SGPA o Low Phase Noise

U ¨ o ˙8

y ˙U

SGP1003A/SGP1006A/o8P ˚ o8P ˚ o8P ˚ o8P ˚ o8P ˚

CONTENTS

1 Ready to use

- Front panel show
- Rear panel display
- Put into service

This section shows a comparison of the front and rear panels. It explains how to use the instrument through the buttons and connectors.

1.1 Front panel show

The front panel includes the display, function buttons (on the left side of the screen), control buttons and output interface (on the right side of the screen). The following parts provide controls and connectors

Figure 2-1 Front panel appearance

1.1.1 Function button

The function buttons on the left side of the signal source can reset the device and provide some auxiliary functions of the device.

 RESET

MENU

RF ON/OFF
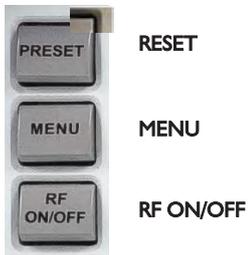
1. In the initial state, the output frequency is 10GHz, the output power is 0dBm, the RF output is turned off, the modulation signal generation is turned off, the modulation is turned off, and all communication interfaces are turned off.

1.1.2 Standby indicator light and standby switch

The standby indicator light and the power on/standby switch are located at the lower left of the front panel.
The power on/standby switch is used to change the device between power on and standby states
(distinguished by the color of the indicator light on the switch)
The standby indicator light status indications are as follows:

- The red indicator light is on to indicate that the device is in standby mode.
- The green indicator light is on, indicating the device is in power-on state

1.1.3 Display

The display clearly shows all the main settings and the status of the signal generator.
The screen is divided into the following parts:

- Frequency and power display in the information bar
  - Frequency and power settings
    - Status bar

- Module Block Diagram

  The module block diagram shows the current configuration status and the signal flow inside the device.

1.1.4 Setting button

The buttons on the right side of the screen are used to set parameters, select views, and control windows.

1.1.4.1 Buttons for setting parameters

These buttons provide quick setup of RF signal functions.

 FREQ

LEVEL

BACKSPACE

ESC

1.1.5 Keyboard for data entry

The keys in the data entry area are used to enter alphanumeric data and units.

The input keys are only available when the cursor is placed in the data entry box. Their specific functions vary depending on the type of data entry box.

Button	Function
0...9	Type the corresponding number
.	Enter a decimal point
Unit button	Selecting a unit simultaneously confirms the entered value or is used to change the current unit, etc. Triggers a unit change without changing the current absolute value. The unit of the key is different when the parameter is set differently.
–	Add a minus sign before the current setting column

1.1.6 Knob and arrow keys

The knob and direction keys are used to quickly move the cursor or change the setting value.

Knob Function:
• Increase or decrease the value of the current digit in step mode
• Move the cursor in the data entry box
• Moving the selection box in the graphical interface
• Scroll through options in a menu or list
• When pressed, the function switches between the up and down keys and the left and right keys.

Tip: The functions of the knob are the same as "up key", "down key" or "left key" and "right key". The specific function is switched by pressing the knob.

Arrow key

The directional pad contains four arrow keys and an OK key.

Up/Down Button:
    Increase or decrease the current value in step mode
    Browse options in a menu or list
Left/Right Button:
    Move the cursor in step mode
    Move the selection box in a graphical interface
OK:
    In setting mode, confirm the current input parameter is valid and end setting mode
    Confirm the current option in the menu and enter the related tab page
    Change the current setting button state in the list or enter setting mode

1.1.7 Front panel output interface

The RF output interface and pulse modulation input and output interface are located on the front panel.

PULSE OUT

PULSE IN

RF 50Ω
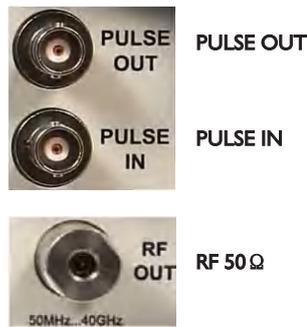
Maximum input power limit.

When the RF OUT output is not connected.RF should be in OFF state. Otherwise it will cause damage to the machine!

1.2 Rear panel show

Figure 2-2 Rear panel appearance

1.2.1 Overview of connectors

AC power supply, fuse and power switch

After the signal generator is connected to the power supply, it will adapt to the input voltage (range see the typical values table). No manual voltage setting or fuse replacement is required. The power switch can be set to two positions:

- 0

The instrument is disconnected from the power supply.

- 1

The instrument is connected to the power supply and is ready to operate at any time (standby).

Network Interface

Ethernet interface

• Integrating signal generators in the network

• Signal generator remote control

• Remote access to signal generator

Serial Interface

RS422 interface

• Integrate a signal generator into the serial port

• Signal generator remote control

Debug interface

• Firmware Update

Reference Interface

Reference output interface (REF OUT) internal reference signal output

Reference input interface (REF IN) External reference signal input

1.3 Put into service

⚠ **Warning**

Avoid instrument damage or injury

This instrument must be used in an appropriate manner to prevent electric shock, fire, personal injury or damage.

• Do not open the instrument casing.

• Read and follow the "Basic Safety Instructions". Also, read and follow the safety instructions in the next section. Note that the data sheet may establish additional operating conditions.

⚠ **Warning**

Avoid instrument damage

General Safety Instructions contain information and operating conditions that can prevent damage to the instrument. The instrument's data sheet may contain additional operating conditions.

