteristics corresponding to various output signals, please refer to *Sync signal settings*one period.

- **Modulation input:**If the CH2 output mode is set to modulation and an external modulation source is used, this connector receives an external modulation signal. For details on external modulation, see *modulation*.

- **Trigger input:**If the CH2 output mode is set to sweep or burst and an external trigger source is used, this connector receives an external signal as the trigger signal for CH2 (the polarity of the signal can be set).

- **Trigger output:**If the CH2 output mode is set to sweep or burst and the trigger output is turned on, this connector outputs a trigger signal with a specified edge.

2. CH1 auxiliary input/output connector ([CH1 AUX IN/OUT])

BNC female connector, its function is determined by the current working mode of CH1.

- **Synchronous output:**When the synchronization output of CH1 is turned on, this connector outputs a synchronization signal that matches the current configuration of CH1. For the synchronization signal characteristics corresponding to various output signals, please refer to *Sync signal settings*one period.

- **Modulation input:**If the CH1 output mode is set to modulation and an external modulation source is used, this connector receives an external modulation signal. For details on external modulation, see *modulation*.

- **Trigger input:**If the CH1 output mode is set to sweep or burst and an external trigger source is used, this connector receives an external signal as the trigger signal for CH2 (the polarity of the signal can be set).

- **Trigger output:**If the CH1 output mode is set to frequency sweep or burst and the trigger output is turned on, this connector outputs a trigger signal with a specified edge.

3. 10 MHz input/output connector ([10 MHz In/Out])

BNC female connector whose functionality is determined by the type of clock used by the instrument.

- If the instrument uses an internal clock source, this connector (used as 10 MHz Out) can output the 10 MHz clock signal generated by the instrument's internal crystal oscillator.
- If the instrument uses an external clock source, this connector (used as 10 MHz In) receives a clock signal from the external source.

This connector is typically used to establish synchronization between multiple instruments. For clock source settings, see*basic settings*one period.

4.LAN

The instrument is connected to the network via this interface. This instrument complies with LXI CORE 2011 DEVICE instrument standards and can quickly build a test system. When connected to the network, users can send SCPI commands or customize programming to control the instrument through Web Control or host computer software.

5. USB DEVICE

The instrument can be connected to the computer through this interface, and the user can send SCPI commands or customize programming to control the instrument through the host computer software.

6. USB Type-C power jack

The power supply specifications supported by this instrument are: USB PD, 15 V, 3 A. Please use the power adapter provided in the accessory to connect the instrument to the AC power supply (100~240 V, 50~60 Hz).

7. Security keyhole

Use a standard PC/laptop lock cable to secure the instrument to a workbench or other location.

8. Ground terminal

Use a ground wire to connect the chassis to earth ground.

9. Bracket mounting screw holes

The hole spacing is 100 mm×100 mm. Screws (M4*6-10) can be used to fix the instrument to a bracket with the same hole spacing.

4.4.3 User interface introduction

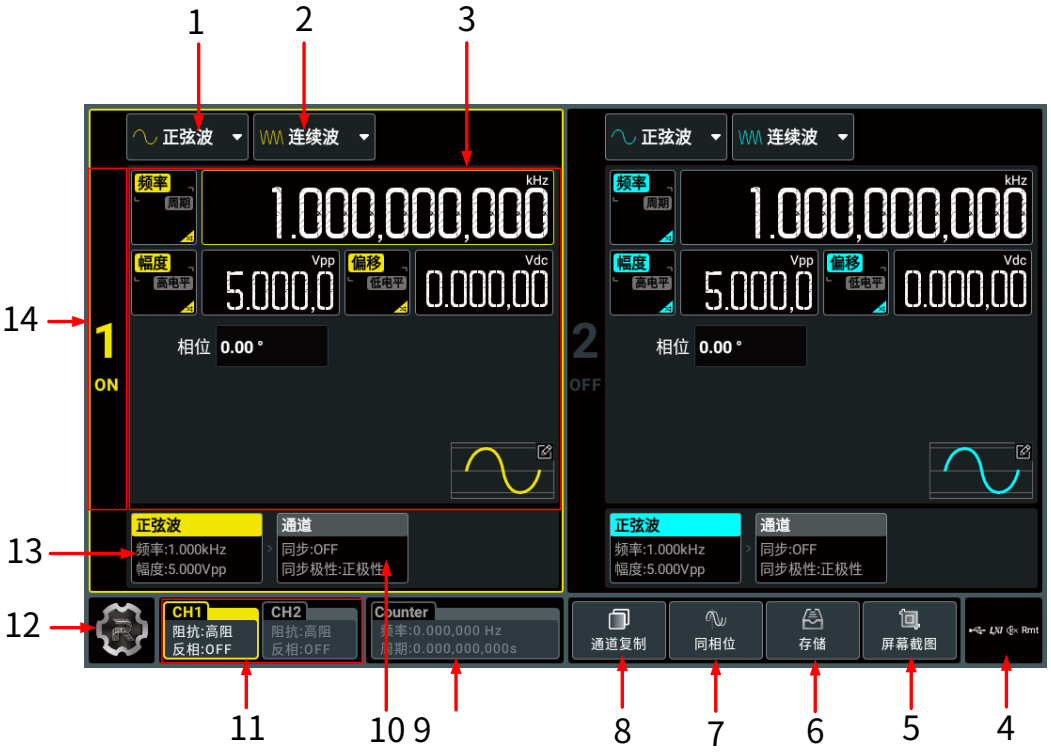


Figure 4.6 User interface

1. Waveform type drop-down menu

Click the drop-down menu to select the waveform type of the corresponding channel. The available waveform types are related to the currently selected output mode.

2. Output mode drop-down menu

Click the drop-down menu to select the output mode of the corresponding channel as continuous wave, modulation, sweep, burst or sequence.

3. Parameter configuration area

In this area, the waveform parameters and channel parameters of the corresponding channels can be configured respectively. When the frequency meter is turned on, the channel 2 configuration area is used to configure the frequency meter parameters.

4. Notification area

The U disk icon, LAN interface connection icon, sound icon and remote control icon are displayed. Click this area to open the auxiliary settings menu.

- U disk icon: When the instrument detects the U disk, this area displays  .
- LAN interface connection icon: When the LAN interface is successfully connected, this area displays  .
- Sound icon: Select in the Assistance menu **basic settings** > **sound** Sound can be turned on or off. sound on When , this area displays; wh  sound is turned off, it displays  .

- Remote control icon: When the instrument is in remote control mode, this area displays Rmt.
- Time: When the time display is turned on, the system time will be displayed.

5. Screen capture function key

Click this function key to quickly capture the current screen and save the image to the internal memory.

6. Storage key

Click this key to open the storage menu.

7. In-phase keys

Click this button to perform in-phase operation. For details see *In phase* one period.

8. Channel copy key

Click this key to open the channel copy menu, and you can copy all states and waveforms of one channel to another channel. For details see *Channel copy* one period.

9. Frequency meter label

Displays the frequency value and period value measured by the frequency meter. When the frequency meter is turned on, this label lights up and displays the frequency and period parameters measured by the frequency meter.

10. Channel tab

Display the synchronization switch status and synchronization polarity of the corresponding channel. Click this tab to enter the channel parameter configuration interface.

11. Channel status label

Display the switch status (whether "CH1" and "CH2" are lit), selected status (whether the label is highlighted), impedance and inversion settings of channel 1 and channel 2 respectively. Click a label to select a specific channel.

12. Function navigation icons

Click this icon to open the function navigation menu. In the function navigation menu, click each function button (auxiliary, preset, help, coupling, shutdown) to enter the corresponding function menu for function configuration.

13. Waveform tab

Displays the selected continuous waveform type, frequency and amplitude. Click this tab to enter the waveform parameter configuration interface.

14. Channel label

Indicates whether this area is CH1 ("1") or CH2 ("2"), and the channel's switch status (ON/OFF). Click this area to turn on or off the corresponding channel output.

4.5 touch screen gestures

This instrument is mainly configured and operated through its own capacitive touch screen, which is simple, convenient, flexible and highly sensitive. Touchscreen controls support multi-touch and gesture operations, including touching and dragging.

4.5.1 touch

Use one finger to lightly tap an icon or text on the screen, such as *Figure 4.7* shown. Functions enabled by touch include:

- Touch the menu displayed on the screen to operate the menu.
- Touch the function navigation icon in the lower left corner of the screen to open the function navigation.
- Touch the pop-up numeric keyboard to set parameters.
- Touch the virtual keyboard to set the file name.
- Touch the close button in the upper right corner of the information pop-up box to close the pop-up box.
- Touch other windows displayed on the screen to operate on the windows.