> ⚠ **Warning**
>
> **Damage during operation:**
>
> An inappropriate operating station or test setup may cause damage to the device and connected equipment. Please ensure the following points before turning on the instrument:
>
> • All fan openings are unobstructed and airflow is unobstructed. The minimum distance between the rear panel and the wall is 10cm
>
> • The environment is dry and free of condensation.
>
> • The instrument is placed under the conditions described in the following sections.
>
> • The ambient temperature does not exceed the range specified in the data sheet.
>
> • The signal outputs are connected correctly and are not overloaded.
>
> **The Dangers of Electrostatic Discharge (ESD)**
>
> Electrostatic discharge (ESD) can cause damage to electronic components of instruments and test equipment (DUT). ESD is most likely to occur when connecting or disconnecting a test fixture from a device under test or a test port. To prevent static electricity, use a wrist strap or cord to connect the human body to ground, or use a conductive ground mat and heel strap combination.

1.3.1 EMI Suppression

Electromagnetic interference (EMI) may affect the measurement results

Suppress the generated electromagnetic interface (EMI)

• Use high-quality shielded cables, such as double-shielded RF and LAN cables.

• Do not leave the cable open at the end

• Please note the EMC classification in the data sheet

1.3.2 Unpacking and checking the instrument

To remove the instrument from the package, you need to check the integrity of the equipment first, and do the following 5

1. Remove the pearl cotton protecting the front and rear panels of the instrument

2. Remove the pearl cotton protecting the instrument body

3. Check the instrument delivery list and the list of various items and accessories for completeness and carefully check the list

4. Check the instrument for damage. If there is any damage, immediately contact the carrier who delivered the instrument and do not discard the packaging materials and boxes yet.

> **Packaging Materials**
>
> Save the original packaging material and use it to protect the controls and connectors if the equipment needs to be shipped at a later date.

1.3.3 Placing or installing the instrument

The signal generator is designed for use under laboratory conditions, either on a benchtop or using a rack adapter (number see data sheet).

Desktop operation

For desktop operation, the surface should be flat and the instrument should be placed horizontally, supported by the non-slip feet at the bottom of the instrument, or propped up by support feet.

> ⚠ **Warning**
>
> **Avoid damage from support feet**
> When the instrument does not need to be supported or carried, the support feet can be folded up.
>
> • In order to maintain the stability of the instrument, the support legs need to be fully extended or retracted.
>
> • Do not place anything under the instrument when the support legs are extended.
>
> • If the support legs are overloaded, they may break. The total load on the support legs should not exceed 500N.
>
> ⚠ max. 500 N
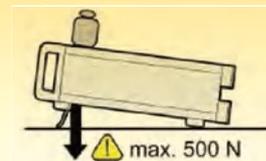
> ⚠ **Warning**
>
> Risk of damage to rack mounted instruments
>
> Insufficient airflow can cause the instrument to overheat, which may interfere with operation or even cause damage.
>
> Ensure that all fan openings are normally open so that airflow is not obstructed, with a minimum distance of 10 cm to the wall.

1.3.4 Connect the instrument to AC power

The signal generator adapts to the AC supply voltage. There is no need to manually set the voltage or change fuses. The AC power switch is located on the rear panel.

1.3.5 Power on

Turn off AC power

You can keep the AC power on for a long time to keep your last settings on the instrument.

Turning off the AC power is only necessary when the instrument must be completely powered off.

Turn on the power switch

1. Connect the device to AC power.

2. Turn on the power switch and slide it to the I position (on): When the power is turned on, the device is in standby or on state, and the specific state is determined by the state of the standby button on the front panel.

3. When the instrument is in standby mode, the red light of the standby switch is on; when the instrument is in power-on mode, the green light of the standby switch is on.

1.3.5.1 Standby and Power-On Status

The standby switch is located at the lower left of the front panel.

Switch between standby and on mode

• Press the standby switch to turn on the instrument, otherwise the instrument enters standby mode.

In the power-on state, the green LED of the power symbol on the standby switch lights up, and the instrument can be used for related operations. All modules start to be powered, and the signal generator starts the program initialization.

In standby mode, the red LED of the power symbol on the standby switch is on, and the power is only supplied to the controller and the standby switch. It is safe to turn off the IQ power switch or unplug the IQ power supply in this mode.

1.3.5.2 Start display

The system starts and begins self-test. If the system was shut down normally last time, the instrument uses the last set parameters.

When the startup is completed, the currently turned on modules will be displayed, and the instrument can be operated at this time.

1.3.5.3 Functional Check

During operation, the signal generator automatically monitors the main functions of the instrument.

If an operational problem is detected, the message bar will display "ERROR" followed by a brief error message.

1.3.5.4 Default Settings

When the instrument is turned on, it is not the default setting, but the setting state when the instrument is turned off. When a new configuration is required or the current setting is no longer used, you can restore the factory settings through PRESET in SETUP.

Default state

The following list gives the preset states.

• RF Frequency   10GHz
• Level   0dBm
• RF Output   Off
• MODGEN State   Off
• Modulation State   Off
• Sweep State   Off

1.3.6 Turning off the instrument

⚠ **Warning**

Avoid data loss

If you shut down the running device via the power switch on the rear panel or unplug the AC power cord directly, the instrument will lose its current setting parameters. In addition, program data may be lost.

First, press the standby switch to the standby state to shut down correctly.

1. Press the standby switch to the standby state to save the current setting parameters! Shut down the operating system, and then the instrument enters the standby state, and the red LED of the power symbol lights up.

2. Turn off the main power and turn the main power switch to the O position (OFF). At this time, the power symbol LED of the standby switch on the front panel goes out.

1.3.7 Power fuse

The signal generator is protected by a 5*20 glass fuse 3A type. The fuse is placed between the main power switch and the AC socket. Only the fuse types mentioned above can be used.

2 Started

This chapter helps you get familiar with the use of the signal generator. It briefly introduces the device through practical application examples, and describes the module block diagram and signal flow.

At the same time, this chapter shows how to use various control methods through step-by-step configuration operations. The examples are intended to provide a quick setting guide. No additional equipment is required.

The signal generator mainly includes the following control methods:

· Manual operation

· Remote control

Manual Operation

The signal generator can be operated through the front panel.

The signal generator has an intuitive human-machine interface. The central element of the display is the system block diagram that shows the signal flow, and the generated signal can be seen directly.

Each module represents a function contained in the device. Therefore, the user can understand which modules have played a role in the signal generation process. The connection status of the inputs and outputs is also displayed through the system block diagram. Therefore, the user can intuitively see which input and output signal connections are connected.
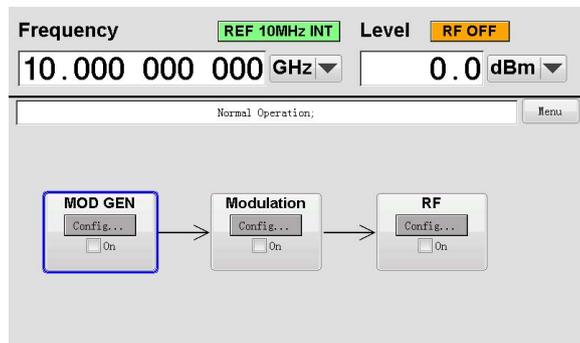
By rotating the knob and pressing the button, the user can switch between the graphical interface and the dialog box, and can control the instrument with one hand. The cursor in the graphical function interface or dialog box moves line by line. If each block in the graphical interface is activated, the background of the block will become a highlighted color background.

Remote control

Remote control is the repetitive action of controlling an instrument through remote control commands or automation. If remote control is to be achieved, the instrument must be connected to a computer running a control program.

2.1 Description of the plate

The signal path in the graphical interface contains all the modules required to generate the signal.

The following block diagram shows a complete device

Modulation   Generation

The internal modulation source is configured through this panel. An internal pulse generator can be used as a pulse modulation source. The internally generated pulse signal can be output through the PULSE OUT on the front panel of the instrument. The pulse width and period of the pulse signal are configured in this panel.

The display status of the panel indicates whether the modulation source is working. When this function is turned on, the panel color will turn blue and the status will be checked.

Modulation
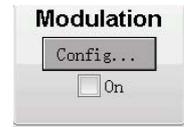
Internal and external pulse delay modulation can be configured here.

The internal pulse modulation source is configured in the "MOD GEN" section, and the external pulse signal can be input through the BNC connector marked PULSE IN on the front panel of the instrument. The external pulse signal input level is required to be a 3.3VTTL signal.

The display status of the panel indicates whether the pulse modulation is working. When this function is turned on, the panel color will turn blue and the status will be checked.

RF

In this section, you can set various parameters under the sweep mode.

The display status of the section indicates whether the sweep mode is turned on. When the function is turned on, the color of the section will turn blue and the status will be checked.

Continuous frequency and power display

The main parameters of the RF signal (frequency and power) are always displayed at the top of the screen and can be set by pressing the FREQ or LEVEL buttons. The status of the RF output and the reference status are also displayed here.

Frequency REF 10MHz INT Level RF OFF
10.000 000 000 GHz 0.0 dBm

Operate through a graphical function interface

Function

The menus are assigned to specific function blocks in the block diagram. Function blocks represent elements of signal generation. By pressing the OK key you enter the corresponding setting panel.

Signal Flow Graph

The signal flow between modules and the input and output signals are displayed graphically.

MOD GEN → Modulation → RF
Config... Config... Config...
On On On
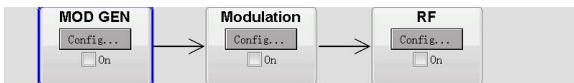
Menu

The menu bar can be opened or closed by pressing the MENU button.

Frequency REF 10MHz INT Level RF OFF
10.100 000 000 GHz 0.0 dBm

MENU
Settings
System
Account
LCD Lightness
Languages
Factory Reset
REF
MODGEN
Modulation
RF
Communication
About

Normal Operation: Menu
Account
Account Admin
Password
Login Cancle
RF
Config...
On On
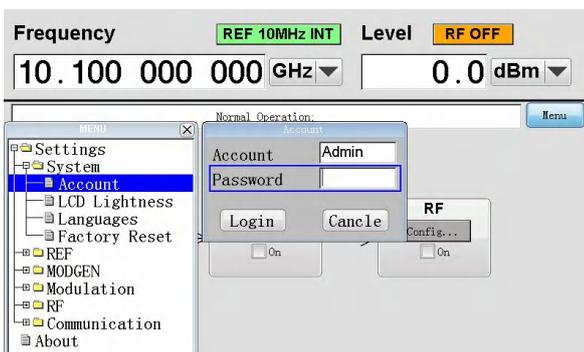
RF on (off)

To turn RF on (off), press the panel button.

RF OFF — RF Off
RF ON — RF On

Reference Switching

The reference is automatically switched between internal and external references. When an external reference clock is connected, it automatically switches to the external reference clock. Otherwise, the internal reference clock is used. The reference clock frequency is 10MHz.

2.2 Dialog box structure

Parameters are set via the menu bar. Menus are accessed via the graphical user interface or by pressing the MEUN button.

The menus are in Windows format. The details of the menus vary depending on their function. However, they all have the same main elements.

Each menu consists of a title bar, title bar buttons, and an area for setting the relevant parameters.

The title bar shows the name of the current setting menu. The title bar button is used to close the menu. The buttons can be operated via the ESC button on the front panel.