Figure 4.7 Touch gesture

4.5.2 drag

Use one finger to hold down the drag target, and then drag it to the target location, such as *Figure 4.8* shown. You can drag window controls to change the window position (such as the numeric keypad)

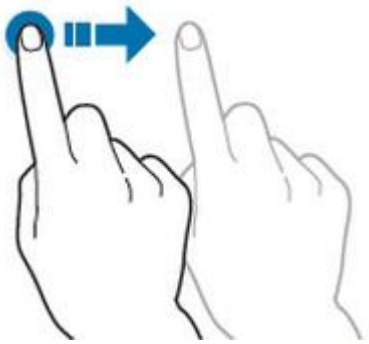


Figure 4.8 Drag gesture

4.6 Parameter setting method

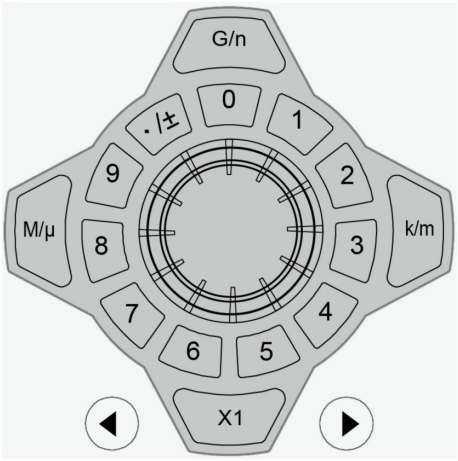
This instrument supports parameter setting through the front panel parameter input area and the touch screen.

illustrate

This manual mainly uses the touch screen as an example to introduce the settings of each parameter.

4.6.1 Set parameters using keys and knobs

Some parameters of the instrument can be set through the parameter input area on the front panel. The parameter input area consists of knobs, numeric keyboard, unit keys and direction keys, as shown in the figure below.



Knob

You can rotate the knob to move the focus cursor in the parameter configuration area, select different controls, and then perform the following operations:

- **If the current focus cursor selects the parameter input box:**Press the knob to enter the editing mode of this parameter, use the front panel direction keys to move the focus position to select the modified data bit, and then rotate the knob to increase (clockwise) or decrease (counterclockwise) the value at the focus. Press the knob again to confirm parameter settings and exit parameter editing mode.
- **If the current focus cursor selects the drop-down box:**Press the knob to open the drop-down menu, then turn the knob to select a parameter in the drop-down menu, press the knob again to confirm the selection and close the drop-down menu.
- **If the current focus cursor selects a button, switch, or tab:**Pressing a knob is equivalent to clicking the corresponding button/switch/tab via the touch screen.

numeric keypad

Ring-type numeric keyboard, including numeric keys 0~9 and decimal point/symbol multiplex keys. If the current focus cursor selects an input box, Press the number buttons to enter numbers, press 

You can switch to input decimal point ".", symbol "-" or symbol "+". When typing using the numeric ring pad, you can also do the following:

- Press the knob to confirm your entry.
- Press the arrow keys  Delete characters.
- Press the arrow keys  Cancel input.

Unit selection key

When using the ring-type numeric keyboard on the front panel to enter parameters, it is used to select the unit of the parameter.

- X1 :Set parameters to default units. For example, when setting the phase, press 1 > X1 , the phase will be set is 1°; when setting the frequency, press 1 > X1 , the frequency will be set to 1 Hz.
- M/μ / k/m / G/n : When setting the frequency, use the unit (M, k, G) before the character "/" on the button. Use the unit after "/" (μ, m, n) when specifying interval, amplitude or offset. For example, when setting the frequency, press 1 > k/m , the frequency will be set to 1 kHz; when setting the period, press 1 > k/m , the cycle time will be set to 1 ms.

hint

When the set value exceeds the limit, the instrument automatically adjusts the parameters to meet the requirements.

Arrow key

- In normal mode, it is used to move the focus cursor to select the control, which is equivalent to rotating a knob.
- In parameter editing mode, it is used to move the focus position to select the numerical digit to be modified.
- When inputting using the ring numeric keyboard, ◀ Used to delete characters, ▶ Used to cancel input and close the input box.

4.6.2 Enter parameters using the touch screen

All parameters of the instrument can be entered through the touch function. Touch the parameter input box and a virtual keyboard will pop up. Parameter settings can be completed through the keyboard. How to use the virtual keyboard is described below.

Enter Chinese and English

This instrument supports Chinese and English input methods when naming files. The following describes how to use the Chinese and English input keyboards for input.

- **Enter English**

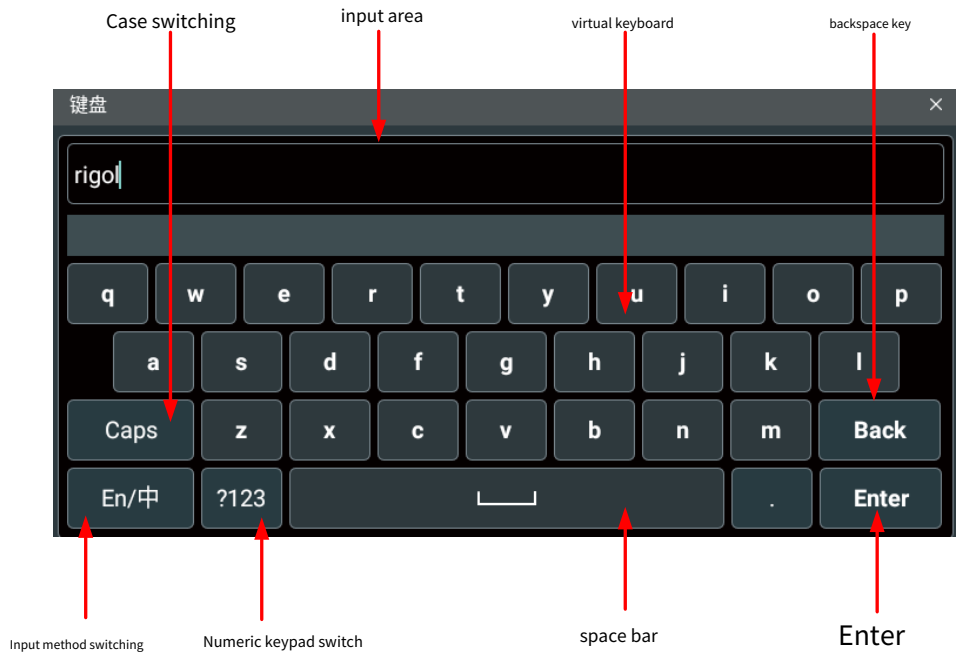


Figure 4.9 English keyboard input interface

1.Choose English input method

First check the "Input Method Switch" key status. If it is currently displayed as "En/Medium", please jump to step 2; if it is currently displayed as "Medium/En", click the "Input Method Switch" key to switch to "En/Medium". ”，“En” is ranked first, then the current input state is English.

2.Clear the name input area

If the current "input area" does not contain characters, please skip to the next step; if the current "input area" contains characters, click the "backspace key" to delete all characters in the name input area in sequence.

3.Enter uppercase characters

If you want to enter uppercase characters, first observe the "Caps" key. If it is currently selected, you can click the virtual keyboard to directly enter uppercase letters. Otherwise, you can click the "Caps" key to switch it to the selected state, and then click the virtual keyboard to enter uppercase letters. All input will be displayed in the "input area" of the keyboard.

4.Enter lowercase letters

Referring to the previous step, when "Caps" is unselected, lowercase letters can be entered.

5.Enter numbers or symbols

In the alphabetical keyboard state, if you want to enter numbers or symbols, you can click the "Numeric Keyboard Switch" key to switch to the numeric symbol keyboard, and then click the virtual keyboard to enter numbers or symbols. All input will appear in the keyboard's "input area".

6.Modify or delete entered characters

During name input, you can modify or delete entered characters. To delete the entered characters, click the "backspace key" on the virtual keyboard to delete the characters. If you modify an entered character, delete the character and re-enter the required character.

You can directly move the cursor to the character that needs to be modified or deleted, delete the character or re-enter the required character after deletion.

7.Enter confirmation

After completing the input, select the "Enter" key.