Example: Pulse Generation

PWM Generator
State OFF
Pulse width 50 ns
Pulse period 50 ns
SynPulse delay 0 ns
Pulse mode constant
Train number
Train period
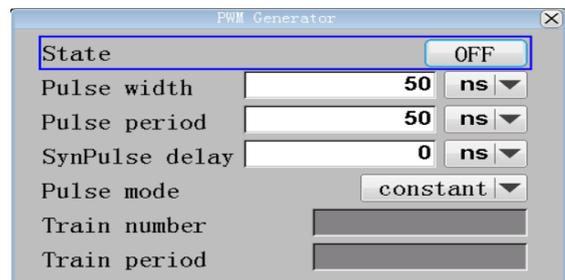
3 Manual Operation

3.1 Setting parameters

3.1.1 Using the cursor

When the instrument is turned on, the cursor is on the first panel of the graphical function interface by default. Move the cursor in the graphical function interface

Move the cursor by the following methods:

a) Use the knob or arrow keys

b) Use the ESC key

Note: The function of the ESC key depends on the current cursor position.

Calls up the next higher selection level.

Closes an open window without entering a new value; the old value or parameter is saved.

If the dialog has a Cancel button, this function is implemented.

Closes any kind of dialog if the edit mode is not enabled.

Switches between different menu entry areas.

Switches from the main parameter setting bar at the top to the menu bar or graphical function interface.

Press the FREQ or LEVEL button to move the cursor to the top parameter setting bar.

3.1.2 Select a setting parameter

The method of selecting the controlled parameter is the same whether in the graphical function interface, menu bar or dialog box.

Move the cursor to the parameter to select it.

The selected parameter is highlighted with a blue frame.

3.1.3 Turning parameters on or off

Parameters can be turned on or off using buttons or selection boxes.

1. Select a parameter.

2. Change the state of the parameter using the OK key.

The button's color and label change, and the checkbox becomes checked or unchecked.

3.1.4 Enter a value

Numbers can be edited in the input field. Incorrect input values can be cleared by pressing the BACKSPACE key.

To enter a new value

1. Select a parameter.

2. Press the OK key to enter the edit mode

3. Press the numeric key to enter the required value. The previous value will be cleared and the new value will be written.

Change the value

1. Enter edit mode

2. Use the left/right button to change the cursor position

The value of the cursor position can be changed

3. Use the up/down button or knob to change the value of the selected position to increase or decrease

3.1.5 Using the Unit Key

The unit parameter is displayed next to the value. When the parameter is edited, the unit can be selected from the pull-down menu or the unit button on the front panel. When the input is completed, the unit is changed. In this process, the value is not **changed but the new unit is automatically adopted.**

Assigning Units

To assign a unit to a value, use one of the following options:

1. Press the Units key on the front panel.

2. Select the appropriate value from the drop-down menu next to the parameter value, and then press the OK key.

Changing Units

To switch units, after entering the value and not in the edit state, use one of the following options:

1. Press the Units key on the front panel.

2. Select the appropriate value from the drop-down menu next to the parameter value, and then press the OK key.

3.1.6 Select a value from the drop-down menu

The drop-down menu provides a list of specified parameters. To select an item in the list, follow these steps:

1. Press the OK key to open the drop-down menu.

2. Use the knob or up/down arrow keys to move the selection, and the selected item will be highlighted.

3. Press the OK key to confirm the selection.

3.2 Setting Example

3.2.1 Setting a frequency

In this example, a single carrier signal is set. The steps are as follows:

1. Restore factory settings (optional)

Press the PRESET button to restore factory settings
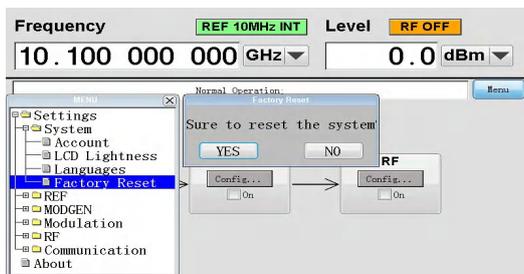
2. Set frequency and power

a) Press the FREQ button

b) Press the '1', '0', 'GHz' buttons in sequence

c) Press the LEVEL button

d) Press the '1', '0', 'dBm' buttons in sequence

3.2.2 Generate a pulse modulation signal

This section provides an example of how to generate a pulse modulation signal through configuration. The steps to generate a pulse modulation signal are as follows:

1. Restore factory settings (optional)

Press the PRESET button to restore factory settings
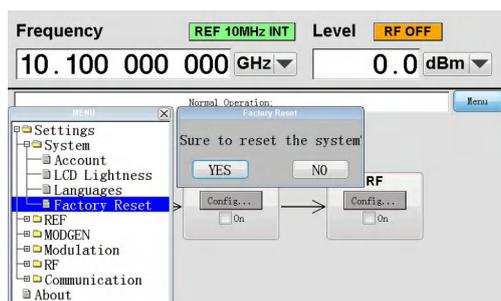
2. Select and open the modulation signal generation module

a) Rotate the knob or press the button to select the modulation generation module.

b) Press the OK button to open the modulation signal generation panel
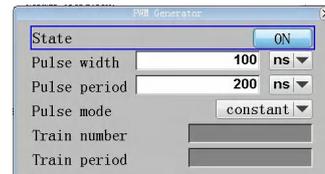
c) Move the cursor to the pulse width column or pulse period column.
Press Enter and type the required value.

d) Finally, select the status column and press the OK key, and the status changes to (Open).

e) Press the ESC key to return to the main interface

3. Select and open the modulation module

a) Turn the knob or press the button to select the modulation module
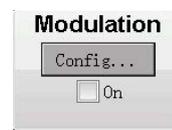
b) Press the OK key to open the modulation panel
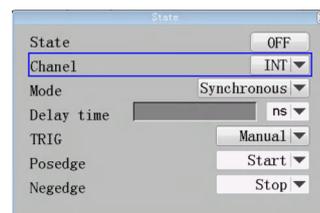
c) Move the cursor to the channel selection, and press Enter to change the pulse modulation signal channel. If an external input pulse modulation signal is used, the channel needs to be selected as "external".

d) Move the cursor to the mode selection, and press Enter to change the pulse modulation mode. If it is synchronous mode, when the modulation is triggered, the modulation output starts at the same time. If it is delayed mode, the modulation is triggered, and the set delay time is delayed before the modulation output starts.

e) Move the cursor to the trigger source selection. When manually triggered, the modulation is turned on or off by changing the status bar status. If it is external, an external input trigger signal is required to turn on or off the pulse modulation, and the definition of the rising edge and falling edge can be changed by setting.

f) Select the status bar and press the OK key to change the status to "On"

g) Press the ESC key to return to the main interface

4. Set the frequency and power and turn on the RF output

a) Press the FREQ button to enter the frequency input mode. The frequency input area is in the upper left corner of the page.

After entering the typing mode, the selection box will be selected

Frequency	REF 10MHz INT	Level	RF OFF
10.000 000 000 GHz ▼		0.0 dBm ▼	

Enter the frequency using the numeric keys and unit keys.

b) Enter power

0.0 dBm ▼
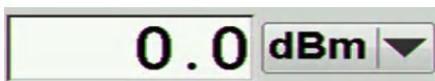
c) Press the ESC button to return to the main interface

d) Select RF ON/OFF

Press the button to turn on the RF output (if it is off). Now the RF output port outputs the pulse modulated signal.

3.2.3 Generate a frequency sweep signal

This section provides an example of how to generate a frequency sweep signal through configuration. The steps to generate a frequency sweep signal are as follows:

1. Restore factory settings (optional)
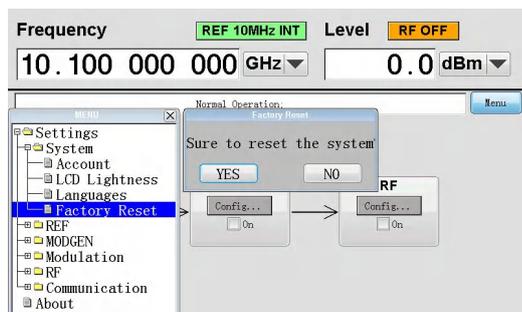
2. Configure and activate the frequency sweep function

a) Rotate the knob or press the button to select the RF section

b) Press the OK button to open the frequency sweep setting panel
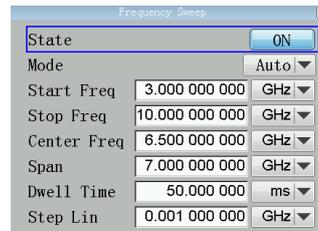
c) Select the Mode bar and press the OK key, open the drop-down menu, select Automatic, Mode, and press OK.
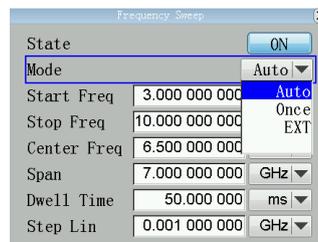
d) Finally, select the status bar and press the OK button to turn on the sweep mode.

e) Press the ESC button to return to the main page.

The RF output is not turned on yet, so there is no signal output from the RF output port.

3. Turn on RF output

Select RF ON/OFF

Press the button to turn on the RF output (in the off state).

3.2.4 Change system language

1. Restore factory settings (optional)

Press the PRESET button to restore factory settings
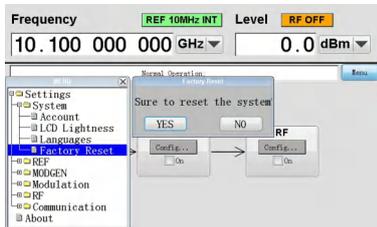
2. Change the language system

   a) Press the MENU key and use the up and down arrow keys to move to the language setting column
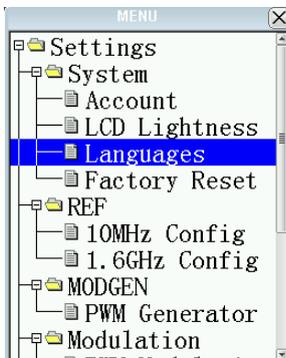
   b) Press the OK button and a language window will pop up on the interface. After changing the setting, the system will automatically change after 3 seconds.

3.2.5 Changing Brightness

1. Restore factory settings (optional)
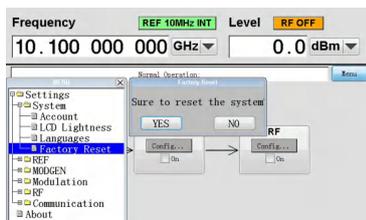
2. Change brightness

   a) Press the MENU button and use the up and down arrow keys to move to the LCD backlight brightness bar
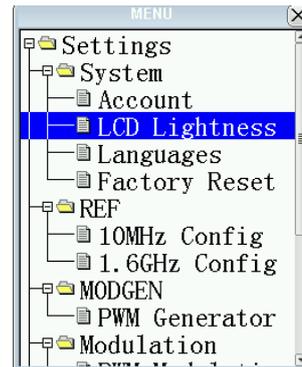
b) Press the OK button, and a brightness adjustment window will pop up. Use the left and right buttons to change the brightness. Press the OK button to confirm the brightness.
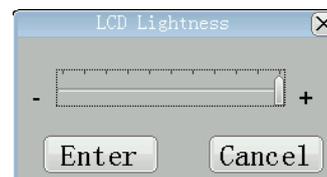
c) Press the ESC key to return to the main interface