- **Enter Chinese**

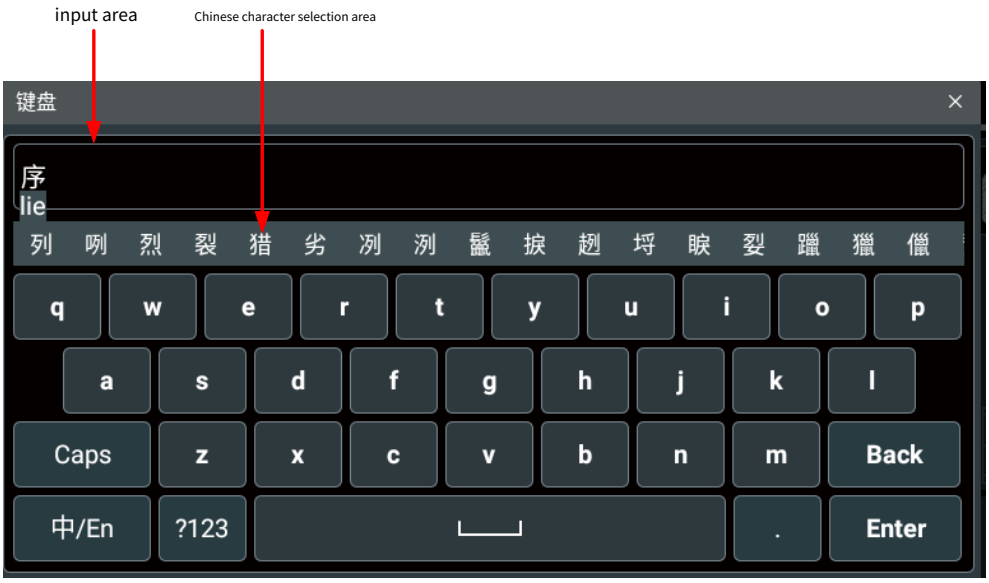


Figure 4.10 Chinese keyboard input interface

1.Select Chinese input method

First check the "Input Method Switch" key status. If it is currently displayed as "Chinese/En", please jump to the next step; if it is currently displayed as "En/Chinese", click the "Input Method Switch" key to switch to "Chinese/En" ”，“中” is ranked first, then the current state is Chinese input.

2.Clear the name input area

If the current "input area" does not contain characters, please skip to the next step; if the current "input area" contains characters, click the "backspace key" to delete all characters in the name input area in sequence.

3.Enter Chinese characters

Click on the virtual keyboard, input pinyin, and the Chinese characters to be selected will appear in the "Chinese character selection area". Swipe left and right to see more Chinese characters to be selected. Click to select a Chinese character, and the selected Chinese character will be displayed in the input area.

4.Modify or delete entered characters

During name input, you can modify or delete entered characters. To delete the entered characters, click the "backspace key" on the virtual keyboard to delete the characters. If you modify an entered character, delete the character and re-enter the required character.

5.Enter confirmation

After completing the input, select the "Enter" key.

Enter value

When setting or modifying each function parameter, you need to enter the corresponding value through the numeric keyboard.

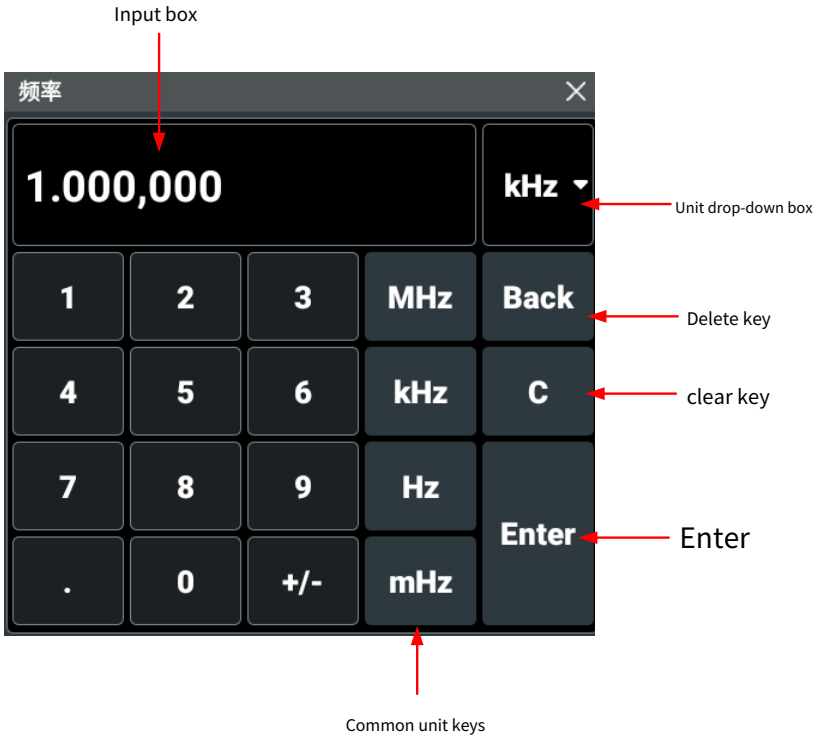


Figure 4.11 Numeric keyboard

Click the numeric keys on the numeric keyboard to enter the value. After entering all the values, click the required unit key. The numeric keyboard will automatically close and the parameter settings will be completed. The unit drop-down box contains all available units. You can also click the unit drop-down box to select the desired unit (if there are multiple units available), then click the "Enter" key to confirm the input and close the numeric keyboard.

4.7 Use the built-in help system

The help document of this instrument provides relevant help information for the instrument functions and menus. Click the > **help**, enter "Help "Help" function menu.

In the "Help" menu, you can obtain the corresponding help information by clicking the link of the corresponding chapter.

4.8 View option information and option installation

The DG900 Pro offers performance upgrade options to meet your measurement needs. If you need to use the option function, please first follow the *Appendix A: Accessories and Options* Order the appropriate option using the order number provided in and install it as described in this section. Additionally, you can view all options for your instrument and activate newly purchased options.

View options

Click the navigation icon at the bottom left of the screen  > Auxiliary, enter the accessibility menu. Click on the accessibility menu **Options list** Enter the list to view the option installation status.

Installation options

The option authorization code (License, one for each instrument) is a text with a fixed length. An option license file is a file that meets this specific format and has a file extension of ".lic". After successfully purchasing the required option, you will receive the corresponding key (used to obtain the option authorization code). Please follow the steps below to install the option.

1. Obtain option authorization code

a.Log in to RIGOL official website (*http://www.rigol.com*), click**Service Center> Product Authorization Code Registration**, enter the software authorization code registration interface;

b.Enter the correct key and instrument serial number in the software authorization code registration interface (click the navigation icon at the bottom left of the screen  > Auxiliary > **about** button to obtain the serial number) and verification code, click**generate**Click the button to obtain the option authorization code (License). If you need to use the option authorization file, please download it to a USB flash drive.

2. Install options

You can install options in three ways:

- Open the option authorization file (*.lic), obtain the option authorization code (License), and install the option through: SYSTem:LICense:INSTall "<License>".
- Save the option authorization file to a USB flash drive, connect the USB flash drive to the instrument correctly (you can also transfer the file to the instrument's C drive), and install the option through: SYSTem:LICense:INSTall:UDISk "<path>".
- Save the option authorization file to a USB flash drive, connect the USB flash drive to the instrument correctly (you can also transfer the file to the instrument's C drive), click o**storage**strument interface to open the storage menu, select the option authorization file,**Options**n click to install the option.

After installation, a prompt box indicating that the option has been activated pops up on the interface.

hint

- SCPI commands please refer to *"DG800 Pro/DG900 Pro Programming Manual"*.
- During the installation of options, it is strictly prohibited to cut off the power supply.
- Users cannot modify the authorization file name by themselves.

5 continuous wave

Click the "Output Mode" drop-down menu on the user interface, select "Continuous Wave", and configure the channel to output continuous wave. The continuous wave setting interface is shown in the figure below.

Figure 5.1 Continuous wave setting interface

After selecting a channel to output a continuous waveform, the user can configure the channel to output the following waveform and preview the waveform in the waveform preview area.

- Configure output sine wave
- Configure output square wave
- Configure output sawtooth wave
- Configure output pulse wave
- Configure output noise
- Configure output arbitrary waveform
- Configure output harmonics

The frequency and amplitude setting range of the waveform are as shown in the table below.

Table 5.1 Continuous waveform frequency setting range

waveform	DG902Pro	DG912Pro	DG922Pro
sine wave	1μHz~70MHz	1μHz~150MHz	1μHz~200MHz
square wave	1μHz~60MHz	1μHz~60MHz	1μHz~60MHz
triangle wave	1μHz~3MHz	1μHz~5MHz	1μHz~5MHz
pulse wave	1μHz~50MHz	1μHz~50MHz	1μHz~50MHz
Standard arbitrary wave	1μHz~30MHz	1μHz~50MHz	1μHz~50MHz
harmonic	1 mHz~35 MHz	1 mHz~75 MHz	1 mHz~100 MHz

Table 5.2 Amplitude setting range

frequency	High resistance		Load (50Ω)	
	scope	resolution	scope	resolution
[1 μHz,50 MHz]	2mVpp~20Vpp	0.1mVpp	1mVpp~10Vpp	0.05mVpp
(50MHz,100MHz]	2mVpp~10Vpp		1mVpp~5Vpp	
(100MHz,200MHz]	2mVpp~4Vpp		1mVpp~2Vpp	

5.1 Output sine wave

You can choose to output a sine wave in the following ways:

- In the continuous wave setting interface (*Figure 5.1*), click the "Waveform Type" drop-down menu and select "Sine Wave".
- In the continuous wave setting interface (*Figure 5.1*), click the "Waveform Preview/Selection" area, and click in the built-in waveform selection menu that opens. **Sine**
- Press the front panel 

button.

After entering the sine wave setting interface, you can configure the channel to output different sine waves through the following operations. **Set frequency/period**

Click **frequency/period** Switch key to switch to frequency setting. At this time, "Frequency" is highlighted on the switch key. Click the corresponding input box, set the sine wave frequency through the pop-up virtual numeric keyboard. The default sine wave frequency is 1 kHz and the resolution is 1 μHz. Please refer to the settable frequency range of sine waves of different models of instruments. *Table 5.1: Continuous waveform frequency setting range*. Click this button again to switch to the period setting, period = 1/frequency.

Set amplitude/high level

Click **Amplitude/high level** Switch key to switch to amplitude setting. At this time, "Amplitude" is highlighted on the switch key. Click the corresponding input box and set the sine wave amplitude through the pop-up virtual numeric keyboard. The units supported by the amplitude are Vpp, Vrms and dBm (not supported at high impedance). The sine wave amplitude defaults to 5 Vpp, the amplitude range and resolution are limited by the "Impedance" and "Frequency/Period" settings, see *Table 5.2: Amplitude setting range*.

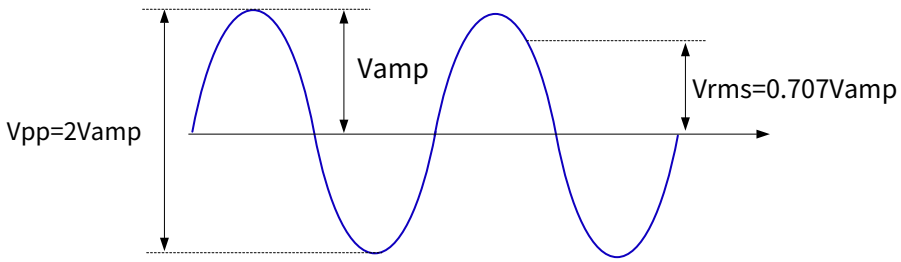
Click this key again to switch to high level setting, high level = offset + amplitude/2. The high level setting range is related to the low level setting value: (high level - low level) does not exceed the current settable range of the amplitude (*Table 5.2: Amplitude setting range*).

illustrate

1. How to convert the amplitude in Vpp to the corresponding value in Vrms?

Vpp is the unit that represents the peak-to-peak value of the signal, and Vrms is the unit that represents the effective value of the signal. The instrument uses Vpp by default. When setting the amplitude, in the virtual numeric keyboard that pops up, click the unit drop-down menu to select a different unit, and click "Enter" to switch the unit of the current amplitude. Arbitrary waves and harmonics do not support amplitude setting with Vpp and Vrms.

For different waveforms, the relationship between Vpp and Vrms is different. Taking the sine wave as an example, the relationship between the two is shown in the figure below.



According to the above figure, it can be deduced that the conversion relationship between sine wave Vpp and Vrms satisfies the following relationship:

$$Vpp = 2\sqrt{2}Vrms$$

2. How to set the amplitude of the waveform in dBm?

a.refer to *Set impedance* Set the impedance to "Load".

b.When setting the amplitude, in the virtual numeric keyboard that pops up, click the unit drop-down menu and select "dBm".

c.After entering the required value, click "Enter" to set the waveform amplitude in dBm.

dBm is a unit that represents the absolute value of signal power. The relationship between dBm and Vrms is as follows:

$$dBm = 10\lg\left(\frac{Vrms^2}{R} \times \frac{1}{0.001W}\right)$$

Among them, W is the signal power unit; R represents the output impedance value of the channel, which must be a certain value. Therefore, when the output impedance is high resistance, the unit dBm cannot be used.

Set offset/low level

Click **Offset/low level** Switch key to switch to offset setting. At this time, "Offset" is highlighted on the switch key. Click the corresponding input box and set the sine wave offset through the pop-up virtual numeric keyboard. The settable range of the sine wave offset is limited by "Impedance" and "Amplitude/High Level", and the default is 0 Vdc.

Click this key again to switch to low level setting, low level = offset-amplitude/2. The low level setting range is related to the high level setting value: (high level - low level) does not exceed the current settable range of the amplitude (*Table 5.2: Amplitude setting range*).

hint

Amplitude and offset, high level and low level always appear in pairs. For example, when switching to the offset setting, "Amplitude/High Level" will automatically switch to the amplitude setting.

Set starting phase

Click **Phase** The input box of the item sets the starting phase. The starting phase range is -360°~360°, the default value is 0°, and the resolution is 0.01°.

Channel settings

In addition to the above settings, you can also *continuous wave* Interface Click the channel tab to switch to the channel setting interface and configure parameters related to the channel output. For detailed operations, please refer to *Channel settings* one period.

Turn on channel output

After completing the parameter settings of the waveform, you need to enable the channel to output the waveform. You can turn on channel output through the following operations.

- Click the channel status label at the bottom of the screen to open the channel output.
- Press the corresponding channel switch key on the front panel On/Off Turn on channel output.
- Click the channel identification bar on the left side of the parameter configuration area to open the output of the corresponding channel.

5.2 Output square wave

You can choose to output a square wave in the following ways:

- In the continuous wave setting interface (*Figure 5.1*), click the "Waveform Type" drop-down menu and select "Square Wave".
- In the continuous wave setting interface (*Figure 5.1*), click the "Waveform Preview/Selection" area, and click in the opened built-in waveform selection menu **Square**.
- Press the front panel Square button.

After entering the square wave setting interface, you can configure the channel to output different square waves through the following operations. **Set frequency/period**

Click **frequency/period** Switch key to switch to frequency setting. At this time, "Frequency" is highlighted on the switch key. Click the corresponding input box and set the square wave frequency through the pop-up virtual numeric keyboard. The square wave frequency defaults to 1 kHz and the resolution is 1 μHz. Please refer to the settable frequency range of square waves of different models of instruments. *Table 5.1: Continuous waveform frequency setting range*. Click this button again to switch to the period setting, period = 1/frequency.

Set amplitude/high level

Click **Amplitude/high level** Switch key to switch to amplitude setting. At this time, "Amplitude" is highlighted on the switch key. Click the corresponding input box and set the square wave amplitude through the pop-up virtual numeric keyboard. The units supported by the amplitude are Vpp, Vrms and dBm (not supported at high impedance). For an introduction on how to set the amplitude in Vrms and dBm units, please refer to *Output sine wave*. Square wave amplitude

The amplitude defaults to 5 Vpp, the amplitude range and resolution are limited by the "Impedance" and "Frequency/Period" settings, see *Table 5.2: Amplitude setting range*.

Click this key again to switch to high level setting, high level = offset + amplitude/2. The high level setting range is related to the low level setting value: (high level - low level) does not exceed the current settable range of the amplitude (*Table 5.2: Amplitude setting range*).

Set offset/low level

Click **Offset/low level** Switch key to switch to offset setting. At this time, "Offset" is highlighted on the switch key. Click the corresponding input box and set the square wave offset through the pop-up virtual numeric keyboard. The settable range of the square wave offset is limited by "Impedance" and "Amplitude/High Level", and the default is 0 Vdc.

Click this key again to switch to low level setting, low level = offset-amplitude/2. The low level setting range is related to the high level setting value: (high level - low level) does not exceed the current settable range of the amplitude (*Table 5.2: Amplitude setting range*).

hint

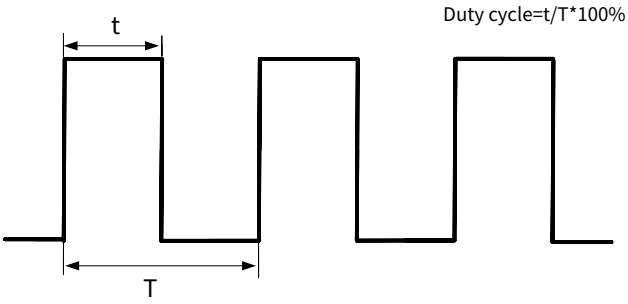
Amplitude comes in pairs with offset, high level and low level. For example, when switching to the offset setting, "Amplitude/High Level" will automatically switch to the amplitude setting.

Set starting phase

Click **Phase** The input box of the item sets the starting phase. The starting phase range is -360°~360°, the default value is 0°, and the resolution is 0.01°.