3.2.6 Frequency (power) step setting

1. Restore factory settings (optional)
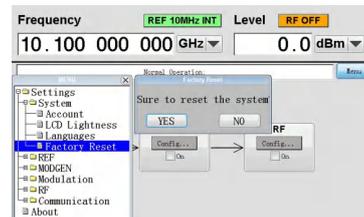
2. Frequency step setting

   a) Press the MENU key and use the up and down arrow keys to move to Basic Settings

   b) Select Frequency, set a value, and press the OK key.
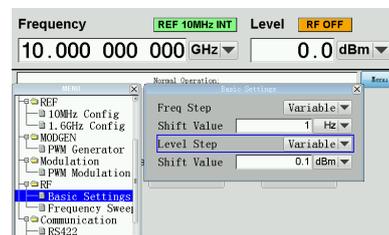
c) Move the cursor to the frequency interface and use the up and down arrow keys to step through the frequencies according to the set value.

d) Power is the same as above.

4 Remote Control

The signal generator provides two remote control interfaces: serial port and network port. The relevant settings can be found in the communication directory of the menu panel.

4.1 Serial Port

After opening the serial port dialog box, you can see that there are five parameters that can be set. You can set the relevant parameters by following the steps below:

a) Move the selection box to the parameter bar that needs to be modified

b) Press the OK button to open the drop-down window

c) Change the selection by turning the knob or pressing the up/down arrow keys

d) Press the OK button to modify the parameters
Finally, you need to turn on the switch in the status bar to enable the serial port communication function

e) Set the address bit. In order to facilitate users to control multiple devices through a bus, the system sets the address bit. When using RS422 communication, the communication format is "<ADDR/" + command word + end character. The end character is "\r\n" (hexadecimal corresponds to 0x0D 0x0A). As shown in the figure above, the serial port command to set the frequency of channel 1 is "<55/FREQ110 GHz\r\n"

4.1.1 Hardware interface definition

RS422

PIN	SIGNAL
1	GND
2	NA
3	TX− (TRANSMIT DATA LOW)−CONNECT TO CONTROLLER RX−
4	N/A
5	RX−(RECEIVE DATA LOW)−CONNECT TO CONTROLLER TX−
6	N/A
7	TX+(TRANSMIT DATA HI)−CONNECT TO CONTROLLER RX+
8	N/A
9	RX+(RECEIVE DATA HI)−CONNECT TO CONTROLLER TX+

4.2 Network Port

The signal generator uses the network protocol: TCP Client. The address, subnet mask, gateway and other parameters can be set through the network port dialog box. The network port number is: 2000.
After opening the network port dialog box, you can see that there are five parameters that can be set. You can set the relevant parameters through the following steps:
a) Move the selection box to the parameter bar that needs to be modified
b) Press the OK key to enter the edit mode
c) Press the numeric key to enter the value
Rotate the knob or press the left/right direction key to move the cursor. Press the decimal point key to move the cursor to the next digit and enter it
d) Press the OK key to confirm the input parameter and exit the edit mode

Finally, you need to turn on the status bar switch to enable the network port communication function. Note: Network port control does not require address bits and end characters
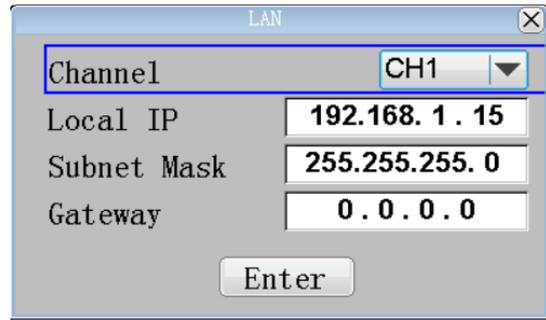
The external trigger input of the signal source has two application modes: pulse modulation generation trigger and frequency sweep external trigger. Only one of the two application modes can be used at the same time. Pulse modulation generation trigger: You can choose the rising edge or falling edge to start pulse modulation, otherwise turn off pulse modulation. If the external trigger mode is selected in the pulse modulation mode, the external trigger input corresponding to this function is enabled.
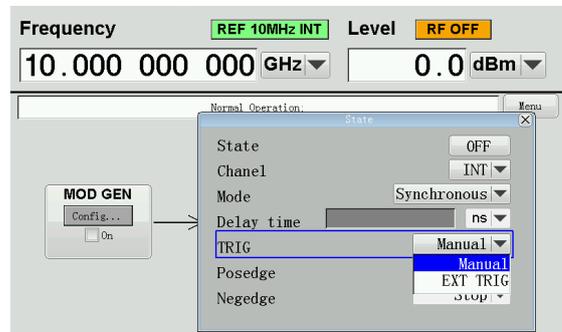
External sweep trigger: Select the external trigger mode in the sweep mode. By default, the system will step the frequency once for each rising edge of an external trigger. This function is enabled for external trigger input.
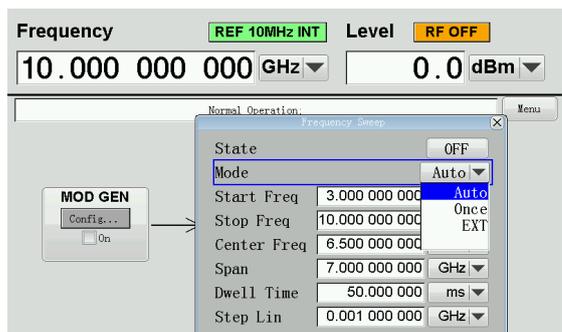
4.3 Control Commands

Note: Special instructions in the following commands

1. When setting frequency-related parameters, the unit is one of "GHz", "MHz", "kHz","Hz".

2. When setting power-related parameters, the unit is "dBm".

3. The format of setting commands is: [command word][space][data][space][unit].
The format of query commands is: [command word][?].