Set duty cycle

The duty cycle is defined as the percentage of the period in which the high level of the waveform lasts, as shown in the figure below. This parameter is only valid when square wave and pulse wave are selected.



Click **duty cycle** Set the square wave duty cycle in the input box of the item. The range can be set to 0.01%~99.99% (limited by frequency/period setting). system), the default is 50%, and the resolution is 0.01%.

Channel settings

In addition to the above settings, you can also *Figure 5.1*Interface Click the channel tab to switch to the channel setting interface and configure parameters related to the channel output. For detailed operations, please see *Channel settings*.

Turn on channel output

See section "Outputting Sine Waves" *Turn on channel output*.

5.3 Output sawtooth wave

You can choose to output the sawtooth wave in the following ways:

- In the continuous wave setting interface (*Figure 5.1*), click the "Waveform Type" drop-down menu and select "Sawtooth Wave".
- In the continuous wave setting interface (*Figure 5.1*), click the "Waveform Preview/Selection" area, and click in the opened built-in waveform selection menu **Ramp**.
- Press the front panel 

button.

After entering the sawtooth wave setting interface, you can configure the channel to output different sawtooth waves through the following operations.

Set frequency/period

Click **frequency/period** Switch key to switch to frequency setting. At this time, "Frequency" is highlighted on the switch key. Click the corresponding input box and set the sawtooth wave frequency through the pop-up virtual numeric keyboard. The sawtooth wave frequency defaults to 1 kHz and the resolution is 1 μHz. Please refer to the settable frequency range of sawtooth waves of different models of instruments. *Table 5.1: Continuous waveform frequency setting range*. Click this button again to switch to the period setting, period = 1/frequency.

Set amplitude/high level

Click **Amplitude/high level** Switch key to switch to amplitude setting. At this time, "Amplitude" is highlighted on the switch key. Click the corresponding input box and set the sawtooth wave amplitude through the pop-up virtual numeric keyboard. The units supported by the amplitude are Vpp, Vrms and dBm (not supported at high impedance). For an introduction on how to set the amplitude in Vrms and dBm units, please refer to *Output sine wave*. The sawtooth wave amplitude defaults to 5 Vpp, and the amplitude range and resolution are limited by the "Impedance" and "Frequency/Period" settings, see *Table 5.2: Amplitude setting range*.

Click this key again to switch to high level setting, high level = offset + amplitude/2. The high level setting range is related to the low level setting value: (high level - low level) does not exceed the current settable range of the amplitude (*Table 5.2: Amplitude setting range*).

Set offset/low level

Click **Offset/low level** Switch key to switch to offset setting. At this time, "Offset" is highlighted on the switch key. Click the corresponding input box and set the sawtooth wave offset through the pop-up virtual numeric keyboard. The settable range of the sawtooth wave offset is limited by "Impedance" and "Amplitude/High Level", and the default is 0 Vdc.

Click this key again to switch to low level setting, low level = offset-amplitude/2. The low level setting range is related to the high level setting value: (high level - low level) does not exceed the current settable range of the amplitude (*Table 5.2: Amplitude setting range*).

hint

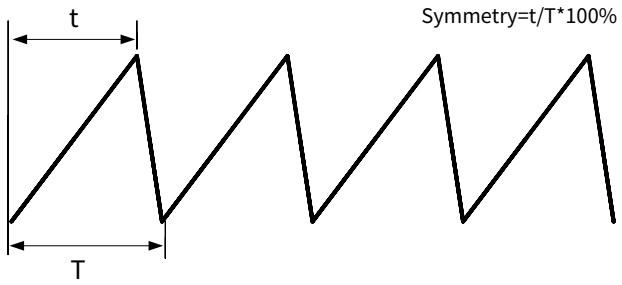
Amplitude comes in pairs with offset, high level and low level. For example, when switching to the offset setting, "Amplitude/High Level" will automatically switch to the amplitude setting.

Set starting phase

Click **Phase** The input box of the item sets the starting phase. The starting phase range is -360°~360°, the default value is 0°, and the resolution is 0.01°.

Set symmetry

Symmetry is defined as the percentage of the period during which a sawtooth waveform is rising, as shown in the figure below. This parameter is only effective when sawtooth wave is selected.



Click **symmetry** The input box of the item sets the symmetry. The settable range of symmetry is 0% to 100%, and the default value is 50%. Resolution 0.1%.

Channel settings

In addition to the above settings, you can also *continuous wave* Interface Click the channel tab to switch to the channel setting interface and configure parameters related to the channel output. For detailed operations, please refer to *Channel settings* one period.

Turn on channel output

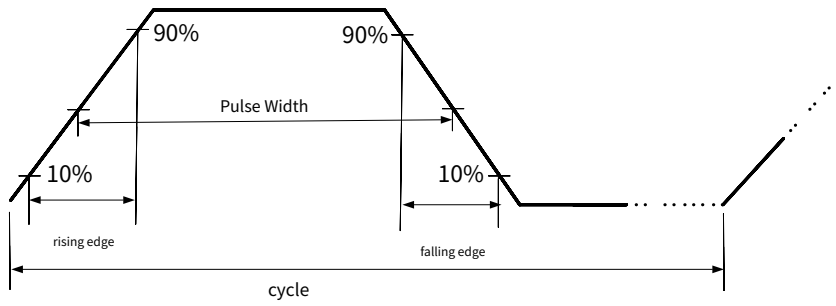
Please refer to the "Output Sine Wave" section *Turn on channel output*.

5.4 Output pulse wave

You can select the output pulse wave in the following ways:

- In the continuous wave setting interface (*Figure 5.1*), click the "Waveform Type" drop-down menu and select "Pulse".
- In the continuous wave setting interface (*Figure 5.1*), click the "Waveform Preview/Selection" area, and click in the opened built-in waveform selection menu **Pulse**.
- Press the front panel Pulse button.

To output a pulse wave, in addition to configuring the basic parameters introduced previously (such as frequency, amplitude, offset, starting phase, high level, low level), you also need to set the "pulse width/duty cycle", " rising edge" and "falling edge".



Set frequency/period

Click **frequency/period** Switch key to switch to frequency setting. At this time, "Frequency" is highlighted on the switch key. Click the corresponding input box and set the pulse wave frequency through the pop-up virtual numeric keyboard. The pulse wave frequency defaults to 1 kHz and the resolution is 1 μHz. Please refer to the settable frequency range of pulse waves of different models of instruments. *Table 5.1: Continuous waveform frequency setting range*. Click this button again to switch to the period setting, period = 1/frequency.

Set amplitude/high level

Click **Amplitude/high level** Switch key to switch to amplitude setting. At this time, "Amplitude" is highlighted on the switch key. Click the corresponding input box and set the pulse wave amplitude through the pop-up virtual numeric keyboard. The units supported by the amplitude are Vpp, Vrms and dBm (not supported at high impedance). For an introduction on how to set the amplitude in Vrms and dBm units, please refer to *Output sine wave*. The pulse wave amplitude defaults to 5 Vpp, and the amplitude range and resolution are limited by the "Impedance" and "Frequency/Period" settings, see *Table 5.2: Amplitude setting range*.

Click this key again to switch to high level setting, high level = offset + amplitude/2. The high level setting range is related to the low level setting value: (high level - low level) does not exceed the current settable range of the amplitude (*Table 5.2: Amplitude setting range*).

Set offset/low level

Click **Offset/low level** Switch key to switch to offset setting. At this time, "Offset" is highlighted on the switch key. Click the corresponding input box and set the pulse wave offset through the pop-up virtual numeric keyboard. The offset range of the pulse wave can be set to be limited by "Impedance" and "Amplitude/High Level", and the default is 0 Vdc.

Click this key again to switch to low level setting, low level = offset-amplitude/2. The low level setting range is related to the high level setting value: (high level - low level) does not exceed the current settable range of the amplitude (*Table 5.2: Amplitude setting range*).

hint

Amplitude comes in pairs with offset, high level and low level. For example, when switching to the offset setting, "Amplitude/High Level" will automatically switch to the amplitude setting.

Set starting phase

Click **Phase** The input box of the item sets the starting phase. The starting phase range is -360°~360°, the default value is 0°, and the resolution is 0.01°.

Pulse width/duty cycle

The pulse width is defined as the time interval from the 50% threshold of the rising edge level of the pulse to the 50% threshold of the falling edge level, as shown in the figure above. Pulse duty cycle is defined as the pulse width as a percentage of the pulse period. The two are related to each other, and modifying one parameter will automatically modify the other parameter.