4. All commands must be terminated with the '\n' character.

5. The return value is only a number. The specific meaning is described below.

4.3.1 Control command word

Ⅰ.Output frequency related commands[FREQ] 1.

Query the current set frequency：FREQ?

Return value: [Frequency] in Hz

2. Set frequency: FREQ [Set data] [Unit]

Ⅱ.Output power related commands[LEVEL]

1. Query the current set power： LEVEL ?

Return value: [Power], in dBm

2. Set power LEVEL [Setting data] [Unit]

3. Query the current output status: LEVEL:STATE

Return value: 1/0 [ON/OFF]

4. Set the RF output state: LEVEL:STATE [ON/OFF]

Ⅲ.Modulation generation related commands[MODGEN]

1. Query the modulation generation status：

MODGEN:PWM:STATE?

return value： 1/0 [ON/OFF]

2. Set the modulation generation state：

MODGEN:PWM:STATE [ON/OFF]

3. Query the pulse width of the pulse signal：

MODGEN:PWM:PW?

Return value: [Pulse width] Unit is ns
4. Set the pulse width of the generated pulse：MODGEN:PWM:PW

[Setting data] [Unit]

5. Query pulse signal period：

MODGEN:PWM:PER?

Return value: [cycle] in ns

6. Set the pulse period

MODGEN:PWM:PER

[Setting data] [Unit]

7. Query pulse generation mode：

MODGEN:PWM:MODE?

return value： 1/0 [TRAIN/CONT]
（TRAIN：Pulse sequence；CONT：Continuous pulse）

8. Set the pulse generation mode：

MODGEN:PWM:MODE

[CONT/TRAIN]

（CONT：Continuous pulse；TRAIN：Pulse sequence）

9. Query pulse sequence period：MODGEN:PWM:TPER？

Return value: [number of sequences]

10. Set the pulse train period：

MODGEN:PWM:TPER [Setting data] [Unit]

(Unit: Point)

11. Query pulse sequence period：MODGEN:PWM:TNUM？

Return value: [number of sequences]

12. Set the number of pulse trains：

MODGEN:PWM:TNUM [Setting data] [Unit]
(Unit: Point)

Ⅳ. Pulse Width Modulation Related Commands [PWM]

1. Query the pulse width modulation state: PWM:STATE?

Return value： 1/0 [ON/OFF]

2. Set the PWM state：PWM:STATE [ON/OFF]

3. Query the modulation signal channel：

PWM:CHANNEL?return value： 0/1 [EXT/INT]

（EXT：External pulse input；INT：Internal pulse source）

4. Set the modulation signal channel：PWM:CHANNEL [EXT/INT]

（EXT：External pulse input；INT：Internal pulse source）

5. Query pulse modulation mode：PWM:MODE?

return value： 0/1 [SYN/DEL]

（SYN：Synchronous pulse trigger；DEL：Delayed pulse trigger）

6. Set the pulse width modulation mode：PWM:MODE [SYN/DEL]

(SYN：Synchronous pulse trigger；

DEL：Delayed pulse trigger）

7. Query the delay time of the delayed pulse modulation mode：
PWM:DWEL?

return valu[Delay time] The unit is ns

8. Set the delay time of the delayed pulse modulation mode：

PWM:DWEL [Setting data] [Unit]

9. Query the pulse modulation trigger mode：

PWM:TRIG:MODE?return value： 1/0 [EXT/MAN]

(EXT: external trigger starts pulse modulation; MAN:

manual start of pulse modulation)

10. Set the pulse modulation trigger mode：

PWM:TRIG:MODE [MAN/EXT]

(EXT: external trigger starts pulse modulation; MAN:

manual start of pulse modulation)

11. Query the pulse modulation external trigger rising

edge function：PWM:TRIG:PEDGE?

return value:0/1[START/STOP]

(External trigger pulse modulation rising edge starts/

ends)

12. Set the pulse modulation external trigger rising edge function:

PWM:TRIG:PEDGE [START/STOP]

(External trigger pulse modulation rising edge start/

end)

13. Query the pulse modulation external trigger falling

edge function：PWM:TRIG:NEDGE?

return value:0/1[START/STOP]

(External trigger pulse modulation falling edge start/

end)

14. Set the pulse modulation external trigger falling edge function:

PWM:TRIG:NEDGE [START/STOP]

(External trigger pulse modulation falling edge start/

end)

Ⅴ. Sweep related commands[SWE:FREQ]

1. Query the frequency sweep status：SWE:FREQ:STATE?

   return value：1/0 [ON/OFF]

2. Set the sweep state：SWE :FREQ:STATE [ON/OFF]

3. Query sweep mode：SWE:FREQ:MODE?

   return value：0/1/2 [AUTO/ SINGLE/EXT]（AUTO：Cycle Sweep；

   SINGLE：Single sweep；EXT：Trigger Sweep）

4. Set the sweep mode：SWE:FREQ:MODE

   [AUTO/ SINGLE/EXT]

（AUTO：Cycle Sweep；SINGLE：Single sweep；EXT：Trigger Sweep）

5. Query the sweep start frequency：SWE:FREQ:START?

return value：[Start frequency] Unit: Hz

6. Set the sweep start frequency：SWE:FREQ:START

[Setting data] [Unit]