Click **Pulse width/duty cycle** Press the switch key to switch to the pulse width setting. At this time, "Pulse Width" is highlighted on the switch key. Click the corresponding input box, and set the pulse wave width through the pop-up virtual numeric keyboard. The settable range of pulse width is 9 ns~1 Ms, the default value is 500 μs, and the resolution is 0.1 ns.

Click this button again to switch to the duty cycle setting, duty cycle = pulse width/pulse period. The duty cycle can be set in the range of 0.01% to 99.99%, the default value is 50%, and the resolution is 0.01%.

hint

- The pulse width setting is limited by the period setting value and the minimum pulse width (minimum pulse width: 9 ns): minimum pulse width ⩽ pulse width ⩽ (pulse period - minimum pulse width).
- The pulse duty cycle is limited by the minimum pulse width and pulse period: (minimum pulse width/pulse period)*100%⩽pulse duty cycle⩽(1-minimum pulse width/pulse period)*100%.

Set rising edge/falling edge

The rising edge time is defined as the time for the pulse level to rise from 10% to 90%; the falling edge time is defined as the time for the pulse level to fall from 90% to 10%.

Click **rising edge** In the input box, set the rising edge of the pulse wave through the pop-up virtual numeric keyboard; click **falling edge** item input box, Set the falling edge of the pulse wave through the pop-up virtual numeric keyboard. The settable range of the rising (falling) edge is 3 ns~1 s, the default value is 3 ns, and the resolution is 0.1 ns.

hint

The settable range of the rising (falling) edge time is limited by the currently set pulse width: 3 ns ⩽ rising (falling) edge time ⩽ 0.625 × pulse width. When the set value exceeds the limit value, the instrument will automatically adjust the edge time to adapt to the specified pulse width.

Channel settings

In addition to the above settings, you can also*continuous wave*Interface Click the channel tab to switch to the channel setting interface and configure parameters related to the channel output. For detailed operations, please refer to*Channel settings*one period.

Turn on channel output

Please refer to the "Output Sine Wave" section*Turn on channel output*.

5.5 Output noise

You can select the output noise in the following ways:

- In the continuous wave setting interface (*Figure 5.1*), click the "Waveform Type" drop-down menu and select "Noise".
- In the continuous wave setting interface (*Figure 5.1*), click the "Waveform Preview/Selection" area, and click in the opened built-in waveform selection menu **Noise**.
- Press the front panel 

button.

After entering the noise setting interface, you can configure the channel to output different noise waveforms through the following

operations. **Set amplitude/high level**

Click **Amplitude/high level** Switch key to switch to amplitude setting. At this time, "Amplitude" is highlighted on the switch key. Click the corresponding input box and set the noise amplitude through the pop-up virtual numeric keyboard. The units supported by the amplitude are Vpp, Vrms and dBm (not supported at high impedance). For an introduction on how to set the amplitude in Vrms and dBm units, please refer to*Output sine wave*. Noise amplitude defaults to 5 Vpp, amplitude range and resolution are limited by the "Impedance" and "Frequency/Period" settings, see*Table 5.2: Amplitude setting range*.

Click this key again to switch to high level setting, high level = offset + amplitude/2. The high level setting range is related to the low level setting value: (high level - low level) does not exceed the current settable range of the amplitude (*Table 5.2: Amplitude setting range*).

Set offset/low level

Click **Offset/low level** Switch key to switch to offset setting. At this time, "Offset" is highlighted on the switch key. Click the corresponding input box, set the noise offset through the pop-up virtual numeric keyboard. The offset range of the noise waveform can be set to be limited by "Impedance" and "Amplitude/High Level", and the default is 0 Vdc.

Click this key again to switch to low level setting, low level = offset-amplitude/2. The low level setting range is related to the high level setting value: (high level - low level) does not exceed the current settable range of the amplitude (*Table 5.2: Amplitude setting range*).

hint

Amplitude and offset, high level and low level always appear in pairs. For example, when switching to the offset setting, "Amplitude/High Level" will automatically switch to the amplitude setting.

Channel settings

In addition to the above settings, you can also*continuous wave*Interface Click the channel tab to switch to the channel setting interface and configure parameters related to the channel output. For detailed operations, please refer to*Channel settings*one period.

Turn on channel output

Please refer to the "Output Sine Wave" section*Turn on channel output*.

5.6 Output arbitrary wave

In the continuous wave setting interface (*Figure 5.1*), click the "Waveform Type" drop-down menu to select "Arbitrary Wave", or press the

Open the arbitrary waveform setting interface. You can configure the channel to output different arbitrary waves through the following operations.

Select arbitrary wave

After selecting arbitrary waveform, the arbitrary waveform defaults to "Sinc". In the arbitrary waveform setting interface, click the "Waveform Preview/Selection" area to open the built-in waveform selection menu and select an arbitrary waveform. Click on the left side of the waveform selection menu **Commonly used waveforms** **project** **segment modulation** **born** **Materials and engineering** **medical** **standard** **Math functions** **Trigonometric functions** **inverse trigonometric function** **window function** Select an arbitrary wave as shown in the table below shape. The name of the selected arbitrary waveform in the arbitrary waveform setting interface **waveform** item is displayed.

Table 5.3 Built-in arbitrary waveform description

name	illustrate
Commonly used waveforms	
DC	DC voltage
Abssine	Absolute value of sine
Abssinehalf	Absolute value of half sine
Ampalt	gain oscillation curve
Attalt	Decay oscillation curve
Gausspulse	Gaussian pulse

name	illustrate
Negramp	inverted triangle
Npulse	negative pulse
Pulse	positive pulse
Sinetra	Sine-Tra Waveform
Sinever	Sine-Ver Waveform
Stair D	Staircase descent
Stair Ud	Ladder up/down
Stair Up	Ladder up
Trapezia	trapezoid
project	
Bandlimited	band limited signal
Blaseiwave	Blasting vibration “time-vibration velocity” curve
Butterworth	Butterworth filter
Chebyshev1	Type I Chebyshev filter
Chebyshev2	Type II Chebyshev filter
Combin	Combination function
Cpulse	C-Pulse signal
cwPulse	CW pulse signal
Damped Osc	Damped oscillation “time-displacement” curve
Dualtone	Dual audio signal
Gamma	Gamma signal
Gatevibr	Gate self-oscillation signal
LfmPulse	Chirp signal
Mcnoise	Mechanical construction noise
Nimh Discharge	Ni-MH battery discharge curve
Pahcur	Brushless DC motor current waveform
Quake	seismic waves
Radar	radar signal
Ripple	Power ripple
Roundhalf	hemispheric wave
Stepresp	step response signal
Swing Osc	Swing oscillation kinetic energy-time curve
Tv	TV signal
Voice	voice signal
segment modulation	
Three Am	Sine segmented amplitude modulated wave
Three Fm	Sine segmented FM wave
Three Pfm	Pulse segmented FM wave
Three Pm	Sine segmented phase modulated wave
Three Pwm	pulse width segmented frequency modulated wave
Bioelectricity	

name	illustrate
Cardiac	ECG signal
Eog	electrooculogram
Eeg	electroencephalogram
Emg	EMG
Pulsilogram	Ordinary person’s pulse curve
Resspeed	Exhalation flow rate curve of ordinary people
medical	
LfP	Low frequency pulse electrotherapy waveform
Tens1	Neuroelectrical Stimulation Therapy Waveform 1
Tens2	Neuroelectrical Stimulation Therapy Waveform 2
Tens3	Neuroelectrical Stimulation Therapy Waveform 3
standard	
Ignition	Automobile internal combustion engine ignition waveform
Iso16750 2 Sp	Car starting profile with oscillation
ISO16750 2 Vr	Operating voltage profile of the car when resetting
Iso7637 2 Tp1	Automotive transients due to power outage
Iso7637 2 Tp2a	Automotive transients due to inductance in wiring
Iso7637 2 Tp2b	Automotive transients due to startup transition shutdown
Iso7637 2 Tp3a	Automobile transients due to switching
Iso7637 2 Tp3b	Automobile transients due to switching
Iso7637 2 Tp4	Cross-sectional view of car working during startup
Iso7637 2 Tp5a	Automotive transients caused by cutting battery power
Iso7637 2 Tp5b	Automotive transients caused by cutting battery power
Scr	SCR sintering temperature release chart
Surge	surge signal
Math functions	
Airy	Airy function
Besselj	Bessel function of kind I
Bessely	Bessel functions of type II
Cauchy	Cauchy distribution
Cubic	cubic function
Dirichlet	Dirichlet function
Erf	error function
ERf	complementary error function
Erfcinv	anti-complementary error function
Erfinv	inverse error function
Expfall	exponential decreasing function
Exprise	exponential function
Gauss	Gaussian distribution, or normal distribution
Haversine	semisine function
Laguerre	quartic Laguerre polynomial

name	illustrate
Laplace	Laplacian distribution
Legend	quintic Legendre polynomial
Log	Base 10 logarithmic function
Lognormal	lognormal distribution
Lorentz	Lorentz function
Maxwell	Maxwell distribution
Rayleigh	Rayleigh distribution
Versiera	Minoshi Line
Weibull	Weber distribution
X2	square function
Trigonometric functions	
Cosh	hyperbolic cosine
Cosint	cosine integral
Cot	cotangent function
Coth Con	concave hyperbolic cotangent
Coth Pro	Raised hyperbolic cotangent
Csc Con	concave cosecant
Csc Pro	raised cosecant
Csch Con	concave hyperbolic cosecant
Csch Pro	Convex hyperbolic cosecant
Recip Con	sunken reciprocal
Recip Pro	Raised reciprocal
SecCon	concave secant
Sec Pro	raised secant
Sech	hyperbolic secant
Sinc	Sinc function
Sinh	hyperbolic sine
Sinint	sine integral
Sqrt	square root function
Tan	tangent function
Tanh	hyperbolic tangent
inverse trigonometric function	
Acos	arc cosine function
Acosh	Inverse hyperbolic cosine function
Acot Con	concave inverse cotangent function
Acot Pro	Raised inverse cotangent function
Acoth Con	concave inverse hyperbolic cotangent function
Acoth Pro	Raised inverse hyperbolic cotangent function
AcscCon	concave inverse cosecant function
Acsc Pro	convex inverse cosecant function
AcschCon	concave inverse hyperbolic cosecant function

name	illustrate
Acsch Pro	Convex inverse hyperbolic cosecant function
AsecCon	concave inverse secant function
Asec Pro	Raised arcsec function
Asech	Inverse hyperbolic secant function
Asin	arcsine function
Asinh	Inverse hyperbolic sine function
Atan	arctangent function
Atanh	inverse hyperbolic tangent function
window function	
Barlett	Bartlett window
Barthannwin	Modified Bartlett Window
Blackman	blackman window
Blackman H	BlackmanH window
Bohmanwin	BohmanWin window
Boxcar	rectangular window
Chebwin	Chebyshev window
Flattopwin	flat top window
Hamming	Hamming window
Hanning	Hanning window
Kaiser	Kaiser window
Nuttallwin	Minimum four-term Blackman-Harris window
Parzenwin	Parzen window
Taylorwin	Taylaor window
Triang	Triangular window, also called Fejer window
Tukeywin	Tukey window

Setting parameters

After selecting the corresponding waveform, you can set the frequency/period, amplitude/high level, offset/low level, and phase of the arbitrary waveform.

Please refer to *Output sine wave* section to configure waveform parameters and output.

5.7 Output harmonics

DG900 Pro can be used as a harmonic generator to output harmonics with specified order, amplitude and phase. It is usually used in the testing of harmonic detection equipment or harmonic filtering equipment. According to Fourier transform theory, the time domain waveform is the superposition of a series of sine waves, expressed by the following equation:

$$f(t)-A_1\sin(2-f_1t--_1)-A_2\sin(2-f_2t--_2)-A_3\sin(2-f_3t--_3)-...$$

Typically, the frequency is fThe component of is called the fundamental wave, $f_1$is the fundamental frequency, $A_1$is the amplitude of the fundamental wave, $\phi_1$is the phase of the fundamental wave. In addition, each The frequency of the component is usually an integer multiple of the fundamental frequency and is called a harmonic. Components with frequencies that are odd multiples of the fundamental frequency are called odd harmonics, such as 3, 5, and 7 harmonics; components with frequencies that are even multiples of the fundamental frequency are called even harmonics, such as 2, 4, and 6 subharmonic.

In the continuous wave setting interface (*Figure 5.1*), click the "Waveform Type" item drop-down menu to select "Harmonic", or click the "Waveform Preview/ Selection" area, and click in the opened built-in waveform selection menu **Harmonic**, enter the harmonic setting interface, as shown below shown.

Figure 5.2 Harmonic setting interface

Set fundamental wave parameters

DG900 Pro allows users to set the frequency/period, amplitude/high level, offset/low level and starting phase parameters of the fundamental wave. Please refer to *Output sine wave* Set the above fundamental parameters as described in . Please note that the fundamental wave amplitude does not support the units of Vrms and dBm.

hint

The maximum value that the fundamental wave frequency can be set (*Ffund*) is affected by the harmonic order (*N*) and the upper limit of harmonic frequency (*Fmax*)Impact:*Ffund*≤(2 ×*Fmax*÷ *N*). When changing the harmonic order, the fundamental frequency may be adjusted. The harmonic frequency upper limit of different models (*Fmax*) please refer to See *Table 5.1: Continuous waveform frequency setting range*.

Set harmonic type

Click the "Harmonic Type" drop-down menu and select the desired harmonic type.

- **Sequential harmonics:**The instrument only outputs single harmonic components. For example, the wave components of **frequency** Set to 5, then only the 5th harmonic will be output. order harmonics.
- **Mixed harmonics:**The instrument output contains harmonics with multiple harmonic components.

  Under mixed harmonics, 20-bit binary data is used to represent the output status of the 20th harmonic. 1 means turning on the output of the corresponding harmonic, and 0 means turning off the output of the corresponding harmonic. Click **customize** Item input box, through the pop-up virtual key

Just set the value of each data bit on the disk (note that the leftmost bit represents the fundamental wave, which is fixed to X and is not allowed to be modified). For example: set the 20-bit data to X001 0000 0000 0000 0001, which means outputting the fundamental wave and the 4th and 20th harmonics.

Edit order harmonics

Click the "Harmonic Type" drop-down menu to select "Sequence", and click the output harmonic component in the sequence harmonic setting interface. Item input box settings to 2~20, and the default is 2. After the setting is completed, the amplitude and phase of the current harmonic can be set:

- **Harmonic amplitude:**Click Harmonic amplitude In the input box, set the amplitude of the current harmonic through the pop-up virtual keyboard.
- **Harmonic phase:**Click harmonic phase In the input box, set the phase of the current harmonic through the pop-up virtual keyboard.

Edit Mixed Harmonics

Click the "Harmonic Type" drop-down menu to select "Hybrid", and click on the Mixed Harmonic Settings interface customize Set the harmonics of the output combination. After the setting is completed, you can click the harmonic editing table and set the amplitude and phase of each harmonic in the pop-up "Table Modification" menu.

Figure 5.3 Table modification menu

- **Harmonic amplitude:**Click in the form Amplitude For any cell in a column, set the specified harmonic through the pop-up virtual keyboard. amplitude.
- **Harmonic phase:**Click in the form **Phase** For any cell in a column, set the specified harmonic through the pop-up virtual keyboard. phase.

hint

You can serial number Enter the harmonic order to be set in the item input box for quick positioning.

Channel settings

In addition to the above settings, you can also *continuous wave* Interface Click the channel tab to switch to the channel setting interface and configure parameters related to the channel output. For detailed operations, please refer to *Channel settings* one period.

Turn on channel output

Please refer to the "Output Sine Wave" section *Turn on channel output*.

6 modulation

DG900 Pro can output a variety of modulated waveforms. The supported modulation methods are AM, FM, PM, ASK, FSK, PSK, PWM and SUM. The modulated wave supports internal modulation sources and external modulation sources.

Click the "Output Mode" drop-down menu in the user interface, select "Modulation", and enter the modulation setting interface, as shown in the figure below. You can click the corresponding tab at the bottom of the interface to enter the continuous wave (carrier) setting interface, modulation setting interface or channel setting interface. Please refer to the continuous wave (carrier) setting and channel setting respectively. *continuous wave* and *Channel settings*, this section only introduces the modulation settings.

Figure 6.1 Modulation setting interface

6.1 Amplitude modulation (AM)

The modulated waveform of AM (Amplitude Modulation) consists of a carrier wave and a modulating wave. The amplitude of the carrier wave changes with the instantaneous voltage of the modulating wave. In the "Modulation Settings Interface" (*Figure 6.1*) Click the drop-down menu of the "Modulation Mode" item, select the modulation mode as "Amplitude Modulation", and then set other modulation parameters according to the following content.

Select and set carrier

The AM carrier waveform can be sine wave, square wave, sawtooth wave and arbitrary waveform (except DC), and the default is sine wave. Click the "Waveform Type" item drop-down menu, or press the corresponding waveform selection key on the front panel to select the carrier waveform. Enter the carrier setting interface, refer to*continuous wave*One section sets the waveform parameters of the carrier.

Set modulation waveform

The instrument can receive modulation signals from internal or external sources as modulation sources. Click **modulation source** drop-down menu, you can select "Inside "External Source" or "External Source".