7. Query the sweep cutoff frequency：SWE:FREQ:STOP?

return value：[Cut-off frequency] Unit: Hz

8. Set the sweep cutoff frequency：SWE:FREQ:STOP

[Setting data] [Unit]

9. Query the sweep center frequency：SWE:FREQ:CENT?

return value：Center frequency] in Hz

10.   Set the sweep center frequency：SWE:FREQ:CENT

[Setting data] [Unit]

11.   Query the sweep bandwidth：SWE:FREQ:SPAN?

return value：[Sweep bandwidth] Unit: Hz

12.   Setting the sweep bandwidth：SWE:FREQ:SPAN

[Setting data] [Unit]

13.   Query the sweep frequency retention time：

SWE:FREQ:DWEL?return value：[Residence time] Unit: ns

14.   Setting the sweep dwell time：SWE:FREQ:DWEL

[Setting data] [Unit]

15.   Query the sweep step frequency：SWE:FREQ:STEP?

return value：[Step frequency] Unit: Hz

4.3.2 Compatible with KEYSIGHT control commands

Ⅰ. Output frequency related commands[FREQ]

1. Query the current set

   frequency：

   [:SOURce]:FREQuency[:CW]?

   [:SOURce]:FREQuency[:FIXed]? Ret

   urn value: [Frequency] in Hz

2. Setting frequency：

   [:SOURce]:FREQuency[:CW]

   [:SOURce]:FREQuency[:FIXed]

Ⅱ. Output power related commands[LEVEL]

1. Query the current set power:
[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]?
Return value: [Power], in dBm

2. Setting power :
[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]

3. 3. Query the current output status :
OUTPut[:STATe]?
return value：0/1 [ON/OFF]

4. Set the RF output status:
OUTPut[:STATe]

Ⅲ、Refer to output related commands[REF]

1. Query the current reference status:
REF_10M:STATE?
REF_1G6:STATE?

2. Set the reference state:
REF_10M:STATE
REF_1G6:STATE

IV. Modulation generation related commands [MODGEN]

1. Query the modulation generation status:
MODGEN:PWM:STATE? [:SOURce]:PULM:STATe?

   return value：0/1 [ON/OFF]

2. Set the modulation generation status:
MODGEN:PWM:STATE [:SOURce]:PULM:STATe

3. Query the pulse width of the pulse signal:
[:SOURce]:PULM:INTernal:PWIDth?
Return value: [Pulse width] Unit is ns

4. Set the pulse width of the generated pulse:
[:SOURce]:PULM:INTernal:PWIDth

5. Query the pulse signal period:
[:SOURce]:PULM:INTernal:PERiod?
Return value: [cycle] unit is ns

6. Set the pulse generation cycle:
[:SOURce]:PULM:INTernal:PERiod

Ⅴ.Pulse Width Modulation Related Commands [PWM]

1. Query the delay time of the delayed pulse modulation
mode:[:SOURce]:PULM:INTernal:DELay?
Return value: [delay time] in ns

2. Set the delay time of the delayed pulse modulation mode:
[:SOURce]:PULM:INTernal:DELay
[:SOURce]:PULM:INTernal:DELay

3. Query the pulse width modulation status:
OUTPut:MODulation[:STATe]?
Return value: 1/0 [ON/OFF]

4. Set the pulse width modulation state:
OUTPut:MODulation[:STATe]

5. Query the modulation signal channel:
[:SOURce]:PULM:SOURce?
Return value: 0/1 [EXT/INT]

6. Set the modulation signal channel:
[:SOURce]:PULM:SOURce

7. Query pulse modulation mode:
[:SOURce]:PULM:SOURce?
Return value: [MAN(IMM)/EXT]

8. Set the pulse width modulation mode:
TRIGger[:SEQuence]:SOURce

VI. Sweep frequency related commands [SWE:FREQ]

1. Query the frequency sweep status：

[:SOURce]:SWEep:CONTrol:STATe

Return value: 1/0 [ON/OFF]

2. Set the frequency sweep status:

[:SOURce]:SWEep:CONTrol:STATe

3. Query the sweep mode:

[:SOURce]:SWEep:MODE

Return value: 0/1/2 [AUTO/SINGLE/EXT]

4. Set the sweep mode:

[:SOURce]:SWEep:MODE

5. Query the sweep start frequency:

[:SOURce]:FREQuency:STARt

Return value: [Start frequency] in Hz

6. Set the sweep start frequency:

[:SOURce]:FREQuency:STARt

7. Query the sweep cutoff frequency:

[:SOURce]:FREQuency:STOP

Return value: [Cutoff frequency] in Hz

8. Set the sweep cutoff frequency:

[:SOURce]:FREQuency:STOP

9. Query the sweep center frequency:

[:SOURce]:FREQuency:CENTer?

Return value: [Center frequency] in Hz

10. Set the sweep center frequency:

[:SOURce]:FREQuency:CENTer

11. Query the sweep bandwidth:

[:SOURce]:FREQuency:SPAN?

Return value: [Sweep bandwidth] in Hz

12. Set the sweep bandwidth:

[:SOURce]:FREQuency:SPAN

13. Query the frequency sweep retention

time:[:SOURce]:SWEep:DWELl?

14. Set the sweep retention time

[:SOURce]:SWEep:DWELl

15. Query the sweep step frequency:

[:SOURce]:FREQuency[:CW]:STEP[:INCRement]?

16. Set the sweep step frequency:

[:SOURce]:FREQuency[:CW]:STEP[:INCRement]

- END -