- **Internal sources**

  After selecting "Internal Source" the user can click **modulation waveform** Select the modulation waveform from the drop-down menu of the item. The available waveforms include:

  - sine wave
  - Square wave: 50% duty cycle
  - Triangular wave: 50% symmetry
  - Upper sawtooth: 100% symmetry
  - Lower sawtooth: 0% symmetry
  - Noise: Gaussian white noise
  - Arbitrary wave: standard arbitrary wave except DC. The carrier wave and internal modulation waveform are not supported to be arbitrary waves at the same time.

- **external sources**

  After selecting "External Source", **modulation waveform** and **modulation frequency** Grayed out and disabled. The instrument receives the signal from the corresponding channel on the rear panel. **[AUX IN/OUT]**Connector input for external modulated signal. At this time, the AM modulation amplitude is controlled by the ±5 V signal level on this connector.

illustrate

How to achieve mutual modulation between dual channels? Taking the CH2 output signal as the modulation signal as an example:

1. Use double BNC cables to connect the CH2 channel output to CH1 on the rear panel.**[AUX IN/OUT]**connector is connected.
2. Select CH1, select the output mode as "Modulation" and select the required modulation type, and set the corresponding parameters. **modulation source** Set to "External source".
3. Select CH2 and set the required modulation waveform and corresponding parameters.
4. Turn on the CH1 output switch.

Set modulation frequency

After selecting the internal modulation source, click **modulation frequency** In the input box, set the modulation wave frequency through the pop-up virtual numeric keyboard. Can Set the range to 2 mHz~1 MHz, the default is 100 Hz, and the resolution is 1 μHz.

hint

When an external modulation source is selected, this parameter is grayed out and unavailable.

Set modulation depth

Modulation depth represents the degree of amplitude change, expressed as a percentage. Click **modulation depth** Item input box to set the modulation depth.

AM modulation depth range is 0% to 120%, default is 100%, resolution 0.01%.

- At 0% modulation, the output amplitude is half the carrier amplitude.
- At 100% modulation, the output amplitude is equal to the carrier amplitude.
- When greater than 100% modulation, the output amplitude will not exceed the maximum output amplitude (see *Table 5.2: Amplitude setting range*).

When selecting an external modulation source, the AM modulation amplitude is also affected by the corresponding channel on the rear panel.**[AUX IN/OUT]**±5 V signal level control on the connector, for example, setting the modulation depth to 100% will output the maximum amplitude when the modulation signal is +5 V and the minimum amplitude when the modulation signal is -5 V.

carrier suppression

DG900 Pro supports conventional amplitude modulation and Double Sideband Suppressed Carrier (DSB-SC) amplitude modulation. In conventional amplitude modulation, the modulated wave contains a carrier component. Since the carrier component carries no information, the modulation efficiency is low. In order to improve the modulation efficiency, the carrier component is suppressed based on conventional amplitude modulation. This method is called double sideband suppressed carrier modulation.

By default, regular amplitude modulation is selected, click **carrier suppression** switch, you can turn on or off the suppression of carrier double sideband modulation system.

6.2 Frequency Modulation (FM)

The modulated waveform of FM (Frequency Modulation) consists of a carrier wave and a modulating wave. The frequency of the carrier wave changes with the instantaneous voltage of the modulating wave. In the "Modulation Settings Interface" (*Figure 6.1*) Click the drop-down menu of the "Modulation Mode" item, select the modulation mode as "Frequency Modulation", and then set other modulation parameters according to the following content.

Select and set carrier

FM carrier waveform can be sine wave, square wave, sawtooth wave and arbitrary waveform (except DC), and the default is sine wave. Click the "Waveform Type" item drop-down menu, or press the corresponding waveform selection key on the front panel to select the carrier waveform. Enter the carrier setting interface, refer to *continuous wave* One section sets the waveform parameters of the carrier.

Set modulation waveform

The instrument can receive modulation signals from internal or external sources as modulation sources. Click **modulation source** drop-down menu, you can select "Inside "External Source" or "External Source".

- **Internal sources**

  After selecting "Internal Source" the user can click **modulation waveform** Select the modulation waveform from the drop-down menu of the item. The available waveforms include:

  - sine wave
  - Square wave: 50% duty cycle
  - Triangular wave: 50% symmetry

- Upper sawtooth: 100% symmetry
- Lower sawtooth: 0% symmetry
- Noise: Gaussian white noise
- Arbitrary wave: standard arbitrary wave except DC. The carrier wave and internal modulation waveform are not supported to be arbitrary waves at the same time.

- **external sources**

  After selecting "External Source", modulation waveform and modulation frequency Grayed out and disabled. The instrument accepts input from the corresponding channel on the rear panel. **[AUX IN/OUT]**Connector input for external modulated signal. At this time, the FM modulation amplitude is controlled by the ±5 V signal level on this connector.

Set modulation frequency

After selecting the internal modulation source, click modulation frequency In the input box, set the modulation wave frequency through the pop-up virtual numeric keyboard. Can Set the range to 2 mHz~1 MHz, the default is 100 Hz, and the resolution is 1 μHz.

hint

When an external modulation source is selected, this parameter is grayed out and unavailable.

Set frequency offset

Frequency offset represents the maximum change in frequency of the modulated waveform relative to the carrier frequency. Frequency offset Item input box, settings Click Frequency Offset. The minimum frequency offset is 1 μHz.

- The frequency offset must be less than or equal to the current carrier frequency -1 μHz.
- The sum of the frequency offset and the carrier frequency must be less than or equal to the upper frequency limit of the selected carrier.

When an external modulation source is selected, the frequency offset is affected by the corresponding channel on the rear panel.**[AUX IN/OUT]**±5 V signal level control on connector. For example, if the frequency offset is set to 1 kHz, a +5 V signal level corresponds to a 1 kHz increase in frequency. Lower external signal levels produce less offset, and negative signal levels lower the frequency below the carrier frequency.

6.3 Phase Modulation (PM)

The modulated waveform of PM (Phase Modulation) consists of carrier wave and modulation waveform. The phase of the carrier changes with the instantaneous voltage of the modulating waveform. In the "Modulation Settings Interface" (*Figure 6.1*) Click the drop-down menu of the "Modulation Mode" item, select the modulation mode as "Phase Modulation", and then set other modulation parameters according to the following content.

Select and set carrier

The PM carrier waveform can be sine wave, square wave, sawtooth wave and arbitrary waveform (except DC), and the default is sine wave. Click the "Waveform Type" item drop-down menu, or press the corresponding waveform selection key on the front panel to select the carrier waveform and enter the carrier setting interface. Please refer to *continuous wave*One section sets the waveform parameters of different carriers respectively.

Set modulation waveform

The instrument can receive modulation signals from internal or external sources as modulation sources. Click modulation source drop-down menu, you can select "Inside "External Source" or "External Source".

- **Internal sources**

  After selecting "Internal Source" the user can click modulation waveform Select the modulation waveform from the drop-down menu of the item. The available waveforms include:

  - sine wave
  - Square wave: 50% duty cycle
  - Triangular wave: 50% symmetry
  - Upper sawtooth: 100% symmetry
  - Lower sawtooth: 0% symmetry
  - Noise: Gaussian white noise
  - Arbitrary wave: standard arbitrary wave except DC. The carrier wave and internal modulation waveform are not supported to be arbitrary waves at the same time.

- **external sources**

  After selecting "External Source", modulation waveform and modulation frequency Grayed out and disabled. The instrument accepts input from the corresponding channel on the rear panel. **[AUX IN/OUT]**Connector input for external modulated signal. At this time, the PM modulation amplitude is controlled by the ±5 V signal level on this connector.

Set modulation frequency

After selecting the internal modulation source, click modulation frequency In the input box, set the modulation wave frequency through the pop-up virtual numeric keyboard. Can Set the range to 2 mHz~1 MHz, the default is 100 Hz, and the resolution is 1 μHz.

hint

When an external modulation source is selected, this parameter is grayed out and unavailable.

Set phase deviation

The phase deviation represents the maximum change in phase between the modulated waveform and the carrier wa phase deviation Item input box, set phase deviation. The setting range of phase deviation is 0°~360°, the default value is 90°, and the resolution is 0.01°.

When an external modulation source is selected, the phase offset is determined by the corresponding channel on the rear panel.**[AUX IN/OUT]**±5 V signal level control on connector. For example, if the phase deviation is set to 180°, then a +5 V signal level corresponds to a 180° change in phase. Lower external signal levels produce less deviation.

6.4 Amplitude shift keying (ASK)

When using ASK (Amplitude Shift Keying) modulation, you can configure the output signal to "shift" its output amplitude between two preset amplitudes ("carrier amplitude" and "modulation amplitude"). In the "Modulation Settings Interface" (*Figure 6.1*) Click "Adjust